Autism in the Workplace:

Testing the Self-Efficacy of Adults With Autism Spectrum Disorder When

Using New Media as a Mediated Training Stimuli

By

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“If I did not have my work, I would not have my life.”

– Temple Grandin
Abstract

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The University of Wisconsin-Whitewater, 2017
Under the Supervision of Dr. Jonathan Wickert

This study examined the effects of a multimedia training stimuli, which included one of the newest interactive medias – virtual reality. The main purpose of the study was to test the impact of Multimedia on the self-efficacy of adults with Autism Spectrum Disorder. Participants were assigned to one of two groups. Both groups took a pre and post self-efficacy measurement survey in order to measure their self-efficacy on performing the task of wiring an electrical outlet. This measure was to determine if there were any changes in the self-efficacy of the study group after receiving the training compared to the control group. The experimental group \((n=10)\) received informative video training on how to wire an electrical outlet, followed by a virtual reality simulation of wiring an electrical outlet. The control group \((n=3)\) received no training on how to wire an electrical outlet. The experimental group was also interviewed for qualitative results to provide a more in-depth understanding of the effects of virtual reality as training stimuli
for people with Autism Spectrum Disorder. Results emerged that indicate that adults with Autism Spectrum Disorder found multimedia to be a fun and engaging training method, and performance scores suggested that a multimedia method of training, including virtual reality, does increase the self-efficacy of adults with Autism Spectrum Disorder and is an effective learning tool. These findings support that multimedia can be utilized by organizations to help people with Autism Spectrum Disorder manage their uncertainty during the encounter (entry) phase of assimilation.
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Chapter 1: Introduction

Modern organizations strive to create initiatives that diversify their workforce and eliminate discrimination during the hiring process (Garriaga, & Mele, 2004). Many organizations are making notable efforts to hire more employees with disabilities, including individuals diagnosed with Autism Spectrum Disorder (ASD). Organizations such as Walgreens, Microsoft, Hewlett Packard, Vodafone, and SAP are recognizing the benefits of hiring people with ASD, and are indeed hiring these individuals.

Regardless of the efforts made to increase the employment of people with disabilities, workforce participation among the ASD community remains to be a work in progress with statistics showing 90% of adults with ASD are either unemployed or underemployed, and 35% of adults with ASD have never been employed (Shattuck, Narendorf, Cooper, Sterzing, Wagner, & Taylor, 2012; Advancing Futures for Adults with Autism, 2016). More than 3.5 million Americans live with ASD, and an estimated 500,000 teens with ASD will be entering adulthood in the next decade, bringing an annual cost to U.S. taxpayers of between 175 and 196 billion dollars for services to help adults with ASD (Buescher, Cidav, Knapp, & Mandell, 2014). Understanding the most effective ways to communicate with newly hired employees with ASD is essential to increasing positive outcomes during organizational assimilation.

Even as efforts are being made to diversify during hiring, there are still major barriers in the workplace that continue to exist for people diagnosed with ASD. Fitting into an organization’s culture can create a high level of anxiety for any newly hired employee (Kramer, 1989). However, newcomers with ASD can often display “clinical levels of anxiety” (Swain, Scarpa, White, & Laugeson, 2015). Such high levels of anxiety
affect an individual’s confidence, and put people with ASD at a disadvantage during the encounter phase of organizational assimilation.

Individuals with ASD often have difficulty correcting moment-to-moment emotional experiences and expressions in comparison to their typically developed coworkers (Swain, et al., 2015). Other potential challenges that employees with ASD often face in the workplace include: 1) having great attention to detail, but not being able to grasp a bigger picture; 2) having an inability to focus; 3) impulsivity; 4) having difficulty processing verbal, written, auditory, or experience information; 5) having a reduction in safety awareness; 6) being easily distracted by noise, smell, and proximity sensory issues; and 7) having difficulty understanding the concept of time and literal understanding (Kenyon, 2015; Swain, et al., 2015). These challenges can lead to uncertainty, which can affect the individual’s workplace experience. By recognizing barriers, organizations can offset the challenges facing employees with ASD by better educating managers and employees about these disadvantaged coworkers. Developing better communicative practices that demonstrate a commitment to the improvement of the methods used to train employees diagnosed with ASD during the organizational encounter stage of assimilation will increase the positive outcomes for employees with ASD.

There has been an insufficient amount of research performed on the achievement of positive outcomes for adults with ASD in the workplace. Positive outcomes include measurements of employee attitudes, their work performance, their job satisfaction, their commitment to the organization, the anxiety they experience while working, and turnover rate (Ashford & Black, 1996). ASD employees may more easily achieve these positive
outcomes if organizations adopt training methods that are more conducive to how people with ASD learn.

There is a correlation between positive outcomes and feelings of self-efficacy (Kammeyer-Mueller & Wanberg, 2003). Self-efficacy is a person’s confidence in their ability to succeed at performing a task (Bandura, 1988). In other words, the more confident someone is on the job, the better at their job they will be. Knowing that newcomers with ASD often display high levels of anxiety at the workplace (Swain et al., 2015), the reduction of anxiety would be a logical step to help them achieve occupational success. This raises the question of how organizations reduce anxiety, especially during the encounter phase. This paper proposes that the anxiety individuals with ASD experience can be reduced during the encounter phase of assimilation with training methods that utilize multimedia training stimuli (MTS).

An important factor in the achievement of occupational success and positive outcomes is learner engagement. Training is learning, and the learning process for typically developed individuals is much more effective when learners are engaged in what they are being taught (Kearsley & Shneiderman, 1998). Interactive learning environments foster critical thinking, problem solving and motivates the learning audience. Edutainment, learning and being entertained simultaneously, makes learning more enjoyable, and less threatening (Green & Jenkins, 2014). New technologies such as interactive video (IV), augmented reality (AR), virtual reality (VR), and video games, or gamification, are being utilized to create edutainment training tools. The use of these edutainment training methods has seen an increase in popularity by organizations. Companies such as Etcetera Edutainment, BullEx Digital Safety, and Summit Training
Source are creating game-based learning video games for safety training (Bloom, 2009). While some research has been focused on vocational training for employees with ASD, it has focused on social interaction (Kuriaskose, & Lahiri, 2015; Smith, Fleming, Wright, Losh, Humm, Olsen, & Bell, 2015; Kandalaft, Didehbani, Krawczyk, Allen, & Chapman, 2013; Wallace, Parsons, Westbury, White, White, & Bailey, 2010). The use of new technology for engaged task modeling remains virtually uninvestigated for people with ASD.

New technology, including VR, may be useful as a learning tool for newly hired employees with ASD. Visual prompts, such as pictures, signs, videos, etc., are effective for people with ASD (Roberts, 2002). Study participants with ASD have shown positive results across a range of employment settings when technology in the form of video modeling using a tablet with an application called VideoTote (Burke, Allen, Howard, Downey, Matz, & Bowen, 2013). In a study to determine if children with Autism could tolerate VR headgear, participants showed definite signs of learning, and became proactive, making attempts to use the equipment without being prompted or helped (Strickland, Marcus, Mesibov, & Hogan, 1996). Another study compared two groups of adult workers with ASD to ascertain if the use of an iPod Touch for vocational support could reduce the need for job coaches, and improves their overall job performance (Gentry, Kriner, Sima, McDonough, & Wehman, 2015). While the overall results were inconclusive, the use of the personal digital assistants (PDA)’s during training was considered preferable by researchers. These findings indicate that the use of new technology as a learning tool can better serve organizations in training employees with ASD during onboarding.
It was necessary for this preliminary study to draw from several theoretical frameworks. First, organizational assimilation is an important theory to include because it proposes that there are four phases that an individual experiences when they join an organization. These phases include the anticipatory socialization phase, the encounter phase, the metamorphosis phase, and the exit phase (Jablin, 1987; 2001). This study focuses on the anticipatory socialization and the encounter phases of organizational assimilation. It is during the anticipatory socialization phase that individuals determine what kind of job they may want to perform and what organization they may want to be employed by in the future, and it is during the encounter phase that newcomers, especially those with ASD, seek and obtain information to reduce their uncertainty, are trained to fulfill their organizational role, and feel the most anxiety (Jablin, 1987; 2001; Kramer, 1989; Miller, 1996; Swain, et al., 2015). It is therefore important that these phases are focused on when considering an individuals’ self-efficacy as self-efficacy correlates to anxiety (Kammeyer-Mueller & Wanberg, 2003).

Next, this preliminary study will employ communication strategies that help reduce the uncertainty that can assist newcomers with ASD during the anticipatory socialization and encounter phases. One of the most important theories that this study will examine is social cognitive theory (SCT), specifically, self-efficacy, which is an individual’s confidence in their ability to perform a task (Bandura, 1988). The reason SCT has such importance for this study is because of its connection to self-efficacy. A low sense of self-efficacy can create anxiety and produce negative behavioral outcomes for learners (Schunk, 2010). In fact, low self-efficacy makes it virtually impossible for a learner to learn because they will develop a low expectancy value and actually believe
themselves into failure by poor performance (Oliver, 1974). Self-efficacy learning processes are typically used in educational settings; however, the same principals should apply to the encounter phase of organizational assimilation since both are times of acquiring information and learning. This study tests the self-efficacy of individuals with ASD to see if it can be increased when using new technology such as virtual reality.

Finally, this preliminary study draws from the engagement theory, which states that students learn most effectively in an interactive and engaging learning atmosphere (Meece, Blumenfeld, & Hoyle, 1988; Kearsley & Schneiderman, 1999; O’Brien & Toms, 2008). One of the ways to get learners engaged and motivated is through gamification. Gamified instruction helps learners feel more relaxed, especially during failures when learning (Leaning, 2015). Feeling relaxed while learning may be especially important when considering the anxiety felt by newcomers, especially those with ASD (Kramer, 1989; Swain, et al., 2015). Engagement theory will help this study better understand if people diagnosed with ASD actually benefit from the use of virtual reality as a learning tool to help increase self-efficacy.

The purpose of this preliminary study is to determine if new technology, which in this study will include a VR simulation and an informative video to learn one specific task of an electrician, can affect the self-efficacy of the learner. The study will also review if participants are engaged during MTS training. Findings from this preliminary study will provide evidence to determine if MTS can contribute to the positive outcomes of adults with ASD in the workplace, and provide empirical evidence to either support or abandon new technology as a tool for training newly hired ASD employees during the onboarding phase of organizational assimilation, or perhaps encourage future studies.
Identifying the impact of new technology as a learning tool will not only provide organizations with information they need to confidently hire employees diagnosed with ASD in the future, but to also increase the odds of employment success by providing evidence-based, successful training methods for those individuals.

