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Pilot Study: Assistive Technology as a Vocational Support for Individuals with Autism Spectrum Disorder

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Pilot Study: Assistive Technology as a Vocational Support for Individuals with Autism Spectrum Disorder

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A culminating capstone project submitted to the faculty of Dominican University of California in partial fulfillment of the requirements for the degree of
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This project, written under the direction of the candidates' faculty advisor and approved by the chair of the Master's program, has been presented to and accepted by the Faculty of the Occupational Therapy Department in partial fulfillment of the requirements for the degree of Master in Science in Occupational Therapy. The content, project, and research methodologies presented in this work represent the work of the candidates alone.

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Abstract

The purpose of this pilot study was to determine the effectiveness of video-based instruction (VBI) to support completion of vocational tasks. A mixed-method approach was utilized to explore the use of VBI on a personal digital assistant with individuals with autism spectrum disorder (ASD). Using two assembling cooking tasks, researchers investigated the level of independence with task completion through written instruction versus VBI. The results indicated a small non-significant increase in the level of independence with task completion during the VBI task independent of intelligence quotient (IQ) levels. Participant's feedback of VBI was also noted as positive to help learn other tasks. This study presents evidence for the use of assistive technology to support task completion in the area of vocation for individuals with ASD.

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Introduction

Autism spectrum disorder (ASD) is described as a lifelong neurodevelopmental condition. People with ASD display persistent impairments in social communication and social interaction, including restricted and repetitive behaviors, interests, and activities (American Psychiatric Association, 2013). Within the last decade, the prevalence of ASD has significantly increased from one in 150 births in 2000 to one in 68 births in 2012 (Centers for Disease Control and Prevention, 2016). With the increasing availability of effective multidisciplinary therapies, children with ASD are growing to become young adults who are able to function and work in mainstream inclusive environments (Hillier et al., 2007). Current research studies have focused on the use of video-based instruction (VBI) as a method to improve learning abilities within the ASD community. VBI includes the use of personal digital assistants (PDAs), which are small handheld devices equipped with a microprocessor that is used for storing and organizing personal information (PDA, n.d.). PDAs include the use of applications comprised of video modeling (VM) and video prompting (VP). VM involves showing a video featuring a peer or instructor successfully modeling a specific task, often breaking the task into smaller steps to be played in sequence. (VP) utilizes verbal instructions to help individuals work through steps in a task. The literature suggests the use of PDAs is a helpful strategy to learn new skills. PDAs can also be used as-supportive aids to decrease the need for invasive personal supports and increase functional independence for individuals with ASD. Therefore, the intent of this study was to examine the effects of assistive technology (VBI on a PDA), as compared to written instruction, as a vocational support for learning novel tasks for young adults with ASD.

Literature Review

Characteristics of Individuals with ASD

Individuals with ASD present a wide variety of characteristics as described in the Diagnostic and Statistical Manual of Mental Disorders (DSM-V), such as deficits in cognition, communication, and social skills (American Psychiatric Association, 2013). Each individual has varying skills and abilities, which may affect performance in multiple aspects of living. Although cognition and socialization may be affected, several challenges can also be turned into strengths if given the optimal environment and accommodations. Assessing the individual's challenges as well as strengths are equally important when fostering vocational growth and inclusion into the community (Carter et al., 2015). Individuals with ASD have the ability to be successfully employed as long as their vocational needs are met (Hendricks, 2010).

Cognitive skills. Individuals with ASD can have intelligence in the typical range, but still display deficits in executive functioning (Merchán-Naranjo et al., 2016). Executive functioning encompasses a combination of higher order processes that are essential to regulate behavior and provide mental control (Merchán-Naranjo et al., 2016). Difficulties with attention, processing speed, retention of verbal and visual information, and problem solving are common in individuals with ASD (Merchán-Naranjo et al., 2016). In spite of these deficits, individuals with ASD can improve their cognition and learn novel tasks with appropriate accommodations.

Communication and social skills. Social interaction is difficult for individuals with ASD as a result of irregular emotional responses and limited reciprocal communication when engaged in peer interactions (Billstedt, Gillberg, & Gillberg, 2007; Howlin, 2003). However, if they are an expert on a certain topic or have an exceptional interest in a subject, individuals with ASD may be able to communicate directly with great detail (Shore, 2016). These individuals

often have difficulty reading facial expressions, labeling emotions, and maintaining eye contact (Billstedt et al., 2007; David et. al., 2010). Although individuals with ASD may have difficulty with processing nonverbal social cues, they have the ability to learn these skills through social narratives and direct instruction (Gagnon, 2001). The lack of social awareness can actually be perceived as a valuable asset because they would be less likely to feel self-conscious, as compared to typically developing individuals (Shore, 2016). Although they have many challenges in communication skills, individuals with ASD are often able to thrive when given the right modifications in the workplace and community.

Government and Community Resources for Employment

Achieving employment is a natural progression for adolescents as they transition into adulthood and leads to economic and social well-being (Roux et al., 2013). Individuals with ASD are able to perform jobs that have structure and consistency. Roux et al. (2013) listed several jobs that would be considered successful placements of employment, such as transportation and materials moving jobs, production and assembly work, factory work, food processing, preparation and serving, and building and grounds maintenance. Unfortunately, 6 out of 10 adults with ASD do not gain employment and must rely on family, friends, or government subsidies in order to live (Cimera & Cowan, 2009).

Benefits for government and community. Many adults with ASD are unemployed and, therefore, require government assistance to live. However with better vocational outcomes, the need for government-related supports will decrease. The mean cost for support of an adult with ASD in the United States is $50,320 annually and for an adult with ASD plus a comorbidity of intellectual disability the annual cost is $88,026 (Buescher, Cidav, Knapp, & Mandell, 2014). By initially investing money into supporting individuals with ASD to join the workforce, society

will save significantly over a period of time through increased productivity in businesses, reduced payment of benefits, and funding for day programs (Jacob, Scott, Falkmer & Falkmer, 2015). Services to support adults with ASD cost taxpayers in the United States $193.09 per hour, but when employed, these workers are able to generate monetary benefits versus costs to the community (Cimera & Burgess, 2011). In the United States, an individual with ASD works on average 23.7 hours per week and earns $8.38 earns per hour, slightly more than a minimum wage of $7.25 an hour. Average annual income earnings are calculated to be $9,533.09, which is below the national poverty level of $13,690 a year for a two-person family (Cimera & Burgess, 2011). Although these tallied earnings are not livable wages in the United States, employed adults with ASD will earn some money for their expenses and reduce the need for government assistance and financial support from taxpayers.

Employment supports. Individuals with ASD have difficulties in job attainment as a result of lack of information about available services and insufficient support (Wei, Wagner, Hudson, Yu, & Shattuck, 2014). Furthermore, 73.1% of employed adults with ASD informed their employers of their disability, but only 37.2% reported having workplace accommodations in place (Newman et al., 2011). Teaching effective communication skills for interacting with supervisors and coworkers, understanding and interpreting social rules, and developing independent work habits are necessary skills for successful employment (Jacob et al., 2015). Individuals with ASD benefit from participating in career and technical education, prior to leaving high school, to support a successful transition into the workplace and learn more about available supports. Additionally, vocational counselors provide education to find the best-fit job placements, which increases the number of hours and the amount of money to be earned. Thus,

adults with ASD are able to support themselves and increase their independent participation in the community (Jacob et al., 2015).

Benefits for employers. Employers who are willing to create a worker-friendly environment with accommodations and flexibility are important for the success of individuals with ASD in the workplace. In return, by employing individuals with ASD, employers often receive benefits of having employees with many positive qualities including reliability, lower levels of absenteeism, trustworthiness, attention to detail, a high degree of accuracy in visual tasks, advantageous long-term memory, and concentration (Jacob et al., 2015). These benefits result in greater productivity and work ethic. Individuals with ASD perform well at jobs typically developing people may have difficulties with, such as working in isolation or doing repetitive tasks. Additionally, if individuals with ASD have employment supports they can increase job longevity (Jacob et al., 2015). To ensure success, assistive technology, such as PDAs, will help break down barriers and provide the support adults with ASD need to create a positive work environment (Hill, Belcher, Brigman, Renner, & Stephens, 2013).

