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Functional Digital Literacy: Improving Email Skills with Adolescents with Intellectual Disabilities

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By

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Abstract

Technology continues to permeate many areas of daily life. This has become more apparent during the current pandemic. Many services innovatively moved to hybrid or technology-based methods of service. However, not all individuals accessed technology with the same opportunities. Persistent inequities remain for individuals with disabilities, stemming from several variables, but most noticeably a lack education-based planning to include skills required to access technology necessary to improve post-secondary outcomes. A multiple probe design across three behaviors replicated across six adolescent participants investigated the use of systematic prompting using system of least prompts delivered using distance learning technology to increase basic email skills in adolescents with intellectual and developmental disabilities (IDD). All participants increased their email skills in composing, replying and adding an attachment.

Keywords: *Technology, Applied Behavior Analysis, Intellectual Disabilities, Email, Post-Secondary Skills*

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Functional Digital Literacy: Improving Email Skills with Adolescents with Disabilities

Technology use by Americans has increased steadily through the past decades. The frequency with which individuals access the internet and use technology-based devices continues to rise as more adults and adolescents use digital technology to socialize, access information, and interact with employment and educational services (Alsalem, 2016; Pew Research Center, 2021). In 2011, 83% of Americans owned a cell phone and 35% of Americans owned a smart phone. A decade later, ownership has continued to rise with 97% of Americans reporting ownership of a cell phone and 85% of which own a smart phone device (Pew Research Center, 2021).

Additionally, rates of internet and social media use continue to increase among Americans. The Pew Research center reported rates of internet usage around 70%, and social media usage around 50% in 2011. More recently in 2021, rates of usage rose to 93% with the internet and 72% for social media with nearly a 20% increase over the past 10 years (Pew Research Center, 2021). Furthermore, of those that were surveyed in 2021, 8 out of 10 adults reported going online daily, with 31% reporting that they are almost constantly on the internet (Pew Research Center, 2021). More recently, conditions of the pandemic influenced and increased reliance on technology to provide services in an effort to contain the spread of COVID-19. Prior to the pandemic internet usage fell around 90% in 2019, and from 2019-2021 rose an additional 3% during the pandemic as schools, medicine and other public agencies looked at alternatives to provide services (Pew Research Center, 2021). It is evident from these numbers that technology use (e.g., smart

technology, internet, social media) continues to increase in prevalence and influence American lifestyles. However, use of the internet and digital technology is not universal across all populations in the United States.

Individuals with disabilities are less likely to access services and goods supported through technology. The Pew Research Center reported adults with disabilities access and use the internet disproportionately less than their typical age peers, with only 54% reporting access and use of the internet compared to the previously reported rate of 93% across the general adult population (Pew Research Center, 2011; Pew Research Center, 2021). Several residual effects were identified including, increased likelihood for lower income levels and levels of education because of lowered levels of access. Attributes such as access to broadband internet, wireless internet and technology devices are often correlated with higher income brackets and college level education. Additionally, individuals without consistent access to mobile devices and internet are at a disadvantage in accessing social and employment opportunities and increasing skill sets that could otherwise add or increase income and accessibility levels (Pew Research Center, 2021).

Necessity of access and possession of skill sets were further highlighted during the COVID-19 pandemic as news outlets and schools discussed inequities in access to education and services as many institutions moved to digital platforms. These inequities of access were present not only for adults, but also adolescents and children with disabilities. A variety of sources reported that parents and adolescents with disabilities lacked skills required to access educational materials and services, and experienced increases in maladaptive behavior related to frustration and difficulty associated with attempted technology use (Fredrick et al., 2020; Jeste et al., 2020; Khanlou et al., 2020;

Levine, 2020; Nelson, 2020; Stenhoff et al., 2020). Additionally, families lacked access to consistent and reliable internet signals, technology to continue distance learning and intermittent communication services. The pandemic involved periods of isolation and while some individuals were able to use social media and technology to maintain social interactions, those without these skills were further excluded from these interactions and accessing their societal surroundings (Alsalem, 2016; Jeste et al., 2020; Stenhoff et al., 2020).

The rapid move to distance learning frequently delivered through teleconference software did not yield time to equip families and students with instructional supports to acquire these skills. These skills were frequently overlooked in curriculum and goal planning for students by most educators leading to disparity in access to services (Khanlou et al, 2020). Research and news outlets reported inequities between various demographic groups during the pandemic. Individuals with disabilities, including adults and children, are less likely to have and maintain steady access to the internet, computer, and smart technology (Pew Research Center, 2017). They are less likely to have the skills, resources and technology to access services and supports; this includes tablets and computers to complete and access schoolwork, or transportation to acquire school materials for distance learning.

One area identified as necessary for distance learning and accessing services included digital literacy skills. Without the skill sets required to operate the technology, access was hindered for children and adults with disabilities. Despite provision of technology, it cannot be used accurately or effectively without having a basic level of skill to operate technology. This inequity could be addressed through service providers

and educators. Providers could decrease the gap between individuals with disabilities and their peers through incorporation of digital literacy instruction and specific goal planning to meet societal needs.

Email has become a gate keeper in terms of access. The provision of an email address is required to access and submit applications for jobs, service providers and employment opportunities. It is less common to come across businesses or entities to continue to require physical copies of paperwork. Often paperwork may be submitted for electronic completion and electronic signatures, which are inaccessible if an individual does not have access or the skills, required to use email. Additionally, access to applications for smart devices require an email to access and download, and communication platforms such as instant messaging, iMessage, social media are also inaccessible without the provision of an email address. For this reason, email continues to be an essential digitial literacy skill for individuals in order to participate more fully within society.

Currently, digital literacy is not often incorporated in the goal planning in educational environments or through intervention services. The focus has been primarily on behavior management, academics, social skills, and daily living skills. However, with the ever-increasing role that technology continues to play, arguably digital literacy skills are a necessity to promote and provide opportunities for social interaction, employment, and education for individuals with disabilities, specifically those with developmental disabilities. Integration of digital literacy skill sets is essential in breaking down the inequity barriers faced by individuals with developmental disabilities (Fredrick et al.,

2020; Jeste et al., 2020; Khanlou et al., 2020; Levine, 2020; Nelson, 2020; Stenhoff et al., 2020).

Purpose

The purpose of this study was to evaluate whether systematic instruction could be used to develop effective interventions, implemented through teleconference technology, and improve skill acquisition of digital literacy skills in individuals, aged 12-17 years, with developmental disabilities. A multiple probe design across behaviors was used to evaluate application of direct instruction and systematic prompting through teleconference technology to teach basic email skills including compose and send email and reply to email. The secondary objective sought to evaluate and extend the literature on the efficacy of systematic instruction-based intervention delivered over teleconference technology and acquisition of skills by persons with developmental disabilities.

Research Questions

Is the system of least prompts delivered using teleconference technology an effective instructional strategy to:

1. Increase the level of independence for completion of steps required to compose and send an email?
2. Increase the level of independence for completion of steps required to send a reply to an email?
3. Increase the level of independence for completion of steps required to select, attach a document, and send as a reply.

Review of the Literature

Functional Digital Literacy

The concept of digital literacy was first described by Glister in 1997 as "the ability to understand and use information in multiple formats from a wide range of sources when presented via computers" (as cited in Cihak et al., 2015, p. 156). Initially, digital literacy was described as basic user computing skills, including soft skills such as operating a computer and accessing the internet for evaluation of information (Lankshear & Knobel, 2008). As technology continued to evolve so too did the definition of digital literacy, Eshet-Alkalai altered the description to include additional specifics such as, "a growing variety of technical skills in order to perform tasks and solve problems in digital environments (2004, p 93.) These additions incorporated aspects of how technology was developing to include and expand platforms for which it was accessed and used.

Early educational focus surrounding functional literacy centered around workplace skills, a basic understanding and performance of discrete skills (Selber, 2004). Selber (2004) built on these concepts addressing the inherent social component associated with functional literacy and expansion beyond workplace skills. In relation to the digital age, Selber (2004) described functional literacy as the most basic skills required to operate and access digital platforms, systems, including forms of communication. Functional digital literacy thereby is defined as the ability to use technology with accuracy and fidelity to engage in the digital community meaningfully (Cihak et al., 2015) and is the definition around which this study is based.

Components of Digital Literacy

Three main components comprise the concept of digital literacy, "use," "understand," and "create" (Buijs et al., 2017). "Use" refers to the basic skills required to operate computers, smart devices, and navigate the internet. These skills include, but are not limited to, basic operation of technology including skills like keyboarding, and software usage. "Understand" includes the skills required to contextualize and comprehend information while also evaluating the quality and accuracy of the information. Understanding refers to an individual's ability to locate and access information and then decide on aspects such as credibility, sources, purpose, and/or target audiences. "Create" refers to the skills for engaging with technology and producing content, from sending text messages, video conferencing, to interacting in virtual environments and producing content like blogs or social media posts (Buijs et al., 2017). Proficiency in these skills supports active and productive interactions with technology and increases interaction and integration into society (Bujis et al., 2017; Cihak et al., 2015).

Functional digital literacy links digital literacy skill sets to life skill areas such as socialization, transition, leisure, and daily living (Carey et al., 2005; Khanlou et al., 2020). For example, social interaction has increasingly moved to a digital platform through use of services such as social media (e.g., Facebook, Instagram), and text message exchanges that contain text and visual icons such as emoticons (Carey et al., 2005). Daily living skills such as communication, shopping and purchasing have been converted to include a digitalized format such as purchasing items online and food delivery services (Cihak et al., 2015). Digital literacy in the form of digital platforms and

technology merges with life skills such as communication and social interaction to form "functional digital literacy."

Assistive Technology, Intervention Delivery and Literacy

Technology has historically been researched within the scope of assistive or adaptive technology for individuals with intellectual and developmental disabilities (IDD), or as a method of instruction delivery (Dobransky & Hargittai, 2016; Tanis et al., 2012; Walser et al., 2012). Primarily research using technology has centered around use as an intervention delivery system such as instructional delivery methods or a method of prompting (e.g., prompting through the steps of a specific task) (Ayers et al., 2013; Cihak et al., 2015; Cumming & Rodriguez, 2017; Goo et al., 2019; Kagohara et al., 2013; Pandya & Avila, 2017; Walser et al., 2012; Zisimopoulous et al., 2011). Current research has also focused on single skill sets with specific digital devices such as using a smart device or tablet to request a preferred item for communication (Flores et al., 2012; Kagohara, 2011; Kagohara et al., 2011), or academic skills such as literacy specific to language arts, or math numeracy skills (Chai et al., 2014; Creech-Galloway et al., 2013). Generally, these studies fall into one of the following categories, school/academics, home/ daily living skills, community skills, communication, and employment skills (Cumming & Rodriguez, 2017; Goo et al., 2019; Kagohara et al., 2013).

Assistive technology is another well researched area but differs from digital literacy. The goal of assistive technology is centered on the use of technology whether high tech (e.g., tablets or voice output devices), to low tech (e.g., grasping aids) to facilitate communication skills, mobility and educational learning supports within the learning environment. On the other hand, digital literacy targets the actual skill sets

required to use technology versus assistive technology's focus on facilitation. Technology has the potential as a tool to become more than an education-related support, enhancing access and independence across various environments for individuals with IDD (Carey et al., 2005; Crook et al., 2017; Cummings & Rodriguez, 2017; Seok & DaCosta, 2017).

A basic level of skill is required for individuals to interact effectively in digital environments (Cihak et al., 2015). Interventions such as video modeling do not provide the basic level of skill required for individuals with disabilities, to generalize skills across devices, settings, and contexts or to access and engage in digital environments (Buijs et al., 2017; Cihak et al., 2015). Rather, students with IDD learn to perform one task such as watching a video to help with a cleaning activity, but do not generalize beyond that skill. The device, instead of being used for multiple purposes. is used for the primary purpose of watching that one specific video. Furthermore, a body of research supporting evidence-based strategies and digital literacy is lacking. Therefore, research-based strategies need to be established and a shift to incorporate and include basic skills for use of digital environment such as email skills, net etiquette, safety skills, etc.

Students with IDD must be prepared with similar skill sets to maintain interactions with their environment, whether through the workplace, or navigating daily life experiences (Cihak et al., 2015). Unfortunately, these individuals are often left with deficits in digital literacy skills, due to educational plans and service provider plans focused on academic, social, and daily living skills (Buijs et al., 2017; Chadwick et al., 2016; Cihak et al., 2015). Acquisition of these skills are vital to increasing equity, post-

secondary opportunities, and autonomy of individuals with IDD (Casey & Bruce, 2011; Chadwick et al., 2016; Cihak et al., 2015).

Digital Divide, Post-Secondary Outcomes, and Transition

Digital media and technology have become embedded in our cultural practices and daily lives. Adults and adolescents are interacting and using digital technology with increased frequency with internet and social media usage falling around 90% (Pew Research Center, 2021). A survey study shared on NPR from Commonsense, stated that over 53% of children own a smartphone by the age of 11, and one in five children own a smartphone by the age of 8 years (NPR, October 31, 2019). According to Elmquist and McLaughlin (2018), 73% of adolescents have smart phones and access technology and social media frequently for self-expression, socializing, connecting with others while building a sense of community, as well as academic and business purposes (Elmquist & McLaughlin, 2018; Seok & DaCosta, 2017).

These results are mirrored with individuals with disabilities, as technology progresses so does their access and use, shaping daily life in both use and function for both individuals with IDD and their peers (Ayers et al., 2013; Cihak et al., 2015; Crook et al., 2017; Cummings & Rodriguez, 2017; Elmquist & Mclaughlin, 2018; Goo et al., 2019; Seok & DaCosta, 2017; Shaffer et al., 2015). Even though technology has become mainstream widening potential access, individuals with disabilities continue to fall behind peers in ownership and literacy illustrating a persistent digital divide (Reinhart et al., 2011).

Prior decades saw a digital divide influenced by access of technology. However, with increased widespread access over the past decades, this factor has become less

influential. Rather a lack of literacy and competency in skill sets have become heavy influencers in contributing and maintaining a digital divide (Dobransky & Hargittai, 2016; Reinhart et al., 2011; Tanis et al., 2012). Individuals are separated by their ability, or lack thereof, to use technology and digital platforms, resulting in inequities among specific demographics (Dobransky & Hargittai, 2016; Wehmeyer et al., 2008).

Individuals with IDD are more likely to fall in the group underutilizing technology (Tanis et al., 2012; Wehmeyer et al., 2008). This specific population may have limited access to resources and basic technology skill sets hindering employment opportunities, interactions and communication, and overall quality of life (Dobransky & Hargittai, 2016). As a result, this population is marginalized limiting their ability to participate fully in society, and potentially excluding individuals (Ayers et al., 2013; Buijs et al., 2017; Dobransky & Hargittai, 2016; Reinhart et al., 2011).

Post-Secondary Outcomes

Research supports positive impacts from increased technology use for individuals with IDD, including extension of physical abilities, facilitation of educational activities, and greater opportunities to socialize and participate within society (Buijs et al., 2017; Good & Fang, 2015; Tanis et al., 2012). Post-secondary outcome measures areas of life specifically, social, vocational, and domestic participation, with higher measures indicating a more successful integration and participation in society (Ayers et al., 2013).

However, post-secondary measures for individuals with IDD continue to falter behind measures of their same age peers and are less likely to meet the conditions associated with full participation in society (Ayers et al., 2013). Research outcomes for individuals with disabilities suggest that over 60% of individuals with IDD are

unemployed, limiting their presence in the work force (Bouck, 2017; Courtade et al., 2012). Additionally, individuals with disabilities are more likely to live in a lower income bracket, achieve lower levels of education and earn less than their nondisabled peers (Bialik, 2017; Pew Research Center, 2021). In 2015, the median salary earned by adults with a disability (16 years and older) was approximately $21,500, while peers without disabilities earned a median salary of $31,800, illustrating a clear deficit in earned income between the two groups (Bialik, 2017).

Additionally, Shaffer et al. (2005) reported over 60% of jobs now require competency with information technologies and will likely continue to grow, illustrating how digital technology continues to become a greater presence in society. In a 2008 study conducted by DiMaggio and Bonikowski internet use was associated with increased wages over time for U.S. workers in both home and workplace use. Likewise, internet use is also associated with increased life outcomes such as educational outcomes, increased access to employment, higher income, and maintaining social connections (Dobransky & Hargittai, 2016).

However, individuals with disabilities report a deficit in web-based skill sets, are less likely to access the internet from a smart phone and use the internet with less frequency (Dobransky & Hargittai, 2016; Sachdeva et al., 2015). They are more likely to rate themselves as insufficient in their ability to use the internet and other communication devices such as smart technology (Anderson & Perrin, 2017). Additionally, as technology advances, so do the challenges including design without considerations for people with disabilities, and the pace at which technology evolves (Dobransky & Hargittai, 2016; Tanis et al., 2012).

Post-secondary measures of independent living continue to remain low with only 22-27% of individuals with IDD reported living independently 2 years after leaving the K-12 educational environment and 13-22% reported living in a group home or supervised living arrangement (Ayers et al., 2013; Bouck, 2017). An 8-year follow up on post-secondary conditions highlighted 33-49% of those living independently or in a supported group home/supervised environment relied on food stamps illustrating financial dependency on government programs, and limited presence in the work force with over 60% of individuals unemployed (Courtade et al., 2011). Moreover, employment and postsecondary opportunities increasingly include some online component from online application processes, emailing, to social media job recruitment or training classes indicating the importance of digital literacy skill acquisition (Cihak et al., 2015).

Social Opportunities

Social interactions and opportunities have become digitalized through formats such as Facebook, video conferencing, and texting (Ayers et al., 2013; Cihak et al., 2015; Minsha et al., 2011). When social measures were reviewed, only 28-50% of the same individuals were found to be participating in social experiences including volunteer opportunities, attending religious institutions, and extracurricular activities such as clubs (Ayers et al., 2013; Bouck, 2017).

Results of a survey conducted by Carey et al. (2005) involving 83 adults with intellectual disability (ID) indicated only 41% of respondents reported using a computer. A smaller percentage 25% of respondents reported using the internet, falling below norm-aged peer groups. Email communication has become a predominant mode of

communication as was noted in the 2010 U.S. Census Bureau; however, a study by Palmer et al. (2012) reported only 18.7% of individuals with IDD had an email address.

These results indicate that after students with IDD leave the K-12 setting, their involvement within society decreases, employment and economic disparities widen, and digital literacy skills show a weakened presence (Ayers et al., 2013; Bouck, 2017). This is counter intuitive to the purpose of intervention and improving societal participation of individuals with IDD (Swain & Pearson, 2002). As the presence of technology expands so will the need for digital literacy skills. If these skills are not addressed within educational curriculum or through the goal planning and target skill acquisition of service providers for children and adolescents with IDD, these disparities will continue to persist with increasing rates (Swain & Pearson, 2002).

Safety

Concerns remain regarding digital literacy and the risks associated with use of digital platforms (Buijs et al., 2017; Good & Fang, 2015). Family members, educators, and service providers may be dissuaded or prevent individuals with disabilities from accessing or using technology for fear of potential risks. Research has documented individuals with ID have increased risks for becoming victims of sexual assault and financial schemes (Buijs et al., 2017; Chadwick et al., 2016; Good & Fang, 2015). However, with direct instruction on appropriate use and safety skills can decrease risk for individuals.

Teleconference Intervention Delivery

Teleconference, a form of service delivery where information and health related services are delivered by tele-communications, has been used to assist in provision of

care of services by healthcare providers, service providers, and more recently education providers (Pollard et al., 2017; Sandrock, 2010). Teleconference services have been documented in the research literature as a method of conducting formal assessments and observations (Wacker et al., 2013), training parents support service personnel (Benson et al., 2017; Neely et al., 2017; Tomlinson et al., 2018), and to provide intervention delivery. Recently, teleconference software has been used in the delivery of services within the educational and in-home intervention environments (Ferguson et al., 2019; Rispoli & Machalicek, 2020).

While research predominantly falls within assessment and intervention programs specific to training professionals, the field is still growing in the application of interventions using this delivery method with individuals with disabilities, especially beyond the paradigm of application with those with autism. However, with recent pandemic environmental constraints that attempt to limit contact and the spread of disease across vulnerable populations, teleconference provides a means to access for individuals in need of services and intervention without increasing risks of exposure. Furthermore, the use of teleconference methods allows the provision of services across distances that allow providers and families increase access to services (Ferguson et al., 2019; Rispoli & Machalicek, 2020).

