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Improving Daily Living Skills in College Students with Autism Spectrum Disorder Using a Peer-Mediated Daily Living Checklist Intervention

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Publication Date
2019

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Improving Daily Living Skills in College Students with Autism Spectrum Disorder Using a Peer-Mediated Daily Living Checklist Intervention

A dissertation submitted in partial satisfaction of the requirements for the degree of Doctor of Philosophy in Counseling, Clinical, and School Psychology

by

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ACKNOWLEDGEMENTS

My dissertation would not be complete without the support and assistance of my academic and personal community. First, I would like to thank my advisors and mentors Drs. Robert Koegel and Ty Vernon. Your expertise, passion, and patience were invaluable contributions to my personal and professional growth. I am forever grateful that you took a chance on bringing me into the Autism Center seven whole years ago! I would also like to thank Maryam Kia-Keating for your patience and support as my supervisor in the Hosford Clinic, as well as your invaluable wisdom in the development of the design and implementation of this project.

To Mom, Dad, Emma, and Kevin: you are without a doubt my biggest cheerleaders, even if you don’t fully understand what I’m doing! I have been able to accomplish a goal I had never realized possible because you knew I was capable of achieving it. Thank you for keeping me grounded and consistently reminding me of my values and my goals.

To Skyler, I don’t know how I would have accomplished any of this without your patience, encouragement and reality checks these past 5 years. I am looking forward to many other accomplishments with you by my side (Luna too). Thank you, my love.

To my CCSP and Santa Barbara friends, Amy, Katie, Sruthi, Ana, Sabrina, Jordan and many more, you have given me joy and laughter (and wine) during the biggest professional and personal challenges in my 5 years of graduate school. You are all intelligent, passionate and kind people who I am proud to call my friends. I can’t wait to see how you will impact this world!
To all the supervisors and mentors across my training (especially Lynn Koegel, Anna Krasno, Judy Reaven, Audrey Blakeley-Smith, and Nuri Reyes), thank you for your guidance and wisdom to push me to grow professionally and personally. Lastly, I would like to thank Shereen Cohen, my research assistants and the participating peer mentors, Maxwell Higgins, Adriana Fegroso, Kelly Vien, Sarah McGauley, and Angela Subido, whose hard work and dedication made this project possible. Thank you for tolerating my many nagging and anxious emails!
VITA OF ERIN THERESE ENGSTROM

June 2019

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Anticipated Doctor of Philosophy in Counseling, Clinical and School Psychology
Dissertation: Improving Daily Living Skills in College Students with Autism Spectrum Disorder Using a Peer-Mediated Self-Management Intervention
Advisors: Drs. Robert Koegel and Ty Vernon
APA Accredited Internship: University of Colorado School of Medicine- JFK Developmental Disabilities University of California, Santa Barbara

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ABSTRACT

Improving Daily Living Skills in College Students with Autism Spectrum Disorder Using a Peer-Mediated Daily Living Checklist Intervention

By

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Research suggests individuals with Autism Spectrum Disorder (ASD) have difficulties with daily living skills that affect adaptive behavior, which are a major barrier to success in higher education settings. Adaptive behavior has been shown to be the single-strongest predictor of positive outcomes for individuals with ASD, yet few interventions target the improvement of daily living skills within this population, with even fewer targeting college students. Since interventions that integrate motivational and peer-mediated components have improved social communication in adults with ASD, it is possible that incorporating these methods into a daily living checklist, a type of self-management intervention, may lead to improvements in daily living skills for this population as well. The purpose of this study was to assess whether the use of peer-mediated motivational components would increase (1) the percentage of targeted daily living tasks completed per week. In addition, data was collected to systematically examine if this intervention would (2) increase measures of adaptive behavior skill; (3) decrease symptoms of depression; (4) decrease symptoms of anxiety; (5) increase measures of overall quality of life, and (6) improve quarterly academic grade reports. Three college students with ASD between the ages of 18 and 20 participated. A multiple
baseline across participants design was used, where a baseline condition with a self-management daily living checklist without peer-mediation was compared to a peer-mediated intervention condition with check-ins by a peer mentor to complete the daily living checklist. Follow up data were collected for two participants four weeks after the completion of the intervention. (1) All participants increased the percentage of targeted daily living skill tasks completed each week with large effect sizes, with effects maintained at follow-up for two participants. (2) All participants demonstrated some improvement on subdomains of the Daily Living Skill domain on the VABS-III, and 2 participants improved their overall Adaptive Behavior Composite score on the VABS-III. (3) All participants decreased their total score on the BDI-II. (4) Two participants decreased their total score on the BAI. Additionally, (5) all participants maintained good ratings of quality of life as measured by the QLAA. Finally (6), 2 participants demonstrated maintenance of good academic standing following completion of the intervention. Results are discussed in regards to assisting college students with ASD with improving their daily living skills. Additionally, implications of findings and future directions related to the examination of collateral areas relating to mental health, quality of life, and academic performance are explored. Further research would be helpful to continue to develop and examine interventions to assist college students with ASD to live independently and successfully.
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Introduction