Improving Skills in the Workplace through VBI

Research studies have investigated the benefits of PDAs as one strategy to help individuals with ASD adapt and thrive in the work environment. PDAs, such as smartphones, portable media players, and tablets, are of strong interest as a possible assistive technology for individuals with ASD because of their ability to be adapted and modified to suit the needs of the individual in multiple aspects of the workplace (Mechling, 2011). With technology rapidly changing, the portability and convenience of PDAs, such as iPads, remain a socially acceptable method to provide support for employees with ASD in community businesses, leading to functionality in the workplace (Kellems & Morningstar, 2012). Each individual with ASD has

personal characteristics that can be strengths in the workplace if provided with the proper resources, such as VBI on a PDA.

Developing and retaining new vocational skill sets. VBI has been shown to develop new vocational skills in individuals with ASD. In a recent study, researchers determined the positive benefits of VM in developing unique, applicable skills that could be generalized into job opportunities at local community businesses (Allen, Wallace, Greene, Bowen, & Burke, 2010). In this study, Allen et al. (2010) found that adults with ASD learned vocational skills that were applicable to performing in inflated costumes at a local retail store and later determined that the participants were able to demonstrate these skills at a different department store. Allen et al. (2010) suggested that the participants in their study maintained the skills learned from VM and were able to generalize and maintain these skills into new novel social environments when given proper training. In addition, the literature suggests that VM is beneficial for learning new skill sets that could be seen as desirable for an employment position (Bereznak, Ayres, Mechling & Alexander, 2012). Bereznak et al. (2012) determined that VP on a PDA increased performance in specific vocational skills, such as operating a copy machine. In another subset of vocational skills, VM was found to be beneficial in improving matching skills (Alexander, Ayres, Smith, Shepley, & Mataras, 2013). Alexander et al. (2013) studied the effects of VM on an iPad during a vocational task of sorting mail and found that the matching skills developed were able to be generalized into novel mail sorting tasks.

Learning complex multi-step tasks. Several researchers focused their attention on the efficacy of VBI in teaching complex, multi-step tasks to adults with developmental disabilities. According to Mechling and Ortega-Hurndon (2007), VM through computer-based instruction was found effective in teaching complex multi-step office tasks, such as watering a plant,

delivering mail, or changing paper towels. In another study, four participants with ASD used VM through VideoTote software on a tablet device to learn a complex shipping and packaging task with an average of 73 steps (Burke et al., 2013). With the use of VM on a PDA, every participant showed improvement in the percentage of correctly completed task steps during the intervention condition when they used the software intuitively (Burke et al., 2013). This study has shown the efficacy of VBI to help individuals with ASD learn complex vocational tasks and act as a valuable tool for on-the-job support (Burke et al., 2013).

A further review of the literature supports the portability and efficiency of PDAs when utilizing VM in community-based businesses. Kellems and Morningstar (2012) observed four young adult participants with ASD who were provided video modeling interventions on an iPad in their employment setting. This study concluded that participants achieved a higher percentage of correctly completed steps in complex vocation-related tasks, such as cleaning a restroom, completing inventory, or taking out the garbage (Kellems & Morningstar, 2012). Results from this study also signified that community business owners agreed that portable technology usage by employees with disabilities helped the employee complete a complex work-related task (Kellems & Morningstar, 2012).

Improving autonomy in the workplace. Evidence supports the use of PDAs in reducing the need for job coaching or other job supports for adults with ASD, reducing the cost to employers and society (Hill et al., 2013; Gentry, Kriner, Sima, McDonough, Wehman, 2015). Gentry et al. (2015) concluded that use of new technology reduced the need for on-the-job supports, without interfering with the functional performance of employees with ASD.

Maintaining vocational skills and increased independence. VBI was effective in maintaining vocational skills while increasing self-sufficiency when individuals with ASD were

employed. Van Laarhoven, Winiarski, Blood, and Chan (2012) found that individuals with ASD were able to maintain and improve already acquired vocational skills as a result of VBI. Participants increased their performance, efficiency, and accuracy during the tasks. This study provides evidence that VBI increased independence, maintained vocational skills, and generalized learning to other vocational employments, signifying less reliance on job-related supports (Van Laarhoven et al., 2012).

Increased cognitive adaptations in the workplace. Adults with ASD who engaged in competitive employment positions over a long duration of time showed improvement in their overall cognitive skills (Garcia-Villamisar & Hughes, 2007). To sustain competitive employment, PDA technology was used as a vocational support to help adults with ASD overcome their cognitive and behavioral challenges while on the job (Gentry, Lau, Molinelli, Fallen, & Kriner, 2012). Gentry et al. (2012) found substantial improvements in the areas of task completion, organization and a decrease in behavioral challenges when participants utilized modeling programs as a cognitive aid. PDAs can also be used as an appropriate method for adults with ASD to help retain cognitive abilities and sustain skills within the workplace. With a variety of applications on the market, this study demonstrated that PDAs produced customized strategies to promote functional independence in the workplace (Gentry et al., 2012).

Increased transitional abilities and problem-solving strategies. The ability to transition efficiently between tasks and to problem solve effectively is a potential challenge for individuals with ASD and contributes to limitations in vocational goals. Palmen, Didden, and Verhoeven (2012) found that VM helped improve problem solving strategies when engaged in vocational-related tasks, is an effective method to teach students to reason through difficult tasks, and aids in transitioning to the next task. This study concluded that the use of PDAs helped improve

transitional abilities and increased overall independence in adults with ASD (Palmen et al., 2012).

Summary

Current data demonstrates that individuals with ASD face challenges, such as underemployment and limited vocational resources. However, individuals with ASD have the ability to work utilizing their unique strengths. PDAs have the potential to increase independence through socially acceptable technology to support employees with ASD in vocational activities. Individuals with ASD have communication and social skills barriers, but studies support increased cognition and retention of novel tasks through the use of VBIs. On a larger scale, VBI is cost effective for the government, community, and employers. PDAs as a workplace aid are beneficial on an individual level for increased productivity and assist with transitions between tasks for adults with ASD.

Although there is much evidence that supports the use of assistive technology for individuals with ASD, there still remains many gaps and limitations in the research on VBI as a vocational support. Many studies used small groups of participants and cannot be generalized to the entire population of ASD because of varying ranges in strengths, weaknesses, and impairments in each participant. The tasks performed were limited to basic cooking or workplace tasks and its transferability to more complex activities still remains undetermined.

Statement of Purpose

This study was developed in response to the difficulties individuals with ASD have when performing vocational skills. Previous studies have featured video modeling and video prompting technology as a vocational support to reduce the need for paraprofessional aides, life

coaches, and other professionals. If individuals with ASD have increased independence and require less on-the-job support, there will be an overall reduction in vocational support costs and successful integration into the work environment. The purpose of this study was to collect data to determine whether the use of VBI on a PDA increases the ability to correctly learn steps in novel tasks for males and females with ASD ages 14-50 years old. We hypothesized that when individuals with ASD use VBI on a PDA to learn a novel assembly-based cooking task, the result will be an increase in the level of independence when compared with the use of written instructions to complete a novel assembly-based cooking task. Although individuals with ASD are not limited to employment in the foodservice industry, increased independence in a multi-step assembly cooking task are skills generalized to other complex assembly tasks. Results from this study may further support existing literature that showed assistive technology, in the form of VBI, increased independence, cognitive skills, and competency in adults with ASD.