There are many advantages to using VR as a learning tool. VR is repetitious, interactive, allows a person to make errors without consequence, provides instant feedback, and allows individuals to participate in real-life situations (Issenberg, McGaghie, Petrusa, Gordon, & Scalese, 2005). Previous studies have indicated that VR helps people with ASD improve their vocational outcomes, and has been shown to raise the self-efficacy of participants with ASD in studies using VR simulations to enhance their job interviewing skills (Smith, Ginger, Wright, Wright, Taylor, Humm, Olsen, Bell, & Fleming, 2014; Smith, Fleming, Wright, Losh, Humm, Olsen, & Bell, 2015). While other studies have focused on using VR to help people with ASD improve their social interaction skills and increase their self-efficacy during social situations, the significance of this preliminary study is that this study focuses on using VR as a way to increase the self-efficacy of individuals with ASD while performing tasks during the encounter phase of assimilation, which would indicate that this training would decrease their anxiety and uncertainty when they enter into a new organization or start a new job.
Chapter 2: Literature Review

Organizational assimilation theory can be utilized to aid newly hired adults who are diagnosed with ASD by reducing the uncertainty they experience when executing organizational tasks. Empirical studies afford the necessary data to provide a better understanding of assimilation and self-efficacy during both the anticipatory socialization and encounter phases of assimilation (Jablin, 1987, 2001; Bandura, 1997, 2008). Equally important are studies that utilized new technology, such as VR, to test what impactful changes could be made to improve both the interactive skills necessary to obtain employment, and the vocational outcomes of newly hired employees with ASD (Kandalaft et al., 2013; Strickland et al., 2013; Smith et. al, 2014; Smith et. al, 2015). While those studies addressed key social interaction problems, they did not investigate learning organizational roles, reducing new member uncertainty, or the most effective ways to give instruction to people with ASD. This study examines effective ways for people with ASD to learn in order to develop training methods that increase self-efficacy and reduce uncertainty.

There are benefits to both the community and to the hiring organizations when employing people with ASD. First, services for adults with ASD bring an annual cost to U.S. taxpayers of between 175 and 196 billion dollars (Buescher, et al., 2014). By helping people with ASD obtain meaningful employment, a cost savings is passed on to the U.S. taxpayer. Second, people with ASD are considered by many to be stellar employees because they often display above average intelligence, have the ability to do repetitive tasks over long periods of time, have a talent to detect patterns, and have the ability to think at a high level of detail and depth (White, 2014; Picciuto, 2015; Errata,
Finally, there is evidence to support that obtaining and maintaining meaningful employment is beneficial to adults with ASD (Benefits of Occupational Therapy for Autism, 2016). Participation in a conventional environment, such as having the financial means to support themselves and make their own desired purchases, are benefits that can increase their self-confidence and self-esteem (Sonne, 2009). Other benefits include demonstrations to expand beyond their comfort zone of abilities, as well as their “people network,” and an overall positive increase in their attitude (Sonne, 2009). Providing a strong support system for newly hired employees with ASD will increase their self-efficacy and self-esteem, thus, increasing the likelihood of them achieving positive vocational outcomes.

**Organizational Assimilation**

Assimilation occurs when an individual joins, participates in, and leaves an organization (Jablin, 1987). Assimilation can be further divided into two parts: 1) socialization – when an organization attempts to influence the behaviors and decision making processes of newcomers to meet organizational goals; and 2) individualization – when an individual joins an organization and attempts to change the organization change to meet their needs (Jablin, 2001).

Individuals experience four phases of the assimilation process. These phases include: 1) the anticipatory socialization phase – what an individual anticipates it will be like to be a part of a particular vocation or organization. This phase is divided into two processes. Vocational anticipatory socialization, where an individual selects a specific occupation or career to perform, such as an electrician, and organizational anticipatory socialization, where an individual selects a specific organization to join, such as General
Electric; 2) the encounter phase – when an individual joins an organization. This is their experiences, engagement and participation during the first days, weeks and months as a new organizational member; 3) the metamorphosis phase – when an organizational newcomer begins to feel like an incumbent or organizational expert; and 4) the exit phase – when an organizational member makes the decision to leave an organization (Jablin, 1987; 2001).

Advancement from phase to phase does not always go as expected, or how an organization or an individual may hope. Transition from the encounter phase to the metamorphosis phase requires a newcomer to switch from being a learner of their organizational roles to feeling confident enough to consider him or herself an established member of the organization (Schlossberg, 1981). Some members may struggle more with learning their organizational roles than others. Organizations measure member competency through how well a member learns and performs their organizational tasks, how well they develop relationships within the organization, their knowledge of the organization itself, and whether or not the member brings a positive affect to the organization (Gailliard, Meyers, & Seibold, 2010; Meyers, & Oetzel, 2003). Individuals who take longer than others to progress through the encounter phase may be at a disadvantage to their coworkers. Some may never make it to the metamorphosis phase. What leads one person to metamorphosis may not lead another to feel like they belong. Therefore, one person may need a friend group while another may need to feel like an expert.

Employee success is often measured by what is called positive and negative outcomes, which indicates an organizational member’s attitudes, work performance, job
satisfaction, organizational commitment, occupational anxiety, and turnover rate (Ashford, & Black, 1996). Fitting into an organization’s culture can create a high level of anxiety for any newly hired employee (Kramer, 1989). Empirical evidence has shown that high levels of anxiety can affect an individual’s confidence, and low confidence correlates with feelings of low self-efficacy (Kammeyer-Mueller, & Wanberg, 2003). If organizations want to create an environment that provides their members an equal opportunity to learn, they will need to ensure that all members have the ability to learn at a comfortable pace, free from judgment and any unreasonable amount of anxiety. Strategies will need to be developed for members with ASD to provide proper learning protocols during both the anticipatory socialization and encounter phases of assimilation.

One of the barriers that newcomers with ASD often face in the workplace is an extreme level of anxiety (Swain et al., 2015). High anxiety levels can be a disadvantage during the encounter phase as it can contribute to self-perceived performance deficiencies, and ultimately poor job performance (Judge, Locke, & Durham, 1997). Poor job performance is often used to measure an organizational member’s competence (Meyers, & Oetzel, 2003; Gailliard, Myers, & Seibold, 2010). Scholars should prioritize conducting studies that provide empirical evidence to help prevent such job performance misdiagnoses for organizational members who have developmental disabilities such as ASD.

The encounter phase is characterized as individuals having a heightened level of uncertainty, and seeking information to manage that uncertainty (Miller, & Jablin, 1991). During the encounter phase, new members obtain information regarding his or her role within the organization, or the expectations for them as new members. While they are
receiving necessary information to successfully assimilate, newcomers process the information and familiarize themselves with organizational processes (Jablin, 1984; Morrison, 2002). The encounter phase is a learning stage. It is when a new member is being trained to do their job, when they are getting comfortable, when they are learning organizational hierarchy, norms, routines, roles, safety protocols, and other information they are expected to retain (Morrison, 1995; Jablin, 2001; Kammeyer-Mueller, & Wanberg, 2003; Ashforth, Sluss, & Harrison, 2007). Organizational members who are uncertain will experience some level of discomfort (Morrison, 1995). That discomfort will have an amplified impact on an individual with ASD as they exhibit extreme levels of anxiety in the workplace (Swain et al., 2015). Uncertainty needs to be managed in order for organizational members with ASD to learn their roles comfortably and free of anxiety.

The tactics organizations use to assimilate new members can have lasting effects (Van Maanen, & Schein, 1979). Organizations, either consciously or unconsciously, choose between six strategies to assimilate new members. The first choice is between group and individual socialization. Group socialization occurs when newcomers partake in the same training at the same time. Individual socialization occurs when an individual receives one-on-one, personalized training. The second choice is between formal and informal training. Informal training is in essence being trained on the job. The member shows up for work and the organization puts them right to work. Formal training is when a member is trained to perform their organizational role prior to actually performing their organizational role. The third choice is between sequential and random socialization. Sequential socialization occurs when a member learns a new task in a specific order, and
is not allowed to move on to the next task until they master the first task. This type of strategy is usually associated with formal training. Random socialization occurs when a member learns skills randomly as they appear, and is usually associated with informal training. The fourth choice is between fixed and variable socialization. Fixed socialization has an exact time allotment given to learn a skill or task. Variable socialization has no time allotted to learn a skill or task. The fifth choice is between serial and disjunctive socialization. Serial socialization occurs when an individual familiar with the organizational role is assigned to the newcomer, works with them to help them learn the role and answer questions as needed. Disjunctive socialization occurs when the newcomer has nobody assigned to work with them and to help them learn. The sixth choice is between divestiture and investiture socialization. Divestiture socialization occurs when an organization attempts to replace the individual characteristics of the newcomer with desired, standardized characteristics, such as the military. Investiture socialization occurs when an organization appreciates and builds upon a member’s uniqueness (Kramer, 2010).

Organizational members seek information to manage their uncertainty (Kramer, 2010). Uncertainty is divided into four categories. They are: 1) task related – knowing what tasks you are expected to complete as a member, and how you will be evaluated; 2) relational uncertainties – knowing who you work with, and developing relationships with them; 3) organizational uncertainties – knowing the organization’s culture, history, and behavioral norms; and 4) political and power uncertainties – knowing who is influential, who to talk to get things done, and who can create opportunities for you (Kramer, 2010).
Newcomers to organizations experience elevated levels of uncertainty (Gallagher, & Sias, 2009). There are three strategies that individuals use to manage uncertainty. They are: 1) passive – gaining information through observation; 2) active – gaining information through asking a knowledgeable member questions, but not the source of uncertainty; and 3) interactive – directly communicating and interacting with the source of uncertainty (Berger, 1979). To make an individual feel comfortable, it is not necessary to reduce all uncertainty (Kramer, 2010); however, individuals with ASD have difficulty with social interaction (Kandalaft et. al, 2012). This would indicate that these strategies might work for some individuals with ASD, but it is more likely that they would not work, and they would never feel comfortable seeking information using active or interactive strategies. A passive strategy is the most likely of the three to work for people with ASD; however, seeking information through observance would involve steps and sequencing, which can often be difficult for people with ASD (Boucher, & Lewis, 1989).

Individuals use both internal and external sources for information acquisition during uncertainty management (Kramer, 2010). Examples of internal sources, using an internal or cognitive process rather than actively seeking information, include carrying over past work experiences or expectations, predicting information they will receive if they seek any, and imagining a supervisor’s criteria for work performance expectations (Kramer, 2004). Examples of the most often used external sources are peers and coworkers, supervisors, mentors, handbooks, webpages, and controlled media (Kramer, 2010). New media, such as VR, offers trainees several advantages over traditional methods of training (Issenberg et. al, 2005). Individuals with ASD should see equal benefit to such training, and perhaps even benefit more. Achieving mastery at their
organizational role, free of judgment and at their own learning rate, prior to the encounter phase may help these individuals manage, and reduce, their uncertainty.

**Educational Theories For Assimilating People with ASD**

Assimilation requires a new or perspective member to be willing and able to receive, process and retain information and perform the tasks necessary to adequately perform the needs of the organization designated to them (Jablin, 1984; Morrison, 1995; Jablin, 2001; Morrison, 2002; Kammeyer-Mueller, & Wanberg, 2003; Ashforth et al., 2008). There are some who argue that education and training concepts are completely different concepts regarding the development of employees (Garavan, 1997).

Training takes place when one acquires the skill, knowledge or behavior necessary for core competency of a specific organizational role - learning by doing. Education also takes place when one acquires skills and knowledge, but education is more systematic and ongoing than training. Education also develops a sense of judgment and reasoning, which is presented through a different methodology, and typically takes place in an institution of learning (Garavan, 1997).

Learners must determine whether they should engage in training or education. To make that determination, attributes such as the purpose of the learning experience, evidence of the learning experience, difficulty to learn, length of learning process, and style of learning need to be considered (Chickering, & Reisser, 1993).