Theoretical Framework

Applied Behavior Analysis

Behavior analysis is the science of behavior and has been the foundational framework that practitioners have grounded their practices in serving individuals with developmental disabilities for decades. Baer et al. (1968) first described the seven

foundational dimensions of behavior analysis, which include applied, behavioral, analytical, technological, conceptually systematic, effective, and generality. Each dimension guides those within the field and how they research, apply, and study behavior.

The first dimension, applied, addresses the concept of benefiting participants or society with the research. The second dimension, behavioral, describes the intervention, including operationalized descriptions of the dependent and independent variables in measurable, and observable terms. Analytical, the third dimension, addresses internal validity, directing systematic and controlled manipulation to determine cause and effect between variables. The fourth dimension, technological, states the need for replication and providing sufficient information regarding participants, settings, and procedures. Conceptually systematic, the fifth dimension, requires interventions and manipulated variables are grounded in research and conceptual theory of applied behavioral sciences. The sixth dimension, effective, requires socially important outcomes indicating value to the participant and society, often addressed or notes as social validity. The final dimension, generality reflects upon demonstration of effects across environments, people, and various settings, and maintained acquired skills (Baer et al., 1968; Gast & Ledford, 2014; Kazdin, 2011). This framework will inform the development and implementation of the proposed study.

Systematic Instruction and Systematic Response Prompting

Evidence-based instructional strategies refer to the practices, content, and programming that produces improved or positive outcomes, and is supported by a body of research (Spooner et al., 2012). Research has demonstrated that explicit teaching and

the use of systematic strategies such as systematic response prompting methods are effective evidence-based practices for skill acquisition for individuals with IDD (Collins et al., 2018; Jimenez & Saunders, 2019; Saunders et al., 2013; Saunders et al., 2018). Systematic response prompting specifies actions taken by the adult either prior to a student response or after an error is made, increasing probability of correct responses, and decreasing probability of incorrect responses (Saunders et al., 2013; Saunders et al., 2018).

This system ensures that the student has access to reinforcement by prompting correct responses while decreasing probability of incorrect responses, leading the student to increase probability of displaying the correct response under future similar environmental variables (Collins et al., 2018). Examples of systematic prompting include prompting procedures such as constant time delay, progressive time delay, system of least intrusive prompts, simultaneous prompting, and most-to-least prompts (Collins et al., 2018; Jimenez & Saunders, 2019; Saunders et al., 2013; Saunders et al., 2018). These systematic prompting procedures are used frequently in the field of educational and behavioral research regarding individuals with IDD and are associated with skill acquisition (Collins et al., 2018; Saunders et al., 2013).

System of Least Prompts

The system of least prompts is a form of systematic response prompting that provides increasing levels of assistance as needed for participant responses. The method has been established as an evidence-based practice both within educational and research environments, and across a variety of ages and skill domains (Chazin et al., 2020). This prompting method uses a structured format that includes provision of an instructional

cue, a period of wait time in which the individual is given the opportunity to respond independently, and then a hierarchy of assisting prompts that increases in level of intrusiveness as the prompter moves through it (Chazin et al., 2020; Shepley et al., 2019).

The prompting method provides the opportunity for independent responses, and if the participant is unable to respond, or fails to provide the correct response, then the next intrusive prompt is provided, followed by a more intrusive prompt if needed. Prompting hierarchies must have at least two prompts and increase in level of assistance with the last prompt, the controlling prompt, ensuring display of the correct response. This form of prompting is favored over other systematic response prompting methods due to its opportunity for independent responses, and decreased opportunities for prompt dependency in that only the level of needed assistance is provided.

Method

Participants and Setting

Following gaining Institutional Review Board approvals from both the school district and the university, recruitment took place through letters sent home via the classroom teacher. Recruitment letters included information about the study and contact information for investigators and were translated into both English and Spanish. An explanation of the purpose of the study was included along with a description of goals including increased use, understanding, and procedures for using email within a secure and monitored manner. Parent permission forms were returned with parent signatures and an indication of whether they approved participation in the study. Child assent was then collected by reading an assent script to the participant and gathering verbal agreement to

participate in the study. Both permission and assent were required to participate in the study.

Potential participants were selected using specific exclusion and inclusion criteria (See Figure 1). Participants had to be between the ages of 12-17 years of age without turning 18 years within 3 months at the time of recruitment. Participants had to have a formal diagnosis of an intellectual or developmental disability (ID, DD) meeting requirements set forth by the Individuals with Disabilities Education Act (IDEA), qualifying individuals for special education services. They had to attend a public middle or high school in the school district from which IRB approval was given and participate in a specialized education program for students with disabilities. A reading level of third grade or higher was required of participants. Participants also had to have basic experience with a computer including the ability to move a mouse to click/select, type or tap keyboard keys, or experience in the use of assistive technology such as speech-to-text software to compose and communicate written language. Potential participants not meeting these criteria were excluded from recruitment and participation in the study.

Additionally, consent and assent from both parents and potential participants were both required for participation in the study. If one party or both did not supply consent and assent, then the potential participant was excluded from participation. Finally, the specialized classroom in which they attended for part of their academic school day had to have a computer, laptop, or tablet device available for participant access during the study time frame. The device had to have consistent access to the internet and working audio and visual capabilities. Potential participants attending specialized classrooms without access to these standards were excluded from participation and recruitment.

Participants

Six participants were recruited for the study between 16-17 years of age (See Table 1). Four participants were male, and two participants were female. All participants had a formal diagnosis of ID, and Teresa, Lucia, and Berto also had a health impairment meeting requirements set forth by the Individuals with Disabilities Education Act (IDEA), qualifying individuals for special education services. Participants had access, within their special education classroom setting to a desktop computer with an internet connection, the ability to access a web browser, and access to a web camera. All participants had low adaptive assessment composite scores, except for Santino for whom specific scores were unavailable. Academic achievement test scores were below average to lower extreme average for sub tests including letter and word recognition, reading comprehension, written expression, and spelling for all participants. It should be noted that specific scores were not available for Lucia, but her file specifically labeled her skill levels as in the lower extreme range.

Additionally, the participants met criteria for basic computer operating skills including the ability to use a mouse or to click and select through other adaptive methods, the ability to type simple 3–4-word sentences, and a reading level of at least third grade.

Setting

Students were recruited from a classroom serving adolescents with IDD in a local school district. Participants attended a local high school and attended a specialized classroom setting for students with disabilities for at least a portion of the school day. The school district is located in an urban city in a western state. The district serves approximately 61,500 students. Approximately 47% of students qualify for free and

reduced lunch, 14% are considered English Language Learners, and 14% have an individualized education plan (IEP).

The study was conducted through the Zoom platform provided through the school district which provided teleconferencing services for employed teaching personnel. The subscription came with encryption, met FERPA compliance requirements, and required a unique meeting number and password to access the connection where the study was completed. Sessions took place via a specific and password protected Zoom internet room. The researcher joined from a computer in one location and the participants joined via a computer from their classroom. Participants used a computer located in a back corner of the room at the teacher's desk. Participants wore headphones to enhance audio volume from the teleconference platform and to block out some of the classroom noise while other students worked in the room. All sessions were video recorded and uploaded to a secure cloud server provided by the university and met privacy standards.

Materials

The study used Google Chrome as the web browser to access the internet and email due to its uniformity across devices and product software (Wook et al., 2019). Participants were likely to encounter this browser on computers and smart devices in school, personal, and work environments. The study used a researcher-created email account through Gmail by Google, which provides free email addresses. This email address was set up by the investigator to allow for administrative monitoring to ensure safety of participants. All communications received within the email address came from the researcher, and all sent communications were sent to email addresses maintained by

the researcher. This process provided an environment where email skills were taught and supervised within a contained space.

Each participant was given a visual support to access through all phases of the study (See Appendix A). The visual support information such username, password, and approved contact information with first and last names and email address. The participants were given a hard copy that remained in the classroom. The researcher also retained an electronic copy that was available to share during intervention phases.

Design

The study employed a multiple probe design across three behaviors that were similar in relation to email use, but functionally independent (i.e., compose, reply, add attachments). This design was selected due to appropriateness of investigating an intervention that involves the acquisition of multiple non-reversible behaviors. This design provides a structure to identify experimental control through the collection of baseline data across behaviors through probes and systematically introducing interventions to target one of three responses over time (Gast & Ledford, 2014, Horner & Baer, 1987). This approach allowed baseline probe data to be collected across behaviors periodically instead of continuous collection which could incur unwanted effects such as, reinforcement of undesired behaviors, participant fatigue, and complications with compliance. In addition, skills that have not yet been taught were unlikely to manifest without instruction; the design controlled for that possibility through periodic probe data collection of all three responses during the duration of the study. Periodic data collection assisted with documenting participant discrimination capabilities prior to and during intervention.

Two of the target responses were counter balanced, “Compose” and “Reply” to ensure experimental control. Because of the nature of the process for “Add Attachment” included procedural steps that could have influenced the acquisition of the other target behaviors, it remained the last behavior targeted for all participants. Targeted skills were counterbalanced as follows:

- Participant 1 (Juan)- (A) Compose, (B) Reply, (C) Add Attachments
- Participant 2 (Teresa)- (A) Compose, (B) Reply, (C) Add Attachments
- Participant 3 (Lucia)- (B) Reply, (A) Compose, (C) Add Attachments
- Participant 4 (Berto)- (B) Reply, (A) Compose, (C) Add Attachments
- Participant 5 (Orlando)- (B) Reply, (A) Compose, (C) Add Attachments
- Participant 6 (Santino)- (A) Compose, (B) Reply, (C) Add Attachments

Additionally, replicating the study across three or more participants and the counterbalance of targeted behaviors aided in decreasing threats to internal validity (Gast & Ledford, 2014; Horner et al., 2005). The intervention was systematically introduced over time with each participant. Participants were required to meet a minimum criterion of 80% independence across a set of chained steps for three consecutive sessions to move to the next phase of the study. This ensured a measure of control over internal and external environmental factors, including identifying and controlling through data-based review of level and trends between and within phases, and across behaviors and participants (Gast & Ledford, 2014). A minimum of five data points were collected for each phase through probes and data had to show stability prior to introduction of the intervention and moving from phases.

Dependent Variable

The dependent variable was similar across all three behaviors and measured the percentage of steps completed independently. Each skill was task analyzed (See Table 2) for identifying the chained steps required to complete the targeted behaviors (i.e., composing an email, replying to an email, adding an attachment). Percentage of independently completed steps was calculated by totaling the number of steps completed independently and then dividing by the total number of steps in the chained task. The same dependent variable measure was used during all phases (i.e., baseline, intervention, and maintenance).

Independent Variable

The independent variable, delivered via teleconference software, was an intervention package introduced systematically across behaviors and participants. The intervention utilized systematic direct instruction using the system of least prompts to target acquisition of the specified chained steps for behaviors "compose email, "reply to email," and "add attachments." The first participant received the intervention after baseline data included at least five data points and showed stability. Similar standards were required for introduction of the independent variable for each participant. Each target behavior had a set of steps taught in a specific order using systematic response prompting to ensure the participant emitted the correct response for each step. The system of least-to-most response prompting was used for fading assistance during intervention.

Data Collection

Data were collected each school day, averaging four to five sessions a week. The sequence of chained skills was marked with either "+" for correct completion of steps or

"-" for incorrect responses during baseline data collection. During intervention, data were collected by marking independent responses with "+" or recording the prompt level required for step completion. Data were collected simultaneously while the participant was responding.

Inter-rater Reliability

Data collection procedures were practiced prior to the start of the study. The researcher was the primary data collector and the co-investigator completed reliability checks via video recordings of the sessions. Agreement criterion reached at least 90% agreement on trial-by-trial measures for data collection prior to collecting initial data for the study. Inter-rater reliability, also known as inter-observer agreement (IOA), checks were completed by using point-by-point methodology for at least 30% of sessions during each phase across all participants. Reliability checks were conducted by a review of recorded video segments. Video recordings were stored on a secure server provided by the university. IOA was calculated by taking the number of agreements and dividing it by the number of agreements plus disagreements and multiplying by 100. IOA for baseline for Reply averaged 98% (Range 86-100%), for Compose the mean was 98% (Range 86-100%), and for Attach the mean was 99% (Range 86-100%). For intervention, IOA was 100% for Reply, 94% (Range 77-100%) for Compose, and 95% (Range 71-100%) for Attach. Finally, for maintenance IOA was 100% for Reply, 97% (Range 77-100%) for Compose, and 100% for Attach.

Procedures

Pre-Baseline

The primary researcher set-up specific email addresses, login, and password information for use by each participant using Gmail. The researcher maintained all listed email addresses during the duration of the study, which included verifying e-mail exchanges, inbox materials, and login use. The researcher also retained an electronic and hard copy of the visual support should the researcher need to share it during experimental phases. A technology check was completed prior to baseline with the classroom teacher and student prior to beginning baseline procedures ensuring access to internet, participant familiarity with mouse and keyboard use, specify teacher role during sessions, access to the selected teleconference system Zoom platform, and a working audio and video connection.

Baseline

Participants accessed a desktop computer located in their classroom and connected via the internet to a private, FERPA compliant Zoom video conference room for each session. The researcher completed set up procedural checks prior to beginning any baseline data collection. This included verifying through visual checks that participants had the visual support and audio and technology checks verifying all parties were able to hear and be seen. The researcher then shared their desktop screen remotely and verified it was seen by participants The participant was given remote control of the researcher's computer, verified by having the participant move the mouse demonstrating remote control. The participant was then given the instructional prompt for the target behavior probe (e.g., "Send __ an email," with the name of the recipient filling in the blank). Participants were given positive verbal praise in the form of the following phrase,

"Thank you for getting started," for any initiation or attempt to complete the task within 30 s. Additionally, during baseline probe sessions for skill (B) "Reply" and skill (C) "Add Attachment" the participants were given verbal praise for reading the emails out loud in the form of a verbal statement "Nice reading." Since the research project was not measuring reading comprehension or fluency, if the participant struggled to read or identify a word while reading an email in either of these targeted behaviors, the researcher provided the word verbally to the participant.

The task ended when either 30 s had been reached without any initiation attempts, the participant indicated they were done, or the participant indicated they did not know what to do or could not complete the task. If the participants asked questions or asked for help excluding the request to identify a word in an email, the investigator responded with comments of encouragement such as "do your best" or "do what you can," but did not assist during the baseline probe. A "+" was recorded for any steps completed independently and "- "for incorrect or incomplete steps (See Appendix B, Appendix G, Appendix J).

Sessions were recorded for inter-rater reliability and procedural fidelity checks were conducted by a secondary researcher using a procedural checklist (See Appendix C, Appendix F, Appendix K). Data were collected for at least five sessions across behaviors for participants and required stability prior to transitioning to intervention phases.

Intervention

Prior to the start of each session, set up procedures were completed based on the target behavior (See Appendix E, Appendix H, Appendix M). Browser checks were completed to ensure the browser was up to date and any previously accessed sites and

information were cleared. The inbox was checked and cleared of any drafts or sent emails from previous sessions. If intervention required email probes, then they were sent prior to beginning the session with the participant. For example, an e-mail must be sent to the participant prior to beginning the trial for "replying to an email." In addition, the inbox for the e-mail retained at least two or three emails to provide continuity across phases, reflect similar environmental experiences of email use, and avoid potential discriminative stimuli (e.g., an empty inbox would suggest the need to compose email versus emails available to indicate a need to reply). Rather, the participant needed to listen to the instructional cue to determine the action required. Once these preparation checks were finished, participant checks were completed. Participant checks were similar to baseline and included technology checks (i.e., audio and visual checks, screen sharing, confirmation of remote access) and ensuring access to the visual support (See Appendix A).

Intervention across all skills utilized an intervention package of direct instruction and systematic response prompting. Each phase had a specific instructional cue that was provided and a response prompting hierarchy that was followed to ensure the participant emitted the correct response (See Appendix D, Appendix I, Appendix L). Content such as subject, greetings, and closings were not provided unless the participant reached the prompt hierarchy level in which examples were to be given. This was done to help facilitate independence and creation of original compositions from participants.

A system of least intrusive response prompting was used during direct instruction. This form of systematic prompting paired with systematic instruction employs a strong evidence-base, is demonstrated to be effective for individuals with IDD, and is self-

fading limiting prompt dependency (Saunders et al., 2013). The system of least prompts was embedded in the data form for each target behavior guiding the researcher through each prompt hierarchy specific to each step (See Appendix D, Appendix I, Appendix L). The following is a breakdown of the prompt hierarchy from least intrusive to most intrusive:

1. Indirect Verbal (IV): Unspecific verbal statement or question related to step completion (e.g., "what should you do next?")
2. Direct Verbal (DV): Specifically telling the participant the step (e.g., "Type a greeting.")
3. Specific Direct Verbal (SDV): A more specific verbal direction (e.g., "Type 'hello'.")
4. Visual Model (VM): To be used with filling in username and password only. The prompt involves showing the visual support and highlighting the information to be entered
5. Partial Model with verbal (PM): This prompt level incorporates the partial completion of the step with a verbal prompt (e.g., Typing the "H" from hello and a verbal statement to type "Hello")
6. Full Model (FM): This prompt entails the researcher completing the whole step (e.g., typing the word "Hello")

After the instructional cue participants were provided 3-5 s of wait time before initiating the next intrusive prompt, unless there was a documented requirement for a longer wait time. If the participant attempted an incorrect response, the researcher immediately provided the pre-determined, next intrusive prompt as a method of error

correction. Each chained step acted as the discriminative stimulus for the following step. Verbal praise was provided directly after the participant initiated the trial (i.e., moving the mouse, attempting to type) and consisted of the phrase, "Thank you for getting started."

Additionally, for the "reply" and "attachment" behaviors, the researcher also provided praise for reading out loud since the skills required comprehension of the sent message but were not a focus of intervention. Since the research project was not measuring reading comprehension or fluency, if the participant struggled to read or identify a word while reading an email in either of these targeted behaviors, the researcher provided the word verbally to the participant. Verbal praise was provided by emitting the phrase, "Nice reading," to the participants after reading was complete. Verbal praise for participation was provided at the conclusion of the session and included a close variation of the phrase, "thank you for working or completing the task today."

Data were collected on the number of steps completed in the chained task analysis independently and divided by the total number of steps. Sessions were recorded and viewed by a secondary researcher for inter-rater reliability and procedural fidelity checks using a procedural checklist (see Appendix E, Appendix H, Appendix M). Participants were required to meet mastery criterion of a minimum of 80% independent completion of steps across three consecutive sessions to transition to intervention with the next targeted behavior. This percentage was determined by reviewing the components of the task analysis and determining that elements such as the greeting and closing while targeted do not inhibit the action of sending an email communication; therefore, allowance of two missed independent steps were afforded to the participant to assist in progression to the

next targeted skill. While a greeting and/or closing are needed for appropriate letter structure, their absence neither restricts nor impedes the participant's ability to compose and send information through an email. After the participant reached mastery criterion for an intervention phase, baseline probe data were collected over a minimum of three sessions prior to introduction of intervention for the next behavior. This was done to control for confounding variables and maintain internal validity (Gast & Ledford, 2014).

Maintenance

Maintenance probes were conducted upon conclusion of an intervention phase. Procedures mirrored those utilized for each targeted behavior during baseline. Procedural checks were completed by the researcher prior to data collection. This included resetting web browser settings and clearing username and password information, clearing draft, and sent email from the inbox, and sending any required emails from designated outside accounts. Technology checks were then completed to ensure audio and visual technology was working and that the participant was able to access the researcher's desktop remotely. Then, depending on the behavior for which maintenance probes were being conducted, the researcher proceeded with the instructional cue for that skill, as was done in baseline. The researcher refrained from providing instruction or response prompting and ended the maintenance probe session after 3-5 seconds of inactivity, completion of the skill, or the participant indicated they were done. Maintenance data were collected in succession for at least three data points prior to intervening with a new skill. Once participants had reached mastery criteria for all three targeted skills maintenance probes were conducted once per week for each skill.

