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# Using Picture-Based Task-Analytic Instruction to Teach Students with Moderate Intellectual Disability to Email Peers without Disabilities

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This preliminary study investigated the effects of using picture-based task analyses and an iPad to teach students with intellectual disability how to send and reply to emails. Three middle-school-aged students with intellectual disability as well as three peers without disabilities participated in this investigation. The intervention consisted of two 15-step task analyses: one for sending an email, and the second for replying to an email, least to most prompting, and constant time delay. Results showed students' improved ability to send and reply to emails on an iPad with the support of picture-based task analyses. Implications for practice and future research are discussed.

*Keywords:* email, picture-based task analysis, intellectual disability

Collaboration and communication are important components of life skills curricula for students with moderate to severe intellectual disability. Life skills curricula largely determines the independent functioning of students with intellectual disability (Bouck, 2010). One way to promote collaboration and communication is the use of technology. Technology is a means through which many people communicate by calling, texting, emailing, or posting. Therefore, students benefit from learning to navigate various devices and applications. Research with individuals with disabilities has focused on the use of such tools to communicate. For example, Skovholt and Svennevig (2006) examined the use of email for communication in the workplace. However, there have been few studies examining the extent to which students with intellectual disability are able to use an email exchange to communicate. The skill of sending an email has become a vital 21st century skill for all students to learn to use in social, academic, and vocational settings.

The increase in accessible technology has furthered the growth of using computer-assisted instruction in classrooms. Computer-assisted instruction is an evidence-based practice used for students with intellectual disability (Mesibov & Shea, 2011). This method of instruction utilizes computers or other technology instruments (e.g., iPhones) to teach a skill. Ok and Kim (2017) conducted a meta-analysis and reported on numerous studies that have demonstrated a positive impact through the use of iPads and iPods on academic achievement and engagement of PK-12 students with disabilities. This access to technology not only creates greater learning opportunities but also increases the motivation for students with disabilities to learn while engaging with tools used by their same-age peers (Cumming et al., 2014). Mobile technologies such as iPad applications have been found to increase engagement of students with disabilities, as well as have an overall positive perception from teachers and parents (Rodriguez, Strnadova, & Cumming, 2013). One benefit of using an iPad with students with moderate to severe intellectual disability is that the devices are portable and easy to use for video modeling or task analytic instruction (Rodriguez et. al., 2013). iPads and other iOS devices also serve as an important tool for individuals with disabilities because of their Universal Design for Learning (UDL) features. UDL features include multiple means of representation, expression, and engagement. These features on all iPads provide accessibility and accommodations for individuals with various disabilities (McMahon & Walker, 2014).

The evidence-based practice of task analytic instruction provides curriculum-based information on student performance and a starting point for teaching (Stokes, Cameron, Dorsey, & Fleming, 2004). A task analysis is used by teachers to analyze skills and knowledge that should be taught and then break it down into small, discrete behaviors or steps for students (Collins, 2012). Picture-based task analysis has been used to teach many different skills to students with moderate to severe intellectual disability (Carr & Felce, 2008) such as cooking, grooming, and vocational skills (Bouck, 2010; Cook, 2002; Granberg, Brante, Olsson, & Sydner 2017; Stokes et al., 2004). Furthermore, there is research that combines task analytic instruction with computer-assisted instruction with positive outcomes for students with disabilities. For example, Ayres, Maquire, and McClimon (2009) used chained task training with a task analysis and computer-based video instruction to teach academic skills to students with autism and intellectual disability.

Peers without disabilities play an important role in interventions designed to improved communication skills for students with disabilities. Studies have found that teaching social skills using peer mediation during play can greatly increase social interactions in students with autism and intellectual disability (Morrison, Kamps, Garcia, & Parker, 2001). Peer-based instruction can promote positive attitudes towards students with intellectual disability and is a viable option to increase independent performance (Carter, Sisco, Melekoglu, & Kurkowski, 2007; Miracle, Collins, Schuster, & Grisham-Brown, 2001).