While it is evident that there may be some differences between training and education, learning takes place during both training and education. Strategies, tactics, methods and theories that are common in the field of education can be utilized during the assimilation of new members of an organization. Theories such as the theory of multiple
Multiple Intelligences. The theory of multiple intelligences emerged from cognitive research and proposes that learners are unique in their learning process and learn in different ways (Gardner, 1991). There are seven identifiably distinctive learning styles. While a learner may be capable of learning using more than one style, and often does use more than one learning style, there is always one style that is dominant. The first multiple intelligence style of learning is visual-spatial, where individuals learn best through imagery, such as models, video, pictures and multimedia. Next, the bodily-kinesthetic learning style, where individuals best learn through physical activity, such as hands-on learning with real objects. Then there is the musical learning style, where individuals learn best by putting lessons in lyrical form or rhythm, such as music or multimedia. Then there is the interpersonal learning style, where individuals best learn through interactive activities, such as group activities and seminars. Next, there is the intrapersonal learning style, which is the most independent of all learners; these individuals best learn though independent study and introspection, such as books, privacy and time. Then there are linguistic learners, who best learn by reading books together, lecture, tape recorders, books and games. Finally, there are logical-mathematical learners, individuals who are conceptual and best learn through logic games and investigations, such as experiments and puzzles (Gardner, 1983). Another learning style was later added, the naturalistic learning style, where individuals make distinctions in nature, or their natural surroundings, and apply them practically to hunting, farming, and biological science, or gathering (Gardner, & Hatch, 1989).
Understanding multiple intelligences and allowing individuals the opportunity to learn in the way that best matches their learning style is a strategy that should be considered during the anticipatory socialization and encounter phases. Most, if not all, learning styles utilize multimedia, or what is referred to as mixed media, as a learning aid (Gardner, 1991). This coincides with media effects research that indicates that content delivered through multiple modalities result in greater memory gain (Sundar, 2000).

Advancements in digital media have made the use of multiple media channels plausible, accessible, and easily modified to assist learners of all styles. Learners with ASD have been known to interpret information using visual spatial intelligence, and tend to think in terms of pictures (Porter, 2006). A functional MRI study revealed that people with ASD rely on visual parts of their brain to process information (Ring et al., 1999). People with ASD can benefit from training methods that utilize visual-spatial tools during the anticipatory socialization and encounter phases of assimilation.

**Engagement Theory.** The major premise of the engagement theory is that effective learning, such as creating, problem solving, reasoning, decision-making and evaluation, occurs when learners are engaged in what they are being taught (Kearsley, & Shneiderman, 1998). Interactive environments have more impact than traditional learning environments because they serve as both education and entertainment, commonly referred to as edutainment (Green & Jenkins, 2014). The popularity of utilizing new technology for training is growing. Companies such as Etcetera Edutainment, BullEx Digital Safety, and Summit Training Source are creating game-based learning video games for safety training (Bloom, 2009).
People with ASD tend to have difficulty with sequences, and too many steps in a process can confuse them (Boucher, & Lewis, 1989). People with ASD also tend to lose focus during verbal instruction or demonstration of task (Boucher, & Lewis, 1989; Kenyon, 2015). These difficulties indicate that engaged learning would benefit individuals with ASD because engagement demands focus and attention to what one is doing. Successful workplace outcomes have been achieved by individuals with ASD when organizations employ engagement principles during (Hagnar, & Cooney, 2005); however, more empirical analysis needs to be conducted in order to obtain the data necessary to effectively evaluate whether technology is a viable solution for employees with ASD during the anticipatory socialization and encounter phases of assimilation.

**Social Cognitive Theory.** When newcomers manage their uncertainty, one of the strategies they use is the passive strategy, where they gather needed information through observation (Berger, 1979). The social cognitive theory posits that knowledge can be acquired through modeling (Bandura, 1988). The observance of models can train people on how to deal with different situations or perform a behavior. The process of modeling occurs when a learner observes a behavior performed by a model in order to potentially imitate that behavior. Modeling is in essence what is used during serial socialization in the encounter phase of assimilation (Kramer, 2010).

Models can include, but are not limited to, live demonstrations, mediated sources, or even indirect forms such as verbal and written instruction (Bandura, 1986). There are four components to the modeling process: 1) the observer must pay attention to the behavior to be able to successfully model it; 2) the observer must be able to remember the behavior as a symbolic representation in order to convert that memory to an action; 3) the
observer must be able to think through and actually perform the various steps of the
behavior; they must practice; and 4) the observer must have motivation to learn, or to
want to learn (Bandura, 1986).

Social cognitive theory is an expansion of the social learning theory. Both the
social learning theory and the social cognitive theory assume that learners learn through
the observation of others; however, social cognitive theory puts more emphasis on social
interaction, and how learners learned from their past experiences (Bandura, 1986).

Key concepts of the social cognitive theory are that people learn their behaviors
through situation, and the observation of other people’s behavior (Bandura, 1986).
Together, these concepts create the triadic reciprocal causation factors. The triadic
reciprocal causation factors do not only influence each other, but can also interact with
each other. They are: 1) personal characteristics - an individual’s biological qualities
and/or cognitive abilities; 2) behavior - providing a learner with a successful learning
response when performing a behavior correctly; and 3) environmental factors - providing
appropriate and supportive environmental conditions that improve conditions for learning
and/or self-efficacy (Bandura, 1986, 1994, 2001). Any of these factors can have an
impact on a person’s ability to learn, and even assimilate into an organization.

Another key distinction within the social cognitive theory is that there are
capacities, or capabilities, that are “distinctly human,” such as: 1) symbolizing capacity –
human ability to communicate through the use of symbols, or language; 2) self-regulatory
capacity – human ability to motivate themselves to achieve goals; 3) self-reflective
capacity – human ability to evaluate their decisions to verify thought; and 4) vicarious
capacity – human ability to learn through the observance of others performing an action,
not direct experience (Bandura, 1994). In other words, animals have the ability to learn a desired behavior, or to be trained, but humans are unique in their ability to mentally process, interpret, understand, retain, form beliefs and attitudes, make decisions, and problem solve. This difference may not seem significant, as the end result is that both humans and animals can learn; however, those “distinctly human” capacities can change an educator’s approach toward training learners.

The social cognitive theory is a significant construct for training people with ASD in the workplace because the modeling process is a commonly used organizational training strategy. The social cognition theory focuses on learning behavior through observance. In organizational encounter, it is referred to as uncertainty management through information acquisition (Kramer, 2010). To learn observational roles, or to learn behavior that an organization desires members to know, members must use external sources to gather information. Common methods to gather information include inquiry of peers, observation, and media (Miller, & Jablin, 1991). This may be difficult for individuals with ASD due to their social interaction limitations and their aptitude for getting distracted (Hagnar, & Cooney, 2005; Kenyon, 2015). These challenges can be successfully addressed by using mediated modeling, using modalities such as video and VR. This type of modification allows for individuals with ASD to observe remotely, learn their organizational roles comfortably, and then slowly be integrated into the workplace.

**Self-efficacy, Media Effects, and ASD.** Self-efficacy is a person’s belief that they are competent enough to perform a task (Bandura, 1982). Self-efficacy is an essential consideration in a new member’s ability to experience either a positive or
negative outcome in the workplace. Having low self-efficacy can result in negative outcomes for a person at a workplace, including depression, poor attitudes, subpar work performance, lack of job satisfaction, increased stress, poor initial effort, giving up, and low self-worth. Having a high self-efficacy can result in positive outcomes for a person at a workplace, including a person’s belief that they can perform well, and that they can master difficult tasks presented to them (Mischel, & Shoda, 1995; Bandura, Barbaranelli, Caprara, & Pastorelli, 1996; Csikszentmihalyi, M., 1997; Judge et al., 1997).

Learning environments can improve a learner’s performance by better developing self-efficacy. Self-efficacy is an essential component to a person’s overall happiness, and it helps a person maintain interest while performing a task – keeping them motivated and engaged (Bandura, Barbaranelli, Caprara, & Pastorelli, 1996). Having a higher self-efficacy drives a person to have loftier goals, which foster firmer commitments to achieve those goals (Bandura, 1997). Despite a person’s past or current environments, anyone has the ability to increase his or her self-efficacy. This can be accomplished by: 1) mastery experience – begin with simpler tasks, master those tasks and gain confidence, then move on to more complex tasks; 2) social modeling – similar to the vicarious mode, this is having the learner observe a model that the learner can identify with, an equal in their mind, who is able to accomplish the desired task; 3) improving physical and emotional states – ensuring that the learner is calm and relaxed prior to attempting to accomplish the desired task. If the learner is not calm and relaxed, they will have a much more difficult time accomplishing the desired task; and 4) verbal persuasion – speaking encouraging words to the learner, telling them that they can do the desired task (Bandura et al., 1996; Bandura, 1993; McAlister, Perry, & Parcel 2008). Improving the self-efficacy of new
members with ASD during the anticipatory socialization and encounter phases of assimilation can be an added strategy to help achieve an increase in their positive outcomes.

The purpose of this pilot study was to test if the use of a MTS method, including a VR simulation, would increase the self-efficacy of individuals with ASD. To measure this, we will first need to investigate whether ASD learners initially believe that they have the ability to perform an assigned task. Next, we will need to provide a communication strategy that can potentially improve the ASD learner’s self-efficacy to perform an assigned task. Then, we need to perform a research study that provides mediated training to ASD learners utilizing the communication strategy mentioned above. Finally, we will need to reinvestigate whether ASD learners believe that they have the ability to perform assigned task after receiving mediated training. Doing so may prove or disprove that new technology, such as VR, can help improve the self-efficacy of adults with ASD during the vocational anticipatory socialization process.

Mediated Messages. Mediated messaging is an efficient and effective way to influence people’s attitudes and guide behaviors (Bandura, 2001). Multimedia is a key part of cognition; it influences behavior, and has been shown to enhance learning (Mayer, & Moreno, 2003).

Mediated messages influence behavior in many ways. Media channels, such as video and virtual reality, replace in-person, face-to-face modeling for observational and vicarious learning with a mediated model. A mediated model allows an organization to provide members with information necessary to reduce uncertainty over and over as needed, making it cost effective, and allowing the information to be reviewed remotely.
This overall gaining of knowledge increases the learner’s confidence (Bandura, 2001; Smith et al., 2014). Confident people predict positive outcomes; people who lack confidence do not. This would indicate that mediated messages help build confidence; thus, self-efficacy (Pajares et al., 2009).

New media is beginning to attract the interest of scholars. Studies are being conducted to ascertain the impact of virtual reality, the Internet, interactive video, gamification, social media, etc. New technology is an effective solution that can help engage learners with ASD, and achieve organizational assimilation objectives (Gentry et al., 2015).

**Video.** One form of a mediated mechanism, or tool, used to influence cognitive functioning is video. Video is an effective tool that can be used to enhance learning (Kay, 2012; Allen, & Smith, 2012; Lloyd, & Robertson, 2012; Rackaway, 2012; Hsin, & Cigas, 2013). Video is a method of modeling that provides engaged learning experiences in training environments, helps a learner retain information, and often increases self-efficacy (Bandura, 2001; Mayer, & Moreno, 2003). Mediated communicative symbols trigger responses and provide meaning to a person’s experiences. Media models allow organizations to provide a learner, or many learners, in one location, or many locations, the opportunity to observe modeled behavior, and/or use the knowledge gained for future use (Meichenbaum, 1984; Bandura, 1986, 1997, 2001).

Adult study subjects diagnosed with ASD have shown positive results across a range of employment settings when video technology was introduced. Using an iPad application called VideoTote, video modeling proved to be an effective method to help people with ASD complete multi-step tasks (Burke, Allen, Howard, Downey, Matz, &
The success of this study provides valuable evidence that utilization of video as a media model can be effective for people with ASD.