Procedural Fidelity

Practice sessions were completed prior to baseline and intervention phases for each skill. This ensured the researcher successfully demonstrated proficiency in moving through steps and procedures prior to implementation. A procedural checklist was compiled including the required steps within each target behavior and will be checked off by the researcher as they are completed (See Appendix C, Appendix E, Appendix F, Appendix H, Appendix K, Appendix M). The procedural checklists included preparation steps with guidance on how to verify its completion with the secondary research, if completed outside the recorded video. For example, in both "reply to an email" and "attach a document," the researcher was required to send an email from the instructional accounts prior to the instructional session with the participant. However, the secondary researcher was able to verify that the email was sent by the presence of the email in the participant's inbox at the start of the instructional trial (See Appendix H, Appendix K).

Emails alternated between four separate email accounts maintained and used by the researcher (See Appendix A). Email address incorporated names similar and different to recipients' names, and a variety of domains (i.e., Yahoo Mail, Gmail, Outlook) to facilitate generalization of skills across a variety of e-mail addresses. Specific to the behavior of "attaching a document to an email," an email was sent to the participant that requested a specific document be attached and sent. The requested documents were previously loaded on the researcher's computer under a folder titled "Attachments." When the participant selected the attachment action on the email during a probe, the attachment folder opened with multiple files listed. Technology -checks were included within the procedural checks lists and conducted prior to beginning the probe.

A second researcher verified procedural fidelity through in-vivo or recorded video segments for at least 30% of sessions across all phases and all participants. Procedural fidelity for baseline for Reply averaged 97% (Range 93-100%), for Compose the mean was 97% (Range 87-100%), and for Attach the mean was 99% (Range 93-100%). For intervention, procedural fidelity averaged 99% (Range 94-100%) for Reply, 97% (Range 89-100%) for Compose, and 99% (Range 96-100%) for Attach. Finally, for Maintenance procedural fidelity averaged 97% (Range 93-100%) for Reply, 99% (Range 93-100%) for Compose, and 96% (Range 93-100%) for Attach.

Social Validity

Social validity surveys were provided to parents, teachers, and participants prior to beginning the study (See Appendices N-P). The intent was to also provide all parties with post-intervention surveys; however, due to time constraints related to the end of the school year, only post-study surveys from participants and the teacher were collected. Social validity surveys for adolescent participants included a self-assessment regarding email and tech skills given both pre- and post-study surveys and, an intervention rating scale adapted from the Children's Intervention Rating Profile (CIRP; Turco & Elliott, 1986). Parents were given a similar skill assessment survey in which they ranged agreement with statements about their child's ability and skills. The classroom teacher was given similar skill assessment surveys to complete for each participant prior to and at the conclusion of the study. In addition, the classroom teacher was given an intervention inventory to complete at the conclusion of the study. Scores for pre- and post-assessment were reviewed regarding changes in perception of skills, as well as trends and themes within the adapted surveys. All six participants completed the pre- and post-study survey

for a 100% return rate. All six participants also completed the intervention rating scale for a 100% return rate.

Half of parents returned the pre-study surveys for a 50% return rate. As mentioned before, post-study surveys failed to go out due to the end of the school year and thus there are no scores available. Return rates for the teacher pre- and post-study surveys was 100% (See Appendix N). The classroom teacher completed both surveys for each participant. Additionally, the classroom teacher was given an adapted Treatment Evaluation Inventory (TEI; Kelley et al., 1989) to complete after the conclusion of the study (See Appendix O).

Data Analysis

Visual analysis, the standard for single subject research, was the primary means for ongoing analysis, transitioning between phases and synthesizing results (Gast & Ledford, 2014; Horner et al., 2005). Visual analysis was an ongoing procedure that was conducted throughout all phases of the study and used to identify timing for introduction of intervention. Data for each phase and target behavior were represented on a line graph. The y-axis represented the percentage of steps independently completed. The x-axis presented each session. A solid line indicated a change in phase including baseline and intervention phases for each target behavior. A dotted phase line represented a transition to a maintenance phase. Visual analysis was conducted by identification of data patterns, comparisons of changes in levels and trends, direction of trend (therapeutic, counter-therapeutic), analysis of magnitude and immediacy of change, and variability and stability of data points, and overlap of data points within and across phases.

The stability envelope analysis was set at 25% for all phases. Analysis used the following standard to determine variability and stability requiring at least 80% of the data range to fall within 25% of the median value. If data met these criteria, then data were scored as relatively stable with low variability. If less than 80% of the data fell within the 25% median range, then data were scored as more variable (Gast & Ledford, 2014).

The split-middle method was used to determine trend within a single condition and divided data into two halves. An ordinate value was determined for each half by calculating the mid-rate and mid-date value. The ordinate values were then linked with a line which reveals the trend direction (e.g., accelerating, decelerating, zero-celerating) (White & Haring 1980; as cited by Gast & Ledford, 2014, p.183) In addition to the split-middle method, the relative level of change was calculated to determine if the trend for a set of data were therapeutic or contra therapeutic (Gast & Ledford, 2014). Analysis used the median of the first and last 3-5 data points of each phase to determine trend direction. The smaller of the medians was subtracted from the larger value and then interpreted for directionality.

Effect size measures were calculated by determining PND (percent of non-overlapping data) for all three targeted skills (Gast & Ledford, 2014; Horner et al., 2005; Lee & Cherney, 2018; Parker et al., 2011; Scruggs & Mastropieri, 1998). PND was calculated by selecting the highest value in baseline and drawing a horizontal line through intervention. All data points above the line in intervention were counted and then divided by the total number of points in intervention phase. The total was then multiplied by 100 to form a percentage. The percentage was then compared to a scale described by Scruggs and Mastropieri (1998) to determine intervention effectiveness. Percentages 49

and below were scored as ineffective, 50-70 as questionable effectiveness, 70-90 as effective, and 90 or above as very effective.

Results

Juan

Compose

Juan's baseline performance for skill (A) "Compose" averaged 67% independence across sessions (See Figure 2). Data within baseline had some variability, with 67% of the data points falling within the stability envelope of ± 25% of the median value of 73 [range: 54.75- 91.25]. The split middle method was used to determine trend direction and revealed a slight decelerating trend. The relative level change had a value of 8 and indicated a contra-therapeutic trend.

Intervention was introduced for skill (A) "Compose" during session 7 with Juan performing 69% independent completion of steps which overlapped with baseline data. In intervention session 8, behavior increased to 85% independent completion of steps, but varied for several subsequent sessions. Performance alternated between 77% and 85% independent completion of steps for sessions 9-12. During session 13, an accelerating trend emerged and continued, with Juan reaching mastery criterion of 80% or higher for three consecutive sessions within a total of 8 intervention sessions (See Table3).

Juan's attendance was steady during intervention with zero absences (See Table 4). His performance averaged 83.75% independent completion of steps. Variability was low with 100% of data points falling within the stability envelope of ± 25% of the median value 85 (range: 63.75-106.25). The split middle method revealed an accelerating trend, and the relative level change had a value of 6.2 indicating a therapeutic trend. A total of

three of the eight data points overlapped with baseline data for a PND value of 63% (See Table 5; Scruggs & Mastropieri, 1998).

Maintenance probe data were collected for sessions 15-40. Maintenance probe data were collected consecutively prior to intervening with a new behavior. Once Juan demonstrated maintaining mastery across three maintenance probes, maintenance moved to collection once per week. Performance values remained consistent with intervention falling between 92%-100% independent completion of steps for up to 7 weeks following the conclusion of intervention for skill (A) "Compose."

Reply

Overall, baseline probe data for the second targeted skill (B) "Reply," indicated an accelerating trend and a relative level of change value of 14 indicating a therapeutic trend. However, when "Reply" baseline data were analyzed, carryover from the introduction of intervention for the previous target skill (A) "Compose" was identified leading to an increase in baseline data for "Reply," even though intervention had yet to be applied to skill (B) "Reply."

Baseline data were split into two halves for analysis with the first half of baseline encompassing sessions 1-7, and the second half sessions 12-19 aligning with data after intervening with skill (A) "Compose" target skill. The first half averaged 57% independent completion of steps, ranging between 43%-71% with 100% of data points falling within the stability envelope of ± 25% of the median value 57 (range: 42.75-71.25), and indicated low variability with a stable 0% slope for trend using the split middle method. The second half of baseline data averaged 76.12% independent completion of steps with 83% of data falling within the stability envelope of ± 25% of the

median value 78.5 (range: 58.87-98.13) indicating low variability in data. The split middle method revealed a decelerating trend and had a relative level change value of 0.

Introduction of intervention took place during session 20. Juan had three data points already over 80% during baseline, for this reason mastery criterion was increased and required 100% independent step completion across three consecutive sessions. Juan met this mastery criterion within eight intervention sessions (See Table 3). He had consistent attendance during intervention with zero absences (See Table 4). Juan's performance averaged 91% independent step completion with 100% of data points falling within the stability envelope of ± 25% of the median value 86 (range: 65.5-107.5). Variability was low and data were stable within the data set. The split middle method revealed an accelerating trend, and the relative level change value was 14 indicating a therapeutic trend. Four data points overlapped with baseline for a PND value of 50% (See Table 5; Scruggs & Mastropieri, 1998).

Maintenance probes were conducted for Skill (B) "Reply" after reaching mastery criterion for probe sessions 28-40. Probes conducted during sessions 28-32 were collected consecutively prior to intervening with the third and final skill (C) "Add attachment." Once Juan had mastered all three skills, all maintenance schedules moved to a weekly probe session for all three skills. Data collected during probe sessions 39 and 40 were collected once per week. Performance during maintenance for skill (B) "Reply" varied between 86-100% independent completion of steps for maintenance probes up to 4 weeks post-intervention. A single outlier data point during session 30 of 57% independence occurred; however, performance returned the following session to 86% and

remained high for subsequent data points. The return to consistent levels of performance indicates retention of skill (B) “Reply.”

Attach

Baseline data for skill (C) “Add Attachments” averaged 68% independent completion of steps (range 29%-86%) with 87.5% of data points falling within the stability envelope of ± 25% of the median value 71 (range: 53.25-88.75) indicating low variability and stability across the phase. The trend was determined using the split middle method and revealed a zero-celerating trend with a relative level change value of 0.

Intervention procedures for skill (C) “Add Attachment” were implemented during session 31. Attendance was consistent during intervention with zero absences (See Table 4). Juan’s performance averaged 91% independent step completion with 100% of data points falling within the stability envelope of ± 25% of the median of 93 (range: 69.75-116.25) indicating low variability within the phase. The split middle method indicates an accelerating trend with a relative level change value of 14 indicating a therapeutic trend. Juan reached mastery criterion averaging 100% independence across three consecutive sessions within eight intervention sessions (see Table 3). Four intervention data points overlapped with baseline data for a PND value of 50% (See Table 5; Scruggs & Mastropieri, 1998).

Maintenance probes were conducted once per week for 2 weeks after reaching mastery criterion for skill (C) “Add Attachment.” The first week Juan maintained performance levels with 100% independent completion of steps. However, the following week his performance fell to 42% independent completion of steps. It should be noted

that this measure took place during the last days of school and instead of following steps to reply to email and include an attachment, Juan only replied to the email.

Teresa

Compose

Teresa's baseline performance for skill (A) "Compose" averaged 0% independence across sessions (See Figure 3). Performance remained stable throughout the phase with 100% of data points falling within the stability envelope ± 25% of the median value 0. The split- middle method was used to determine trend direction and revealed a zero-celerating trend with a relative level change value of 0.

Intervention procedures were implemented during session 6 for skill (A) "Compose" with immediate effects on performance (See Table 3). Teresa's performance improved from 0% independence during baseline to 54% independence. Teresa's performance averaged 79% independence with performance varying between 54% to 100% independence. She met mastery criterion of 80% or higher independent completion of steps for three consecutive sessions within 7 intervention sessions.

Teresa had two absences during intervention (See Table 4). Data had some variability with 71% of data points falling within the stability envelope of ± 25% of the median value 85 (range: 63.75-106.25). The split method revealed an accelerating trend, and the relative level change had a value of 23 indicating a therapeutic trend. Data points did not overlap with baseline data for a PND value of 100% (See Table 5; Scruggs & Mastropieri, 1998).

Maintenance probes were conducted during probe sessions 13-31 over a 7-week period. Data collected during probe sessions 13-16, and 24-27 were collected consecutively prior to the introduction of intervention phases for skill (B) "Reply" and (C) "Add Attachment." Probe data collected during session 31 was collected once a week following mastery of all three skills. Teresa maintained high levels of independence during maintenance probes varying performance between 92%-100% independence. This performance remained consistent up to 7 weeks post intervention for skill (A) "Compose" suggesting retention of the skill.

Reply

Teresa's baseline performance for skill (B) "Reply" averaged 82% independence across sessions (See Table 3). Data within baseline were relatively stable and had low variability with 100% of data points falling within the stability envelope of ± 25% of the median value 86 (range: 64.5-107.5). The split-middle method was used to determine trend direction and revealed a slightly accelerating trend with a relative level change of 15. However, when looking at the last five data points within the condition, slope remained zero-celerating with no variability across data points. Because Teresa demonstrated some skill ability within baseline, the mastery criterion for intervention was changed to reflect 100% independent step completion across three consecutive sessions. This was done to refine the skill set in preparation for the final skill (C) "Add Attachment."

Intervention procedures were introduced for skill (B) "Reply" during probe session 16 (See Table 3). Performance average during the intervention phase was 89% independence with performance ranging between 71%- 100% independence. Mastery

criterion of 100% independence across three consecutive sessions was met within 8 intervention sessions. Teresa had one absence during intervention (See Table 4).

Variability within intervention was low with 100% of data points falling within the stability envelope of ± 25% of the median value 86 (range 64.5-107.5). The split middle method revealed an accelerating trend, with a relative level change value of 14 indicating a therapeutic trend. Magnitude levels were minimal as the effects of the intervention did not appear until probe session probe 21, the sixth probe in a set of eight required to reach mastery. Five data points overlapped with baseline data for a PND value of 38% (See Table 5; Scruggs & Mastropieri, 1998).

Maintenance probes were conducted across sessions 24-31. Maintenance probes conducted during probe sessions 24-27 were collected consecutively prior to the introduction of intervention of the final skill (C) "Add Attachment." Data collected during session 31 was done once that week with Teresa meeting mastery on the final skill (C) "Add Attachment." Teresa's post-intervention performance varied between 86-100%. Performance remained consistent 3 weeks after intervention for skill (B) "Reply."

Attach

Teresa's baseline performance for skill (C) "Add Attachments" averaged 27% independence across sessions (See Table 3). Data points within baseline had low variability and were stable with 86% of data points falling within the stability envelope ± 25% of the median value 29 (range: 21.75- 36.25). The split middle method confirmed a zero-celerating trend and a relative level change of 0.

Intervention procedures were introduced during session 27 for skill (C) "Add Attachment" (See Table3). Immediate intervention effects were observed within the

initial intervention session increasing independence from the average of 27% in baseline to 57% independence. Teresa's average performance during intervention was 86% independence across session. She reached mastery criterion of 80% independence across three consecutive sessions, within 4 intervention sessions. Attendance was consistent with zero absences during intervention (See Table 4).

Data had some variability with 75% of data falling within the stability envelope of ± 25% of the median value 93 (range: 69.75-116.25). The split middle method revealed an accelerating trend with a relative level change value of 28.5 indicating a therapeutic trend. Intervention data points did not overlap with baseline data resulting in a PND value of 100% (See Table 5; Scruggs & Mastropieri, 1998).

A maintenance probe was completed a week after the conclusion of intervention. Teresa maintained 100% independence for the target skill (C) "Add Attachment." Due to the school year ending and mastery occurring near the last day of school, further opportunities to collect maintenance data were not available for this behavior.

Lucia

Reply

Lucia's baseline performance for skill (B) "Reply" averaged 11% independence across sessions (See Figure 4). Data within baseline had low variability and were relatively stable with 80% of the data points falling within the stability envelope of ± 25% of the median value 14 (range: 10.5-17.5). The split-middle method was used to determine trend and revealed a slight accelerating trend that was influenced by one data point with a score of 0%, while the other four points in the baseline were scored as 14%

independence, with the last three points showing a plateau in performance. The relative level change value for baseline was 7%.

Intervention procedures for skill (B) "Reply" were implemented during probe session 6 with the initial data point overlapping with baseline data (See Table 3). However, performance increased during session 7 to 38% independence, initiating an accelerating trend during intervention. Lucia's average performance was 60% independence with Lucia reaching mastery criterion after completing 9 intervention sessions.

Due to the steep accelerating trend, some variability was present across data with 33% of data points falling within the stability envelope of ± 25% of the median value of 71 (range: 53.25-88.75). The relative level change value was 64 indicating a therapeutic trend. A single data point overlapped with baseline data for a PND value of 89% (See Table 5; Scruggs & Mastropieri, 1998). Lucia had a total of four absences during the intervention phase (See Table 4).

Maintenance probes were conducted during probe sessions 15-37. Data collected during probe sessions 15-18 and 28-31 were done consecutively to capture performance stability prior to intervening with skills (A) "Compose" and (C) "Add Attachment." Data collected during probe session 37 occurred once that week following the mastery of the final skill (C) "Add Attachment." Maintenance data were collected over a 6-week period. Lucia's average performance for skill (B) "Reply" was 94% independence. Performance was consistent throughout maintenance probes with little variability and performance frequently at 100% independence suggesting retention of skill 6-weeks after the conclusion of the intervention phase for skill (B) "Reply."

Compose

Lucia's baseline performance for skill (A) "Compose" averaged 0% independence across sessions (See Figure 4). Performance remained consistent and stable throughout baseline with low variability and 100% of data points falling within the stability envelope of ± 25% of the median value 0. The split middle method revealed a zero-celerating trend and had a relative level change value of 0.

Intervention procedures for skill (A) "Compose" were implemented during probe session 18 with immediate effects on Lucia's performance (See Figure 4). Lucia's performance increased from the average of 0% independence during baseline to 38% independence during the initial intervention probe session. Her average performance during intervention was 70% independence. Lucia reached mastery criterion of 80% or higher independent completion of steps across 3 consecutive sessions after 10 intervention sessions. She had a total of three absences (See Table 4).

Data were stable and had low variability with 80% falling within the stability envelope of ± 25% of the median value 77 (range: 57.75-96.25). The split middle method revealed an overall accelerating trend with a relative level change value of 16 indicating a therapeutic trend. None of the data points overlapped with baseline data for a PND value of 100% (See Table 5; Scruggs & Mastropieri, 1998).

Maintenance probes were conducted post-intervention for skill (A) "Compose" during probe sessions 28-37 across a period of 4 weeks. Maintenance probes conducted during probe sessions 28-31 were collected consecutively prior to intervening with the final skill (C) "Add Attachment." Maintenance probe conducted during session 37 was collected once that week after Lucia reached mastery criterion for the final skill (C) "Add

Attachment." Lucia maintained performance and averaged 93.8% independence levels with a range of 85%-100%. These data remained consistent over a 4-week period that also included a 10-day exclusion due to school district COVID health policies.

Attach

Lucia's baseline performance for skill (C) "Add Attachment" averaged 22% independence across sessions (See Figure 4). Based on the split-middle method, trend was accelerating with a distinct increase in performance during probe session 10. The relative level change had a value of 43 indicating a therapeutic trend. Analysis of combined phase data points indicated variability and instability with 14% of data points falling within the stability envelope indicating instability and variability among data points. Further visual inspection identified Lucia's performance increased after the introduction of intervention during the initial target skill (B) "Reply," suggesting possible carryover effects. Therefore, baseline probe data were split into sections, the first encompassing data prior to the introduction of intervention for skill (B) "Reply" probe sessions 1-6, and the second section after the implementation of intervention for "Reply" probe sessions 7-29.

Baseline data showed two patterns. The split middle method was reapplied to the first set of data points during baseline probe sessions 1-6 and indicated a zero-celerating trend with an average of 0% independent completion of steps. Data had little variability and 100% of data points in the set falling within the stability envelope ± 25% of the median value 0.

The second set of data from baseline probe sessions 7-29 had an increase in performance from 0% independence average performance to 40% independence.

Variability was minimal with data varying between 29%-43% independence. The data set had stability and minimal variability with 75% of data points falling within the stability envelope of ± 25% of the median value 43 (range: 32.25-53.75). The trend remained consistent with zero-celeration (split middle method) and a relative level of change value of 0.