Several studies used an iPad during instruction to promote social and academic communication for students with a disability. For example, Xin and Leonard (2014) examined the use of iPads to enhance communication for students with

autism. Three 10-year-old students were chosen for the study, each with autism spectrum disorder and a moderate intellectual disability. During the intervention, the researchers taught the students how to use the iPad with the SonoFlex speech-generating device application for communication with both their teacher and their peers. The results from this study showed an increase in the students' initial requests to indicate their needs and responses to a prompt using the iPad with the speech application. The researchers found that using highly preferred items and activities as well as intensive and frequent interactions improved the students' interactions.

Other studies have examined teaching students with intellectual disability how to compose a complete email. Wang et al. (2016) examined the effects of email modeling and scaffolding on the social writing quality of students with intellectual disability. The results of this study indicated that all students improved their social writing quality after exchanging emails with typical writers over a period of 15 weeks. The students improved their writing mechanics, lexical and syntactic complexity, writing cohesion, pragmatic proprietary, and writing motivation. The researchers also found that the students were more motivated to engage in writing through social media exchanges.

More research on combining task analyses and iPads to facilitate social communication of students with intellectual disability with their peers without disabilities is needed. Therefore, this study sought to demonstrate the benefits of using task analyses and computer-assistance to generate communication. Specifically, this study analyzed ability of students with moderate intellectual disability to send and receive an email with their peers without disabilities.

## Method

### Participants

Three students (pseudonyms used throughout) with moderate intellectual disability and Down syndrome in the 8th grade were chosen to participate in this study. All three students were enrolled in a suburban middle school in a large southeastern school district and received special education services in a self-contained classroom setting. The students qualified for special education for moderate intellectual disability based on their most recent psychological and adaptive behavior assessments. Additionally, the students were familiar with an iPad and/or keyboard as evidenced in classroom practices.

Sarah was a 14-year-old Caucasian female. Evan was a 15-year-old Caucasian male. John was a 15-year-old male who had recently moved to the United States. All participants received their education in a separate academic classroom and were taught with modified curriculum standards. See table 1 below for the students' characteristics.

Table 1
*Characteristics of Student Participants with Intellectual Disability*

| Student | Age/Grade | Gender | Ethnicity | Disability |
|---|---|---|---|---|
| Sarah | 14/8th | Female | Caucasian | Intellectual Disability, Moderate |
| Evan | 15/8th | Male | Caucasian | Intellectual Disability, Moderate |
| John | 15/8th | Male | Caucasian | Intellectual Disability, Moderate |

Additionally, three general education students without disabilities participated in the study. These students (see Table 2) were chosen from the Peer Buddy club at the school and were all in 7th grade at the same school and were familiar with the students with disabilities from previous visits to the special education classroom. The students in the 7th grade were chosen because they were most familiar with the students in the classroom and had a break time that corresponded with work time for the students with intellectual disability. The peers were only one grade apart from the target participants.

Table 2
*Characteristics of Peers without Disabilities*

| Student | Grade | Gender | Ethnicity |
|---|---|---|---|
| Katie | 7th | Female | African American |
| Bonnie | 7th | Female | Caucasian |
| Lacey | 7th | Female | Hispanic |

**Setting**

The study was conducted in a self-contained special education classroom with 10 students with moderate to severe intellectual disability in a large public school district of the eastern United States. The classroom had one teacher and two teacher assistants. The classroom teacher was a Caucasian female and was certified in special education, high and low incidence disabilities. She was in her second year of teaching. One teacher assistant was an African American female and the other teacher assistant was of Hispanic descent. Three students with moderate intellectual disability were targeted for data collection.