**Virtual Reality.** VR training has shown to be an effective interactive training tool for law enforcement, the medical field, and to help people with ASD improve their social interaction skills (Olsen, Sellers, & Phillips, 1999; Persky, & Blascovich, 2008; Fleming, Olsen, Stathes, Boteler, Grossberg, & Pfeifer, 2009; Trepagnier et al., 2011; Smith et. al, 2014; Smith et. al., 2015). Advantages to learning through VR simulation include: 1) repetitive practice with the simulation; 2) active participation and not passive observation; 3) a unique training experience with each simulation; 4) consistent, in-the-moment feedback; 5) opportunity for trainees to make, detect, and correct errors without adverse consequences; 6) accurate representation of real-life situations compared to avatar-based environments; 7) opportunity to apply multiple learning strategies across a range of difficulty levels; and 8) access to web-based educational material that promotes learning skillful strategies before and during the simulation (Issenberg et al., 2005).

There have been multiple studies conducted to test the effectiveness of VR as a vocational learning tool for people diagnosed with ASD. One study found that VR is an effective tool for improving social cognition and occupational functioning (Kandalaft et al., 2013). Another study determined that using VR improves vocational skills (Smith et. al, 2014; Smith et. al., 2015). Finally, in a study that investigated if VR was a modality that should be considered for people with ASD, VR is discussed as helpful because it allows users to isolate specific stimuli and control them. VR also simulates real-life experiences and situations, which makes them more realistic and effective when training individuals with ASD (Strickland et al., 1996). These studies provide useful information
that address the challenges that individuals with ASD face throughout their lives, and the role VR can play to foster their vocational success.

Certain traits that are common in people with ASD can make them appear “strange” to their coworkers, and can be barriers for them in the workplace (Kenyon, 2015). Because of those traits, most of the empirical studies for people with ASD focus on social functioning and interaction, not necessarily task completion (Olsen et al., 1999; Persky, & Blascovich, 2008; Fleming et al., 2009; Trepagnier et al., 2011; Smith et al., 2014; Smith et al., 2015).

VR has been used as a vocational training tool during the anticipatory socialization phase of assimilation - training people with ASD on how to interview for a job (Smith et al., 2014; Smith et al., 2015). These studies provide evidence to suggest that VR can be utilized as a tool for influencing behavior through social modeling, increasing the self-efficacy of the user, reinforcement and motivation, and perhaps reducing causation factors until mastery of the task is accomplished.

In another study, tests were conducted to determine if children with Autism would tolerate VR headgear, or show any meaningful response to a computer-generated environment. Participants all responded in positive ways, showing definite signs of learning, and stayed immersed in the virtual world longer than anticipated. Participants also became proactive, making attempts to use the equipment without being prompted or helped (Strickland et al., 1996). This would indicate that an increase in self-efficacy occurred.

The success of the use of VR in empirical studies provides evidence to suggest that VR can be utilized as an effective vocational media model for people with ASD.
VR has been shown to raise participant’s self-efficacy in job interviewing (Smith et. al, 2014; Smith et. al, 2015), increase social cognition (Kandalaft et. al, 2013), and increase signs of learning and proactivity (Strickland et. al, 1996).

Advantages to learning through VR simulation include repetition, interaction, instant feedback, ability to make errors free of consequence, participation in real-life situations, ability to apply learning strategies across a range of difficulty levels, and access to web-based educational material (Issenberg et. al, 2005). Utilizing these advantages during the anticipatory and encounter stages of assimilation can help newcomers with ASD manager their uncertainty.

By helping newcomers with ASD manage their uncertainty during the anticipatory and encounter phases of assimilation, organizations are demonstrating their commitment to helping people with ASD obtain meaningful employment. Providing training protocols that reduce uncertainty for individuals with ASD will increase their self-efficacy, and increase the likelihood of them achieving positive vocational outcomes.

**Research Questions**

Organizational assimilation theory has often been viewed in terms of a new member entering an organization, but new member assimilation can begin prior to the encounter phase, it can begin in the anticipatory socialization phase (Jablin, 1982; 1987). Positive outcomes for newly hired employees coincide with their level of self-efficacy (Kammeyer-Mueller, & Wanberg, 2003). This study attempts to assess if the self-efficacy of individuals with ASD can be affected through the use of new technology, specifically VR, during the anticipatory socialization phase of assimilation.
RQ1: How does the use of multimedia during the anticipatory socialization phase impact the self-efficacy of an individual with ASD?

Mediated messaging is an efficient and effective way to influence people’s attitudes and behaviors (Bandura, 2001). Visual prompts, such as pictures, signs, video, etc., have been found to be effective tools to help people with ASD learn (Roberts, 2002). Learners with ASD have been known to interpret information using spatial intelligence, and tend to think in terms of pictures (Porter, 2006). This study asks the following question regarding the use of VR as a training tool for new members of an organization with ASD.

RQ2: How do people with ASD describe their training experience when using MTS aids?
Chapter 3: Method

Introduction

Addressing the research questions above required a mixed method approach. To determine if MTS training had an impact on the self-efficacy of the participants, a quantitative approach was utilized to compare the measurement of self-efficacy of an experimental group and a control group before and after training. To ascertain the experience participants had when using MTS aids, this study employed a thematic analysis (TA) that was based on my observance, and the participant’s responses to a series of open-ended questions in reference to their training experiences from the past, as well as from this study. TA was selected because of its simplicity and flexibility, which allows it to be used for any theory. TA identifies patterns of meaning to answer the research questions (Braun, & Clarke, 2006).

The successful outcome of this study was dependent on the recruitment of individuals who self-reported being diagnosed with ASD, and who were over the age of 18. It was also necessary to find participants who were able and willing to actively participate in the VR simulated training, verbally discuss their study experience, and verbally discuss past training experiences with me.

My observance of the participants’ behavior while performing the MTS training provided a better understanding of the participants’ experiences with VR training. The participants’ reflections of their experiences with the MTS training during the interview process allowed for richer data to be collected, which afforded me the opportunity to make assessments and determinations (Spradley, 1979; Bernard, 2002). These direct interactions also allowed participants the opportunity to share past training experiences
with me, giving them the opportunity to offer ideas of how to improve the training. This approach allowed for a better understanding of how people with ASD make sense of their world and provides insight as to what participants find meaningful (Tracy, & Munoz, 2011). This perspective allows for future training methods to be developed that are conducive to the unique worldview of people with ASD.

**Participants**

Because of the uniqueness of the selected sample population, and the limited resources of this study, this research project employed a purposeful sampling technique followed by snowballing (Patton, 2002; Goodman, 1961). Adults diagnosed with ASD were sought so that this study might better understand how VR impacts the self-efficacy, and ultimately the learning, of individuals with ASD when being trained to perform a new task.

It was necessary to observe the participant’s behavior while performing the VR training to help me grasp the essence of the participant’s experiences. Purposeful sampling selects participants who have knowledge of, or are experienced in, the topic of the study (Patton, 2002). Adults with ASD provided this study the data necessary to better understand the effects of MTS, specifically the use of VR, and the impact those types of training may have on the level of self-efficacy a person with ASD has when learning a new task. Purposeful sampling also provided participants who could share past training experiences to better understand if MTS training was a more effective training method. Because of the difficulty to find participants, this study also used the snowballing sampling technique, asking people within the researcher’s network, as well
as individuals who participated in the study, to refer other potential participants from within their own networks (Goodman, 1961).

Participants were recruited through social media, word of mouth, and through the contact of organizations that specialize in vocational assistance for people with disabilities. A “Participants Needed” flyer was posted on my LinkedIn and Facebook networks, and email invitations were sent to the leaders of twelve organizations throughout the state that specialize in vocational assistance for people with disabilities, including ASD. I also contacted disability centers from one large university in the Midwest, and one medium-size university in the Midwest to recruit potential participants.

Once contact was initiated, the organizations shared the flyer with their members, or asked their members directly if they were interested in volunteering for participation. If there was any interest expressed, potential participants were instructed to contact me by email or phone. Once contacted, I would then schedule convenient dates and locations participants and myself to meet, and conduct the study. Interested candidates were asked qualifying questions such as if they had been diagnosed with ASD, and if they have ever participated in the workforce (see “Appendix A”). Candidates who were invited to participate were 18 years of age or older, self-reported being diagnosed with ASD, any gender, and were interested in participating in the workforce. Candidates that were excluded were under the age of 18 years of age, not interested in participating in the workforce, were not diagnosed with ASD, or had a history of any other mental condition, cognitive disability, mental retardation, neurological disease, developmental disability, or drug/alcohol abuse.
Six potential participants, or people who knew potential participants who may be interested in participation, responded to the social media solicitations, and 44 potential participants, or people who knew potential participants who may be interested in participation, responded to the email solicitations. Thirteen adults \((n = 13)\) met the established criteria and were purposefully chosen for their experience as an adult diagnosed with ASD interested in seeking employment, and voluntarily participated in this study. A $10 gift card was offered as a reward for participation.

Participants ranged in age from 19-42 years old, with a mean age of 26 years old, and a standard deviation of 7.539. Of the 13 participants, nine were male (69.2%), and four were female (30.8%), all 13 participants were self-diagnosed with ASD (100%), all 13 participants were Caucasian (100%), and all 13 participants have had at least one job in the past, and were interested in participating in the workforce (100%).

<table>
<thead>
<tr>
<th>Participant</th>
<th>Age</th>
<th>Gender</th>
<th>Race</th>
<th>Diagnosed With ASD</th>
<th>Have Had At Least One Job</th>
<th>Interested In Getting Job</th>
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<tr>
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<td>Yes</td>
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<tr>
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<td>C</td>
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<td>C</td>
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<tr>
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<td>M</td>
<td>C</td>
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Procedure

The chosen task of wiring an electrical outlet was selected because it is a simple, yet a practical and real task. Participants were first asked to watch the informative video. The reason for this was to provide the participants with the necessary knowledge to complete the task of wiring an electrical outlet; basically, to know which colored wire would be connected to the correct screw. After watching the video, the participants were then asked to perform the VR portion of the multimedia training. This interactive training had the participants click onto any of the three wires, and then click onto the correct screw that the wire. When all three wires were connected to the correct screws, the participant would click done. If they had all the wires correctly connected, a green “Correct” sign would light up in the virtual world. If participants did not connect each wire to the correct screw, then a red “Try Again” sign would light up in the virtual world, requiring the participant to try again until they correctly connected the right wires to the right screws. There was no time limit or limit to the number of tries the participants had to complete the task. When the training was completed, the participants were interviewed and asked a series of open-ended questions (see “Appendix E”).

Multimedia. The participants were divided into two groups. The experimental group consisted of ten randomly assigned individuals (seven men, three women), who received the MTS training, which included watching the informative video, and the VR interactive training. The control group consisted of three randomly assigned individuals (two men, one woman), and received no training. Two sets of media stimuli were created for and/or used by this study. The first media stimulus was an informational video, and the second media stimulus was a VR application created specifically for this study.
Informational Video Media Stimuli

An informational video was created using a portion of an already existing YouTube video on how to install an electrical outlet. A link to the original video is available for review (see “Appendix B – Link 1”). Because it was only necessary to inform the study participants on the section of the video focused on connecting the three electrical wires to the three screws attached to the outlet receptacle, that section of video was edited into its own YouTube video by the researcher. The edited version is unlisted and was created for the sole purpose of only being used for this study. This link is also available for review (Appendix B – Link 2”). By watching the video, participants are able to view the process of wiring an electrical outlet socket, and will learn which wire goes to which screw.