Intervention procedures for skill (C) "Add Attachment" were implemented during session 30 (See Figure 4). Immediate intervention effect was observed with Lucia's performance increasing to 71% independent completion of steps. Her average performance was 81% independence. Lucia met mastery criterion within 6 intervention sessions and had consistent attendance with zero absences (See Table 4). Using the split-middle method an accelerating trend was revealed with a relative level change value of 15 indicating a therapeutic trend. The data set had variability with 33% of data points falling within the stability envelope of ± 25% of the median value 78.5 (range: 58.87-98.13). Data points did not overlap with baseline data for a PND value of 100% (See Table 5; Scruggs & Mastropieri, 1998).

Due to limitations by the school schedule, one single maintenance probe was conducted prior to the end of the school year. This data point indicated retention of skills with performance at 100% independence. However, it is unknown if Lucia retained the skill beyond that week.

Berto

Reply

Berto's baseline performance for skill (B) "Reply" averaged 40% independence across sessions (See Figure 5). Data within baseline had some variability with 60% of

data points falling within the stability envelope of ± 25% of the median value 57 (range: 42.75-71.25). The split middle method was used to determine trend and revealed an accelerating trend with a relative level change of 43 indicating a therapeutic trend. However, the last three data points prior to intervention remained stable, with no variability and zero-celerating trend.

Intervention procedures were introduced for skill (B) "Reply" during probe session 6 (See Figure 5). Intervention effects were delayed and did not occur until probe session 9. Berto's performance averaged 65% independence. He met mastery criterion within 6 intervention sessions (See Table3). Berto had consistent attendance with zero absences during intervention (See Table 4).

Data showed some variability with 50% of data points falling within the stability envelope ± 25% of the median value 71.5 (range: 53.64-89.36). The split middle method revealed an accelerating trend with a relative level change value of 57 indicating a therapeutic trend. Three data points overlapped with baseline data for a PND value of 50% (See Table 5; Scruggs & Mastropieri, 1998).

Maintenance probes were conducted post-intervention for skill (B) "Reply" during probe sessions 12-32 and spanned across a 9-week window. Maintenance probes collected during probe sessions 27-32 were completed once per week after Berto had reached mastery criterion for all three target skills. Berto's average performance during maintenance was 83% independence primarily varying between 86%-100% independence. Berto maintained performance through the 9-week maintenance window suggesting retention of the skill 2-3 months after intervention.

Compose

Berto's baseline performance average for skill (A) "Compose" was 1% (See Figure 5). Data within baseline had low variability and were stable with 88% of data points falling within the stability envelope of ± 25% of the median value 0. The split middle method of analysis revealed a zero-celerating trend with a relative level change value of 0.

Intervention procedures were introduced for skill (A) "Compose" during session 12 (See Figure 5). Immediate intervention effects were observed with independence levels increasing from an average performance of 1% in baseline to 15% independence in intervention. Berto reached mastery criterion within 8 intervention sessions (See Table 3) and had consistent attendance with zero absences (See Table 4). His average performance for intervention was 68% independence across sessions. Data within intervention had variability with 29% of data points falling within the stability envelope of ± 25% of the median value 69 (range: 51.75-86.25). Split middle method of analysis revealed an accelerating trend with a relative level change value of 46. Data points in intervention did not overlap with baseline data resulting in a PND value of 100% (See Table 5; Scruggs & Mastropieri, 1998).

Maintenance probes were conducted post-intervention for skill (A) "Compose" during probe sessions 20-32, over a 7-week period. Maintenance probes were conducted consecutively for probe sessions 20-23 prior to the introduction of the intervention phase targeting the final skill (C) "Add Attachment." Maintenance probes conducted during probe sessions 27-32 were done weekly following mastery of the final target skill (C) "Add Attachment." Berto's maintenance performance averaged 91% independence across sessions indicating retention of skill. Performance was primarily between 92%-

100% independence with a few outlier data points averaging 69% independence. Probe data demonstrated some variability with a few data points at 69%, but primarily between 92-100%.

Attach

Berto's baseline performance for skill (C) "Add Attachment" averaged 20% independence across sessions (See Figure 5). Data within baseline had variability with 54% of data points falling within the stability envelope of ± 25% of the median value 29 (range: 21.75-36.25). The split middle method of analysis revealed a slightly accelerating trend with a relative level change value of 15. However, a noticeable increase in performance during baseline probe sessions 10-22 co-occurred with the introduction of intervention for skill (B) "Reply." The trend for probe sessions 10-22 was zero-celerating with an average of 29% independent completion of steps. Data had low variability and were stable for probe sessions 10-22 with 100% of data points falling within the stability envelope of ± 25% of the median value 29 (range: 21.75-36.25) with a relative level change value of 0.

Intervention procedures for skill (C) "Add Attachment" were implemented during session 23 (See Figure 5). Intervention effects were immediate with an increase in independence from 29% in baseline to 38% independence within the first session. Berto's performance averaged 82% independence across sessions, and he met mastery criterion within 4 intervention sessions (See Table 3). Berto had consistent attendance with zero absences during intervention (See Table 4).

The data within intervention had some variability with 75% of data points falling within the stability envelope of ± 25% of the median value 93 (range: 69.75-116.25). The

split middle method revealed an accelerating trend with a relative level change value of 35 indicating a therapeutic trend. Data points did not overlap with baseline data for a PND value of 100% (See Table 5; Scruggs & Mastropieri, 1998).

Maintenance probes were conducted once per week following the conclusion of intervention for skill (C) "Add Attachment" for 5 weeks, except where week five, two data points were collected. This was done as the first data point co-occurred with environmental factors in the classroom that the researcher believed influenced participant performance, resulting in an inaccurate representation of participant performance. The researcher wanted to confirm the data collection was an accurate reflection of ability and retention of skill. Therefore, a second data point was collected for all three skills later in the week to confirm performance. The average performance was 76% independent completion of steps, but the average may have been influenced by the outlier from maintenance probe session 31. Overall, Berto demonstrated maintenance up to 5 weeks after intervention indicating retention of skill.

Orlando

Reply

Orlando's baseline performance for skill (B) "Reply" averaged 25.8% independence across sessions (See Figure 6). Data within baseline had some variability with 60% of data points falling within the stability envelope of ± 25% of the median value based on 43 (range:32.25-53.75). The split middle method was used to determine trend and revealed an accelerating trend, with a relative level of change value of 43 indicating therapeutic trend. However, analysis of the last three data points (i.e., baseline

probe sessions 3-5) demonstrated zero-celeration, no variability or instability with data points.

Intervention procedures for skill (B) "Reply" were introduced during probe session 6 (See Figure 6). Intervention effects were delayed and improvement in performance did not emerge until probe session 10, four sessions into intervention procedures. Orlando required 13 intervention sessions before reaching mastery criterion (See Table 3). He had consistent attendance with zero absences (See Table 4).

Orlando's average performance during intervention was 65% independence across sessions. Data points had some instability and variability with 54% of data points falling within the stability envelope of ± 25% of the median value 71 (range: 53.25-88.75). The split middle method revealed an accelerating trend with a relative level change value of 43 indicating a therapeutic trend. Five data points overlapped with baseline data for a PND value of 62% (See Table 5; Scruggs & Mastropieri, 1998).

Maintenance probes were conducted during probe sessions 19-38 over a 7-week period. Maintenance probes conducted during sessions 19-22 and 26-29 were done consecutively prior to interviewing with skills (A) "Compose" and (C) "Add attachment." Maintenance data collected during sessions 36-38 were collected once a week following mastery of the final skill. Orlando's average performance during maintenance was 83% independence. Orlando maintained skills 4 weeks after intervention; however, some attrition in skill performance occurred at maintenance probe sessions 37 and 38 which co-occurred with the last 2 weeks of school prior to summer break.

Compose

Orlando's baseline performance for skill (A) "Compose" averaged 7.4% independence across sessions (See Figure 6). Orlando had an average performance of 8% independent step completion. Data points were varied and unstable with less than 1% falling within the stability envelope ± 25% of the median value 8 (range: 6-10). An accelerating trend was indicated using the split middle method of analysis and the relative level change value for baseline condition was 15 indicating a therapeutic trend. Initially visual analysis was completed for the entire phase; however, data points were later separated into two sets when observed carryover effects co-occurred with introduction of intervention with the prior skill (B) "Reply"

An increase in Orlando's performance occurred during probe session 7, which co-occurred with the introduction of intervention with behavior (B) "Reply" indicating carry-over effects. Therefore, the data were split into two data sets, data prior to intervention with skill (B) "Reply" probe sessions 1-5, and data points after intervening with reply (i.e., baseline probe sessions 6-21). The first half of baseline probe data (i.e., baseline probe sessions 1 through 5) had an average of 0% independence on step completion, with zero-celeration (split-middle method). Data showed no variability and were stable with 100% of data points falling within the stability envelope of ± 25% of the median value 0. The second half of baseline data (i.e., probe sessions 6-21) had an average of 14% independence across sessions with 83% of data points falling within the stability envelope of 25% of the median value 15 (range: 11.22-18.78) indicating data were stable and with low variability. While performance increased from the first set of baseline data, the split middle method was used with the second set of data points and

revealed a zero-celerating trend. The relative level of change was re-evaluated using the second half of baseline data and revealed a value of 0.

Intervention procedures were implemented during session 22 for skill (A) "Compose" (See Figure 6) Effects were immediate with Orlando's performance increasing to 38% independent completion of steps, followed by a larger increase in performance reaching 85% independent completion of steps for the next intervention session. Orlando met mastery criterion for the second target skill within four intervention sessions (See Table 3); he had one absence (See Table 4).

Orlando's average performance was 75% independence across sessions. The split middle method was used to determine trend and revealed an accelerating trend with a relative level of change of 27 indicating a therapeutic trend. Data had some variability with 75% of data points falling within the stability envelope of ± 25% of the median value 85 (range: 63.75-106.25). Data points did not overlap with baseline data for a PND value of 100% (See Table 5; Scruggs & Mastropieri, 1998).

Maintenance probes were conducted for skill (A) "Compose" during probe sessions 26-38 over a period of 5 weeks. Maintenance probe data were collected consecutively for sessions 26-29 prior to intervening with the final skill. Maintenance probe data collected during probe sessions 36-38 were done on a weekly basis following mastery of the final skill. Orlando maintained consistent independent step completion with average performance of 96% independence across sessions indicating skill retention up to 4 weeks after intervention.

Attach

Orlando's baseline performance for skill (C) "Attach" averaged 11% independence across sessions (See Figure 6). Data were stable and had low variability with 80% of data points falling within the stability envelope of ± 25% of the median value 14 (range: 10.5-11.5). The split-middle method of analysis indicated zero-celerating trend. The relative level change value was 0.

Intervention procedures for skill (C) "Add Attachment" were initiated during probe session 28 (See Figure 6). Effects were immediate with Orlando's performance increasing to 43% independence. Orlando met mastery criterion within 7 intervention sessions (See Table 3) and had consistent attendance with zero absences (See Table 4).

Orlando's average performance was 63% independence across sessions. Data had variability and instability with 57% of data points falling within the stability envelope of ± 25% of the median value 57 (range: 42.75-71.25). The split middle method confirmed an accelerating trend with a relative level change value of 43 indicating the trend was therapeutic. Data points did not overlap with baseline data for a PND value of 100% (See Table 5; Scruggs & Mastropieri, 1998).

Maintenance probes were conducted once per week for 3 weeks prior to the end of the school year. Orlando maintained performance with an average performance of 91% independence across sessions for skill C "Add Attachment." Performance indicates retention of skill.

Santino

Compose

Santino's baseline performance for Skill (A) "Compose" averaged 8% independence across sessions (See Figure 7). Data points were stable and had low

variability with 100% of data points falling within the stability envelope of ± 25% of the median value 8 (range: 6-10). The split middle method revealed a zero-celeration trend with a relative level change value of 0.

Intervention procedures for skill (A) "Compose" were introduced during session 6 (See Figure 7). Intervention effects were immediate with Santino's performance increasing to 23% independence. Santino reached mastery criterion within 14 intervention sessions (See Table 3); he was absent two days (See Table 4).

His performance during intervention was 71% independence across sessions. Data points had some variability and instability with 71% of data points falling within the stability envelope of ± 25% of the median value 77 (range: 57.57-96.25). Overall trend was accelerating (split-middle method) with a relative level change value of 54 indicating a therapeutic trend for intervention. Data points during intervention did not overlap with any baseline data for a PND value of 100% (See Table 5; Scruggs & Mastropieri, 1998).

Maintenance probes were conducted during probe sessions 20-37 across a period of 6 weeks. Data were collected consecutively for probe sessions 20-23 and 28-31 prior to intervening with target behavior (B) "Reply" and (C) "Add Attachment." Maintenance probes were conducted once a week after reaching mastery criterion for the final skill (probe session 37). Santino's performance remained high and averaged 93.3 % independence across sessions suggesting retention of skill.

Reply

Santino's baseline performance for skill (B) "Reply" averaged of 49% independence across sessions (See Figure 7). Data had low variability and were relatively stable with 91% of data points falling within the stability envelope of ± 25% of the

median value 57 (range: 42.75-71.25). The split middle method revealed a zero-celerating trend with a relative level of change value of 0.

Intervention procedures were introduced for skill (B) "Reply" during session 23 (See Figure 7). Santino's average was 80% independence across sessions. Santino met mastery criterion within five intervention sessions (See Table 3) and had six absences (See Table 4). Intervention effects were delayed with the first two data points overlapping with baseline data. However, during intervention session 25, there was a change in trend with a steep increase in slope and Santino reaching 100% independence.

Data had some variability and instability with 75% of data points falling within the 25% stability envelope of ± 25% of the median value 86 (range: 64.25-106.5). The split middle method revealed an accelerating trend with relative level of change value of 36 indicating a therapeutic trend. Two data points overlapped with baseline data for a PND value of 60% (See Table 5) (Scruggs & Mastropieri, 1998).

Maintenance probes were conducted during probe sessions 28-37 across a 3-week period. Data collected during probe sessions 28-31 were done consecutively prior to intervening with the final skill. Data collected during probe session 37 was collected once during the final week of school. Performance remained high with an average of 97% independent across sessions. The average performance suggests retention of skill.

Attach

Santino's baseline performance for skill (C) "Adding Attachment" averaged 25% independence across sessions (See Figure 7). Data were variable with 60% of data points falling within the stability envelope of ± 25% of the median value 29 (range: 21.75-36.25). The trend was slightly accelerating based on the split-middle method of analysis,

but the relative level of change was 0. Of note the highest data point in baseline (43% in session 28) co-occurred with introduction of the intervention for skill (B) "Reply." This was then followed by a decrease in performance with an overall decelerating trend for the last three points as well as, stable baseline data for skills (A) "Compose" and (B) "Reply."

Intervention procedures were introduced for skill (C) "Compose" during probe session 31 (See Figure 7). There was an immediate effect on performance with the initial intervention data point measuring 71% independence across sessions. The average performance for intervention was 90% independence across sessions. Santino met mastery criterion within six intervention sessions (See Table 3) and had consistent attendance with zero absences (See Table 4).

Data had some variability with 60% of data points falling within the 25% stability window of the median 100 ±25([range: 75-125) and an accelerating trend (split-middle method). The relative level change measure was 29 and indicated a therapeutic trend. Intervention data did not overlap with baseline data for a PND value of 100% (See Table 5; Scruggs & Mastropieri, 1998).

Santino mastered this last skill at the very end of the school year. Therefore, only one maintenance probe was conducted. His performance remained high with 100% independence.

Social Validity

Participant Surveys

Participants completed self-assessment surveys (See Appendix P) prior to and at the conclusion of the study (See Table 6). Questions focused on experience using email

and teleconferencing software, specifically Zoom, and how they rated their skills. Scores were on a Likert scale where "5" represented strongly agree and "1" represented strongly disagree. The first item targeted experience with using teleconferencing software, specifically Zoom. All six participant answers indicated previous experience with Zoom software. Post-study survey results were similar except for Teresa who answered that she was unsure about whether she had used it. This may have been due to confusion on phrasing or understanding of what Zoom software was.

The next item asked for level of agreement regarding a statement that the participants used Zoom software well. The pre-study survey average was 4 indicating general agreement with this statement. The post-study survey average fell to 3.33. However, the use of Zoom Software and skills related to using the software were not targeted for intervention. Therefore, it is logical that this score would remain relatively similar in measure.

The next set of questions focused on email use and skills. The initial questions asked the participant if they had an email account. Responses did not change between pre-study survey and post-study survey results. Juan, Lucia, Orlando, and Santino all indicated they had email accounts prior to intervention and those answers remained consistent in post-assessment surveys. Berto was unsure whether he had an email account during both the pre-study survey and post-study survey. Teresa indicated she did not have an email account in the pre-assessment and that answer remained the same following the conclusion of the study.

The next item asked the participants about their ability to use their email account and how strongly they agreed or disagreed that they could use it well. The pre-study

survey average was 2.5 indicating that overall participants disagreed with the statement that they, “use email accounts well.” The post-study survey score was a 3.16, an improvement of 1.16 implying that participant perception improved regarding their skill for using email accounts.

Teresa initially indicated that she strongly disagreed with the statement that she could use email accounts well at the pre-study survey. However, the post-study survey score changed to strongly agreeing she could use an email account well. This change implies an improved change in her self-perception of skill. The pre-study survey and post-study survey scores for Juan, Lucia, Berto, Orlando, and Santino remained the same from the pre-study survey to the post-study survey.

Participants were then asked to indicate if they had experience sending email messages. Juan, Teresa, and Santino all indicated they had experience sending email messages at the pre-study survey. Lucia, Berto, and Orlando indicated they had not sent email messages at the pre-study survey. Thus, 50% of participants noted experience with sending an email.

Finally, the participants were asked to indicate how strongly they agreed with the statement that they could send an email well. The pre-study survey average was 2 indicating that most of the participants did not think they could send email well. The post-study survey average was 4.5, an increase of 2.5 points, which suggests improved perceptions of sending email well.

Juan was the only participant to indicate during the pre-study survey he could send e-mail well with a score of 5. He then gave a score of 5 again at the post-study survey indicating he retained a consistent perception on his ability to send email. Teresa,

Lucia, Berto and Orlando all scored 1 on the pre-study survey suggesting they felt they could not send email well. Teresa and Lucia both increased their rating at the post-study survey scoring 5, indicating that they strongly agreed that they could send email well. Berto's and Orlando's scores also improved at post-study survey with Berto scoring 3 and Orlando scoring 4. Santino gave himself a score of 3 at the pre-study survey. His score also improved at post-study survey and rose to 5 indicating he strongly agreed he could send email.

Children's Intervention Rating Profile

Participants were given an adapted version of the Children's Intervention Rating Profile (CIRP; Turco & Elliott, 1986) at the conclusion of the study (See Appendix Q). All six participants rated the statements using a Likert scale where "1" was strongly disagree and "5" strongly agree (See Table 7). Overall, participants provided positive evaluations of the intervention used. All six participants strongly agreed that the teleconferencing system Zoom was a good mode for communication with an average score of 4.8. Although Juan, Lucia, Berto and Orlando also agreed that there were better ways to communication and instruct. Teresa and Santino strongly disagreed with the statement for an average of 3.5 slightly above the neutral measure.

All six participants agreed or strongly agreed that the instruction was helpful for learning email skills for an average of 4.5. Participants had mixed scores on whether there was better way to teach e-mail use. Teresa and Santino strongly disagreed with the statement. Juan and Berto had a neutral score of 3, and Lucia strongly agreed with the statement. The average score was 2.8 falling towards disagreement with the statement.

Participants had closer consensus on the next statement that "teachers should use this method to teach email skills." Juan scored the statement with a 3 indicating neutrality, while the other five participants agreed or strongly agreed with the statement for an average of 4.5. Additionally, participants had high agreement that the methods should be used with their peers to teach email skills. The average score was 4.3, with participants agreeing or strongly agreeing with the statement except for Juan who scored a 3 indicating neutrality. Participants were asked to score agreement on whether they liked the instruction used during the study. The average rating was 4.5 with all participants scoring that they agreed or strongly agreed except for Juan who scored a "3" indicating neutrality.