Autism Spectrum Disorder (ASD) is a developmental disorder that impacts communication, socialization, and behavioral skills throughout the lifespan (Graetz, 2010; Zager & Alpern, 2010). It is estimated that rates of autism increased 373% between the years of 1980 and 1994 (Dales, Hammer, & Smith, 2001), leading to skyrocketing prevalence rates of individuals with ASD entering adulthood today. Colleges and universities are experiencing a surge of enrollments of college students diagnosed on the autism spectrum, as well as enrollment of those who meet criteria but have not yet been diagnosed (Barnhill, 2016; White, Ollendick, & Bray, 2011). While it is fortunate to see increased rates of individuals with ASD receiving a college education, the challenges of integrating this population into college settings and promoting success in their future careers are becoming evident. Unfortunately, college campuses know little about how to best facilitate transitions and offer adequate support for these students.

Without effective interventions and support services, the challenges associated with ASD can create significant barriers to successful outcomes in the transition phase into adulthood (Howlin, Goode, Hutton & Rutter, 2004). Specifically, adaptive behavior in young adults with ASD can impact participation and success in higher education (Adreon & Durocher, 2007). Developing techniques to assist individuals on the spectrum to succeed in higher education is an important area to examine, as obtaining a college education has been linked to higher quality of life, identity development, and better access to meaningful employment (Zafft, Hart, & Zimbrich, 2004).

Adults with ASD: Symptomology Across the Lifespan
Autism Spectrum Disorder (ASD) is a pervasive developmental disorder characterized by difficulties with social communication and a repetitive or restricted range of activities and interests (APA, 2013). The level of severity varies across individuals, resulting in different manifestations of these characteristics. For example, more severely affected individuals may be minimally verbal, with repetitive, stereotypic behaviors such as hand wringing or body rocking, resulting in a higher need of support for overall functioning. Other individuals who are less severely impacted by ASD may demonstrate challenges in less evident social communicative domains, such as pragmatics (reciprocal conversations, gestures and eye contact integrated with speech), or have a restricted range of interests that they talk about or engage in excessively.

Among these core features, sensitivity to sensory stimuli also seems to be a common feature of ASD, though this domain is not considered a main symptom of the disorder. Sensory sensitivity was included as part of the restricted and repetitive behavior diagnostic category of the Diagnostic and Statistical Manual of Mental Disorders- 5th edition (DSM-5; American Psychiatric Association, 2013). Sensory sensitivity symptoms, such as sensitivity to particular noises or smells, are suggested to significantly affect adjustment to new environments (Adreon & Durocher, 2007). Additionally, researchers found a positive relationship between social communication impairment and hyper responsiveness to certain sensory stimuli and sensory seeking behavior in individuals with ASD (Watson, Patten, Baranek, Poe, Boyd, Freuler, & Lorenzi, 2011). Thus, it is possible that sensory sensitivity plays an important role in the development of social communication, socialization and challenging behaviors in ASD.
Despite the growing number of individuals with ASD reaching adulthood, little is known about the manifestation of core deficits across adolescence and adulthood (Seltzer, et.al., 2003). What is known about symptom development in autism is that features are constantly changing across the lifespan (Seltzer, et.al., 2003). It is hypothesized that there is an interaction between maturation and development on the acquisition of skills, as well as an emphasis on the complex nature of ASD symptomology that contributes to the variability. Specifically, autism is characterized by both an absences of skills (executive functioning, social communication) and a presence of challenging behaviors (rituals and compulsions; Seltzer, et.al., 2003; Burack, Charman, Yirmiya, & Zalazo, 2001; Lord, Rutter, & LeCouteur, 1994) that would make trajectories vary greatly based on these two subtypes of autism symptoms. Furthermore, ASD is a relatively new disorder, first described by Leo Kanner in the early 1940s. Diagnostic practices and criterion have changed drastically over the past 75 years, making it difficult to capture development on cross-sectional comparisons with individuals with autism at different life stages (Seltzer, et.al., 2003). Similarly, developments in treatment, services, and medications have been beneficial to younger autism cohorts more than their older counterparts, affecting symptom trajectories (Seltzer, et.al., 2003; Lord & McGee, 2001). Although there are challenges to understand ASD symptom development, it is critical for researchers to investigate life course issues among this population in order to understand the effect of autism on families and society at large.