The target students in the study participated in small group activities each day to focus on their specific academic needs and IEP goals. During this small group time, students without a disability from the Peer Buddy club at the middle school participated as well. Both the target students and the Peer Buddies signed assent letters for the study and returned letters of consent from their parents. For each session, the students, investigator, and peers were present in the classroom. Additionally, the teacher assistants collected interobserver agreement data.

The primary investigator, trainer and data collector for this study was both a

graduate student and the special education teacher for this separate classroom setting at the middle school. The peer participants were recommended by leader of the Peer Buddies club. The first three peers to return both the assent and consent forms to the investigator were trained to be a part of the study. The students without disabilities were given detailed instruction by the experimenter over the students' role in responding by email to the students with moderate intellectual disability.

**Materials**

An iPad for the students was used during all sessions. The picture task analyses were used for each student during the intervention and maintenance stages (Figures 1 and 2). The picture task analyses were developed by the primary investigator. She engaged in a process of sending (see Figure 1) and replying to an email (similar to Figure 1) and took a screenshot of each step of the process for the task analyses. The students without disability were given the verbal and written step-by-step directions to follow (Figure 2). The investigator used data collection sheets to record students' progress.

**Data Collection Procedures**

**Dependent variable.** The dependent variable was the students' ability to send and receive an email on the iPad by following all steps of the task analyses with a peer without disabilities. It was defined as the number of correct steps of the task analyses performed independently by each student without any prompting. The investigator collected data on each participant's performance during the study using a data collection sheet that listed the steps of the task analysis.

**Interobserver agreement.** To establish interobserver agreement, the classroom teacher (investigator) and one teacher assistant in the classroom both took data on the task analyses sheets for each participant's scores. Two teacher assistants served as data collectors and alternated in this role each session. The two scorers' ratings of the day were compared for each section of the task analyses for every session with each student. The percentage agreement was calculated by dividing the number of agreements by the number agreements plus disagreements and then multiplying that number by 100.

**Social validity.** Social validity data were collected at the end of the study to measure the perceived acceptability of sending and receiving an email through an iPad intervention. Data were collected from both the students with moderate intellectual disability and the students without disabilities. The students with moderate intellectual disability were given the option to dictate their answers to the questionnaire to the investigator if they had difficulty writing their answers. The investigator read the questions aloud to any student who was unable to read fluently on their own.

| Instructions: | Picture | Check it off! |
|---|---|---|
| 1. Turn on iPad by clicking the home button and sliding to unlock. |  | |
| 2. Click on the icon to open Safari browser. |  | |
| 3. Type in www.gmail.com in the web address bar. |  | |
| 4. Click "go." |  | |
| 5. Type in the email: mrsbensonsclass3@gmail.com. |  | |
| 6. Click "next." |  | |
| 7. Type in the passv nt123. |  | |
| 8. Click "sign in." |  | |
| 9. Click the writing icon to compose an email. |  | |
| 10. Type in the email of the recipient in the first line: peerbuddies3@gmail.com |  | |
| 11. Type in the subject of the email in the third line. Choose from:<br>- Hi from (your name)!<br>- Hello from (your name)<br>- Good Morning from (your name) |  | |
| 12. Type the name of the Peer Buddy you are sending the message to.<br>- Hi Peer Buddy 1, (will fill in with actual names)<br>- Hi Peer Buddy 2,<br>- Hi Peer Buddy 3, |  | |
| 13. On one line down, type a message in the email. Choose from:<br>- I am at school today. What are you doing?<br>- I am good today. How are you?<br>- Today, I am going to ____ elective class. What elective class do you have today? |  | |
| 14. On the next line, type your name.<br>- Student 1 (will fill in with actual names)<br>- Student 2<br>- Student 3 |  | |
| 15. Press "send" to send the email. |  | |