Parent Surveys

Parent pre-study surveys were returned for three participants, Juan, Berto and Santino. Parents agreed that both Juan and Santino had experience using Zoom software and could use it well. Berto's parents were unsure about whether he had used it before and disagreed that he could use it well. Both parents of Juan and Santino indicated the students had email accounts and agreed that they could use email well. Berto's parent was unsure about whether he had an email account and disagreed that he could use it well. Both parents of Juan and Santino indicated they had experience with sending an email. Juan's parent agreed that he could send email well, while Santino's parent scored a "3" indicating neutrality and neither agreeing nor disagreeing. Berto's parent indicated he did not have experience sending email, also scored a "3" indicating neutrality in whether he could send an email well. As stated previously, the researcher was unable to gather

post-study survey results from parents. Therefore, only pre-study survey results are discussed.

Teacher Surveys

The classroom teacher was asked to complete pre-study survey and a post-study survey that provided statements about participant skills (See Appendix N). Evaluations were completed for all six participants (See Table 9) with the pre-study survey completed in-person with the researcher, and the post-study survey completed remotely though an electronic form, due to time constraints associated with the end of the school year. Videos of the participants were shared with the teacher for review of skills to assist with survey completion at the conclusion of the study. The survey used a Likert scale to rate agreement with statements from "1" indicating strongly disagree, "3" indicating neutrality, to "5" indicating strongly agree.

According to the pre-study surveys completed by the teacher, four out of six participants were noted to have experience with the teleconferencing software Zoom prior to the start of the study. The teacher was aware that one out of six participants had an email account at the beginning of the study but was unsure for the remaining participants. By the end of the study, all participants had experience with using the teleconferencing software Zoom and had email accounts. Before student participation in the study, the teacher was aware of one student having experience in sending email, two she was unaware of their experience, and the three remaining had no experience with sending email. At the conclusion of the study, all participants had experience sending email messages.

The classroom teacher was also asked to rate agreement with statements about participant skill abilities. Pre-study survey scores reflected teacher disagreement with participants' ability to use the teleconferencing software Zoom well with an average score of 2.2. However, by the end of the study the average score increased by 2.3 points (i.e., an average score of 4.5) suggesting an improved perception of participant ability to use teleconferencing software Zoom well.

Next, the teacher was asked to rate agreement with the statement that each participant could send email well. The pre-study survey average was 1.7 indicating disagreement with the statement. However, at the post-study follow-up survey that score increased by 2.8 points for an average of 4.5 indicating that there was strong agreement with the statement. Finally, the teacher was asked to rate the statement that the participants were able to send email well. Prior to participation in the study, the teacher disagreed with the statement with an average rating of 1.5. When the teacher re-evaluated the statement at the conclusion of the study, the average score increased by 2.8 points to 4.3. This increase indicates agreement with the statements that the participants were able to send e-mail well.

Treatment Evaluation Inventory

The classroom teacher completed an adapted version of the Treatment Evaluation Inventory (TEI, Kelley et al., 1989) (See p O) for each participant (See Table 10). The teacher provided agreement ratings on a Likert scale for statements about intervention, where "1" indicated strongly disagree, "3" indicated neutrality, and "5" indicated strongly agree. Overall, the classroom teacher found the use of the teleconference software Zoom acceptable as an intervention delivery system for participants with an

average score of 5. Strong agreement was also scored for "willingness to use the online instructional approach with students," "acceptable online instructional procedures," and "liking the procedures used" having consistent scores and averages of "5."

Statements regarding intervention effectiveness were also scored by the teacher and received strong agreement ratings for "believing intervention was effective," and "the intervention resulted in new skills for participants" both averaging a 4.7 rating. Scores for "teacher use/choice of similar methods," received consistent ratings of 5 and had an average rating of 5.

Finally, the teacher was asked to provide agreement with statements regarding student perceptions and participation. Teacher response scores indicated strong disagreement that students experienced discomfort during intervention with an average score of 1. Additionally, strong disagreement scores were also marked regarding student choice to avoid similar methods of instruction with an average of 1. Scores reflected agreement with statements regarding "view of participation," with strong agreement that students and the teacher had positive perceptions of participating, averaging a rating of 5.

Discussion

The purpose of this study was to evaluate whether systematic instruction resulted in effective intervention, delivered through teleconferencing software, to improve skill acquisition of digital literacy skills in individuals, aged 12-17 years, with IDD. More specifically, the study sought to answer whether the use of systematic instruction using least-to-most response prompting delivered through teleconferencing software improved the level of independence in completing the steps for the digital literacy behaviors "Composing email," "Replying to email," and "Adding attachments to email."

Instructional practices incorporating the use of systematic instruction and response prompting, particularly the system of least prompts, have a large body of research and evidence in its use as an instructional method to teach adaptive and academic skills with students with IDD (Saunders et al., 2013). The methods employed by the study, systematic instruction and the system of least prompts delivered through teleconference technology, increased skill levels and levels of independence for all participants. Participants began the study with none or minimal skill levels for all three target skills. However, with the introduction of intervention procedures, independent skill performance rapidly increased for participants. All six participants met mastery criteria for all three skills and were able to perform the skills independently by the conclusion of the study. The rate of acquisition was steady and immediate with the introduction of intervention procedures and required on average between 5-9 sessions to meet mastery criteria for each target skill.

Reflecting on the research questions the study attempted to answer, the use of system of least prompts delivered through teleconferencing technology improved levels of independence with completion of steps across all three behaviors (A) "Compose," (B) "Reply," and (C) "Add Attachment" for all six participants. Study results showed an increase in participant performance across all skills for all six participants. While intervention size effects were in the effective range for both skills (A) "Compose" and (C) "Add Attachment," skill (B) "Reply" had questionable effect size measures for four participants, ineffective for one participant, and effective for one participant (Scruggs & Mastropieri, 1998). This is not to suggest that the method is ineffective in increasing

independence and skill acquisition for Skill (B) “Reply,” but rather other factors may have influenced intervention effect size.

It is possible that the similarity of steps between Skill (A) “Compose” and Skill (B) “Reply” may have had an effect on effect size measures. Intervening with skill (A) “Compose” provided exposure and instruction for similar steps for Skill (B) “Reply”. Therefore, when intervention procedures were introduced for Skill (B) “Reply,” the participants generalized part of the skill set. This generalization can be seen where carryover effects were observed in baseline conditions. While these effects were observed, they were not unexpected as again there was some overlap in steps for Skill (A) “Compose” and Skill (B) “Reply”. Furthermore, the intervention with one skill was not enough for participants to demonstrate mastery across all target skills. Participants still required intervention procedures to meet mastery criteria and reach independence.

The study utilized a counterbalanced schedule for both Skill (A) “Compose” and Skill (B) “Reply” with half of the participants beginning with Skill (A) “Compose” and half beginning with Skill (B) “Reply”. Carryover effects were primarily observed when intervening with skill (A) “Compose” first compared to the participants in which the first skill intervened with was skill (B) “Reply”. This may be because of the requirement to login that was included in the task analysis for composing emails. Those that began with skill (A) “Compose” were taught to login and compose a message which had some overlap with the task analysis for skill (B) “Reply”. Participants who began with skill (B) “Reply” were unable to demonstrate any carryover effects since they did not have the skills required to complete the login process required when they completed probes for skill (A) “Compose”. It is possible that had the login step been separated from the task

analysis for skill (A) "Compose" similar carryover effects would have appeared for the group of participants that began with skill (B) "Reply" as was seen for skill (A) "Compose."

The intervention resulted in a dramatic change in Lucia's performance and was necessary for the other participants to meet mastery criteria. Replication of procedures could provide more clarity on effectiveness for skill (B) "Reply," and confirming efficacy of intervention procedures. Therefore, the intervention procedures utilized in the study were effective in skill acquisition for Skill (A) "Compose" and Skill (C) "Add Attachment" and successful in refining Skill (B) "Reply" for all participants.

The present study adds to the body of research regarding instruction and intervention methods for adolescents with IDD. The research conducted has provided early evidence that email skills can be taught to individuals with IDD through systematic instruction and response prompting. Additionally, the study further supports the use of systematic instruction and least-to-most response prompting procedures as an effective instructional method for skill acquisition with individuals with IDD.

A secondary objective sought to evaluate and extend the literature on the efficacy of systematic instruction-based intervention delivery over teleconferencing software and acquisition of skills by persons with IDD. The research community has provided evidence of the use of teleconference software to collect assessment information and provide instruction and training for parents, service providers, and support staff (Benson et al., 2017; Neely et al., 2017; Tomlinson et al., 2018). The literature lacks evidence of the use of teleconference software to provide intervention procedures such systematic instruction and response prompting to adolescents with IDD. Additionally, evidence-

based practices and their use within the context of digital literacy skills and delivery via teleconference software has had minimal evidence within the research community, The present study addresses these shortcomings. Systematic instruction and response prompting were utilized in participant acquisition of digital literacy skills, specifically, email skills (i.e., Compose, reply, add attachment). The results of the study demonstrate that systematic instruction and response prompting can be delivered successfully through teleconference software and that skill acquisition is possible as evidenced by all six participants meeting mastery criteria for all three skills (i.e., Compose, Reply, Add Attachment). While it is too early to conclude that such procedures are evidence-based and acceptable practice for use with teleconferencing software, the present study provides a starting point for support in the use of similar practices and has added to the literature and research regarding both teleconference technology and instructional practices for teaching Digitial Literacy skills to adolescents with IDD.

Social Validity

Skill assessment and treatment evaluation surveys provided agreement that skills had improved by the end of the study. Additionally, the intervention procedures were regarded as favorable, with the teacher and participants indicating willingness by themselves or their peers to learn in a similar style in the future, and teachers might be favorable to similar procedures as well. The classroom teacher rated skills prior to and at the conclusion of the study with ratings increasing an average of 2.6 points on a Likert scale of 5. Perhaps more important than teacher ratings on a survey is that upon conclusion of the study, the teacher ensured that each participant had a personal email for use in transition activities. Similar improvements were seen on participant surveys

averaging a 1-point increase indicating that participant perceptions of their skills improved also. Anecdotally, the classroom teacher also noticed an improvement in student confidence with the targeted skills.

Additionally, it should be noted that participants began to demonstrate an understanding of the use of email to socialize. Juan attempted to initiate social meetings within email messages. He would suggest a social activity (e.g., bowling, meeting during lunch break) and attempt to arrange a meeting time (e.g., after school, 4pm, on the weekend). Other participants began to generate their own conversation strands asking questions of their response partner and their interests (e.g., biggest fear, pets). While the focus of the study did not target increased social interactions, it is apparent that the participants made the connection between the use of email and opportunities to socialize online.

Given that social opportunities for individuals with disabilities drops after they leave the K-12 setting, acquisition of digital literacy skills such as email use holds importance. The digitial platform provides additional opportunities for individuals with disabilities to socialize beyond the K-12 classroom. Social interactions can include skills such as texting, instant message communication exchanges, and interacting with social media. The opportunities are not limited by some of the factors that hinder social opportunities beyond the K-12 environment such as transportation, geographic location, and time. Rather it provides a means to continue interactions with others and the world promoting a continued connection and involvement within society. Therefore, the importance of targeting these skills for acquisition should not be understated given the

implications for social opportunities and participation within society, for individuals with disabilities.

Limitations

This study contained several limitations which should be considered when reviewing and interpreting results. Pandemic conditions and school health protocols provided limitations within the study. Schools restricted outside visitors entering their campus. To mitigate this limitation teleconference software was utilized to provide as close an approximation to in-person instruction as possible.

Additionally, there were times during the study when a student was sick or excluded for possible COVID symptoms or exposure limiting access to the sessions and researcher. Absences may have slowed acquisition rates for participants receiving intervention. This limitation had minimal impact as all participant absences during intervention were generally low except for Santino (i.e., 6 absences) and Lucia (i.e., 4 absences) during skill (B) "Reply" intervention phase. However, both Santino (i.e., 5 intervention sessions) and Lucia (i.e., 9 intervention sessions) met mastery criterion for skill (B) close to or below the average of 8.2 intervention sessions to mastery.

Anecdotally, the classroom teacher indicated that attendance had dramatically improved, particularly for Santino and Lucia since enrollment in the study. Both participants had attendance concerns previously noted in their student files. However, the researcher did not collect any attendance data prior to enrollment in the study and therefore conclusions about any relationships cannot be determined.

The inability to control noise in the classroom where the participants attended during sessions was also a limitation. The participants wore headphones during all

sessions to attempt to block out environmental noise and center attention on the researcher. Nonetheless, there were sessions in which noise volume increased due to environmental variables such as student behavior in the classroom, behavior management or instruction co-occurring in the environment. Instances occurred where participant performance dropped while environmental noise or behavior was excessive or distracting. However, that is not unusual for a school learning environment in which noise levels can fluctuate based on environmental factors. The participants were offered breaks until the noise levels quieted, but on all occasions the participants chose to continue to work. The researcher provided participants reminders to ask for prompts or instructional cues to be repeated if they were unable to hear due to environmental noise or behavior.

The school calendar provided an additional limitation as participants were unavailable during scheduled breaks and holidays. The researcher had to work within the window of active school days and around the participants' school schedules to ensure that their inclusion time and educational plans were followed. However, the effects of this limitation were minimal as most participants averaged 4-5 sessions per week and all met mastery criteria for all three skills. Maintenance data were affected due to the end of the school year and the start of summer break. For most participants, maintenance data for the last targeted skill (C) "Add Attachment" was minimal, and for some a single data point due to the end of the school year. As a result, limited conclusions can be made on participant retention of the skill.

A procedural error related to experimental design was made by the researcher during the transition from baseline to intervention with Berto for skill (A) "Compose." The researcher collected one immediate baseline point for all three behaviors prior to

implementing intervention. A minimum of three baseline points should have been collected across behaviors and analysis for stability and variability made (Gast & Ledford, 2014). However, there was only overlap with a single baseline data point across all three skills, and a single data point overlap when intervention was introduced. This error lowers internal validity. On the other hand, the study was replicated across five additional participants in which the researcher followed transition criteria prior to intervening and had similar intervention results. Therefore, the effect, if any, regarding the error remains minimal.

A limitation was noted during the implementation of intervention procedures for skill (B) "Reply" and skill (C) "Attach" that revolved around the steps where the participant read the received email aloud. In building that task analysis for both skills, the researcher identified the need for participants to read received email to appropriately respond in a reply. It was determined that requiring the participant to read the email out loud would both provide a concrete observational method to consistently determine whether the step had been completed. However, during data collection participants were marked down when the email was not read out loud but had displayed behavior that could establish that the email had been read. For example, participants moved the mouse curser over the words as they read, read silently to themselves (evidenced by the mouth moving but lack of sound), or created responses addressing the content of the received email. The participants were prompted following the prompt hierarchy or marked as incorrect because they did not read the email "out loud." This may have influenced independence data. Furthermore, in terms of societal norms, it is unusual for most people to read their emails out loud.

However, the researcher continued with this expectation for step completion because it was important to ensure the participant had read the email correctly and comprehended the request made. Furthermore, reading comprehension was not being evaluated by the study. To minimize the effect of the limitation, any attempt to read the received e-mail out loud was marked as correct or independent, and the researcher read any words that were misread or the student struggled to read (struggled to sound out, pause of 2-3 seconds, or asked to read).

Additionally, the study utilized researcher created e-mail addresses for use during all phases. The conclusion of the study resulted in termination of access to the email accounts by participants. It is possible that the skills mastered during the study may not have generalized to personal email addresses for the participants. However, towards the conclusion of the study the classroom teacher assisted participants with setting up personal email addresses. Since, the study utilized Gmail which is free for personal email addresses during the study, the classroom teacher was able to set up personal email addresses for the participants with Gmail as well. This ensured similar email settings and environment for future use, increasing the opportunity for generalization of skills for personal use. Measures of generalization and usage of personal e-mail were not collected for the study. This information would have provided additional social validity information for participants and the impact that skill acquisition had for them and their social interactions within the digitial space. This aspect should be considered for replication studies.

Future Research

Future research efforts should target replication of procedure utilized in this study to affirm their effects with adolescents with IDD. The procedures utilized were effective in acquisition of email skills for six participants. However, to draw conclusions about efficacy with use with individuals with IDD, replication across similar populations is needed. Additionally, future research efforts should also target similar populations across various age groups. The study conducted worked with adolescents between the age of 16-17 years of age. It is necessary to establish whether these methods are effective for children, adolescents outside of the 16-17 age range, as well as with adults to better understand the effectiveness and implications for educational practices. Furthermore, replication studies should explore intervention delivery across teleconference software as well, as in-person delivery to determine if any variable or effects on efficiency and effectiveness exist regarding acquisition of basic email skills.

Future research efforts should explore rate of retention of skills. Due to limitations from the school schedule, minimal information and conclusions can be made regarding retention of skills. Participants did demonstrate retention of skills during maintenance probes conducted a week to a month after exiting intervention procedures. However, conclusion cannot be drawn on long term retention of skills. Therefore, future research should seek to explore these measures, how well the skills are retained, if reintroduction to intervention procedures is needed and what effect that has on retention of skills.

The body of research available to educators and practitioners regarding instructional approaches to teach digital literacy was minimal (Cihak, 2015). The

research conducted begins the body of research regarding digital literacy instruction with IDD. Research has studied extensively digital literacy content and skills sets for typically developing children and adolescents. There have been content standards created to ensure skill sets are developed by students participating in public education. However, the research has yet to be extended to individuals with disabilities. The research conducted here is the beginning of establishing that body of research. Just as curriculum and content standards have been created for typically developing peers, so should that work be extended to encompass individuals with disabilities including those with IDD.

Digital literacy encompasses more than the skills required to compose, reply, and include attachments in emails. Rather, it is the ability to use, create, and understand information across digital environments, for the purpose of work, socialization, and exchange of information (Eschet-Alkalai, 2004, Glister, 1997, & Selber, 2004). Therefore, a multitude of skills comprise the concept of digital literacy, from navigating the internet and evaluating content, interactions via instant messengers, accessing work schedules and applications, to building a repertoire of safety practices. Potential skills to target could include, but are not limited to, safety measures such as identification of spam, and withholding personal and financial information, social skills and social interactions through digitial platforms such as email, social media, and instant messaging, generalization and performance across platforms such as computers, tablets, and smart phones, The International Society for Technology in Education (ISTE) is a non-profit organization that created standards for digital literacy for K-12 institutions and has been adopted by the majority of states in the U.S. These standards should be utilized to direct goal planning for skill acquisition. Future research should explore the application of

systematic instruction and the system of least prompts in acquisition of these skill sets, as well as other potential instructional strategies to establish a comprehensive and extensive body of research.

Currently, post-secondary measures show declining opportunities and autonomy for individuals with IDD with low rates of engagement and preparation for work and education after leaving the K-12 education system (Ayers et al., 2013; Bouck, 2017; Domin, et al., 2020). The acquisition of email skills and other digital literacy skills could impact those measures in a positive manner. Many employment opportunities require access to email to submit job applications, access work schedules, and receive work communications, and employers look for applicants that possess 21st century workplace skills (Bouck, 2017; Oraison et al., 2019). Without instruction in the use of email, opportunities for employment may further decline for individuals with IDD. Longitudinal studies should be conducted to explore the effect of individuals with IDD acquiring digital literacy skills including basic email skills and post-secondary outcomes. For conclusions to be made, future research will need to be conducted.

Implications

Instructional time

The study was completed across 2.5 months with an average of 4-5 sessions conducted each week. Each session averaged between 5-10 minutes. Potential for implementation of procedures in a school schedule is evident. In secondary settings instructional time averages about 5-5.5 hours daily with on average 50 min instructional periods (Education Commission of the States, 2020). The limited amount of time required to implement the procedures for skill instruction, and the acquisition of skill within a 2-

week period suggests there is a possibility for teachers to provide similar instruction of these skills within the educational day.

These instructional procedures should be evaluated again in a classroom setting outside of the teleconference software. It is possible that instructional time may change. However, the researcher predicts that it will likely take equal to or less time to implement in-person. However, that is the researcher's speculation and will need evidence to substantiate the claim. Further replication across a new set of similar participants would provide a secondary measure on time frame requirements and is needed prior to confirming instructional time frames. However, the current study does provide emerging evidence that digital literacy instruction is possible, and through teleconference systems.