Theoretical Framework

The Occupational Adaptation (OA) theoretical framework was used to guide the implementation of this study. The OA framework was developed by Janette Schkade and Sally Schultz in 1992 and provides a holistic approach to human performance and optimal functioning, defining *mastery* of occupation as the ability to adapt to one's occupational environment (Schkade & Schultz, 1992). The developers created this theoretical framework to describe the importance of the adaptation process when engaging in meaningful occupational pursuits, such as in areas of work, play, leisure, and self-care. Schkade and Sally (1992) assumed that occupation provides a foundation for people to adapt based on the individual's intrinsic motivations for mastery, which creates an internal drive for adaptation. This adaptation process is said to be a "normative process" that creates satisfying occupational behaviors for the

individual, which in turn provides positive feedback to be integrated for subsequent use (Schkade & Schultz, 1992, p. 829). According to the main theoretical framework of OA, healthy individuals are able to show some adaptive capacity and relative mastery of their environment (Schkade & Schultz, 1992). In some cases, this adaptive process could be affected by illness, trauma, or disability, creating a lack of mastery. OA was chosen for this study because we are interested in facilitating the adaptive process by utilizing VBI technology to prepare individuals with ASD for mastery of their environment, or in the case of this study, their vocational pursuits. VBI acts as a readiness tool to assist with the adaptive process of learning, challenging individuals with ASD to adapt to novel situations and strive for mastery.

OA describes adaptation and mastery through three elements: the person, the occupational environment, and the interaction (Schkade & Schultz, 1992). Schkade and Schultz (1992) define the person as being made up of sensorimotor, cognitive, and psychosocial subsystems that are present in every occupational response. The interactions of these subsystems develop the unique individual and how they perceive engagement in occupation.

The OA framework describes the occupational environment as a context in which occupations occur (Schkade & Schultz, 1992). The framework takes into account the physical, social, and cultural contexts that could influence the occupational response. Schkade and Schultz define the physical subsystem as “nonhuman factors”, the social subsystem as external persons who influence the environment by “social predispositions, attitudes, and actions”, and the cultural subsystem as the rituals, routines, and roles that influence work, play, leisure, or self-care.

The interaction between the person and the occupational environment results in an occupational challenge (Schkade & Schultz, 1992). The occupational challenge requires the

person's skills, internal and external motivations, to engage in the occupational environment successfully. A successful engagement in occupation is said to result in adaptation, defined by OA as a change in functional abilities when moving towards relative mastery (Schkade & Schultz, 1992). Relative mastery helps one re-evaluate internal and external expectations, utilize positive occupational performance feedback, and generate an adaptive response that could be integrated into new occupational situations.

This study will also consider the motivational perspectives of every participant, an important and necessary factor for successful occupational adaptation. Schultz and Schkade (1992) describe inherent motivation as the ability to engage in occupations that meet the desire of the person, represent one's overall potential, meet the societal expectations, and have some ability to strive towards mastery. This study refers to motivation for autonomy and the ability to reach independence by using VBI assistive technology. Engagement in vocation is seen as a universal desire that meets societal expectations. The intention of this study is to use success in vocation as a motivational factor to facilitate the occupational adaptation process.

The OA theoretical framework helped to assist in the process of determining if VBI was a successful technology to help individuals with ASD learn novel tasks. This study took into consideration the person, the occupational environment, and the interaction between these constraints to observe if occupational adaptation occurred. A follow-up questionnaire was used to determine relative mastery and to see if the internal occupational adaptation process was achieved through the occupational challenge of cooking. If internal occupational adaptation is achieved using VBI, this will positively predict the participant's future occupational functioning ability to perform similar functional tasks in generalized settings (Schultz & Schkade, 1992). The

OA framework helped facilitate this process to achieve optimal occupational performance in the areas of vocation.

Ethical and Legal Considerations

The researchers obtained approval from the Institutional Review Board for the Protection of Human Participants (IRBPHP Approval #10592) on April 3, 2017. This research study upholds the Occupational Therapy Code of Ethics and Ethics Standards (American Occupational Therapy Association [AOTA], 2010) to promote safety for all participants involved. Five principles were used to maintain high ethical standards.

The principle of beneficence refers to showing acts of kindness, preventing harm, and promoting well being to others (AOTA, 2010). Overall, the use of assistive technology is both helpful and supportive for individuals with ASD that want to be functionally independent in many parts of their lives. This study promoted the increased ability for individuals with ASD to feel fulfillment by maintaining employment through the use of VBI.

Non-maleficence focuses on the obligation to not inflict harm on others (AOTA, 2010). The researchers did not exploit participants for financial gain or do anything that conflicted with professional judgment. Prior to beginning the study, researchers verbally discussed the risks and ways to reduce potential harm to the participants. The participants were protected from harm through their ability to stop the study at any time without any negative consequences.

Autonomy and confidentiality emphasize the need to keep sensitive information private and protect the right of an individual to make decisions that will impact their lives (AOTA, 2010). Prior to the study, researchers obtained consent from participants or consent by proxy. Each research participant understood the benefits and risks of being a part of the study. Researchers respectfully gave the participants the ability to withdraw from the study at any point.

To protect participants' confidential information researchers followed HIPAA regulations, data was password protected and kept in a locked drawer, and participant names were coded.

Procedural justice ensured that all processes and regulations were upheld in an unbiased and fair manner (AOTA, 2010). Researchers followed procedures necessary to receive IRB approval. Researchers exhibited fair treatment regulations and professional conduct at all times. For all assessments being used, standardized procedures were followed.

Veracity is based on honest communication and individuals' rights to truthful information (AOTA, 2010). Researchers represented themselves as occupational therapy students and answered any participants' questions truthfully. All the data was gathered and documented accurately and comprehensively for each participant.

Definitions and Variables

- **Autism Spectrum Disorder (ASD):** Lifelong neurodevelopmental condition with characteristics such as impairments in social communication and social interaction as well as restricted and repetitive behaviors, interests, and activities (American Psychiatric Association, 2013).
- **Flesch Reading Ease:** A formula used to assess the difficulty of a reading passage written in English. Scores are determined as follows: 0-29 very confusing; 30-49 difficult, 50-59 fairly difficult; 60-69 standard, 70-79 fairly easy; 80-89 easy, 90-100 very easy (Flesch reading ease, n.d.).
- **Flesch-Kincaid Grade Level:** A formula modifying the Reading Ease formula to produce a grade level score (Flesch grade level, n.d.).

- **Personal Digital Assistant (PDA):** Small handheld devices equipped with a microprocessor that is used for storing and organizing personal information (PDA, n.d.). Examples of PDAs include cellular phones and tablets.
- **Video modeling (VM):** Showing a video featuring a peer or instructor successfully modeling a specific task, often breaking the task into smaller steps to be played in sequence.
- **Video prompting (VP):** Showing a video clip of one step in a task and the individual is given an opportunity to complete the task before being shown the next step.
- **Video-based instruction (VBI):** Video technology used for instruction, which includes video modeling, point-of-view video modeling, video prompting, and computer-based video instruction (Yakubova, Hughes & Hornberger, 2015)
- **VideoTote:** A video modeling application that allows users to easily create, organize, and view training and task videos (The Prevention Group, 2012).

Methods

Design

This mixed methods pilot study evaluated the effectiveness of the use of VBI through a PDA on improving correct steps during a novel cooking task compared to following steps in written instructions on laminated paper. The independent variable was method of instructions: VBI on a PDA or using written instructions to complete a novel task. The dependent variable was the level of independence, which is the derived mean score of assistance from each task using the assistance scale of 1-5. Each participant acted as their own control by comparing scores of performing a novel task with written instructions versus VBI assistive technology on an iPad mini.

Participants

A convenient, non-probability sample of eight males and one female with ASD, 15-27 years old, were recruited through announcements to the community by Autistry Studios and Marin Autism Collaborative (MAC). Participant inclusion criteria included, (1) ages 14-50, (2) confirmation of ASD diagnosis by a licensed medical professional, (3) basic motor imitation skills, (4) ability to attend to a short video segment, and (5) ability to comprehend auditory and written instructions at a Flesch-Kincaid Grade Level 5.0. Participant exclusion criteria included: (1) individuals without an ASD diagnosis, (2) inability to attend to a short video and/or follow instructions, (3) individuals with behaviors that impair participation, and (4) intellectual disability that will prevent them from learning new tasks.