The limited research in lifespan development of ASD suggests some promise that core symptoms and co-occurring challenging behaviors of individuals with ASD are mitigated later in life. Specifically, among high functioning adults with ASD, social
communication improved from childhood to adulthood, while restricted and repetitive behaviors appear to decrease (Starr, Szatmari, Bryson, & Zwaigenbaum, 2003; McGovern & Sigman, 2005; Shattuck, Narendorf, Cooper, Sterzing, Wagner, & Taylor, 2012.). However, difficulties with socialization appear to persist throughout development (Shattuck, Abbetduto, & Greenburg, 2004), meaning challenges with developing, understanding, and maintaining relationships with others endure throughout adulthood. This line of research suggests that despite improvements in social communication and behavior, adults with ASD continue to be isolated from society.

**Long-term Outcomes in ASD**

The literature extensively demonstrates that difficulties associated with ASD symptomology have had adverse effects on outcomes for adults with ASD. Longitudinal research indicates that that only 22% of adults with ASD have “good” outcomes (in relation to employment, independent living, and education), and most remain dependent on families and support services (Howlin et al., 2004). More specifically, despite a nearly 800% increase in access to Vocational Rehabilitation Programs, employment outcomes for this population are consistently low, and those who work do so for fewer hours and for lower wages than other disability groups (Burgess & Cimera, 2014; Cimera & Cowan, 2009). In fact, the National Longitudinal Transition Study (2009) showed that only about 32.5% of young adults with ASD were working for pay versus about 59% of other participants who were receiving special education services. Additionally, more than 50% of young adults with ASD had no participation in employment or higher education in the two years following high school graduation, which is the lowest rate of any other disability category (Roux, et.al., 2013; Shattuck et.al., 2012). The odds of having a job in
lower income households, particularly among individuals with lower conversational and cognitive abilities, were even poorer (Roux, et.al., 2013; Shattuck et.al., 2013).

Considering the poor outcomes in employment and education, it makes sense that the number of individuals with ASD living independently would be meager compared to typically developing populations. In one study examining the global outcomes of young adults with ASD, only 4 of the 48 participants reported living semi-independently, with 60% of participants living at home with a disability pension or in a group home (Eaves & Ho, 2006). This lack of independence was found in other research on adults with ASD as well (Howlin, et.al., 2004; Howlin, 2000; Gillberg & Steffenberg, 1987). Since core features of autism tend to improve despite outcomes being poor, researchers should be looking at other reasons that may be contributing to these challenges. Understanding issues in independent living may shed light on why this population continues to be socially isolated despite the reported improvement trends in the core symptoms of ASD.

**Difficulties with Daily Living Skills as an Effect on Poor Independent Living Outcomes**

Though independent living is largely explored alongside measures of employment and higher education, fewer studies have explored development of independence in the context of daily living skills, and how challenges in this area may affect an individual’s ability to live independently. It is known within the literature that adults with ASD tend to have difficulty with daily living skills, which include tasks related to personal hygiene, attending appointments on time, shopping, and managing bank accounts (Adreon & Durocher, 2007; Williams & Palmer, 2004). In a study of the Vineland Adaptive Behavior Scale’s supplemental norms for autism, children with ASD showed increasingly
larger lags behind their same age peers without ASD, highlighting that problems with daily living skills begin at an early stage and do not appear to improve later on. Building on this understanding, Smith, Maenner, and Seltzer (2012) examined the longitudinal course of daily living skills among individuals with ASD, and they found that while there was an improvement in daily living skills during childhood, these skills plateaued when the adults reached their late 20s and declined once they reached their 30s. While those with co-occurring intellectual disability (ID) had greater gaps in daily living skills, individuals with ASD without ID or other disabilities demonstrated significant declines as well, even when researchers controlled for severity of core symptomology (Smith, et.al., 2012; Klinger, L.G., Klinger, M.R., Mussey, Thomas, & Powell, 2015).