Figure 1. Informational YouTube Video

![Video Still](image)

Participants viewed this video in order to learn the process of wiring an electrical outlet correctly. It provides viewers with the information of which colored wire connects to which colored screw.

Virtual Reality Media Stimuli

A VR application was created using Unity 2.0. The application was uploaded onto an Apple iPhone 5c. The application was accessed through a Qualcomm Snapdragon 820
processor, and by placing the phone into a cardboard VR viewer. To review an example of
the cardboard viewer, a link has been provided (“Appendix B – Link 3”).

To use the VR simulation, participants place the viewer up to their eyes, much like a pair of binoculars, and then look through the viewer. While looking through the viewer, the participant sees the VR simulated electrical socket. The view of the VR world changes as the participant moves or changes the position of their head while looking through the viewer. There is a white locator dot, much like a mouse arrow on a computer screen. That locator dot is the participant’s point of origin, and it moves as the viewer changes position, allowing the participant to place the locator dot in any desired location within the virtual world as they move their head or body. On the top of the viewer is a button. To activate the button, a similar action to activating the shutter on a camera is performed. That button activates the locator dot, much like clicking on a mouse. By participating in the VR simulation, participants are able to experience a multimedia learning experience. Combined with the video, this approach was designed to be more engaging than simply viewing the video, as it requires participants to learn in an interactive way.

Figure 2. Cardboard VR Viewer

![Cardboard VR Viewer](image)

Participants used this device to view the VR simulation. The button seen on the top of the device is what is pressed to activate the locator dot.
Figure 3. VR Electrical Outlet Simulation

When participants looked into the VR viewer, they saw this electrical outlet. The screws were represented by a gold square to represent the brass screw, a gray square to represent the silver screw, and a green square to represent the green screw. The different colored wires were on the side. Clicking on the wire and then the screw allowed participants to connect wires to screws in the virtual environment.

Materials. A modified version of the New General Self-Efficacy scale (NGSE) was constructed for this study, which provides a short but valid scale to measure self-efficacy (Chen, Gully, & Eden, 2001). The scale was a survey consisting of eight statements, followed by a 1-10 interval scale. The modified scale was designed using a ten point Likert scale to improve the reliability of the measurement. Ten point scales offer more variance than five or seven point scales, they offer a more precise measurement, and they better explain a participant’s point of view (Wittink, & Bayer, 2003). It was explained to each participant that by selecting the lowest number, one, that this was an indication that they strongly disagree with the statement, and by selecting the highest number, ten, that this was an indication that they strongly agree with the statement. It was further explained that all numbers in-between were levels of agreement with the statement in various degrees, six through nine being more towards agreeing, and two through five being more towards disagreeing with the statement. By not providing a
middle number, it forced participants to make a choice to agree or disagree at some level (Wittink, & Bayer, 2003).

All participants were asked to complete a pre and post self-efficacy measurement scale for this study. The scale used for this study was modeled after the New General Self-Efficacy Scale (see “Appendix C”), which was developed as a general and reliable measure of self-efficacy (Chen et. al, 2001). The scale used for this study was modified from that scale to address the self-efficacy of the specific task of wiring an electrical outlet (see Appendix D”). The experimental group was asked to complete the scale before they received their multimedia training to measure their current level of self-efficacy on the task of wiring an electrical outlet, and then asked to complete it again after they received their multimedia training in order to measure any differences in the level of their self-efficacy for the task. The control group was asked to complete the first scale, wait for a period of ten minutes, and then take the scale again without receiving any training whatsoever. The control group was necessary to account for any random variances (Campbell & Stanley, 1966). Once the experimental group completed the training, they were asked a series of open-ended questions (see “Appendix E”).
Chapter 4: Results

Successful employment outcomes for individuals with ASD require that research take place in order to provide the information necessary to overcome the obstacles they face in the workplace. This study’s purpose was to determine if new technology, specifically VR, is a viable solution to raise self-efficacy, and ultimately, is an effective learning tool to manage uncertainty for people with ASD. Providing evidence to support these claims required that I develop an MTS training system. To answer the research questions posed for this study, a pretest and posttest measurement of the self-efficacy for participants in the experimental group was conducted and then compared to the control group, and the experimental group would need to be interviewed in order to better grasp their training experiences.

Self-Efficacy: The Impact of Multimedia on Self-Efficacy for Adults with ASD

Both quantitative and qualitative analyses were performed to answer the first research questions of this study. RQ1 asked, “How does the use of multimedia during the vocational anticipatory socialization process impact the self-efficacy of an individual with ASD?” To answer this question, I used an analysis of variance (ANOVA) to determine if there were any significant differences when measuring the pretests and the posttest scores from the modified NGSE Scale between the study group and the control group. In addition to the ANOVA, I used the thematic analysis method to understand the essence of participant experiences with job training and the VR technology in particular. Results from this study suggest that perceptions of self-efficacy were influenced by the use of technology during training in the anticipatory socialization phase of assimilation.
RQ1 ANOVA Results

An ANOVA was conducted on the self-efficacy of the participants (N=13) based on the comparison of the pretest and posttest scores from the modified NGSE Scale for adults with ASD when wiring an electrical outlet used for this study (See “Appendix D”). The between-group analysis resulted in a significant main effect for the multimedia component of self-efficacy, $F(1, 11) = 3.320, p < .096$ (See “Table 1”). Participants who received multimedia training (n=10) showed a significant increase in their self-efficacy to perform the task of wiring an electrical outlet when compared to the control group (n=3) from the pretest to the posttest. There were no significant differences found between the two groups in the pretest ANOVA results, indicating that participants of both groups had an equal level of self-efficacy prior to the study group receiving training. These findings lend support to the assertion that training individuals with ASD using multimedia strategies increases their self-efficacy.

<table>
<thead>
<tr>
<th>Table 2</th>
<th>ANOVA of Posttest Modified NGSE Scale by Experimental Condition</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
</tr>
<tr>
<td>CONTROL</td>
<td>3</td>
</tr>
<tr>
<td>EXPERIMENT</td>
<td>10</td>
</tr>
<tr>
<td>Total (Between Groups)</td>
<td>13</td>
</tr>
</tbody>
</table>
Thematic Analysis Results

In addition to the statistical analysis results provided by the ANOVA, qualitative data collected via semi-structured interviews supports findings in RQ1. High levels of anxiety can affect an individual’s confidence, and low confidence brings low self-efficacy (Kammeyer-Mueller, & Wanberg, 2003). Because of this, it was important for this study to obtain information as to what had caused individuals with ASD to experience anxiety during training in the past, and to determine if the MTS training provided in this study caused them to experience any anxiety. To make these determinations, this study recorded and transcribed 59 pages of single-spaced data in addition to my 12 pages of single-spaced field notes. I then reviewed the data and identified patterns across the data set that answered the research questions, and then coded and themed those patterns.

Two themes emerged, emotional and physical experiences. Emotional experiences can be described as participants’ descriptions of any positive or negative emotions felt while undergoing the training. Physical experiences can be any physical parameters described by the participants while undergoing the training. Emotional experiences included codes such as enjoyment, fear, anxiety, anger, frustration, etc. Physical experiences included codes such as comfort or discomfort caused by the training, which includes VR sickness.
Table 3
Codes and Themes for Thematic Analysis

<table>
<thead>
<tr>
<th>Codes</th>
<th>Positive</th>
<th>Negative</th>
<th>Positive</th>
<th>Negative</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Enjoyment</td>
<td>Fear</td>
<td>Comfort</td>
<td>Discomfort</td>
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<tr>
<td></td>
<td>Engagement</td>
<td>Anxiety</td>
<td>Using Device</td>
<td>Using Device</td>
</tr>
<tr>
<td></td>
<td>Joy</td>
<td>Frustration</td>
<td>VR Sickness</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Excitement</td>
<td>Anger</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Themes      | Emotional Experiences         | Physical Experiences         |

These experiences are crucial to learning and to the results of this study. Emotional experiences drive attention, which drive learning and memory (Sylwester, 1994). Therefore, if participants had negative emotional experiences during training, the training could not be considered effective. On the other hand, if the participants had positive emotional experiences, the training could be considered effective. Positive or negative physical experiences can trigger an emotional response, and are, therefore, equally important to learning and to this study.

**Emotional Experience**

**Enjoyment and Reducing Anxiety.** The MTS training of this study was effective at increasing the self-efficacy of the participants when learning to perform the task of wiring an electrical outlet. According to Bandura (1998), self-efficacy directly impacts behavioral performance. Anyone can increase their self-efficacy through mastery experience, social modeling, improving physical and emotional states, or verbal persuasion. Social modeling is showing the process of accomplishing a behavior (Bandura, 1998). Participants of this study received a social modeling demonstration of wiring an electrical outlet by watching the informative video (see “Appendix B, Link 2”).
One of the advantages VR offers trainees is the ability to make errors without adverse consequences (Issenberg et al., 2005). Alleviating the fear of failure or consequence provided participants in this study with the opportunity to learn in a less stressful environment; thus, improving physical and emotional states. Improving physical and emotional states refers to reducing an individual’s anxiety prior to performing a new behavior (Bandura, 1998). The interactivity of the VR training, which simulated the task of connecting electrical wires to the correct screws, combined with repetitive practice, gave the participants the opportunity to master the task, free from the fear of consequence when mistakes are made. For example, VR-7, a 20-year-old white male who is currently in college to obtain his Bachelor’s Degree, stated the following:

I liked it [the training]. I like VR in general. It’s sort of gamifying the training, which I like. It is not as fun as a video game but somewhere in between that. The video was saying if you did it wrong…the way you would know you did something wrong, it would be like,”fire.” If it is VR, it’s just like, “don’t do that,” whereas making a mistake like in the field is…there is actual consequences to it. There is no penalty [consequences] for making mistakes. I think it [VR] is conducive to a low stress environment, which does help with learning.

In addition to VR-7 stating that he liked the training, these statements support the advantages of using VR as a training tool. VR-7 felt less stress using VR to learn. This is because the informative video stated that if a person put the wrong wire to the wrong screw, it could start a fire. That statement had an emotional effect on VR-7. The verbiage of the video made him afraid that if he made a mistake, attached the wrong wire to the wrong screw, that he could start a fire. His fear that a mistake could cause a fire caused him to have anxiety prior to even making an attempt to actually perform the task. VR-7 having this fear of making a mistake violates the improvement of physical and emotional states to raise self-efficacy (Bandura, 1998). However, once VR-7 recognized that
making a mistake in a virtual simulation had no “actual consequence,” and that making a mistake in the VR simulation would not start a fire, his emotional state improved; thus, his self-efficacy was raised. Further, VR-7’s ability to achieve success through the interactivity of VR allowed for him to master the task, which also increased his self-efficacy.

Mastery experience is performing a simple behavior or task, mastering that behavior or task to gain confidence, and then moving on to more complex behaviors or tasks (Bandura, 1998). In this study, participants were assigned a simple task, which was to watch a behavioral model, the informative video, to obtain the information necessary to succeed at the task of wiring an electrical outlet, and then connect the three wires in an electrical outlet to the correct three screws on the plug. This simple design was intentional to allow participants to gain confidence in their ability to do the job of an electrician by mastering a simple task; thus, increasing their self-efficacy. The interactivity of VR allowed participants to make mistakes, learn from those mistakes and then allow them to repeat the task as many times as needed to master the behavior. The opportunities for trainees to make, detect, and correct errors without adverse consequences are one of the advantages of using VR for training (Issenberg et. al, 2005). By VR-7 recognizing that there are no penalties for making mistakes and that VR provides a low-stress environment, he is providing support that alleviating the fear of making mistakes reduces anxiety and increases an individual’s self-efficacy (Bandura, 1982).