Information was provided to each participant regarding the study for their personal review before the consent to participate. Informed consent was collected from the participants and/or their legal guardians prior to the study. The Dominican Institutional Review Board (IRBPHP Approval #10592) approved this study prior to all data collection.

Measures and Instruments

Autism spectrum disorder. A diagnosis of ASD was verified by obtaining a copy of an evaluation from the family indicating the diagnosis from a licensed professional, such as a developmental pediatrician or psychiatrist. The participant had the option of providing a prior evaluation with the ICD-10 code F84.0 or ICD-9 code 299.00 representing ASD diagnosis.

Wechsler Abbreviated Scale of Intelligence. The Wechsler Abbreviated Scale of Intelligence (WASI) is a normed-referenced test designed for use with individuals between the ages of 6 years to 89 years, 11 months (Wechsler, 1999). This assessment provides four subtests and composite scores that represent intellectual functioning in specific cognitive domains, as

well as a composite score that represents general intellectual abilities. This test takes 15 to 30 minutes to administer and is designed to assess the cognitive ability of adolescents and adults. The WASI was standardized using a sample of 2,245 children and adults in equal numbers of male and female examinees aged 6 through 74, with standardization between ages 75 to 89 included more women than men. Reliability and validity scores reflected high levels of internal consistency, average test-retest coefficients were 0.79 to 0.90 for the composite score in adults and 0.77 to 0.86 in children over the mean retest period of 31 days. The internal structure data found intercorrelation patterns among the subtest scores and the sums of the subtest scores corresponding to the index and full-scale scores provided evidence of convergent and discriminant validity. Standard IQ scores have a mean of 100 with a standard deviation of 15 for verbal comprehension index, correlating with word reading, reading comprehension, and spelling (Wechsler, 1999).

The WASI IQ scores were recorded with results presented for the Verbal Intelligence Quotient (VIQ), Performance Intelligence Quotient (PIQ), and the Full-4 Intelligence Quotient (Full-4 IQ). VIQ subtests were administered through oral and written instructions and measured the participant's acquired knowledge, verbal reasoning, and attention to verbal information (Wechsler, 1999). PIQ subtests were administered with tangible objects and measured the participant's fluid reasoning, spatial processing, attentiveness to detail, and visual-motor integration skills. The Full-Scale IQ (FSIQ-4) is derived from all four subtests scores and is an overall estimate of an individual's general level of intellectual functioning, including the scores for both the VIQ and the PIQ combined (Wechsler, 1999).

Social Communication Questionnaire. The Social Communication Questionnaire (SCQ) is a screening for ASD for individuals 4.0 years and older with a mental age 2.0 years and

older, which evaluates communication skills and social functioning (Rutter, Bailey, & Lord, 2003). There are two questionnaires, Lifetime and Current forms. The Lifetime form focuses on the developmental history and provides scores suggesting for further testing of ASD. The Current form takes into account the individual's behavior over the most recent 3-month period. The Current questionnaire form was given to parents and caregivers and was composed of 40 yes-or-no questions that took less than 10 minutes to complete. For the purpose of this study, the Current form scores were used to understand the participants' social communication skills and severity of ASD.

Independence score. The researchers assigned an assistance score for each step (see Appendix A for data scoring sheets), which ranged from 1 to 5 points as described in Table 1. Each step in the task analysis was given an individual score based on the following assistance levels, starting with the least assistive prompt: (5 points) independently completed the step; (4 points) verbal prompt was an instruction given to the participant to either re-read the instructions or to replay the video; (3 points) gestural prompt was tapping the object or ingredient for the designated step while providing a verbal cue; (2 points) partial physical assistance was physically guiding the participant's hand to the object or ingredient for the designated step while providing a verbal cue; (1 point) full physical assistance was a hand-over-hand prompt to guide the participant to complete 100% of the step. Researchers allowed participants to independently complete each step of the task. If the participant was unable to complete a step in the task, the researcher provided prompts every 10 seconds, starting with the least assistive prompt. The total of assistance scores ranged from 17 to 85 points, which was averaged to determine the overall independence score. Higher independence scores indicate greater autonomy in task execution.

Table 1: ***Assistance Scale for Task Steps***

Assistance Level	Points
100% independent task performance	5
Verbal Prompt	4
Gestural Prompt	3
Partial Physical Prompt	2
Full Physical Prompt	1

Procedures and Data Collection Methods

Overview of the study. This study evaluated the use of VBI on improving skills through task analysis for each participant. Participants completed two different 17-step cooking tasks, one used written instructions on a laminated piece of paper and another used VBI. Both cooking tasks were structured with similar activity demands. The VideoTote application was chosen for the purpose of this study to design and create VBI because it was iPad compatible, cost effective, and easily customizable to the user. The tasks were videotaped through use of VideoTote and edited through iMovie. The video was filmed in the same kitchen and with the same equipment that the participants used to complete both tasks. The VBI task and written instructions task were performed individually by all participants in the same kitchen setting with two occupational therapy students (OTS) that scored each task using the assistance scale. The VBI task (intervention task) or the written instructions (control task) were administered in random order to the participant, with the subsequent task administered second. For the next participant, the tasks were administered in opposite order. Both tasks were designed and broken down into analogous 17-steps with similar activity demands using different recipes, as described in Table 2. Data was collected and analyzed for each participant. The final independence score was used to determine if VBI increased autonomy in the participants.

Sequence of events. The sequence of events proceeded as described below. Throughout the study, researchers informed the participant they could stop the study at any time.

First, recruitment of participants. Letters of permission were signed and given to the researchers to recruit through Autistry Studios and Marin Autism Collaborative. Recruitment flyers were distributed to the community organizations and interested participants were emailed by the primary researchers (see Appendix B). A screening demographic questionnaire (see Appendix C) was completed, either by phone or by mail. Completed screening questionnaires were analyzed for eligibility to participate in the research study. Once eligibility was determined, participants were emailed or mailed consent forms and a letter of information. All participants were asked to bring signed forms to Dominican University of California and researchers had additional forms available if participants needed them. All participants were given time to ask questions prior to the research study. Each participant was scheduled to attend a two-hour session at Dominican University of California's rehabilitation kitchen in the Meadowlands building.

Second, provided and administered assessments. Individual assessments were administered and their time requirements were as follows: Wechsler Abbreviated Scale of Intelligence (WASI) for approximately 15-30 minutes (Wechsler, 1999), and Social Communication Questionnaire (SCQ) for approximately 10 minutes (Rutter et al., 2003).

Third, introduced the control and intervention tasks. Participants were given two distinctive 17-step assembly-based cooking activities during the session, one with written instructions and the other with VBI, structured with similar activity demands. The task with written instructions was the control task. The task with VBI was the intervention task. The order of administration between the two tasks was randomized. During the control task, written instructions were provided in a step-by-step manner and participants were asked to complete each step. During the intervention task, researchers provided training beforehand where

participants learned the respective functions of the iPad mini and relevant VideoTote application use through standardized instructions (see Appendix D). A visual key was provided for functions such as the play, pause, forward, and rewind features (see Appendix E). Comprehension of the iPad mini and VideoTote application use were verified through a verbal quiz. Video recordings on the iPad VideoTote application featured an adult model verbally describing each step as it was performed. At the start of each step, the model was displayed on the screen followed by a video clip of the step being performed from the participant's perspective. After the video clip finished, a replay button option to re-watch the video or an arrow button to continue to the following step was displayed on the screen. Participants were asked to complete the intervention task using VBI.