** Wait for your Peer Buddy to let you know when he/she has replied to your email before beginning the next steps.

*Figure 1*. Student task analysis for sending email

| | **Step-by-Step Instructions for Responding to Emails from Students** | Done: |
|---|---|---|
| 1. | Go to gmail.com. | |
| 2. | Sign in using the email: peerbuddies3@gmail.com<br>and the password: [redacted] | |
| 3. | Open the new email in your inbox from your peer buddy and read it. | |
| 4. | Click on "reply." | |
| 5. | Type the "Hi" and the name of the student that sent you the email. | |
| 6. | On the next line, type a message response from one of the following (depends on the message from your peer buddy)<br>- I am at school today too! Hope school goes well for you the rest of the day.<br>- I am doing good today too. Hope you have a great day!<br>- My elective class today is _____. I hope you enjoy your class! | |
| 7. | Sign your name on the next line of the message. | |
| 8. | Click Send. | |

*Figure 2*. Peer buddies' task analysis

**Experimental Design**

This study used a multiple probe across participants design (Cooper, Heron, & Heward, 2007; Kennedy, 2005) to measure the effectiveness of picture-based task analytic instruction and an iPad to teach students with moderate intellectual disability to send and reply to emails with peers without disabilities. The study design included three different phases for each student: (a) baseline probe sessions, (b) intervention phase using both task analyses (send email and receive email), and (c) maintenance checks. The initial baseline data lasted a minimum of five sessions for each participant. Intervention began with the student who demonstrated the lowest and most stable baseline first. Probe trials were conducted intermittently during the baseline phase for the two remaining students. Once the first student's baseline data showed a trend and was stable, the intervention was introduced. The same procedure was used when introducing the intervention to the next two students.

**Procedure**

**Baseline.** Baseline data were collected for at least five sessions for each student. A single opportunity method (Cooper et al., 2007) was used to determine the number of steps students were able to complete correctly and independently before intervention. During a session, a student was given an iPad and told to send and reply to an email with a peer. A student was not given extra tools to complete this task. The assigned peer without a disability was present in the classroom in case the student was able to send an email.

**Intervention.** The intervention consisted of picture task analyses, least to most prompting (i.e., verbal, gestural, physical), and a 5-s constant time delay (CTD; Touchette, 1971). That is, when the student was given an iPad and told to send and reply to an email, the investigator waited 5 s before she provided a verbal

prompt to complete a step of the task analysis. When the student did not respond within 5 s, the investigator provided a gestural prompt by pointing to where the student needed to touch on the iPad (e.g., selecting the compose button). If the student did not respond to the gestural prompt within 5 s, the investigator gently placed the student's index finger where he or she needed to touch on the iPad. When the student completed any of the task analysis steps incorrectly, the investigator implemented an error correction procedure which consisted of modeling the correct response and asking the participant to re-do the step. Each intervention session lasted between 15 to 20 minutes and consisted of instruction on both sending and replying to an email. The mastery criterion for intervention was 100% or 15 out of the 15 steps of each task analysis over three consecutive sessions.

**Maintenance.** After students reached mastery, they were given the iPad with the task analyses to determine the extent to which they complete the skill correctly and independently. Maintenance data collection began one week after each student reached mastery and completed the intervention. Maintenance data were collected over two sessions for each student, with each check point separated by one week.

## Results

Figure 3 represents the overall data for all three students for the baseline, intervention and maintenance phases. The mastery criterion for the study was 15 out of 15 steps on each task analysis, totaling in 30 steps completed independently overall. As demonstrated, each student showed substantial progress in sending and replying to an email to a peer without disabilities.

**Sarah**

The baseline results for Sarah showed she was only able to complete one step of the 30-step task analyses for sending and replying to an email from a peer without disabilities using the iPad without the intervention. Visual analysis of Sarah's baseline data indicates a stable trend for the five baseline sessions (*M* = 1). Once the intervention was introduced, data showed an immediate change in level with an increasing trend and no variability or overlapping data. Sarah's sending and replying to an email averaged 26 correct steps (range = 7-30). She mastered the criterion after receiving the intervention for 11 sessions.