All six participants met mastery criteria for skill acquisition across all three behaviors, increasing their independent completion of steps required for basic e-mail use: composing email, replying to email, and adding attachments. The average number of intervention sessions needed to meet mastery criteria had some variability, but overall required less than 15 sessions (See Table 3). skill (A) "Compose" averaged requiring 8.5 intervention sessions. Skill (B) "Reply" had a similar average of 8.2 intervention sessions. Skill (C) "Add Attachment" averaged the smallest number of required intervention sessions for mastery at 5.8. This score was likely enhanced by the crossover of some steps from skill (B) "Reply" and a lower number of new steps to be acquired. Skill (C) "Add Attachment" was targeted last for all participants because of the similarity of some steps and targeting skill (B) "Reply" prior likely decreased the number of required sessions needed to learn the steps and meet mastery.

Digital Divide

A noteworthy gap persists in addressing the digital literacy skills of individuals with IDD, and the use of efficacious practices targeting these skills (Cihak et al., 2015). The side effects leave individuals with disabilities at a disadvantage in accessing services, communication and social opportunities, employment, and participation in society (Ayers et al., 2013; Bouck, 2017; Cihak et al., 2015; Minsha et al., 2011). The teacher involved informed the researcher at the conclusion of the study that the vocational rehabilitation services were now completed digitally. Forms and communication now occur via the internet for the secondary students, including the participants in her classroom. For participants to access vocational rehabilitation services presently or in the future, they would need to have skill sets associated with digital form completion and email exchange. Without that instruction or skill set this specific population could lose access to needed services.

These conditions will only continue to compound as technology permeates more of our lives, as was evidence recently when schools and services had to move quickly to technology-based service delivery methods (Fredrick et al., 2020; Jeste et al., 2020; Khanlou et al., 2020; Levine, 2020; Nelson, 2020; Stenhoff et al., 2020). It is, therefore, essential that these skills begin to be targeted in educational settings for students with disabilities. For that to happen teachers need to have access to information and supports whether through professional development or through teacher preparation programs, or dissemination of research and information (Buijs et al., 2017; Casey & Bruce, 2011Chadwick et al., 2016; Cihak et al., 2015). Instructional institutions need research, to educate and provide teachers, service providers, and related service personnel with evidence-based practices and approaches so that these skills can be targeted skills for

acquisition approaches within the classroom. Additionally, teachers will need to have support from administration to pursue these skills within the educational planning for students, and therefore professional development will also be needed for administrative school personnel (Buijs et al., 2017; Chadwick et al., 2016).

Conclusion

Individuals with IDD can learn skills related to e-mail use as evidenced by the present research study. The procedures used in this study were successful in acquisition of the skills of composing email, replying to email, and including attachments. Effects were replicated across three skills and across six different participants. Results further support and extend the literature on the use of systematic instruction and least-to-most response prompting procedures delivered through teleconferencing software as an effective approach to teach skills with individuals with IDD. Systematic instruction and response prompting can be delivered through teleconferencing software with success. In addition, the body of research regarding digital literacy requires replication of these procedures and protocols as well as, targeting other skills sets within the scope of digital literacy. Information regarding these methods of instruction needs to be communicated to practitioners and educators working with these populations.