Fourth, observing participants and collecting data. The researchers utilized a standardized script that was read to each participant during the written instructions and VBI tasks. The study was videotaped for referencing and accuracy of scoring. All the materials were pre-measured in labeled cups displayed in the same set-up for each participant. The researchers gave the following instructions to the participants, "I want you to make a chocolate cake/omelet by yourself, so I am not going to talk to you very much. If you have a problem try to solve it yourself. Everything has been measured for you." The researchers provided assistance while standing two feet away from the participant during the task in order to give prompts if the participant did not initiate step completion within 10 seconds. Starting from the least intrusive prompt, the researchers provided and documented the assistance level as needed by the participant by following the five-point assistance scale.

Fifth, thanking the participants. At the conclusion of the study, researchers gave participants a follow-up questionnaire (see Appendix F) and offered refreshments. The

questionnaire was a self-reflection to determine if participants felt they achieved mastery through the use of VBI during the intervention task. Their names were entered into a drawing for a gift card, which was sent to the winner after all participants are tested. Participants were thanked for their time and involvement.

Setting. The study was conducted in the rehabilitation kitchen of Dominican University of California's Occupational Therapy Department located in the Meadowlands building. For consistency, the researchers administered the control and intervention tasks in the same setting and day.

Equipment and apparatus. Materials for the control task included a mug, napkin, fork, cooking spray, liquid eggs, salt, pepper, non-dairy cheese, bacon bits, water, potholder, microwave, and trash can. Materials for the intervention task included a mug, napkin, fork, cooking spray, rice flour, sugar, cocoa powder, baking powder, oil, almond milk, potholder, microwave, and trash can. Prior to each session with a participant, the necessary materials were pre-arranged in the same set up on the counter next to the microwave and sink. An iPad mini was used for learning the predetermined novel intervention task through VBI.

Table 2: ***Steps Required for Control and Intervention Tasks***

Intervention: Chocolate Cake Preparation	Control: Omelet Preparation
1. Spray inside of mug with oil	1. Spray inside of mug with oil
2. Pour ¼ cup flour into the mug	2. Pour eggs into the mug
3. Put 2 tablespoons of sugar into the mug	3. Put ⅛ teaspoon of salt into the mug
4. Put 1 tablespoon of cocoa powder into the mug	4. Put ⅛ teaspoon of pepper into the mug
5. Put ¼ teaspoon of baking powder into the mug	5. Put 1 tablespoon of cheese into the mug
6. Use the fork to mix 5 times and place the fork on the napkin	6. Use the fork to mix 5 times and place the fork on the napkin
7. Put 1 tablespoon of oil into the mug	7. Put 1 tablespoon of bacon bits into the mug
8. Pour ¼ cup of milk into the mug	8. Put 1 tablespoon of water into the mug
9. Use the fork to mix 20 times and place the fork on the napkin	9. Use the fork to mix 20 times and place the fork on the napkin
10. Push the button to open the microwave	10. Push the button to open the microwave
11. Put the mug inside the microwave and close the door	11. Put the mug inside the microwave and close the door
12. Turn the bottom knob to the number 2	12. Turn the bottom knob to the number 2
13. Wait two minutes until the microwave beeps	13. Wait two minutes until the microwave beeps
14. Press the button to open the microwave	14. Press the button to open the microwave
15. Put one hand inside the potholder, take the mug out of the microwave and put the mug on the counter	15. Put one hand inside the potholder, take the mug out of the microwave and put the mug on the counter
16. Close the microwave door and take off the pot holder	16. Close the microwave door and take off the pot holder
17. Throw all plastic containers and trash away in the garbage can	17. Throw all plastic containers and trash away in the garbage can

Steps Required for Control and Intervention Tasks

Steps taken to reduce threats to reliability and validity. Researchers took several measures to increase internal reliability, including administering the intervention with the same researchers, setting, and completion within the one two-hour session. Higher interrater reliability resulted from two researchers scoring the participants simultaneously during both the written instructions task and VBI task conditions to compare results for the accuracy. Researchers used a script and sequence for prompting to enhance interrater reliability. Both researchers stood approximately two feet away from the participant and had an unobstructed view of the steps

performed to score the assistance level of each step. They recorded the lowest assistance score needed that resulted in the completion of the step. After data collection, if any scores differed between the raters, the scores were averaged after reviewing the video recording for accuracy of scoring in order to determine conflicting results. The participants were debriefed post-intervention and told about the purpose of the study, including an explanation of the effectiveness and usefulness of VBI. They each completed a follow-up questionnaire to assess their opinions about VBI and mastery. Instructions for baseline measures and intervention measures through VBI are described in Table 2.

Data Management and Analysis

The assistance level scores from both researchers were used to find the independence score for the written instructions task and the VBI task. Each rater calculated the assistance scores from all 17-steps to determine an independence score. In the case that the independence scores from each rater were different, the average of the scores between the two raters were calculated. The independence scores were compared between the written instructions task and VBI task for each participant. A paired t-test was used to compare the written instructions task and VBI task independence scores in order to determine if VBI on the iPad mini is beneficial and effective.

Results

Nine participants with ASD, eight males and one female with the mean age of 22 years and 4 months, completed both the VBI and written instructions tasks. All participants were from Marin County. Eight participants lived with their parents and one participant lived in a group home. One participant identified as African-American, while all other participants identified as Caucasian. At the time of the study, four participants were working part-time (10-20 hours per

week) and five were unemployed. Four of the unemployed participants were students and three of the part-time working participants were students. All nine participants completed the WASI prior to both the VBI task and written instructions task.

Differences in Task Independence Scores by Instruction Method

This research study's hypothesis that VBI would result in higher task independence was not a confirmed. There was no significant differences in independence scores between the two tasks $t(8)=1.3$, $p>.05$. There was a slight advantage using the VBI intervention to perform a novel task. Notably, the majority of the participants increased performance of cooking tasks with the use of the VBI versus written instructions regardless of order. The total mean change in independence scores between the written instructions task and VBI task was .09, with a minimum change of -.18 and a maximum change of .47.

Differences in Task Independence Scores by IQ

An additional question for analysis was if intelligence would influence the benefits of VBI. For the purposes of analysis, participant's FSIQ-4 scores were categorized into three ranges: below average, average, and above average. Table 3 describes the descriptive data for independence scores for comparison between the VBI task versus the written instructions task of participants with FSIQ-4 scores below the average, <89, and above the average, >120, determined an increased level of independence in the intervention. There does not appear to be a clear influence of IQ on task performance.

Table 3: ***Descriptive data for Independence Scores by FSIQ-4 Category***

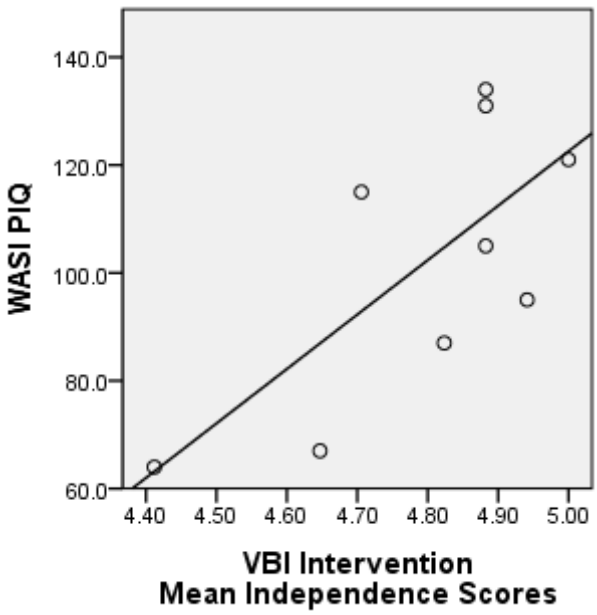
Task	IQ Category	N	Mean	Standard Deviation
Change in Task	-1.00	5	.11	.27
	.00	1	.00	.00
	1.00	3	.10	.15
	Total	9	.09	.21
Written	-1.00	5	4.64	.25
	.00	1	4.71	.00
	1.00	3	4.82	.10
	Total	9	4.71	.21
VBI	-1.00	5	4.74	.22
	.00	1	4.71	.00
	1.00	3	4.92	.07
	Total	9	4.80	.18

Note. IQ categories: -1.00 = below average; .00 = average; 1.00 = above average.