**Fear and Uncertainty.** There can be unintended and undesired effects on the self-efficacy of trainees, as was the case for VR-5. Based on a combination of my field
notes and the audio transcriptions, VR-5, a 28-year-old white female who did not graduate high school and has never been employed, but would like to find employment, experienced extreme fear.

I observed VR-5 coming into the study seemingly confident and excited to participate in the study, she was even joking around with me. While watching the informative video, VR-5 watched intently, and then began to act in a peculiar way. When I informed her that she would be using the VR, VR-5 chewed on her thumbnail and lifted her legs to her chest while sitting on her chair. She appeared to be scared, or perhaps intimidated. When asked what was wrong, she replied, “I’m afraid to do it.” Her fear prevented her from even making an attempt to partake in the VR portion of the training. She refused to use the VR unit. When I asked her what she was afraid of, VR-5 replied, “the technology.” The interview further revealed that she felt “embarrassed” because she was afraid that she wouldn’t do the VR task correctly. She stated that she had failed at things in the past, and was afraid of failing at this task. When she watched the video, she stated that two things occurred. One, she did not like the type of job that she was being trained for, and two, she did not feel capable of performing the task.

It should be noted that field notes were used instead of the interview transcription because the participant shut down and I was only able to obtain head nods and brief answers to the questions asked. The report from VR-5 reveals that the type of job an individual is being trained for can affect self-efficacy. If she simply did not want to do the task she was being trained for because she had no interest in being an electrician, her response suggests that great care needs to be taken in the preparation of the training, specifically in the vocational anticipatory socialization process of the anticipatory
socialization phase of the assimilation process (Jablin, 1987). On the other hand, if she had watched the video and felt she was not capable of performing the task she was being trained for, her perception being that the task was too difficult for her to complete, then training needs to be provided that simplifies the process to make it less intimidating – perhaps break it down to a more step-by-step method. That would further establish mastery for the process.

Another consideration is that perhaps she found the device itself intimidating. She may have felt that she was not capable of operating the VR unit. Based on her reaction, it may appear to some that the VR training lowered VR-5’s self-efficacy, but that is not necessarily the case. First, it could be argued that she came into the study with a low level of self-efficacy. Second, because VR was not the only tool used to train participants in this study, her refusal to use the VR did not prevent her from learning the task. She still gained knowledge of how to wire an electrical outlet from the informative video. Video modeling provides engaged learning experiences in training environments, helps a learner retain information, and often increases self-efficacy (Bandura, 2001; Mayer, & Moreno, 2003). On the NGSE Scale that was modified for this study (See Appendix), VR-6 scored herself a one (Strongly Disagree) during the pretest on question six, “I am confident that I can effectively perform when wiring an electrical outlet,” compared to scoring herself a three during the posttest on the same question; suggesting some improvement in her self-efficacy without the use of VR and only watching the instructional video. This supports that using a mixed media approach appeals to a multitude of learning styles and is a better solution than only offering one modality (Gardner, 1991; Sundar, 2000).
Training: The Multimedia Experience for a Person with ASD

RQ 2 asked, “How do people with ASD describe their training experience when using a multimedia training aid method?” To answer this question, the researcher again used a thematic analysis method to analyze interview data and field notes. Results suggest that a multimedia approach for training individuals with ASD is an effective and engaging method. The strategy of combining VR and the informative video provided a good learning approach. The overall impressions of the VR unit from participants were positive; however, interviews revealed other key findings that deserve consideration.

**Emotional Experience**

The emotional experience theme encapsulates the various experiences that participants underwent during the multimedia training. Participants often expressed some kind of emotion when describing their experience with the provided multimedia training, specifically the VR. I observed that all of the study participants (N = 13) were initially enthusiastic about their participation in the study; however, a range of emotions emerged during the interviews. Emotions participants experienced included enjoyment, fear, frustration, and uncertainty. Participant’s emotions directly impacted their performance and overall attitudes toward the training process.

**Enjoyment of VR Training Experience.** Participants overwhelmingly reported positive experiences with the training. They described it as fun and engaging, similar to the experience of playing a video game, and that it helped them learn the subject matter. Of the ten participants of the study group (n = 10), eight of them reported that they enjoyed the VR training. For example, VR-6, a 25-year-old white male with an
Associate’s Degree, and currently working on getting his Bachelor’s Degree, made the following statement about the VR training:

It was fun and [engaging], like playing a video game. It was similar to playing a video game in that we problem solved the same way you would in a video game. It’s different because it was more of a real-life situation. It made it more interesting to learn I suppose.

VR-6 compared the VR experience to playing a video game, equated the experience to a “real-life situation,” and reported that the training was “more interesting” for him to learn. He also stated that he recognized that he was problem solving during the experience. These statements support that VR-6 was engaged in effective learning, which includes problem solving, reasoning, decision-making and evaluation, takes place when a learner is engaged (Kearsley, & Shneiderman, 1998). Based on his statement, the multimedia training VR-6 received in this study was an effective method for him to learn. By learning the task of wiring an electrical outlet through a multimedia approach, VR-6 managed any uncertainty he had, and ultimately, increased his self-efficacy. Evidence that VR-6’s self-efficacy increased is based on the comparison of his pretest and posttest modified NGSE scale. VR-6 answered all eight of the pretest questions with a one, and answered all of the questions on the posttest with at least a seven. This indicates that his self-efficacy rose after the MTS training. More important is that he stated himself that he enjoyed, and learned from the training.

Another participant inadvertently referenced engagement theory principals when interviewed about his experience with the training. VR-8, a 19-year-old white male who is currently in college to obtain his Bachelor’s Degree, and has about two years of work experience, also enjoyed the training, and described it as follows:
Yeah, it was fun, it was different. I just feel like watching the video was enough and the VR was just doing more. If you were to do just the VR and said, “Okay, figure out how to do this,” and that’d be one way to do it, but that’d be less training more of just solving a puzzle.

VR-8 described his experience as “solving a puzzle.” Puzzles are often referred to as games that facilitate problem-solving strategies (Huang, Cheng, & Chan, 2007). When an individual puts a puzzle together, they evaluate the pieces and decide where they should go. When engaged learning is taking place, learners are problem solving, reasoning, making decisions and evaluating (Kearsley, & Shneiderman, 1998). It can then be inferred that VR-8 was engaged while taking part in the training. VR-8 also commented that while the training was fun and different, “the video was enough” and “the VR was just doing more,” indicating that the VR experience reinforced what he had already learned.

Content delivered through multiple modalities results in greater memory gain (Sundar, 2000). And the use of the VR simulation did help some participants memorize content. For example, VR-9, a 29-year-old white male who has an Associate’s Degree, is in school to obtain a Bachelor’s Degree, and has about ten years of work experience stated:

[The VR] worked with my memory more. I kind of had to do it on my own. I astounded myself when I memorized how to…what everything did because I don’t always feel like I memorized everything correctly. Sometimes I get distracted and might miss a step, and [VR helped with that].

VR-9 revealed that the effect of VR had on him was that it assisted with his ability to memorize the task, and it kept him focused on what he was doing. Staying focused is one of the challenges that people with ASD face in the workplace (Kenyon,
2015; Swain, et al., 2015). As part of an interactive strategy to maintain focus, multimedia training would be effective for this individual.

**Frustration of VR Training Experience.** While most of the participants enjoyed VR training, some did report that they experienced frustration stemming from a range of variables, including having difficulty understanding how to use the VR unit, discomfort when using the device, and the simulation not being a close enough representative of a real-life, hands-on experience of doing the task. For example, field notes from VR-1, a 42-year-old white male with an Associate’s Degree, and 15 years of work experience, revealed that he was frustrated for several reasons.

I asked VR-1 if he had any difficulty with any of the training. VR-1 replied that he did have some difficulty because he had never used VR before and didn’t know what he was doing. VR-1 also said that he was a little confused by the color differences of the screws and wires in the virtual world versus the colors discussed in the video [They were not exactly the same due to limitations of the Unity program – Unity 2.0 is the application that the research team used to create the VR simulation]. When asked about his overall experience, VR-1 said he did enjoy the training, but it was a little too hard, too complicated, to use. I then asked VR-1 if the VR training was easier to use if that would have made a difference. VR-1 said yes. Finally, I asked VR-1 if he thought that VR was a good way to train people on the spectrum. VR-1 replied yes, but that it would have to be either simpler to use, or trainees would have to be trained how to use the VR units prior to being trained for the task.

VR-1 stated that he had difficulty with the training because he had never used VR before. This is a good example of how the participant’s uncertainty to perform the task
affected his attitude toward the overall training experience. Even though he had access to someone who was knowledgeable about the process, he still felt uncertain. His age, being a digital immigrant, may have been a factor, but his uncertainty is more likely because he was being asked to learn two things simultaneously. He had to learn how to operate the VR unit, and he had to learn the task of wiring an electrical outlet. Having the compounding uncertainty of two undertakings may have been an overwhelming experience for him. VR-1’s focus on the color differences between the video screws and wires and the VR screws and wires are certainly worth noting. Some of the challenges people with ASD have in the workplace include being easily distracted by noise, smell, and sensory issues; and one of their attributes is having great attention to detail (Kenyon, 2015; Swain et al., 2015). Unity, the program used to build the VR simulation for this study, had some limitations than can certainly be addressed as technology progresses, or a better VR training simulation is designed. This report affirms that greater care needs to take place when designing this type of training for people with ASD so that variables such as color are no longer a distraction.

Other participants felt that the VR unit wasn’t “user friendly” or caused them to experience nausea or become disorientated. When asked about her general impression of the training she received, VR-4, a 20-year-old white female that did not graduate high school, and has about two years of work experience, gave the following response:

I enjoyed it. It was something new. [VR was fun and engaging]. The device was fun; it was fun to see what you did. [But then I had some difficulties with it and it became frustrating].

VR-4 reported that she became frustrated because she could not figure out how to use the VR unit. She reported that to make it better, she would have liked it to be more
“user-friendly.” When I asked her to specify what she meant by “user-friendly,” she replied that a step-by-step guide of how to use the device should have been provided. When reminded that written directions of how to use the unit were provided prior to the training, she commented that the directions that she received were too “highbrow,” and too difficult for her to understand:

I didn’t understand anything it said. I am not at a high level of reading and understanding...so a step-by-step so that I can understand.

Throughout the study, I consistently reported in my field notes that participants were either simply glancing at the written provided directions of how to perform the task, or not reading the written directions at all, and were instead relying on the verbal instructions that I gave to them. In this case, she asked for a step-by-step guide on how to use the device, but that was exactly what the written directions provided (see “Appendix F”). This indicates that the participant’s learning style was not allowing her to easily understand the written directions. People with ASD tend to think in terms of pictures and interpret information using spatial intelligence (Porter, 2005). Instead of written directions on how to use the device or how to operate the unit, it would have been more useful to provide a video showing how to use the VR unit, or some other visual guide.