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Figures

Figure 1

Recruitment Flow Chart

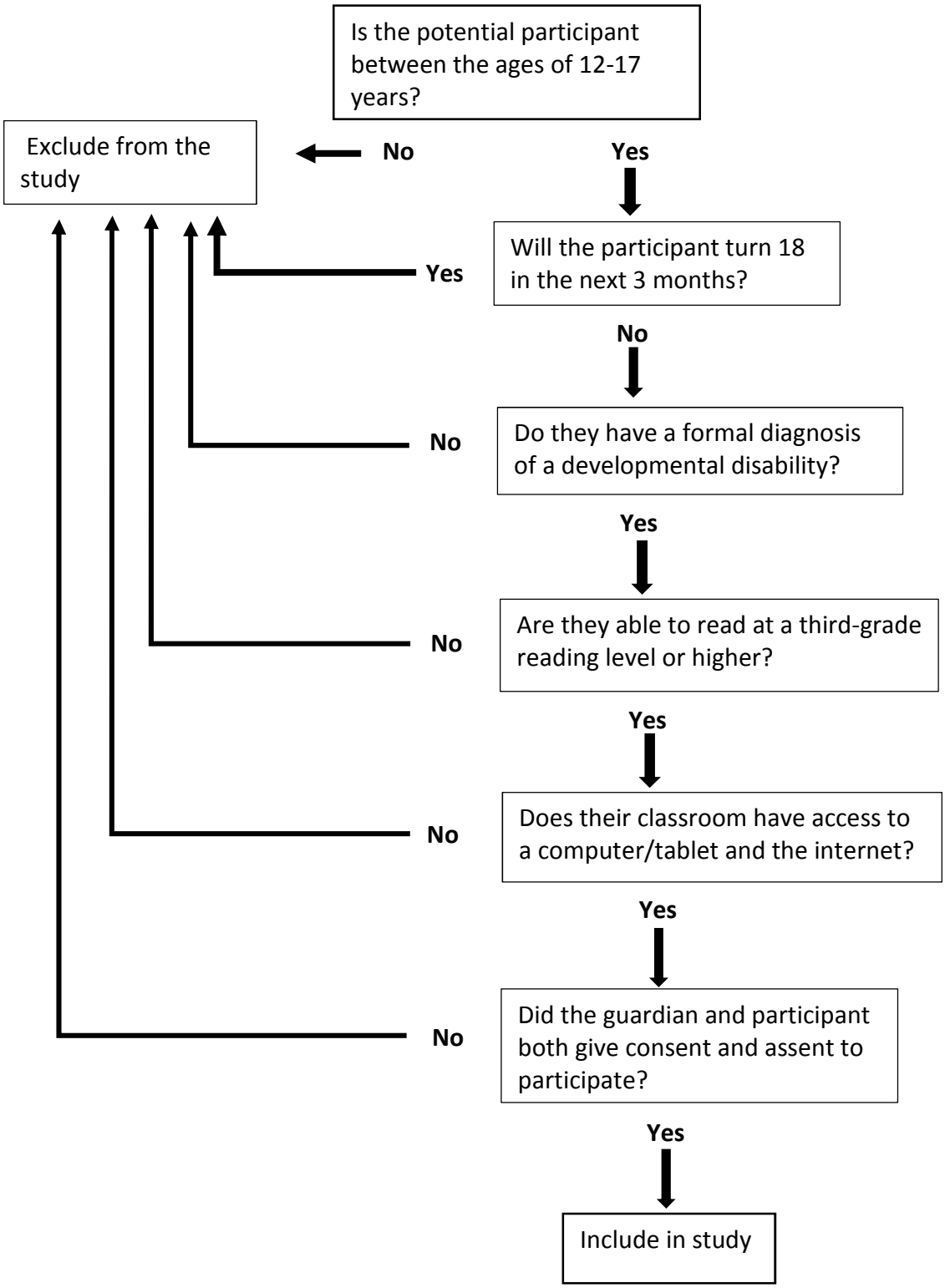


Figure 2

Juan Response Prompting to Teach Email Skills

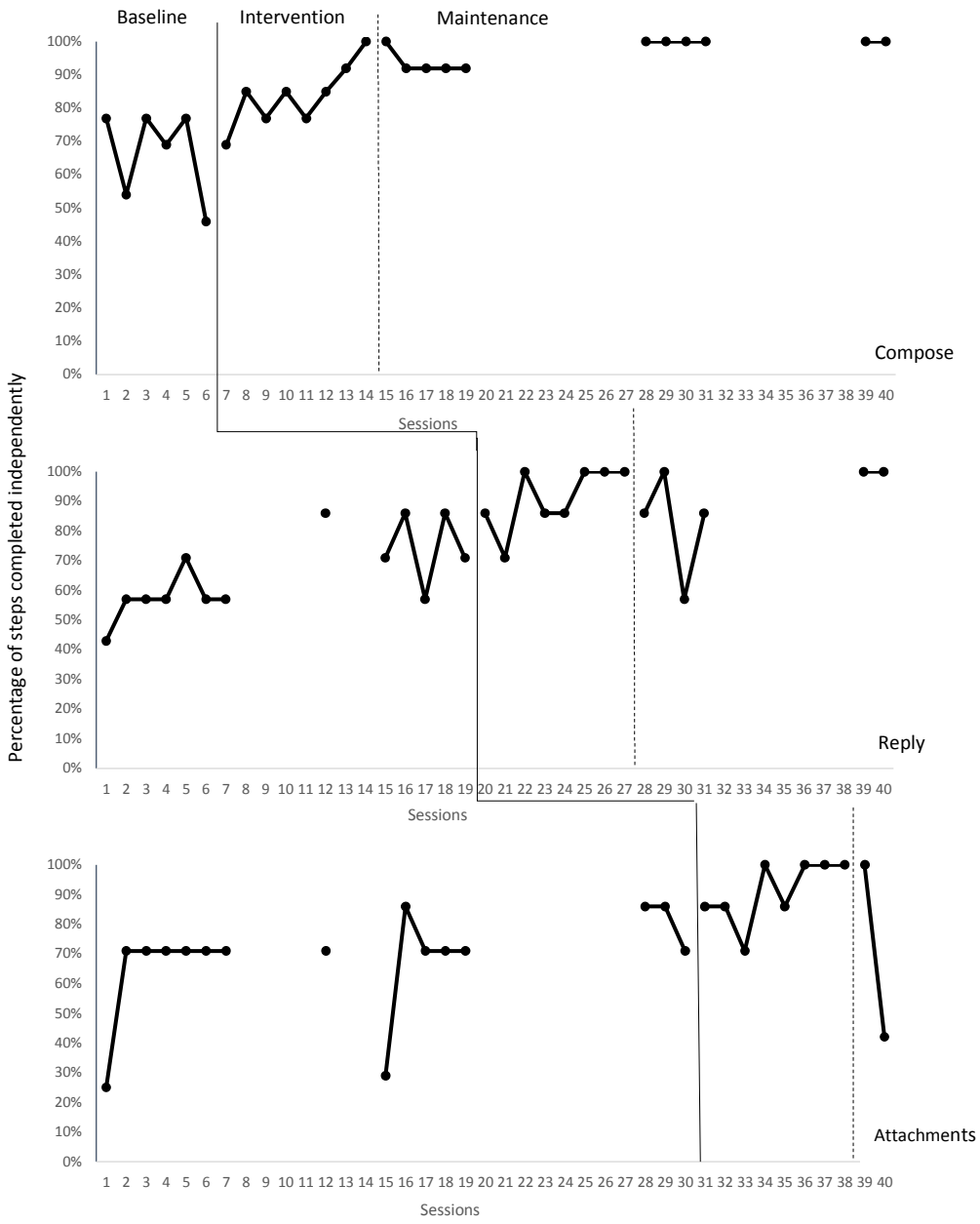


Figure 3

Teresa Response Prompting to Teach Email Skills

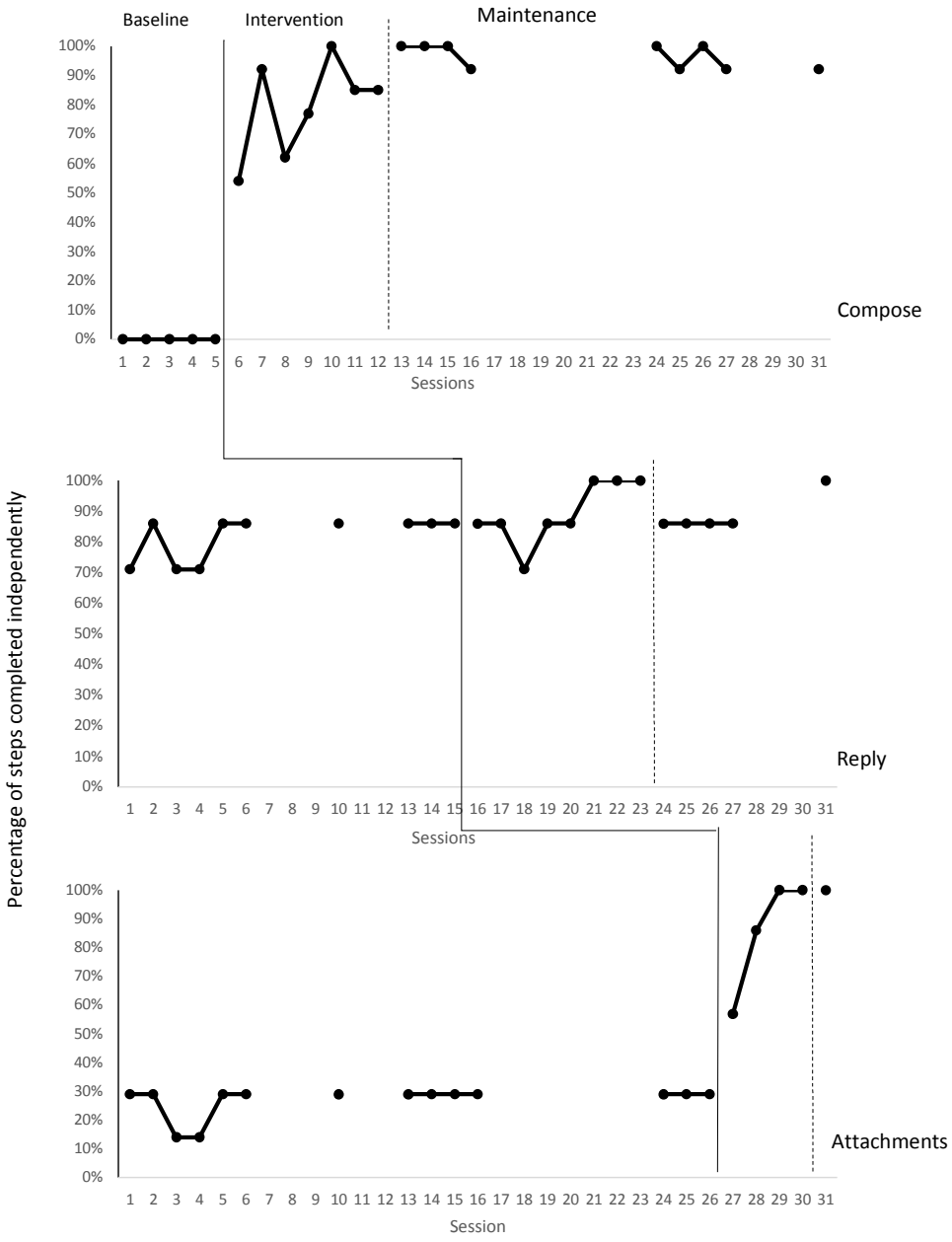


Figure 4

Lucia Response Prompting to Teach Email Skills

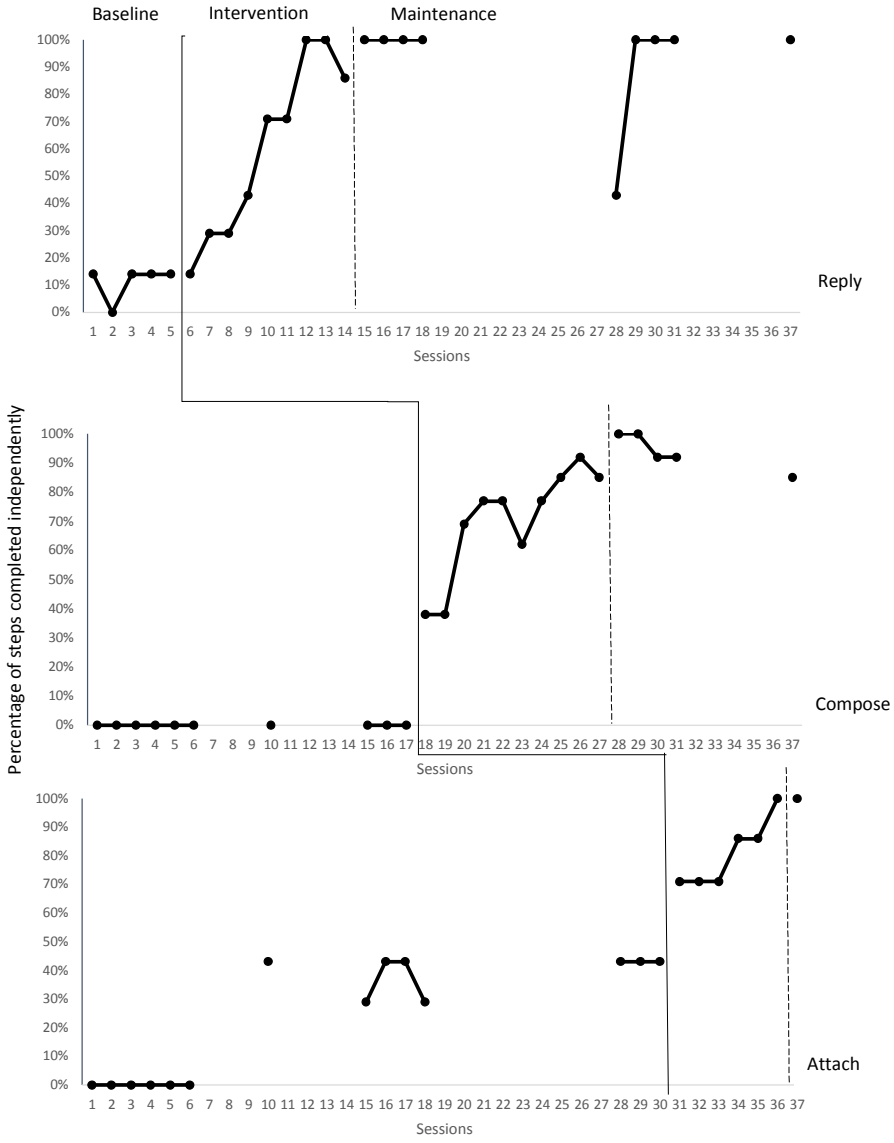


Figure 5

Berto Response Prompting to Teach Email Skills

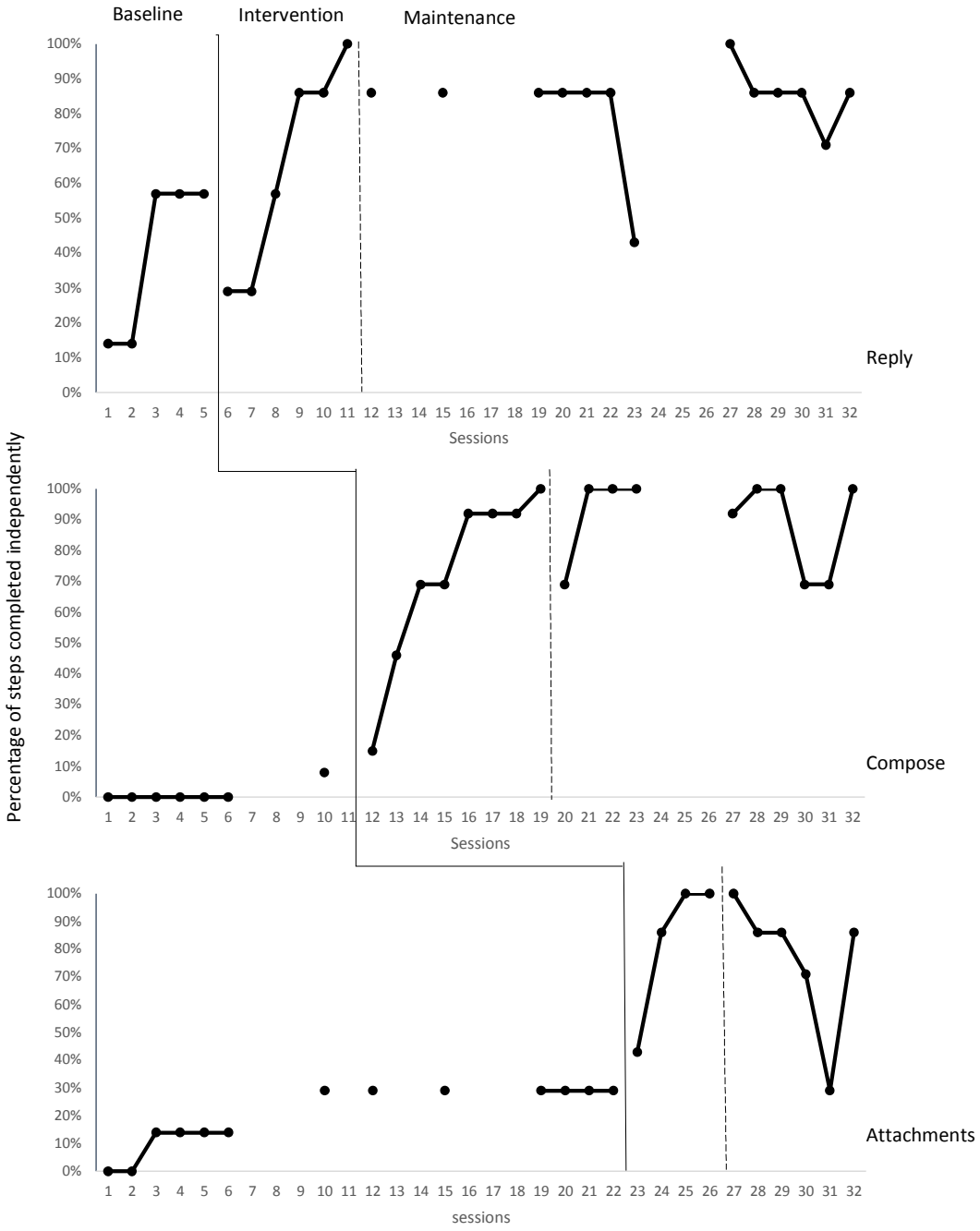


Figure 6

Orlando Response Prompting to Teach Email Skills

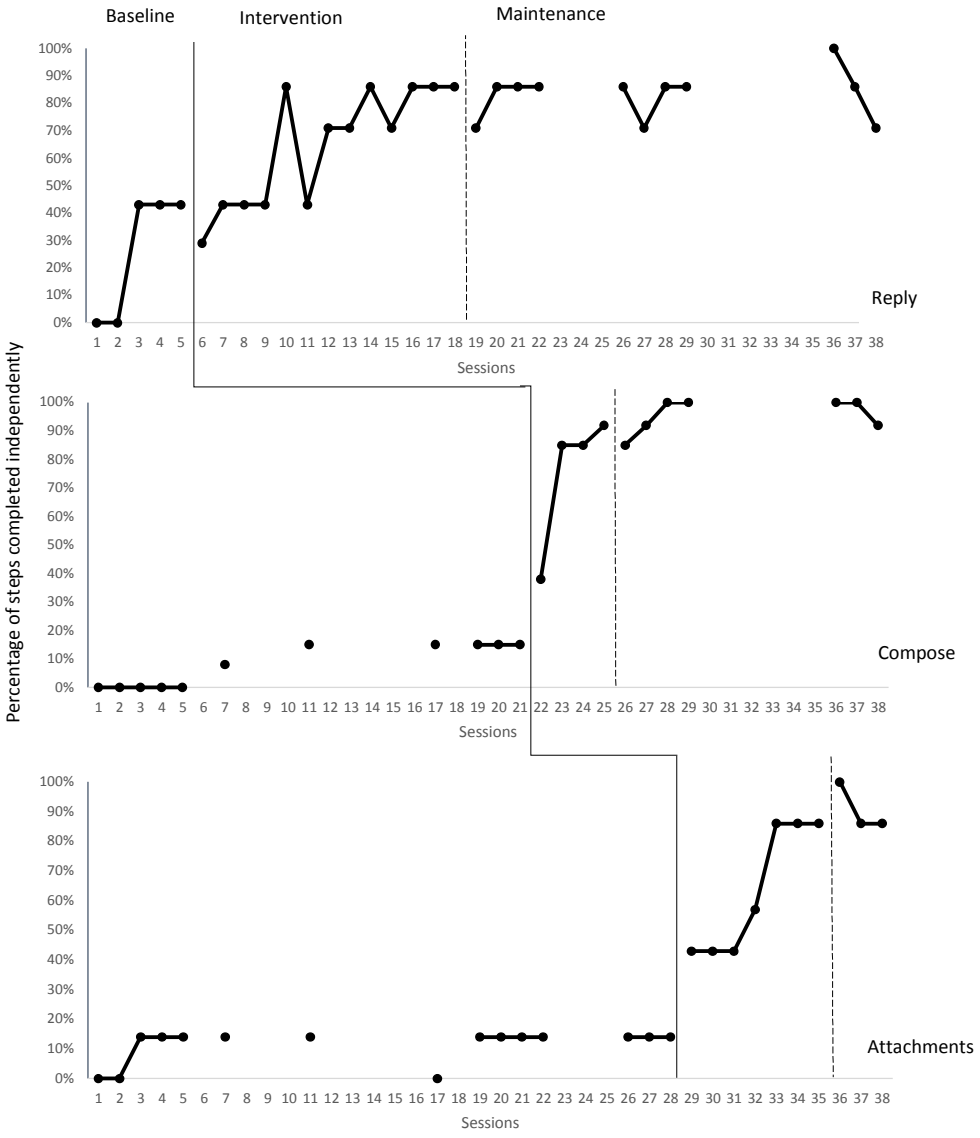
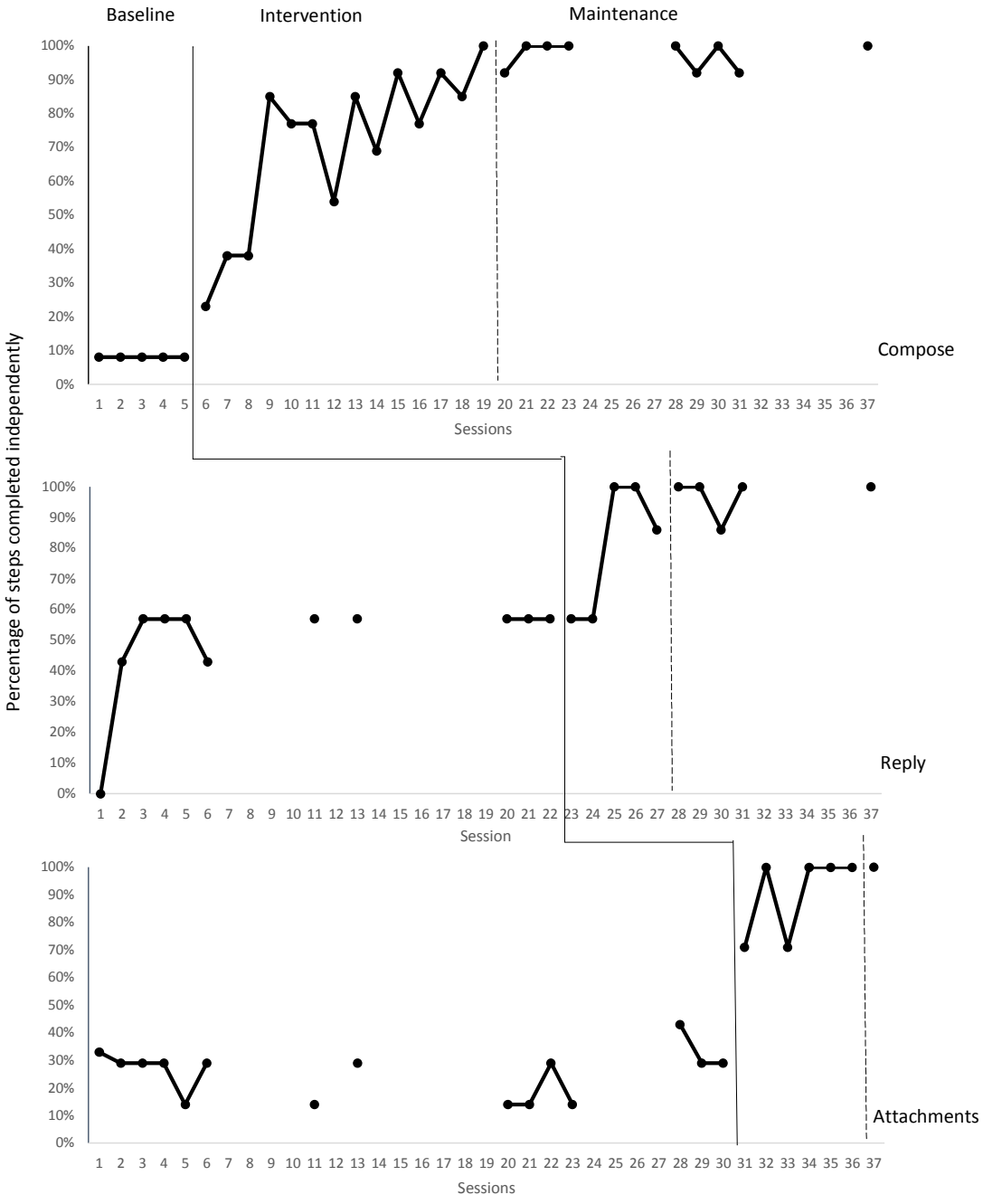


Figure 7

Santino Response Prompting to Teach Email Skills



Tables

Table 1

Demographics

Participant	Juan	Teresa	Lucia	Berto	Orlando	Santino
Grade level	11th	11th	9th	11th	10th	10th
Gender/Age	M 17	F 17	F 17	M 17	M 16	M 17
Language	ESL/ Spanish	ESL/ Spanish	ESL/ Spanish	English	ESL/ Spanish	ESL/ Spanish
Ethnicity	Hispanic/ Latino	Hispanic/ Latino	Hispanic/ Latino	Hispanic/ Latino	Hispanic/ Latino	Hispanic/ Latino
Eligibility	ID	ID & HI	ID & HI	ID &HI	ID	ID
IQ	CTONI-3 FS=61	WAIS- IV FS=67	CTONI-2 FS=49	DAS-II GSA=47 SNC=53	CTONI-2 FS=70 PTI-2 FS=55	UNIT SS=63
Adaptive Assessments	ABAS-3 Composite Home SS=65 School SS=57	ABAS-3 Composite Home SS=50 School SS=60	ABAS-3 Communication SS=76 Daily Living SS=69 Socialization SS=67	ABAS-3 Composite SS=65	ABAS-3 Composite Home SS=65 School SS=72	
ELA Assessments	KTEA-3 Letter rec. SS=51 Reading comp. SS=62 Written Exp. SS=43	KTEA-3 Letter rec. SS=61 Reading comp. SS=69 Written Exp. SS =73 Spelling SS=58	WIAT-3 Lower extreme range	KTEA-3 Letter rec. SS=56 Reading comp. SS=49 Written Exp. SS=45 Spelling SS=55	KTEA-3. Letter rec. SS=40 Reading comp. SS=40 Written Exp. SS=40 Spelling SS=40	KTEA-3 Letter rec. SS=40 Reading comp. SS=50 Written Exp. SS=51 Spelling SS=40

Note: English as a second language (ESL); Intellectual Disability (ID); Health Impairment (HI); Wechsler Adult Intelligence Scale, 4th Edition (WAIS-IV), DAS-II; General Conceptual Ability Standard Score(GCA); Special Nonverbal Cluster Standard Score (SNC);Comprehensive Test of Nonverbal Intelligence (CTONI-2); Universal Nonverbal Intelligence Test (UNIT); Adaptive Behavior Assessment System (ABAS-3); Kaufman Test of Educational Achievement (KTEA-3);Weschler Individual Achievement Test (WAIT-3); Full Scale (FS); Standard Score (SS), Blank areas reflect unknown test scores.

Table 2

Task Analyses for Target Behaviors

Behaviors	Dependent Variable	Task Analysis of chained steps
Compose email	Percent of steps completed independently in the chained steps	1. Move cursor to top right corner of Google screen 2. Click on the "Gmail" link 3. Enter/type email address and click next/enter 4. Enter password and select next/enter 5. Move cursor to "compose" button and click 6. Move cursor to "recipient" line of email 7. Type email address for recipient 8. Move Cursor to "Subject" line and type word/words for subject 9. Move cursor to body of email 10. Type greeting 11. Move cursor to the next line and type a message 12. Move to the next line and type/write closing 13. Move cursor to "Send" and click
Reply to email	Percent of steps completed independently in the chained steps	1. Move cursor and click on the email. 2. Read the email aloud 3. Move cursor to bottom of email and select reply button 4. Type greeting 5. Move to the next line and type message 6. Move to the next line and type closing 7. Move cursor to the send button and click

Behaviors	Dependent Variable	Task Analysis of chained steps
Attach a document to email	Percent of steps completed independently in the chained steps	1. Select email, read out loud, select reply button 2. Enter message in body of paragraph (greeting, message, closing) 3. Move cursor to paperclip and select 4. Select specified document with one click 5. Upload with either a double click or selecting upload button 6. Wait for document to load. 7. Move cursor to send button and click

Table 3

Number of intervention sessions to mastery

Participant	Juan	Teresa	Lucia	Berto	Orlando	Santino	Average
Compose Intervention	8	7	10	8	4	14	8.5
Reply Intervention	8*	8*	9	6	13	5	8.2
Attach Intervention	8*	4	6	4	7	6	5.8

Note: Mastery criterion was 80% or higher across 3 consecutive sessions
** Indicates mastery criterion changed to 100% across 3 consecutive sessions.*

Table 4

Participant Absences

Participant	Juan	Teresa	Lucia	Berto	Orlando	Santino
Compose	0	2	3	0	1	2
Reply	0	1	4	0	0	6
Attach	0	0	0	0	0	0

Table 5

Effect Size Measures

Participant	Skill	PND
Juan	Compose	63%
	Reply	50%
	Attach	50%
Teresa	Compose	100%
	Reply	38%
	Attach	100%
Lucia	Compose	100%
	Reply	89%
	Attach	100%
Berto	Compose	100%
	Reply	50%
	Attach	100%
Orlando	Compose	100%
	Reply	62%
	Attach	100%
Santino	Compose	100%
	Reply	60%
	Attach	100%

Note: PND Scores interpretation (Scruggs & Mastropieri, 1998)
>50% Ineffective
50-70% Questionable effectiveness
70-90% Effective treatment
<90% Very Effective

Table 6

Social Validity Participant Self-Report Scores

	Juan		Teresa		Lucia		Berto		Orlando		Santino		Averages	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
1. I have used Zoom before*	Y	Y	Y	US	Y	Y	Y	Y	Y	Y	Y	Y		
2. I can use Zoom well	5	5	3	2	5	4	5	4	3	2	3	3	4	3.33
3. I have an email account*	Y	Y	N	N	Y	Y	US	US	Y	Y	Y	Y		
4. I can use email account well	5	5	1	5	1	1	3	3	2	2	3	3	2.5	3.16
5. I have sent email message	Y	Y	Y	Y	N	Y	N	Y	N	Y	Y	Y		
6. I send email well	5	5	1	5	1	5	1	3	1	4	3	5	2	4.5

*Note: Items were scores on a Likert Scale: 5 (Strongly Agree) – 1(Strongly Disagree) Statements with * were scored with options of Yes (Y), No(N), or Unsure (US)*

Table 7

Participant Treatment Evaluation

Participant	Juan	Teresa	Lucia	Berto	Orlando	Santino	Average
1. Zoom was a good mode for communication	5	5	4	5	5	5	4.8
2.There are better ways to communicate and instruct students	5	1	5	4	5	1	3.5
3. The instruction was helpful for learning email skills	5	5	4	4	4	5	4.5
4. There are better ways to teach e-mail use	3	1	5	3	4	1	2.8
5. Other teachers should use this method to teach email skills	3	5	3	5	5	5	4.3
6. I liked the instruction	3	5	5	4	5	5	4.5
7. I think this method should be used to teach other kids how to email	3	5	4	4	5	5	4.3

Table 8

Parent Social Validity Scores

Participant	Juan	Berto	Santino	Average
1. My child has used Zoom Software*	Y	US	Y	
2. My child can use Zoom Software well	5	1	5	3.7
3. My child has an email account*	Y	US	Y	
4. My child can use my email account well	5	1	5	3.7
5. My child has sent email messages*	Y	N	Y	
6.My child sends email messages well	5	3	3	3.6

*Note: Items were scores on a Likert Scale: 5 (strongly Agree) – 1(strongly Disagree) Statements with * were scored with options of Yes (Y), No(N), or Unsure (US)*

Table 9

Social Validity Teacher Scores

Participants	Juan		Teresa		Lucia		Berto		Orlando		Santino		Average	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
1. My student has used Zoom before*	Y	Y	US	Y	Y	Y	US	Y	Y	Y	Y	Y		
2. My student can use Zoom well	2	5	3	5	2	4	2	5	1	4	3	4	2.2	4.5
3. My student has an email account*	Y	Y	US	Y	US	Y	US	Y	US	Y	US	Y		
4. My student can use email account well	2	5	3	5	1	3	2	5	1	5	1		1.7	4.5
5. My student has sent email message*	Y	Y	US	Y	N	Y	US	Y	N	Y	N	Y		
6. My student can send email well	2	5	3	5	1	3	1	5	1	4	1	4	1.5	4.3

*Note: Items were scores on a Likert Scale: 5 (Strongly Agree) – 1(strongly Disagree) Statements with * were scored with options of Yes (Y), No(N), or Unsure (US)*

Table 10

Teacher Intervention Evaluation

	Juan	Teresa	Lucia	Berto	Orlando	Santino	Average
1. I found the approach of using zoom acceptable	5	5	5	5	5	5	5
2. I will be willing to use the online instructional approach again for similar skills with my students	5	5	5	5	5	5	5
3. I liked the procedures that were used	5	5	5	5	5	5	5
4. I believe the online instructional procedures were acceptable	5	5	5	5	5	5	5
5. I believe the intervention was effective	5	5	3	5	5	5	4.7
6. I believe that my child experienced discomfort during the intervention/instruction	1	1	1	1	1	1	1
7. I believe the intervention/Instruction resulted in new skills my student will continue to use	5	5	3	5	5	5	4.7
8. I feel like other teachers would accept/choose to use this method of instruction/intervention to teach email skills	5	5	5	5	5	5	5

	Juan	Teresa	Lucia	Berto	Orlando	Santino	Average
9. I believe my student would not choose to learn skills through this method of instruction	1	1	1	1	1	1	1
10. My student had a positive view of participation	5	5	5	5	5	5	5
11. I have a positive view of my student's participation in the instruction/intervention	5	5	5	5	5	5	5

Appendices

Appendix A

Visual Support Handout

Username: Squarepantsbob492@gmail.com Password: Jellyfish1

Person	**Email addresses:**
Andrea Forsyth	aforsyth@nevada.unr.edu
Stewart Demo	demostudent639@gmail.com
Harry Potter	aforsyth2003@gmail.com
Nancy Drew	NancyDrewMystery2021@gmail.com

Appendix B

Compose: Baseline Data Form

Participant:
+ = Correct - = Incorrect
Instructional prompt: "Send ___ an email"
Praise statement: "Thank you for getting started"

Date/ Probe #			
Percent			
Total independent correct/ total trials	/13	/13	/13
1. Move cursor to top right corner of Google screen			
2. Click on the "Gmail" link			
3. Enter/type email address and click next/enter			
4. Enter password and select next/enter			
5. Move cursor to "compose" button and click			
6. Move cursor to "recipient" line of email			
7. Type email address for recipient			
8. Move Cursor to "Subject" line and type word/words for subject			
9. Move cursor to body of email			
10. Type greeting			
11. Move cursor to the next line and type a message			
12. Move to the next line and type/write closing			
13. Move cursor to "Send" and click			

Appendix C

Compose Baseline Probe Procedural Checklist

Steps	Yes ☑	No ☑
1. Verify recently used contacts and email addresses have been removed from browser history. *(Researcher 2: secondary check verified via absence of suggested emails during session*)		
2. Verify user login information has been removed from browser history *(Researcher 2: secondary check verified via absence of username and password absent from session)*		
3. Verify that all bookmarks have been removed from webpage. *(Researcher 2: secondary check verified via absence of bookmarks)*		
4. Open Zoom room (Researcher 2 verified through existence of Zoom recording or in-vivo session)		
5. Begin recording session, wait for participant to arrive		
6. Notify that session is being recorded		
7. Verify video and audio is working for both parties		
8. Verify visual support is present - Ask to show over video		
9. Share screen with Google browser		
10. Verify participant can see browser		
11. Provide remote control to participant and verify the participant has remote control (Ask to move cursor)		
12. Complete Probe: Provide instructional prompt: "send ____ an email. If participant indicates they cannot complete the task, indicates they are finished, or has not initiated initial step within 30 seconds of instructional prompt, terminate probe	Probe #	
13. Provide initial praise for initiating work "Thank you for getting started."		
14. Mark + for correct independent completion of steps, - for incomplete or incorrectly completed steps		
15. End the trial when the participant has completed all steps or indicates they are finished.		