Relationship between Task and WASI Scores

A Pearson's correlation was computed to assess the relationship between the VBI task, written instructions task, VIQ, and PIQ. The results observed a positive correlation between the VBI task and PIQ variables with significance, at $r=.71, n=9, p=.033,$ with increased VBI task scores correlating with increased PIQ scores. A scatter plot was generated to summarize the results between PIQ scores and VBI task scores (Figure 1), noting a strong correlation between the two variables. No significant correlations were found between other variables.

Figure 1: ***Scatterplot of WASI PIQ and VBI Intervention Mean Independence Scores***



Qualitative Analysis

The follow-up questionnaire gathered qualitative data with closed and open-ended questions. Themes from the participant's feedback included "task was too simple" and "VBI could be beneficial when learning difficult tasks".

Some positive comments from the participants that support VBI's efficiency included:

"It can help me look up instructions." - Participant 3

"I am a fairly visual learner, and do better learning new and/or complex procedures while being shown (either physically or by video). The step-by-step chapter breakdown would be very helpful." - Participant 4

"It may help me to learn to cook in the future." - Participant 9

Additionally, eight out of nine participants stated they believed the use of an iPad would help them learn other tasks. All of the participants stated that the iPad helped them to learn to

cook more than reading the written instructions. Participants also noted on the follow-up questionnaire that the iPad was an easy tool to use for assistance during tasks.

Discussion

The purpose of this study was to determine the effectiveness of VBI as an assistive tool to provide support for individuals with ASD to independently complete tasks, an essential skill required for vocation. This research study investigated the effectiveness of VBI on an iPad mini through the completion of two assembly-based cooking tasks: making an omelet and making a chocolate cake in the microwave. The two cooking tasks were broken down through task analysis into 17-steps and required similar activity demands. From this set-up, the researchers hypothesized that participants using VBI would demonstrate a higher level of independence in comparison to the use of written instructions to complete the novel tasks. Our results indicated a slight, but non-significant, increase in the level of independence scores for the VBI task in comparison to the written instructions task. Overall, all participants were able to complete the VBI task with a high level of independence regardless of the level of intelligence or cooking experience. Our results highlighted two findings for the efficacy of VBI for increasing independence in novel task completion. First, data showed a positive correlation between the WASI PIQ score and the VBI intervention level of independence score. Second, our follow-up questionnaire provided positive perspectives on the use of VBI in everyday settings.

In support of VBI, the follow-up questionnaire revealed several positive responses from participants on their experience and use of VBI during the study. The responses from question 4 on the follow-up questionnaire indicated eight out of nine participants thought using an iPad and the VideoTote program would help them learn novel tasks. Seven out of nine participants stated they felt the iPad could help them learn to cook more than written instructions. The follow-up

survey provided valuable insight into the participants' thoughts when using VBI. Although the hypothesis was not supported as anticipated, positive participant's feedback obtained from this study remains a significant step towards defining the effectiveness of VBI and to determine if participants will have greater autonomy when using VBI during completion of vocational tasks.

Interestingly, the results indicated a positive correlation between WASI PIQ scores and the VBI task independence scores. WASI PIQ scores indicate one's ability to use fluid reasoning, spatial processing, attentiveness to detail, and visual-motor integration through the use of tangible objects (Wechsler, 1999). Thus, the results of this study indicate that using VBI interrelates to participant's PIQ subtest scores. Participants' use of VBI incorporates visual manipulation of objects through the iPad and provides feedback as the participant physically manipulates tangible objects. From our initial interpretation of the WASI scores, the current study found that the PIQ scores of participants were within average range when compared to the overall population, indicating that the participants in this study had relatively typical capabilities with visual and physical manipulation of objects. This correlation indicates that participants with a higher WASI PIQ score had better independence outcomes on the VBI task. Hence, this correlation relationship between PIQ scores and VBI task independence scores supports that VBI can be beneficial for individuals that have strong visual-motor integration skills to complete assembly-based tasks.

The main hypothesis of this study was not supported. When comparing participants' written instruction task and VBI task independence scores, the results indicated there was a small increase, yet non-significant, in participants' scores with use of VBI. While VBI was successful in promoting independent task completion, there was no advantage over the use of written instructions. Several factors inherent to the research study may have accounted for this.

The simplicity and design of both the VBI task and written task was a factor that accounted for the hypothesis to not be supported. All participants indicated on the demographic sheet that they had experience with using a microwave. Likewise, a majority of participants indicated on the demographic form that they participated in some form of basic meal preparation. Hence, this current study utilized the assembly of tasks that were novel-orientated, but the task demands were determined to not be novel to the participants. Raters gave a verbal prompt if the participants went to the next step prematurely before playing the video, which lowered the score on the five-point assistance scale. In turn, this lowered the average independence score even if the participants completed the step correctly. In addition, it was evident that the tasks in the research study were too simplistic because most of the participants' level of independence scores were on the high end. Minimal variance in scores indicated a ceiling effect was present. The two 17-step cooking tasks were perceived by participants as too simplified and easy to complete, which created an observed learned effect during completion of the second task, regardless of whether the second task was the control or intervention.

Furthermore, recruited participants were high functioning and received prevocational training through community programs prior to starting this study. Seven out of nine participants were recruited from Autistry Studios, a prevocational program that engages their members in creation and assembly of highly complex tasks. Members at Autistry Studios are involved in projects that require construction, design, and complex manipulation of objects. Thus, members from Autistry Studios potentially had skills and abilities that were beyond the intended design of this research study. The design of this study incorporated a wide spectrum of skills, but our participants demonstrated abilities that were beyond expected. A combination of high

functioning participants and experience with using a microwave potentially resulted in this study's hypothesis not being supported.

The use of technology has grown to be an essential part of everyday communication and a socially acceptable tool to use as an assistive device. The use of an iPad mini for VBI to learn novel tasks can be beneficial and helpful for community integration. Although this study's hypothesis was not supported as expected, the results suggest that individuals with ASD could potentially use the VBI software as an employment support tool in a variety of vocational settings without the need for support from an occupational therapist, job coach, or paraprofessional.

Limitations

There were several limitations that arose during the completion of this study. First, this study recruited a small homogeneous sample of participants who were too high functioning for the simple tasks presented. Participants had experience in prevocational programs which resulted in higher level of ability to perform multi-step tasks. The two 17-step tasks demands may not have been novel to the participants, which created an observed learned effect during completion of the second task, regardless of whether the second task was the control or intervention.

The location of Autistry Studios is in Marin County, which is in an affluent area with individuals of higher socioeconomic status. Many of the participants most likely come from families of higher socioeconomic status and have received early intervention services with a variety of interventions starting from an early age. Furthermore, a majority of participants were Caucasian males and one participant was female. The ability to generalize our results to the entire population is difficult due to narrow demographics. Another limitation of the data analysis was the small sample size in this study, resulting in low statistical power. Individuals with ASD

have a wide range of strengths and abilities; hence, a larger sample size is required to show statistical significance. Additionally, another limitation was the reading difficulty of the instructions. When designing this study, the instructions of the tasks were set at a Flesch-Kincaid scale reading level of grade 5 to ensure that all participants, even with lower IQs, could easily comprehend the task steps. Since the participant's FSIQ-4 scores were comparable to typical similar aged-adults, the instructions were too simple that it may have impacted the overall results. However, those with lower IQ benefited more from the VBI, which may have further skewed results.

Future Research and Recommendations

A recommendation for the future study of VBI is to utilize a more rigorous mixed-methods design involving both quantitative and qualitative components to see the efficacy of VBI. Adding a structured qualitative interview component to this study will bring insight into participant's perspectives, whether positive or negative, on the use of VBI in areas of vocation. Additionally, a structured interview component will allow future researchers to code for common themes that were experienced among participants during the use of VBI when learning novel tasks. Understanding the motivation and perspectives of participants when using VBI will allow researchers to obtain a deeper understanding of how the assistive technology will be utilized in areas of work and vocation. In addition, future research may consider analyzing independence levels of both the written instructions task and VBI tasks over a period of extended time in a longitudinal study, or perhaps consider providing a follow-up session to record any notable differences between the participants' independence levels.