One maintenance data point was collected one week after the skill was mastered, and a second data point was collected two weeks after mastery. The data showed Sarah was able to complete all 30 steps of the task analyses to send and receive an email correctly and independently during both maintenance sessions.

**Evan**

The baseline results for Evan represented a stable data path. Even was only able to complete one step of the 30-step task analyses correctly and independenlty before intervention (*M* = 1). After he was introduced to intervention, Evan showed a substantial increase in his ability to send and reply to email. Visual anlaysis of his data indicates an immidiate change in level, increased trend, and no variability or overlapping data. Evan's sending and replying to an email averaged 27 correct steps (range = 17-30). Evan was able to master the intervention criteria after receiving the intervention for 14 sessions.

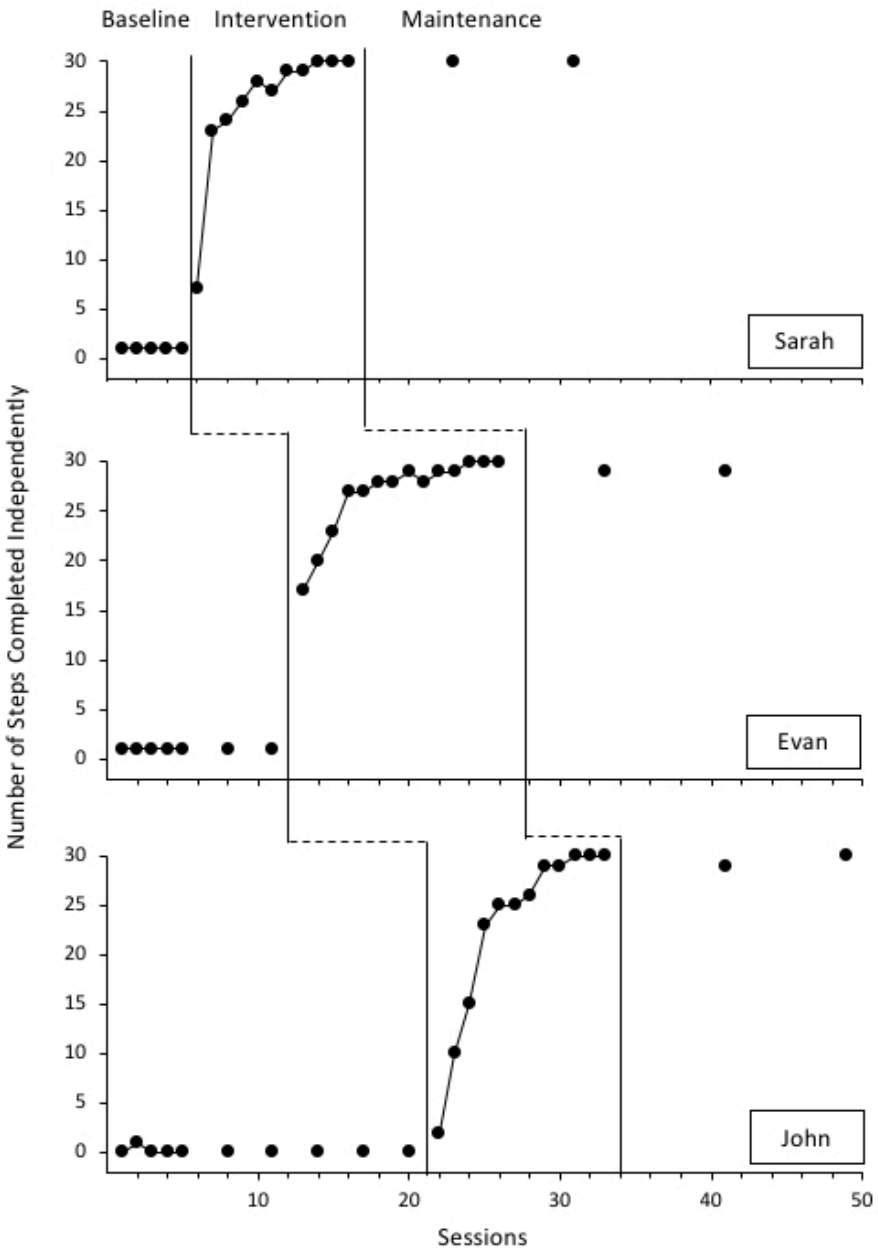


*Figure 3*. Number of steps completed independently on task analyses for sending and replying to email