Appendix D

Compose: Intervention Data Form

Participant:
Behavior: Compose and send email Experiment 1
Mastery Criterion to move to Experiment 2 3 consecutive days at 80% or higher
Instructional prompt: "Send ____ an email."
Verbal Praise: "Thank you for getting started"

Date/Probe		
Mean		
Independent/Total trials	/13	/13
1.Move cursor to top right corner of Google screen (IV) Where do you go to find Gmail? (DV) Go to the top right of the screen to Gmail. (PM) Move mouse partially towards the right corner and include previous DV (FM) Move cursor to the Gmail icon		
2. Click on the "Gmail" link (IV) what should you do next? / "Where do you go next" (DV) Click Gmail (FM)- Click the icon		
3. Enter/type email address then click next/enter (IV) "What should you do next?" / "Where do you go next" (DV) "Enter your email address, it's on the handout" (PM) Enter the first 2 letters of email + "enter the address" (FM) Enter the complete address		
4. Enter password and select enter/next (IV) "What should you do next?"/ "Where do you go next?" (DV) "Enter your password, it's on the handout" (PM) Enter the first letter of the password + "enter the password" (FM) Enter the entire password		
5. Move Cursor to "Compose" and click (IV) "What should you do next?" / "Where do you go next?" (DV) "Move the mouse to the composed button" (PM) Move mouse part way to button + "Press compose" (FM) Move mouse to button and click button		
6. Move cursor to "recipient" line of email (IV) "What should you do next?" / "Where do you go next?" (DV) Move the mouse to the line with "To" (PM) Move mouse part way to the line + "Move mouse to the "To" line (FM) Move the mouse to the recipient line and click to place cursor		
7. Type email address (IV) "What should you do next?" / "Where do you go next?" (DV) "Type the email address from the handout, find which one you need		

(VM) Show "address book from handout" (PM) Type first two letters of email address + "Type the email address, it's on your handout" (FM) Type the whole email address		
8. Move cursor to "Subject" line and type (IV) "What should you do next?" / "Where do you go next?" (DV) "Move to the subject line and type subject" (DVS) "Choose a topic like, movies, games, or weather" (PM) Move cursor to subject line + and type first two letters of subject (FM) Type the subject		
9. Move Cursor to body of email (IV) "What should you do next?" / "Where do you go next?" (DV) Move mouse to the body of the email (PM) Move cursor to body + "Click the mouse to place the cursor (FM) Move the mouse to the body and click it		
10. Type greeting (IV) "What should you do next?" / "Where do you go next?" (DV) "Type the greeting." (DVS) "Type a greeting like Hi, Hello, or Dear." (PM) Type the first letter of the greeting + "Type the greeting" (FM) Type the full greeting		
11. Move to next line and type/write message (IV) "What should you do next?" / "Where do you go next?" (DV) "Type your message" (DVS) Type a sentence about (Chosen subject). You can start with "I like ___" or "It is ___" (PM) Move cursor to next line, type first letter + "Type the message. (FM) Type the message		
12. Move to the next line and type closing (IV) "What should you do next?" / "Where do you go next?" (DV) "Type your farewell and name" (DVS) "Type a closing like bye, from, or take care and your name." (PM) Move the cursor to the next line and type first letter of closing (FM) Type the closing		
13. Move cursor to "Send" and click (IV) "What should you do next?" / "Where do you go next?" (DV) "Move the mouse and click send (PM) Move the mouse over the send button + "click send" (FM) Move the mouse and click send		

Appendix E

Compose Intervention Procedural Checklist

Steps	Yes ☑	No ☑
1. Verify recently used contacts and email addresses have been removed from browser history. *(Researcher 2: secondary check verified via absence of suggested emails during session*)		
2. Verify user login information has been removed from browser history *(Researcher 2: secondary check verified via absence of username and password absent from session)*		
3. Verify that all bookmarks have been removed from webpage. *(Researcher 2: secondary check verified via absence of bookmarks)*		
4. Open Zoom room (Researcher 2 verified through existence of Zoom recording or in-vivo session)		
5. Begin recording session, wait for participant to arrive		
6. Notify that session is being recorded		
7. Verify video and audio is working for both parties		
8. Verify visual support is present - Ask to show over video		
9. Share screen with Google browser		
10. Verify participant can see browser		
11. Provide remote control to participant and verify the participant has remote control (Ask to move cursor)		
12. Complete Probe: Provide instructional prompt: "send ____ an email.	Probe #	
13. Provide initial praise for initiating work "Thank you for getting started."		
14. Mark + for correct independent completion of steps, for prompted answers mark the most intrusive prompt required with 3-5 seconds between prompts. *If participant indicates they do not know what to do or begins an incorrect action immediately move to prompting hierarchy and provide the first level of prompt.		
15. End the trial when the participant has completed all steps.		

16. Calculate number of prompts implemented correctly and number implemented incorrectly		

Appendix F

Reply: Baseline Probe Procedural Checklist

Steps	Yes ☑	No ☑
1. Send email from one of the alternate accounts managed by the researcher (Researcher 2: secondary check verified by viewing email in participant's inbox)		
2. Verify recently used contacts and email addresses have been removed from browser history. *(Researcher 2: secondary check verified via absence of suggested emails during session*)		
3. Login to Gmail account for participant so that it is open to the inbox		
4. Open Zoom room (Researcher 2 verified through existence of Zoom recording or in-vivo session)		
5. Begin recording session, wait for participant to arrive		
6. Notify that session is being recorded		
7. Verify video and audio is working for both parties		
8. Verify visual support is present - Ask to show over video		
9. Share screen with Google browser		
10. Verify participant can see browser		
11. Provide remote control to participant and verify the participant has remote control (Ask to move cursor)		
12. Complete Probe: Provide instructional prompt: "reply to ____" If participant indicates they cannot complete the task, indicates they are finished, or has not initiated initial step within 30 seconds of instructional prompt, terminate probe	Probe #	
13. Provide initial praise for initiating work "Thank you for getting started."		
14. Mark + for correct independent completion of steps, - for incomplete or incorrectly completed steps		
15. End the trial when the participant has completed all steps or indicated they are finished.		

Appendix G

Reply Baseline Data Form

Participant:
Behavior: **Reply to email - Baseline**

Instructional Cue: Reply to ____ 's email.
*Verbal Praise: Give after participant initiates trial "Thank you for getting started."

Date/Probe		
Daily Mean		
Independent/ Total trials	/7	/7
1. Move cursor and click on the email.		
2. Read the email aloud		
3. Move cursor to bottom of email and select reply button		
4. Type greeting		
5. Move to the next line and type message		
6. Move to the next line and type closing		
7. Move cursor to the send button and click		

Appendix H

Reply Intervention Procedural Checklist

Steps	Yes ☑	No ☑
1. Send email from one of the alternate accounts managed by the researcher (Researcher 2: secondary check verified by viewing email in participant's inbox)		
2. Verify recently used contacts and email addresses have been removed from browser history. *(Researcher 2: secondary check verified via absence of suggested emails during session*)		
3. Login to Gmail account for participant so that it is open to the inbox		
4. Open Zoom room (Researcher 2 verified through existence of Zoom recording or in-vivo session)		
5. Begin recording session, wait for participant to arrive		
6. Notify that session is being recorded		
7. Verify video and audio is working for both parties		
8. Verify visual support is present - Ask to show over video		
9. Share screen with Google browser		
10. Verify participant can see browser		
11. Provide remote control to participant and verify the participant has remote control (Ask to move cursor)		
12. Complete Probe: Provide instructional prompt: "reply to ____" If participant indicates they cannot complete the task, indicates they are finished, or has not initiated initial step within 30 seconds of instructional prompt, terminate probe	Probe #	
13. Provide initial praise for initiating work "Thank you for getting started."		

14. Mark + for correct independent completion of steps, for incorrect response or if the participant indicates they need help/don't know what to do move through prompt hierarchy. Mark highest level of prompt required		
15. End the trial when the participant has completed all steps		
16. Calculate number of prompts implemented correctly and number implemented incorrectly		

Appendix I

Reply Intervention Data Form

Participant:
Behavior: **Reply to email**
Mastery Criterion to move to Experiment 3
80% for 3 consecutive days

Instructional Cue: Reply to ____ 's email.
*Verbal Praise: Give after participant initiates trial "Thank you for getting started."

Date/Probe		
Daily Mean		
Independent/ Total trials	/7	/7
1. Move cursor and click on the email. (IV) what do you do first? (DV) Click the email from ____ (PM) Move cursor to email. (FM) Click on the email		
2. Read the email aloud (IV) "What should you do next?" (DV) "Read the email aloud" (PM) Dear the first two words in the email. (FM) Read the whole email		
3. Move cursor to bottom of email and select reply button (IV) What should you do next?) (DV) Click on Reply (PM) Move cursor to reply button (FM) Click on the reply button		
4. Type greeting (IV)" What should you do next?" / "Where do you go next?" (DV) "Type the greeting." (DVS) "Type a greeting like Hi, Hello, or Dear" (PM) Type the first letter of the greeting + "Type the greeting" (FM) Type the full greeting		
5. Move to the next line and type message (IV)" What should you do next?" / "Where do you go next?" (DV) "Type the message" (DVS) "Type a sentence answering the email question; start a sentence with, "Yes, I like;" "No, I don't like" (PM) Move cursor to next line, type first letter + "Type the message. (FM) Type the message		
6. Move to the next line and type closing (IV)" What should you do next?" / "Where do you go next?" (DV) "Type the farewell and name" (DVS) "Type a farewell like 'bye' or 'from' and your name" (PM) Move the cursor to the next line and type first letter" Type the farewell (FM) Type the farewell		
7. Move cursor to the send button and click IV)" What should you do next?" / "Where do you go next" (DV) "Move the mouse and click send		

(PM) Move the mouse over the send button + “click send” (FM) Move the mouse and click send		

Appendix J

Attachments: Baseline Probe Data Form

Participant:
Behavior: **Attach a document to an email.**
Instructional Cue: "Reply to ____ with an attachment"
Verbal Praise: Give after participant initiates trial "Thank you for getting started."
"+" = independent correct responses "- "= incorrect/incomplete responses

Date/Probe			
Mean			
Independent/ Total trials	/7	/7	/7
1. Select email, read out loud, and select the reply button			
2. Enter message in body of paragraph (must include greeting with name, simple sentence with noun and verb and answers posed question, and closing with name)			
3. Move cursor to paperclip and click			
4. Select specified document			
5. upload by either a double-click or moving to upload button and selecting			
6. Wait for document to load.			
7. Move cursor to send button and click			

Appendix K

Attachments: Baseline Procedural Checklist

Steps	Yes ☑	No ☑
1. Send email from one of the alternate accounts managed by the researcher, include request for attachment and posed question. *(Researcher 2: secondary check verified by viewing email in participant's inbox)*		
2. Verify recently used contacts and email addresses have been removed from browser history. *(Researcher 2: secondary check verified via absence of suggested emails during session)*		
3. Login to Gmail account for participant so that it is open to the inbox		
4. Open Zoom room (Researcher 2 verified through existence of Zoom recording or in-vivo session)		
5. Begin recording session Researcher 2 verified through existence of Zoom recording or in-vivo session)		
6. Notify participant that session is being recorded		
7. Verify video and audio is working for both parties		
8. Verify visual support is present - Ask to show over video		
9. Share screen with Google browser		
10. Verify participant can see browser		
11. Provide remote control to participant and verify the participant has remote control (Ask to move cursor)		
12. Complete Probe: Provide instructional prompt: "reply to __ with an attachment" If participant indicates they cannot complete the task, indicates they are finished, or has not initiated initial step within 30 seconds of instructional prompt, terminate probe	Probe #	

If participant asks for help reply with something similar to, "Do as much as you can and tell me when you are done/can't do anymore"		
13. Provide initial praise for initiating work "Thank you for getting started."		
14. Mark + for correct independent completion of steps, - for incomplete or incorrectly completed steps		
15. End the trial when the participant has completed all steps or indicated they are finished.		

Appendix L

Attachments Intervention Data Form

Participant:
Behavior **Attach a document to an email**.
Instructional Cue: "Send a reply with an attachment to ___"
Verbal Praise: Give after participant initiates trial "Thank you for getting started."

Date/Probe				
Mean				
Independent/ Total trials	/7	/7	/7	/7
2. Select email, read, and reply (IV) what should you do first/next? (DV) Click the email, read it aloud, and reply (PM) Complete first part of action needed (select email, read aloud or move to reply button) (FM) Click on the email				
2. Enter message in body of paragraph (greeting, message, closing) (IV)" What should you do next?" / "Where do you go next?" (DV) "Type the greeting and message + and ending with name. (PM) Type the first letter of the greeting + "Type the greeting" (FM) Type the full greeting, message and closing				
3. Move cursor to paperclip and click (IV)" What should you do next?" / "Where do you go next?" (DV) "Move the mouse and click attachment/paperclip (PM) Move the mouse over the paperclip (FM) Move the mouse and click paperclip				
4. Select specified document (IV)" What should you do next?" / "Where do you go next?" (DV) "Move the mouse and click on the file you want to attach (PM) Move the mouse over the file (FM) Move the mouse over the file and select				
5. Upload either by double click or using upload button (IV)" What should you do next?" / "Where do you go next?" (DV) "Move the mouse and click upload (PM) Move the mouse over the upload button (FM) Move the mouse and click upload				
6. Wait for document to load. IV)" What should you do next?" / "Where do you go next?" (DV) Wait for the document to load (PM) Move the mouse counter action if participant tries to click anything (FM) Pause remote control until document has loaded				
7. Move cursor to send button and click IV) "What should you do next?" / "Where do you go next?" (DV) "Move the mouse and click send (PM) Move the mouse over the send button + "click send"				

(FM) Move the mouse and click send				

Appendix M

Attachments Intervention Procedural Checklist

Steps	Yes ☑	No ☑
1. Send email from one of the alternate accounts managed by the researcher, include request for attachment *(Researcher 2: secondary check verified by viewing email in participant's inbox)*		
2. Verify recently used contacts and email addresses have been removed from browser history. *(Researcher 2: secondary check verified via absence of suggested emails during session*)		
3. Login to Gmail account for participant so that it is open to the inbox		
4. Open Zoom room (Researcher 2 verified through existence of Zoom recording or in-vivo session)		
5. Begin recording session, wait for participant to arrive		
6. Notify that session is being recorded		
7. Verify video and audio is working for both parties		
8. Verify visual support is present - Ask to show over video		
9. Share screen with Google browser		
10. Verify participant can see browser		
11. Provide remote control to participant and verify the participant has remote control (Ask to move cursor)		
12. Complete Probe: Provide instructional cue: "reply to __ with an attachment" If participant indicates they cannot complete the task, indicates they are finished, or has not initiated initial step within 30 seconds of instructional prompt, terminate probe	Probe #	
13. Provide initial praise for initiating work "Thank you for getting started."		
14. Mark + for correct independent completion of steps, for incorrect response or if the participant indicates they need		

help/don't know what to do move through prompt hierarchy. Mark highest level of prompt required		
15. End the trial when the participant has completed all steps or indicated they are finished.		
16. Calculate number of prompts implemented correctly and number implemented incorrectly		

Appendix N

Parent/Teacher Skill Assessment Social Validity- Pre/Post

Please indicate your level of agreement with the following statements related to the intervention by circling the number that corresponds with the rating. Your participation in completing this form is voluntary and is not required. If you agree to complete this questionnaire, please complete it and return it to your child's classroom teacher, who will return it to the researcher. If you do not want to complete the form, simply discard it.

1. My child/student has used Zoom teleconference software.



Yes No Unsure

2. My child/student can use Zoom software well.



5 4 3 2 1
Agree Neutral Disagree

3. My child/student has an email account.



Yes No Unsure

4. My child/student can use an email account well.



5 4 3 2 1
Agree Neutral Disagree

5. My child/student has sent email messages.



Yes No Unsure

6. My child/student sends email messages well.



5	4	3	2	1
Agree		Neutral		Disagree

Appendix O

Teacher Social Validity- Post

Adapted from TEI (Treatment Evaluation Inventory)

Please indicate your level of agreement with the following statements related to the intervention by circling the number that corresponds with the rating. Your participation in completing this form is voluntary and is not required. If you agree to complete this questionnaire, please complete it and return it to your child's classroom teacher, who will return it to the researcher. If you do not want to complete the form, simply discard it.

1. I found the approach of using the Zoom platform acceptable.

Strongly Agree	Slightly Agree	Neutral	Slightly disagree	Strongly Disagree
				
5	4	3	2	1

Additional Comments:

2. I would be willing to use the online instructional approach again for similar skills with my student.

Strongly Agree	Slightly Agree	Neutral	Slightly disagree	Strongly Disagree
				
5	4	3	2	1

Additional Comments:

3. I liked the procedures that were used with my student.

Strongly Agree	Slightly Agree	Neutral	Slightly Disagree	Strongly Disagree
				
5	4	3	2	1

Additional Comments:

4. I believe the online instructional procedures were acceptable

Strongly Agree	Slightly Agree	Neutral	Slightly Disagree	Strongly Disagree


5 4 3 2 1

5. I believe the intervention was effective

Strongly Agree | Slightly Agree | Neutral | Slightly Disagree | Strongly Disagree


5 4 3 2 1

6. I believe that my child experienced discomfort during the intervention/instruction.

Strongly Agree | Slightly Agree | Neutral | Slightly Disagree | Strongly Disagree


5 4 3 2 1

7. I believe the intervention/instruction resulted in new skills my student will continue to use.

Strongly Agree | Slightly Agree | Neutral | Slightly Disagree | Strongly Disagree


5 4 3 2 1

8. I feel like other teachers would accept/choose to use this method of instruction/intervention to teach email skills

Strongly Agree | Slightly Agree | Neutral | Slightly Disagree | Strongly Disagree


5 4 3 2 1

9. I believe my student would not choose to learn skills through this method of instruction/intervention if given another opportunity

Strongly Agree	Slightly Agree	Neutral	Slightly Disagree	Strongly Disagree
				
5	4	3	2	1

10.My student had a positive view of participation in the instruction/intervention.

Strongly Agree	Slightly Agree	Neutral	Slightly Disagree	Strongly Disagree
				
5	4	3	2	1

11. I have a positive view of my student's participation in the instruction/intervention.

Strongly Agree	Slightly Agree	Neutral	Slightly Disagree	Strongly Disagree
				
5	4	3	2	1

Appendix P

Participant Social Validity – Pre/Post Self-assessment

Please indicate your level of agreement with the following statements related to the intervention by circling the number that corresponds with the rating. Your participation in completing this form is voluntary and is not required. If you agree to complete this questionnaire, please complete it and return it to your child's classroom teacher, who will return it to the researcher. If you do not want to complete the form, simply discard it.

1. I have used Zoom teleconference software.


Yes


No


Unsure

2. I can use Zoom software well.


5

4


3

2


1

Agree Neutral Disagree

3. I have an email account.


Yes


No


Unsure

4. I can use my email account well.


5

4


3

2


1

Agree Neutral Disagree

5. I have sent email messages.


Yes


No


Unsure

6. I send email messages well.


5

4


3

2


1

Agree Neutral Disagree

Appendix Q

Participant Social Validity- Post

Adapted from CIRP (Children's Intervention Rating Profile)

Please indicate your level of agreement with the following statements related to the intervention by circling the number that corresponds with the rating. Your participation in completing this form is voluntary and is not required. If you agree to complete this questionnaire, please complete it and return it to your child's classroom teacher, who will return it to the researcher. If you do not want to complete the form, simply discard it.

1. Zoom was a good mode for communication and instruction

5 4 3 2 1
Agree Disagree

2. There are better ways to communicate and instruct students/kids/teenagers

5 4 3 2 1
Agree Disagree

3. The instruction was helpful for learning email skills

5 4 3 2 1
Agree Disagree

4. There are better ways to teach email use

5 4 3 2 1
Agree Disagree

5. Other teachers/therapist should use this method to teach email skills

5 4 3 2 1
Agree Disagree

6. I liked the instruction



5 4 3 2 1
Agree Disagree

7. I think this method should be used to teach other kids how to email.



5 4 3 2 1
Agree Disagree