Future research may also consider matching the task closer to the ability level of the participants. Furthermore, future research may consider omitting the written instructions task

from the control task and replacing it with verbal instructions. In addition, future research may include a comparison of VBI and written instructions, featuring two different vocational tasks with similar activity demands. The two tasks will result in different products but contain a comparable number of steps. These suggested methods will help reduce a learned effect in task completion and can potentially replicate assembly-based task scenarios that would arise in vocational settings.

The environment in which a task is completed is important for generalization and transferability of skills. Individuals with ASD may have challenges generalizing and transferring skills between environments. Future research can include testing the effectiveness of VBI to learn relevant vocational skills with participants in their real job settings. Although this current study is focused on helping individuals with ASD learn novel tasks, future researchers may be interested in conducting a study to explore the idea of maintenance of current vocational skills with the use of VBI. Future longitudinal studies can collect data on the level of independence before and after the use of VBI in comparison to those individuals that do not use VBI.

Clinical Implications

Adults with ASD have challenges with everyday tasks. Occupational therapists are focused on improving performance in everyday activities and promoting occupational engagement. The use of VBI can be used as an assistive tool to simplify completion of tasks in a step-by-step modification to support occupational engagement. Occupational therapists are encouraged to use VBI as an intervention with their clients to support its use in practice and determine what methods are effective in supporting occupational independence.

Occupational therapists have become more involved in the field of assistive technology. With the field of assistive technology expanding, society is looking for new and innovative ways

to maximize quality of life, despite a disability. Further research is required for VBI to support the evolving needs of those with developmental challenges, such as individuals with ASD. Occupational therapist have a unique set of skills that are applicable to support the use of VBI in the workplace, including incorporating activity analysis into highly complex vocation tasks and simplifying the learning process through technology. Occupational therapists understand the challenges of individuals with ASD, by understanding the individual's performance skills and performance patterns in relation to the occupation of work. In addition, occupational therapists have the ability to understand a person's work environment, analyze the impacting factors of the work environment, and provide necessary accommodations. Occupational therapists are the ideal healthcare professional to support the use of VBI with individuals with ASD in the workplace to increase self-efficacy and autonomy in vocation and through other aspects of daily living.

Conclusion

The purpose of this pilot study was to determine the effectiveness of VBI as an assistive technology intervention to support learning novel tasks. The results demonstrate potential effectiveness for the use of the VideoTote program to support adults with ASD with step-by-step task completion for multi-step tasks. Our goal was to investigate if the use of VBI can be a tool to increase independence with task completion, a necessary skill for areas of vocation. This research study hypothesized that when individuals with ASD use VBI to complete a novel cooking task, the result will be an increase in the level of independence when compared with written instructions to complete a novel cooking task. This hypothesis was not supported, but consequently, all participants were able to complete tasks with VBI with a high level of independence. The results indicated that VBI intervention was successful in guiding cooking tasks when broken down into simpler steps, regardless of IQ or previous cooking experience.

This study provided potential insights into the use of VBI to support independence in learning novel tasks. An individual may potentially be able to use VBI, even without the ability to read or cook. Further research is recommended to provide additional support for the use of VBI and to determine the long-term effects on vocational skill development.

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Appendix A: Data Scoring Sheet

Researcher: _____ Date: _____

Participant:_____ Order of Task: _____

Instructions to Participant: I want you to make a chocolate cake by yourself, so I am not going to talk to you very much. If you have a problem try to solve it yourself. Everything has been measured for you.

INTERVENTION: Score Sheet for Chocolate Cake						
Table 1: Assistance Scale for Task Steps						
Points	**1**	**2**	**3**	**4**	**5**	**Notes/Observations** **-How many times re-watched** **-Skipped a specific step and prompted back?** **-# of replays?** **-# of skips?**
Assistance Level *Wait 10 seconds and move to next assistance level*	**Full physical assistance** *Hand-over-Hand* *"I'm going to help you do this"*	**Partial physical assistance** *Hand To Object*	**Gestural prompt** *Tap Object*	**Verbal prompt** *Instruct to re-watch the video* *"What did you see in the video?"* *"Replay the video"*	**Able to perform step 100% independent**	
1. Spray inside of mug with oil						
2. Pour ¼ cup flour into the mug						
3. Put 2 tablespoons of sugar into the mug						
4. Put 1 tablespoon of cocoa powder into the mug						
5. Put ¼ teaspoon of baking powder into the mug						
6. Use the whisk to mix 5 times and place the whisk on the napkin						
7. Put 1 tablespoon of oil into the mug						
8. Pour ¼ cup of milk into the mug						

9. Stir until everything is mixed together and place the fork on the napkin				*Is it all mixed together? *Mix it some more		
Points	**1**	**2**	**3**	**4**	**5**	**Notes/Observations**
Assistance Level *Wait 10 seconds and move to next assistance level*	**Full physical assistance** *Hand-over-Hand* *"I'm going to help you do this"*	**Partial physical assistance** *Hand To Object*	**Gestural prompt** *Tap Object*	**Verbal prompt** *Instruct to re-watch the video* *"What did you see in the video?"* *"Replay the video"*	**Able to perform task step 100% independently**	
10. Push the button to open the microwave						
11. Put the mug inside the microwave and close the door						
12. Turn the bottom knob to the number 2						
13. Wait two minutes until the microwave beeps				*Pay attention to the video.		
14. Press the button to open the microwave				*Watch the video		*Note placement of Ipad (in front of microwave?) Note Safety/Problem solving?
15. Put one hand inside the potholder, take the mug out of the microwave and put the mug on the counter						
16. Close the microwave door and take off the pot holder						
17. Throw all plastic containers and trash away in garbage can						

Researcher: _____ Date: _____

Participant:_____ Order of Task: _____

Instructions to participant: I want you to make an omelet by yourself, so I am not going to talk to you very much. If you have a problem try to solve it yourself. Everything has been measured for you.

CONTROL: Score Sheet for Omelet

Table 1: Assistance Scale for Task Steps

Points	1	2	3	4	5	Notes/Observations
Assistance Level *Wait 10 seconds and move to next assistance level*	**Full physical assistance** *Hand-over-Hand*	**Partial physical assistance** *Hand To Object*	**Gestural prompt** *Tap Object*	**Verbal prompt** *Instruct to re-read written step or video*	**Able to perform task step 100% independently**	
1. Spray inside of mug with oil						
2. Pour ¼ eggs into the mug						
3. Put ⅛ teaspoon of salt into the mug						
4. Put ⅛ teaspoon of pepper into the mug						
5. Put 1 tablespoon of cheese into the mug						
6. Use the fork to mix 5 times and place the fork on the napkin						
7. Put 1 tablespoon of bacon bits into the mug						
8. Put 1 tablespoon of water into the mug						

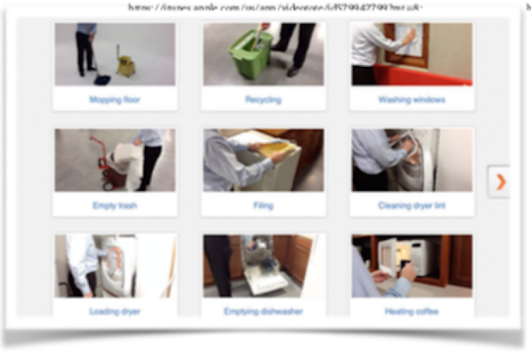
9. Stir until everything is mixed together and place the fork on the napkin				*Is it all mixed together? *Mix it some more		
Points	**1**	**2**	**3**	**4**	**5**	**Notes/Observations**
Assistance Level *Wait 10 seconds and move to next assistance level*	**Full physical assistance** *Hand-over-Hand*	**Partial physical assistance** *Hand To Object*	**Gestural prompt** *Tap Object*	**Verbal prompt** *Instruct to re-read written step or video*	**Able to perform task step 100% independently**	
10. Push the button to open the microwave						
11. Put the mug inside the microwave and close the door						
12. Turn the bottom knob to the number 2						
13. Wait two minutes until the microwave beeps				*Re-read the written step		
14. Press the button to open the microwave						
15. Put one hand inside the potholder, take the mug out of the microwave and put the mug on the counter						
16. Close the microwave door and take off the pot holder						
17. Throw all plastic containers and trash away in garbage can						

Appendix B: Recruitment Flyer

CONDUCTING AN INNOVATIVE

Research Study

April 2017 - August 2017



Video-Based Instruction

Assistive Technology for Individuals with Autism Spectrum Disorder

Occupational therapy students are currently conducting a new research study at Dominican University of California to examine how video-based instruction aids individuals with autism spectrum disorder to learn new tasks. We need your help!