When an individual experiences uncertainty, it makes them uncomfortable (Morrison, 1995). Being uncomfortable can affect an individual’s attitude, and self-efficacy, because uncertainty causes anxiety, and can contribute to self-perceived performance inefficiencies (Judge et. al, 1997). One example of this was participant VR-10, a 22-year-old white male with a high school diploma, and about one year of work experience, who had difficulty using the device. He reported that the training was
“decent.” When asked what issue he had with the unit, he stated, “pressing the buttons. It was very fussy because the wire tended not to go where you were trying to get it.”

The frustration of the device not working as well as he would have liked caused him to have a negative attitude towards the entire training experience. Another example of this occurred when VR-3, a 24-year-old white female with a high school diploma, and about four years of work experience, had difficulty understanding how to use the device. While she reported that she found the training to be fun and engaging, she also reported that she did not enjoy the training. In fact, she had so much difficulty with the VR unit that she did not finish the training. When asked what she had difficulty with, VR-3 replied “technology.” I then asked her what about the technology she had trouble with and she replied, “the colors.” When asked if she enjoyed the training she received, she shook her head no. When asked why, she replied that it was “confusing.” When asked what was confusing, she replied, “everything.” However, she answered yes when asked if the training was fun and engaging, but later inferred that she was referring to the video. She enjoyed the video, not the VR, because the VR confused her. She stated that she did not experience any dizziness, but said that the training would be better if it was an on-screen video game rather than VR.

Because she had difficulty using the VR device, VR-3 reported that she did not enjoy the training she received, even though she also reported that she found the training to be fun and engaging, which is somewhat contradictory. VR-3 reported that she enjoyed was the informative video, not the VR. This was because she found the technology of the VR to be “confusing.” She also had some difficulty with the colors of the VR simulation. Because we know that new members who are uncertain will experience discomfort
(Morrison, 1995), reducing her uncertainty would have made her more comfortable, which in turn could reduce her anxiety and change her attitude.

Anxiety can contribute to self-perceived performance inefficiencies, and ultimately poor job performance (Judge et. al, 1997). VR-3 was one of three participants who did not follow through with the training all the way to completion. Her inability to complete the training was likely because of anxiety caused by the difficulty she had using the VR unit. Her negative attitude towards the overall training she received was due to the VR device confusing her. Perhaps she would have been more comfortable if she had only received the video training, or if she would have received more instruction on how to operate the VR unit prior to the study. By using the VR unit, a device that she was uncertain about, her attitude towards the training was negative, and could have been positive had she perhaps been provided information to reduce her uncertainty of using the VR unit.

VR-3’s focus on color was similar to the report given by VR-1, where he stated that the color differences of the screws and wires in the VR simulation confused him. As technology progresses, this issue should be less of a concern; however, this could be a trend worth noting because color appears to be a sensory distraction for the participants. This report is another example of how much care needs to be taken to ensure that things like color are not overlooked in the future creation of training media for people with ASD. While media builders may overlook certain details they consider trivial, it is clear that the keen sensory perception and the attention to detail that people with ASD have will not allow even the smallest of details to be overlooked.
Physical Experience

**Dizziness and Nausea caused by the VR Device.** Exposure to fully immersive environments, such as VR, are known to cause undesirable effects for some people that are described as being similar to motion sickness. These effects are known as VR sickness, which affects 25 to 40 percent of VR users (Mason, 2017). Symptoms of VR sickness include nausea, disorientation, headache, and even apathy (Cobb, Nichols, Ramsey, & Wilson, 1999). Two of the ten participants in this study experienced disorientation, dizziness or nausea from the use of the VR device during the training, with VR-9 reporting the more severe symptoms. When asked to describe his feelings of illness after using the VR unit, VR-9 shared these statements:

> I don’t know, just nausea. I’m surprised I got sick from it. I started to feel more so dizzy than nauseous…I get sick from high def [video] games too. [The VR training] was more high def than I needed. That has sensory issues probably on that because it’s just a lot of…there’s high def colors. It’s the movement. It’s choppy a little bit. The three dimensional stuff made me feel nauseous a little bit.

This is another example of how color seems to play a role in the experience of users with ASD. While it did not cause them to feel sick, VR-1 and VR-3 focused on the color used in the design of the VR simulation, as well as stating that it confused them. In VR-9’s case, the high definition color was one of the things that made him feel ill. Three out of ten study participants had some kind of issue with color; therefore, the color variable cannot be ignored. The sensitivity to sensory perception that people with ASD have may be more than just a distraction, or a disadvantage in the workplace; it could also make them more susceptible to VR sickness. Another participant who experienced some dizziness was VR-2, a 23-year-old white male with a high school diploma, and
about four years of work experience. When asked if the VR made him feel dizzy, VR-2 reported the following:

Maybe a little dizziness because I was having a hard time focusing on [the electrical socket]. Disorienting because it was hard for me to focus on the 3D model in there. It was blurry, so I had to cross my eyes and I didn't really feel well. Physically I would say that it was a little disorienting because what you're looking at isn't really there.

Similar to VR-9’s experience, VR-2 specifically mentioned the 3D model in the simulation as to what made him feel sick. It is difficult to know whether the true cause of the VR sickness was the 3D design, or limitations caused by the device itself; the VR viewer used for this study was not full immersion technology. Whether it be color, movement, or the 3D design, what is clear is that the number of participants of this study who experienced VR sickness, two of ten participants, is a close representation of the number of people in the general population who experience VR sickness, 25-40 percent. The question then becomes what solutions can be presented to combat VR sickness if it were the training that was provided for them by an organization. Because of their sensory sensitivity, it is conceivable that people with ASD would be a higher risk of VR sickness; however, this study suggests that people with ASD are likely to share the same VR sickness statistics as everyone else. Further, none of the studies from the literature review of this study even mentioned VR sickness, which implies that it either was not an issue, or they did not report it.

In summary, this study measured the pretests and posttests of a modified self-efficacy scale to determine if new technology, specifically VR, is an effective learning tool to raise self-efficacy and manage uncertainty. Results indicated that the self-efficacy of participants in the experimental group was significantly higher after receiving the MTS training than the control group. In addition to the statistical analysis results provided by
the ANOVA, qualitative data collected via semi-structured interviews provided data necessary to answer both research questions.

RQ1: How does the use of multimedia during the anticipatory socialization phase impact the self-efficacy of an individual with ASD?

RQ2: How do people with ASD describe their training experience when using MTS aids?

Two themes emerged, emotional and physical experiences. Emotional experiences included codes of participants’ emotional feelings while undergoing the training, such as enjoyment, fear, anxiety, anger, frustration, etc. Physical experiences included codes of any physical parameters for participants, such as comfort or discomfort caused by the training, including VR sickness. Participants had both positive and negative emotional and physical experiences during the training.
Chapter 5: Discussion

The main goal of this study was to evaluate if the use of multimedia for training had an impact on the self-efficacy of individuals with ASD. Results suggest that participants who received multimedia training showed a significant increase in their self-efficacy to perform the task of wiring an electrical outlet compared to the control group ($p < .096$). Thus, this preliminary study provides initial evidence to lend support to organizations using multimedia strategies for training to enhance the self-efficacy of individuals with ASD, and provide a suitable learning environment for them to achieve positive outcomes in the workplace.

Throughout the interviews, participants reported their experiences using multimedia as a training method. Overall, participants reported that they enjoyed the training, specifically the VR, stating that it was fun and engaging. Some participants experienced frustration, fear, and even VR sickness; however, it is clear that a combination including the interactivity of VR and behavioral modeling using video provides a good training strategy for people with ASD.

Using VR as a part of the overall training strategy is effective for people with ASD for several reasons. First, one of the advantages of using VR as a training tool is that allows the user to make errors, and then repeat actions to correct those errors without the fear of consequences (Issenberg et. al, 2005). Second, it allows for interactive situational training that can be performed free of distraction or perceived scrutiny. This study provided several examples of participants experiencing uncertainty and overcoming it with a training strategy that included the VR modality. Findings from this study are supported by the theories presented in the literature review and provide validity. Also
important was how theories from outside the field of communication could be utilized. Multiple intelligences and the engagement theory are theoretic immigrants to communication, and native to the educational field; however, they were proven useful to this communication study because of the correlation between learning and training, which takes place during organizational assimilation. Social cognitive theory and self-efficacy have been used in many different fields of study including psychology, education, and occasionally communication. These theories were key for this study to reduce the uncertainty of participants, another component of organizational assimilation. All of these theories helped strengthen the argument that VR is a viable training tool for people with ASD.

The engagement theory proposes that effective learning takes place when learners are engaged (Kearsley, & Shneiderman, 1988). VR is an interactive and engaging modality to use for training (Issenberg et al., 2005). Interactive environments have more impact than traditional learning environments (Green & Jenkins, 2014). Participants of this study overwhelmingly reported that the VR training they received was fun and engaging. One participant even reported that he felt as if he were “solving a puzzle” when performing the training. Solving a puzzle requires problem solving, evaluation and decision-making (Huang et al., 2007). The engagement theory proposes that engagement takes place when problem solving, reasoning, making decisions and evaluation takes place (Kearsley, & Shneiderman, 1998). This suggests that people with ASD are experiencing engagement when VR is employed as a learning tool.

The theory of multiple intelligences states that learners are unique in their learning process (Gardner, 1991). There are eight learning styles all learners use to learn.
Those styles include visual-spatial, bodily-kinesthetic, music-auditory, interpersonal, intrapersonal, linguistic, logical-mathematical, and naturalistic learning (Gardner, 1983; Gardner, & Hatch, 1989). Content delivered through multiple modalities results in greater memory gain (Sundar, 2000). Learners with ASD have been known to interpret information using visual-spatial intelligence, (Porter, 2006). One example is that one of the participants of this study reported that the training helped him to memorize the steps and stay focused. This finding supports that there is a correlation between MTS training and the ability of people with ASD to learn.

The key concept for the social cognitive theory is that individuals learn behavior through situation and through the observance of model behavior (Bandura, 1986). The MTS training developed for this study provided both a video behavior model and an interactive VR model. The informative video was intended to provide participants of this study with the information necessary to complete the VR simulated task of wiring an electrical outlet. Mediated messaging is an efficient and effective way to influence people’s attitudes and guide behaviors (Bandura, 2001). Video provides engaged learning experiences in training environments, helps a learner retain information, and often increases self-efficacy (Bandura, 2001; Mayer, & Moreno, 2003). This study provided evidence that mediated messaging could influence the attitudes and behaviors of people with ASD. All participants reported that they enjoyed some aspect of the MTS training, whether it was the video, the VR, or both, and all participants reported that they learned from the training.

Self-efficacy is a person’s belief that they can perform a task (Bandura, 1982). Having low self-efficacy makes it virtually impossible for a learner to learn because they
will develop a low expectancy value and actually believe themself into failure by poor performance (Oliver, 1974). High levels of anxiety can lower an individual’s confidence, and low confidence brings low self-efficacy (Kammeyer-Mueller, & Wanberg, 2003).

One of the advantages of using VR is having the ability to make errors, and the ability to repeat the actions to correct the errors without the fear of consequences (Issenberg et. al, 2005). Reducing the uncertainty people with ASD feel prior to actually performing organizational tasks gives them confidence needed to succeed. This study provided quantitative results that participants who receive the MTS training had a significant increase in their self-efficacy compared to participants who did not receive MTS training. In addition, the use of VR for this study allowed for repetition of performing the task of wiring an electrical socket to take place. Repetition is an effective learning technique. It is long term encoding through rehearsal, which is a key to knowledge acquisition (Sternberg & Williams, 2010). Mastery of task is a key to achieving a higher self-efficacy (Bandura, 1998). By providing a training strategy that allowed for participants to repeat the task until they achieved success, the participants who received MTS training should have increased their self-efficacy, which did indeed happen as evidenced by the quantitative results.