The maintenance results for Evan showed that he maintained the skill of sending and replying to an email after the withdrawal of intervention. However, unlike during the intervention phase, Evan was only able to complete 29 out of 30 steps correctly and independently. Evan did not hit the button "reply" when he was trying to reply to an email.

**John**

The baseline results for John showed a stable trend at the zero level with the

exception of the second baseline session. John was able to open the iPad screen during the second baseline session. However, starting from the third baseline session, John did not complete any of the task analysis steps correctly (*M* = 0.1). After John was introduced to the intervention, he showed a slow increasing trend in the first intervention session, but then showed a more substantial increase in the subsequent sessions. His intervention data had no overlapping data or variability. John's averaged correct steps completed on the task analyses during intervention was 23 steps (range = 2-30). John mastered the intervention criteria after receiving the intervention for 12 sessions.

John showed similar consistency at his two maintenance checkpoints. In the first maintenance session, John was able to complete 29 out of 30 steps correctly and independently. He did not complete the step that entailed hitting the "compose" button in the email. However, in the second maintenance session, John was able to complete all 30 steps of the task analyses correctly and independently.

**Interobserver Agreement Results**

During every baseline, intervention, and maintenance session, one teacher assistant (TA) in the classroom took data along with the investigator. The TA observed each student and marked whether or not the student was able to complete each step of the task analyses correctly and independently. After the sessions, the primary investigator and the TA compared their scores. Overall average percent agreement was 92% (range = 83-100%). Specifically, the range of IOA for Sarah was 98-100% during baseline, 85-99% during intervention, and 92-100% during maintenance. The range of IOA for Evan was 96-100% during baseline, 87-97% during intervention, and 93-98% during maintenance. The range of IOA for John was 99-100% during baseline, 83-99% during intervention, and 93-100% during maintenance.

**Social Validity Results**

Each target student and peer participant completed a social validity questionnaire at the end of the study. Table 3 shows students' and peers' responses to the questionnaire. Students and peers indicated they liked the intervention, they learned how to use email, and they improved their social communication. When asked what they liked best about the intervention, target students commented, "It was fun," and "the iPad." Peers stated that they liked "hanging out with the students," "seeing they can email," and "getting to know the students."

Table 3. Social Validity Results

| Statement | S1 | S2 | S3 | P1 | P2 | P3 |
|---|---|---|---|---|---|---|
| 1. I like the program to teach people how to send and reply to emails on an iPad using task analyses. | Yes | Yes | Yes | Yes | Yes | Yes |
| 2. The study helped me | Yes | Yes | Yes | Yes | Yes | Yes |

| | | | | | | |
|---|---|---|---|---|---|---|
| learn how send emails with peers. | | | | | | |
| 3. The program helped me learn how to have social communication with peers. | Yes | Yes | Yes | Yes | Yes | Yes |
| 4. I would like my teacher to continue using this program to teach others how to send and reply to emails on an iPad. | Yes | Yes | Yes | Yes | Yes | Yes |
| 5. I would like to participate in this study again if my teacher wants me to. | Yes | Yes | Yes | Yes | Yes | Yes |
| 6. I would use these skills to help me do better in school and to socially communicate with peers. | Yes | Maybe | Maybe | Yes | Yes | Yes |

Note: S = Student, P = Peer

**Discussion**

The purpose of this study was to examine the effects of task analytic instruction to teach students how to use an iPad send and reply to emails with peers without disabilities. The study was conducted with three middle school aged students with moderate intellectual disability. Results showed the students improved their ability to send and reply to email with their non-disabled peers. This finding supports previous research (e.g., Johnson, 2013; Miller, Krockover, & Doughty, 2013; Weng & Bouck, 2014; Xin, Sheppard, & Brown, 2017) that also demonstrated the impact of using an iPad

for instruction. The study also extended the research by having students use an iPad for email exchanges.