1

SCREENING QUESTIONNAIRE

If you are interested in participating in this study, please contact Erin Chaffee to continue with the screening process

2

CONSENT & INFORMATION FORMS

Once participants are selected, the research team will distribute consent forms & additional information about the study

3

ASSESSMENTS & RESEARCH STUDY

2-hour session at Dominican University of California to complete the research study

(refreshments provided)

Who is eligible to participate?

Individuals with a diagnosis of autism spectrum disorder

14 - 50 years old

Ability to understand written and verbal instructions

How can employment outcomes be improved through the use of video-based instruction?

After completion of the research study, each participant will be entered into a drawing for a $25 gift card

To learn more about this research study, please contact: Erin Chaffee
Email: **asdstudy.dominican@gmail.com**

Appendix C: Demographic Form

Instructions: Please provide a response for each of the following questions:

Name: _____ Date of birth: _____ /_____ / _____

Mailing Address:

_____

Street City State Zip code

Phone number: (____) _____ - _____

Email: _____

Gender: □ Female □ Male

1. **I live with:** ***(Select all that apply)***
   - □ Grandparent(s)
   - □ Parent(s)
   - □ Roommate
   - □ Sibling(s)
   - □ Group Home/Independent
   - □ Other

   If other, please specify: _____

2. **What race(s) do you identify with?** ***(Select all that apply)***
   - □ Caucasian
   - □ African American
   - □ Asian/Pacific Islander
   - □ American Indian
   - □ Hispanic/Latino
   - □ Other

   If other, please specify: _____

3. **Do you read and write in English?**
   - □ Yes
   - □ No

4. **In January 2017-April 2017, I am available on:** ***(Select all that apply)***
   - □ Friday
   - □ Saturday
   - □ Sunday
   - □ Other

   If other, please specify: _____

5. **Do you have a diagnosis of autism spectrum disorder?**
   - □ Yes, diagnosed at ____ years old.
   - □ No

   Can you provide documentation?
   - □ Yes
   - □ No

6. **Do you have a method of transportation to get around the community independently?**
   - □ Yes
   - □ No

   If yes, please specify: _____

7. **What mode of communication are you most comfortable with?** ***(Select all that apply)***
   - □ Written (text, email, mail, etc.)
   - □ Verbal
   - □ Non-verbal (sign language)
   - □ Assistive/Augmentative Communication (PECS, voice output device)
   - □ Other

   If other, please specify: _____

8. **What treatments or services do you participate in?** ***(Select all that apply)***
   - □ Occupational Therapy
   - □ Physical Therapy
   - □ Speech Therapy
   - □ Pre-Vocational Workshop
   - □ Other
   - □ None

   If other, please specify: _____

9. **Are you a student?**
   - □ Yes
   - □No

10. **What is your highest level of education?** ***(Select one)***
    - □ Some High School
    - □ Certificate of Completion
    - □ High School Graduate/GED
    - □ Some College
    - □ College Graduate
    - □ Graduate
    - □ Other

    If other, please specify: _____

11. **What is your employment status?** ***(Select one)***
    - □ Not currently employed
    - □ Part Time Employment (less than 10 hours per week)
    - □ Part Time Employment (10-20 hours per week)
    - □ Part Time Employment (20-30 hours per week)
    - □ Full Time Employment

    If employed, please describe job duties:

    _____
    _____
    _____
    _____
    _____

12. **Which of the following vocational aids have you used or are currently using in school/work?** ***(Select all that apply)***
    - □ Job Coach
    - □ Written Instructional Aids
    - □ Pictorial Visual Aids
    - □ Video-Based Instruction
    - □ Other
    - □ None

    If other, please specify: _____

13. What kind of technology do you currently use? ***(Select all that apply)***

□ Computer □ Cellphone □ iPad
□ Video Games □ Television □ Washing Machine/Dryer
□ Other □ None

If other, please specify: _____

14. What kind of cooking devices do you use? ***(Select all that apply)***

□ Microwave □ Toaster Oven
□ Stove □ Oven
□ Convection Oven □ Fryer
□ Other □ None

If other, please specify: _____

15. What types of meals do you prepare? ***(Select all that apply)***

□ Pre Packaged (i.e. canned soups, hot pockets, frozen meals, etc.)
□ Self-Assembly (i.e. sandwiches, salads, etc.)
□ Other
□ None

If other, please specify:_____

16. Do you have sensitivities or food allergies to any of the following? ***(Select all that apply)***

□ Gluten (i.e. wheat, barley, rye, oats)
□ Dairy/Casein (i.e. milk, cheese, yogurt)
□ None

Appendix D: Video Tote Instructions

1. This is the Video Tote Program that we will be using today. This video is not about drawing a mouse, but about learning how to use the Video Tote features.

2. To begin, we are going to learn how to start the video. The gray triangle or the orange triangle on the screen is the play button (Point to gray and orange triangles). Go ahead and press the play button once.

3. As you can see, the video stops right after it is complete. This means the video has come to an end. If you would like to continue to the next video, press either the play button again. (Gray triangle or orange triangle)

4. Now, if you would like to replay the video. Press the double orange triangles with the word "back" once (point to double orange triangles). Then, press the play button. Go ahead and do that now (Wait till video replays). The video will replay again.

5. Take note of the chapter numbers on the bottom right corner. When replaying a video, make sure it only goes back one chapter number.

6. If you notice the video pauses a second time after hitting the back button, just press the play button again one time. We will practice this in this video if it occurs. You will not be using the Pause or Next Button on the screen.

7. We are now going to practice some of the features using VideoTote. Use the paper and marker that is in front of you to complete the instructional video.

8. You will be asked some brief questions after the video ends, so pay attention to the features.

9. Go ahead and press the play button and follow the instructions. Do as best as you can.

10. If participant draws and does not continue – What would you do now to continue with the video?

    a. If they need help or can't draw: What would you do to replay the video?

    b. Last video segment: Lets pretend you need to replay the video. What would you do to replay the video?

    c. Did you see the second pause? What would you do now?

Appendix E: VideoTote Key

1. To play the video, Press the  or  on the screen.

Wait until entire video finishes.

2. To Replay the video, press the  , then press  .

Press  one more time, if necessary. Wait until entire video finishes.

Icon	Description
	**Back Button (Replay Video)**
	**Play Button**

Appendix F: Follow-Up Questionnaire

1. Did you feel stressed at any point during the cooking tasks?

   □ No □ Yes

   Specify: _____

2. The iPad was confusing for me to use.

   □ No □ Yes

   Specify: _____

3. Using an iPad helped me to learn to cook more than reading instructions.

   □ No □ Yes

   Specify: _____

4. I think using an iPad can help me to learn other tasks.

   □ No □ Yes

   Specify: _____

5. I think using an iPad at my job will help me.

   □ No □ Yes

   Specify: _____

6. Other Comments/Additional Thoughts

   _____

   _____

   _____

   _____

   _____

   _____