Organizational assimilation occurs as a life-long learning process about work (Jablin, 1987). Newcomers to organizations transition from learners to established members when they feel confident in their ability to perform their organizational roles (Schlossberg, 1981). Some members may struggle more while learning their organizational roles than others. New technology is an effective solution that can help engage learners with ASD, and achieve organizational objectives (Gentry et al., 2015).
One of the barriers that newcomers with ASD often face in the workplace is an extreme level of anxiety (Swain et al., 2015). High anxiety levels can be a disadvantage during the encounter phase as it can contribute to self-perceived performance deficiencies, and ultimately poor job performance (Judge, Locke, & Durham, 1997). Participants reported that they learned from the training, felt engaged and had fun, which indicates that people with ASD could increase self-efficacy and learn tasks through MTS training, thus reducing their anxiety and managing their task related uncertainty.

VR experts claim that people who experience motion sickness from VR get used to it over time, suggesting that if a person is prone to getting VR sickness – the more they use VR, the less likely they are to get sick when using it (Columbia University School of Engineering and Applied Science, 2014). That attitude is dangerous for any individual receiving VR training, but it is especially dangerous to have if intending on training people with ASD who tend to be easily distracted and focus their attention on things that cause them anxiety or harm. What is unknown is if they would ever be able to move past VR sickness once they experienced it. An organization offering VR training to people with ASD would have to be proactive and first ask individuals receiving the training if they ever experienced motion sickness or seasickness. If the answer was no, then they could probably proceed with the training without incident; however, if the answer was yes, then certain measures would need to take place.

There are suggestions available to reduce the likelihood of VR sickness occurring available. One of the simpler solutions is to limit the time spent in the VR simulation (Ruddle, 2004). Another solution is called Nasum Virtualis, which is in essence a virtual nose that the VR designer builds into the center of the video display (Whittinghill,
Ziegler, Moore, & Case, 2015). Finally, another solution would be to limit the movement of the user in the VR simulation (Kemeny, George, Merienne, & Colombet, 2017). Any of these preemptive solutions would be preferable for an organization using VR to train people with ASD than simply expecting individuals to get used to it.

**Figure 4. Nasum Virtualis**

A Nasum Virtualis is literally adding a virtual human nose into the center of the video display. By adding this virtual nose, it gives the user a frame of reference that helps ground them, which reduces VR sickness.

There were some limitations to this study. First, due to the limited resources of this study, the sample population was undersized. A larger sample would provide more validity to the findings of self-efficacy for the participants. Second, the design of the VR that was used, as well the unit used for this study itself had limitations. The study could not have been done without the help of the people who made the effort during their spare time to build the simulation. While what was used for the training served the purpose of this study, and is appreciated, a budgeted project would have allowed a more sophisticated system to be built, and may have eliminated some of the frustrations over color and ease of use.

Another limitation was the assigned task used for training. The study had one task for one vocational area, which was the participants assuming the role of an electrician trainee who is learning how to wire an electrical outlet. Perhaps having at least one more
choice of job type would have been useful. According to Grandin (1999), the best jobs for people with ASD include computer programming, engineer, photographer, mechanic, technical repair, and librarian. For people with ASD that are non-verbal, data entry, factory assembly workers, and other jobs that require little communication are good choices.

Several participants had some difficulty using the device. For some, it was the task, but for others, it was the device itself. In essence, they were experiencing uncertainty of how to use the device, which caused them to have anxiety or frustration. This could have easily been avoided by providing more thorough training to the participants. That said, device uncertainty can be avoided if organizations provide their learners training on how to use VR units prior to task training that utilizes VR simulation.

It is recommended that future studies consider investigating VR sickness in relation to individuals with ASD. This study found that the amount of participants who suffered from VR sickness was inline the general population; however, because of their sensory sensitivity, it is an area that requires further investigation. Potential solutions that work for the general population to alleviate VR sickness, such as the Nasum Virtualis (virtual nose), should also be investigated to see if there are similar benefits and results.

The simple design of the MTS training in this study was intentional to allow participants to gain confidence so that they would feel confident that they could do the job of an electrician by mastering a simple task. To truly know if the training increased self-efficacy by utilizing mastery experience, an individual mastering a simple task to gain the confidence necessary to allow them to accomplish more complex tasks (Bandura, 1998), future studies should not just measure if self-efficacy increases after
only one task is performed. Mastering a simple task like connecting wires to the correct screws should be followed by more complex tasks of an electrician, and then a posttest should be performed to measure self-efficacy. That would provide better evidence that the mastery experience method increased the self-efficacy of the participants.

Another recommendation for future studies is to investigate if people with ASD have a reliance on others that hinders their ability to self-manage uncertainty. Throughout this study, I noticed family members, job coaches, and even the researcher providing assistance to the participants at times. Once assistance was provided, participants who received the assistance seemed to rely more on the help, and try less to do things on their own. While it was meant to be helpful, the researcher recognized that it might actually be causing the recipient harm. Thus, a study to investigate the effects of the influence of others would be interesting.

Finally, it is recommended that future studies consider investigating if sensory sensitivity is affected when more detail is added to virtual worlds. For example, a new product is in development that is an add-on to current VR viewers, such as the Oculus Rift. The add-on device is called the FEELREAL Sensory Mask, and provides users with a more detailed experience. The device currently offers seven odors that can be generated into the mask, it can blow hot or cold air for a wind flow experience, it can spray the user with a water mist, and it has a microphone and vibro engine for interactive sound, such as a conversation. It would be interesting to see what kind of effect such detail for the senses would have on people with ASD.
This mask is currently being developed in New York, and is not yet on the market. The mask is compatible with several different existing VR viewers, such as the Oculus Rift. Users are able to smell through the odor generator, a hot and cold air wind flow can be generated, there is an ultrasonic ionizing system that creates water mist, and you can hear and talk through the device for interactivity.

In conclusion, a multimedia approach to training is an effective strategy for increasing the self-efficacy, and improving the positive outcomes of individuals with ASD. Though there have been improvements made on the vocational assistance programs offered, a major gap of available sources necessary to address the vocational skills that an individual with ASD needs to succeed after they leave high school (Taylor, McPheeters, Sathe, Dove, Veenstra-Vanderweele, & Warren, 2012). This study provides preliminary evidence that the use of multimedia training methods may be an effective method to provide task training, reduce uncertainty during the encounter phase of assimilation, and increase the self-efficacy of individuals with ASD in the workplace. The multimedia approach used in this study can serve as a platform for future studies intending on the continual investigation of the impact and effects of the multimedia approach, or as a platform available to organizations, families and vocational assistance programs to continually improve positive outcomes in the workplace for people with ASD.


APPENDIX A: Participant Demographic Questionnaire

1. What year were you born? __________

2. What is your gender? __________________________

3. Racial/Ethnic Identity – please check all categories that you would describe yourself as:
   _____ American Indian / Native American          _____ White / Caucasian          _____ Asian
   _____ Pacific Islander          _____ Black / African American          _____ Hispanic / Latino
   _____ Other - Please specify: ____________________________________________________

4. What is your highest level of education?
   _____ High School – did not receive degree          _____ High School – graduated
   _____ Took some college courses – did not receive degree          _____ Associates Degree
   _____ Bachelor’s degree          _____ Master’s degree          _____ Ph.D.
   _____ Other - Please specify: ____________________________________________________

5. Have you been diagnosed with Autism (ASD)?
   Yes _____          No _____

6. Excluding Autism (ASD), do you have, or have a history of, any mental conditions, cognitive disabilities, mental retardation, neurological disease, developmental disability, or drug or alcohol abuse?
   Yes _____          No _____

7. Are you able to provide consent to participate in this study?
   Yes _____          No _____

8. Are you interested in participating in the workforce?
   Yes _____          No _____

9. Do you now, or have you ever had, a job?          Yes _____          No _____
   If so, list jobs and how long you were employed: __________________________________________
                                                       __________________________________________
                                                       __________________________________________
## APPENDIX B: Web Links

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APPENDIX C: Original New General Self-Efficacy Scale

NGSE Scale

1. I will be able to achieve most of the goals that I have set for myself.
2. When facing difficult tasks, I am certain that I will accomplish them.
3. In general, I think that I can obtain outcomes that are important to me.
4. I believe I can succeed at most any endeavor to which I set my mind.
5. I will be able to successfully overcome many challenges.
6. I am confident that I can perform effectively on many different tasks.
7. Compared to other people, I can do most tasks very well.
8. Even when things are tough, I can perform quite well.
APPENDIX D: New General Self-Efficacy Scale Modified for this Study

NGSE Scale for Adults with ASD Wiring an Electrical Socket

1. I will be able to achieve the goal of wiring an electrical outlet.
2. When facing the tasks of wiring an electrical outlet, I am certain that I can accomplish them.
3. In general, I think that I can wire an electrical outlet.
4. I believe I can succeed at wiring an electrical outlet.
5. I will be able to successfully overcome many challenges when wiring an electrical outlet.
6. I am confident that I can effectively perform when wiring an electrical outlet.
7. Compared to other people, I can perform the tasks of wiring an electrical outlet well.
8. Even when things are tough, I can wire an electrical outlet well.
APPENDIX E: Open-Ended Experimental Group Interview Questions

1. Tell me about a time you were trained for a new job. How did they train you? Was it difficult for you to learn new tasks? What kinds of problems did you encounter?

2. Do you like playing video games? Explain how you think virtual reality training like you received today is like playing a video game. How is it different?

3. What was your general impression of the training you received today? Did you enjoy it? What did you like or not like about the training in comparison to the training you have received from places you have worked at previously, or received training from in the past?

4. Did you feel this training was fun and engaging? Tell me why it was fun or not fun. What could have made this a better experience?

5. What would you have done differently if you were designing the training you received today for yourself or any person who has been diagnosed with ASD?

6. Did you experience any dizziness, or any kind of anxiety during the virtual reality experience? Tell me about how you felt.
Appendix F: Step-By-Step Instructions for VR Simulation of Electrical Outlet

1. Watch the how-to video explaining how to perform task.

2. Locate the Electric Socket

3. Orientate your Point of View so that you are facing the Socket

4. Look at one of three areas on the socket, which represent placements for screws which are colored as shown in the video:

   Silver – upper left       Brass – upper right       Green – lower left

5. When you direct your view (gaze) at the location, it will highlight and the cursor circle will expand. While the location is highlighted, use the viewer button (upper right on the Cardboard viewer) to indicate that you are selecting that area.

6. When an area has been selected, then:
   a) Turn to your right in the VR setting.
   b) Select one of three wires: Black   White   Copper

7. Like the screw locations, directing your gaze at a wire will cause the wire to highlight in color and the cursor circle will expand. Select the highlighted wire by pressing the button on the viewer. This will move the selected wire to attach to the location selected on the socket.

8. Attach wires to the other two locations on the socket following the same steps.

9. When you have all three wires attached to the locations you think are correct, look down to find a panel with three buttons: select the DONE button.

10. Look to the left of the socket.

    If you see a green ‘Correct – Good Job!’ sign, you have attached all three wires correctly.

    If you see a red ‘Incorrect – Try Again’ sign, you have attached one more wires incorrectly and can try again.

11. To try again, select the RESET button from the three button panel on the floor, and the wires will now be placed to the right of the electrical socket as when you first started the simulation.