Results support the benefits of task-analytic instruction on teaching a new skill to students with moderate intellectual disability. One of the students in the study was only able to read functional sight words (e.g., stop, go, classroom, school, bus); however, the picture cues on the task analyses supported the student's ability to send and reply to an email without verbal prompting from the interventionist by the end of the study. These results are similar to findings of a study by Carr and Felce (2008) which used a picture task analyses for instruction with students with moderate intellectual disability. The pictures assisted the students in the current study to complete this functional social skill (sending and replying to an email) independently.

More research is needed on interventions that promote students' social communication (e.g., email, social media). This study builds on the findings of Wang et al. (2016) regarding the social impact of sending and receiving emails for students with moderate disability. It also contributes to research on instruction in life skills for this population of students. Finally, because no contrived reinforcers were used, the substantial increase in students' performance suggests sending and responding to email was highly motivating.

**Limitations and Directions for Future Research**

This study had limitations that can be addressed in future research. First, measures of procedural fidelity (Cooper et al., 2007) were not conducted due to time constraints in the classroom. In this preliminary study; however, a major component of the intervention was the task analyses for sending and replying to email. All target students improved their ability to send and reply to email with peers. Future studies should include measures of procedural fidelity on the task analyses and other components of the intervention (i.e., least to most prompting, constant time delay). Furthermore, future studies could experimentally evaluate the effects of each intervention component (i.e., task analysis, least to most prompting, constant time delay) on students' ability to send and reply to email.

Another limitation to the study was that the wording on the task analyses were often difficult for the students to understand without explicit instruction. The words "reply" and "compose" were not simple words the students understood before the study. Additionally, the phrase "on one line down" did not clearly communicate to students that they would have to press the "enter" key on the keyboard to shift one line down. Each of these steps had to be taught by the interventionist first with least to most prompting before students could master these steps. Future studies could use more familiar terms or provide explicit vocabulary instruction prior to the intervention.

This study included measures of maintenance, but did not measure generalization. Future research should consider teaching students to send and respond to email in a variety of contexts and situations, such as with different people (e.g., family, friends), different topics (e.g., leisure activities, sports), different locations (e.g., home, bus stop), and with different devices (e.g., smart phone, laptop computer). Future research could also investigate the use of a variety of scripts (embedded in the task analysis) to support students' email composition. For example, students could practice with

scripts aimed at communicating with a coworker or boss, a teacher, or family members.

**Implications for Practice**

This study offers practical implications for teachers. First, teachers should carefully consider using peers without disabilities when teaching a social skill such as sending and replying to emails to students. The peers used in this study were already involved in the students' classroom and completed a training about their roles before working with the students. Teachers should be cautious and particular in choosing the peers in order to provide the most successful opportunity for social communication. Next, because the task analysis is portable, parents or siblings may be to provide students further practice opportunities to send and to reply to email outside of school. Finally, teachers need to ensure the pictures on task analyses match the device (e.g., iPad, smartphone, other email applications) students will use to send and reply to email. This is important for non-readers who can benefit from picture-based task analyses.

**Conclusion**

The purpose of this study was to examine the effects of using task analyses and an iPad to teach students with moderate intellectual disabilities how to send and receive an email with peers without disabilities. The results of the study indicated a clear increase in students' independent ability to send and receive an email on an iPad. These positive outcomes support teaching independent communication skills to students with moderate intellectual disabilities using peers, and a variety of supports such as picture-based task analyses, and technology tools.

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