Although challenges with daily living skills are not considered a core feature of ASD, it appears that difficulties with acquiring and maintaining daily living skills affects many individuals with ASD in a variety of domains that lead to their poorer outcomes. For example, if an individual has difficulties with personal hygiene, then the likelihood of success in initiating relationships or obtaining employment will be hindered. In this example, appropriate social communication skill would have less impact on obtaining employment if the interviewee is poorly groomed or seemingly disorganized in an interview setting. Without success in obtaining employment, this may lead to less likelihood of financial independence, more time at home, and continued social isolation as a result. Thus, evaluating potential barriers to success in daily living skills and developing techniques to improve them would be beneficial to improving long-term outcomes for individuals with ASD.

**Adaptive Behavior in ASD**
In order to understand the cause of decline in daily living skills, it is important to understand adaptive behavior among adults with ASD. Adaptive behavior is a broad construct describing one’s ability to function independently in their environment (Pugliese, Anthony, Strang, Dudley, Wallace, Naiman, & Kenworthy, 2016; Turygin, 2016). It includes communication, socialization, self-care, home living, functional academics, community use, health and safety, leisure, and occupational skills. Impairments in adaptive functioning in the subdomains of socialization and communication are not surprisingly prevalent among the ASD population (Volkmar, Sparrow, Goudreau, Cicchetti, Paul, & Cohen, 1987); measures of adaptive behavior have been used as a way to distinguish ASD from other clinical groups (Turygin, 2016; Klin, 2000). However, individuals with autism, with and without ID, also consistently score lower in daily living skill domains, including hygiene, grooming, house keeping, and meal preparation (Matson, Dempsey, & Fodstad, 2009). Since adaptive behavior is impacted in autism, some studies have sought to understand how these deficits have affected poor outcomes observed in the literature. In one cross-sectional study by Klinger, Mussey, Thomas, and Powell, (2015), adaptive behavior was the strongest predictor of long term outcomes among individuals with ASD, even when controlled for symptom severity and language skills. Unfortunately, studies addressing adaptive behavior in adults with ASD are often overlooked, despite the critical need for better understanding of the cause of challenges and development and implementation of interventions.

There are several reasons why individuals with ASD may have challenges in adaptive behavior. First, deficits in executive functioning have been shown to impact
adaptive behavior skills in individuals with ASD. Executive functions are defined as cognitive processes needed for goal-directed behavior involving various skills like organization, planning, working memory, initiation, self-monitoring and inhibition of certain behaviors (Adreon & Durocher, 2007). These challenges appear to impact cognitive and social communicative domains (Gilotty, Kenworthy, Sirian, Black, & Wagner, 2002). For example, success in social functioning relies on “‘integration and weighing of multiple contextual variables, selective attention, and inductive logic’” (Rumsey, 1985, p. 34), so an individual must be capable of fluid evaluation of subtle and complex social information and flexibility in adapting to changing cues. Thus, when the cognitive ability to perform these tasks is impaired, social reciprocity and understanding are impacted.

In terms of daily living skills, impairments in executive functioning impact the individual with ASD’s ability to plan and organize daily living tasks, break down larger tasks into smaller ones, and maintain attention on difficult tasks (Adreon & Durocher, 2007). Difficulty in planning and organizing can affect an individual’s ability and motivation to complete multicomponent skills such as cooking, cleaning, or completing academic or employment-related tasks. Other issues in adaptive behavior may be related to the intense adult support that children with autism receive early on in development. In a survey of over 700 paraprofessional respondents, researchers found that students with disabilities (including autism) spent upwards of 86% of their school day within three feet of a paraprofessional (Giangreco & Broer, 2005). Constant adult prompting, while initially helpful to remediate academic challenges, may be detrimental in the long term, as many do not effectively fade out their support. Without constant paraprofessional
support, individuals with ASD had greater difficulty with completing tasks on their own, which impacted abilities in employment and residential settings (Hume, Loftin, & Lantz, 2009). More and more individuals with ASD are entering adulthood without the appropriate skill set or self-efficacy to live independently and thrive academically like many of their typically developing peers.

**College as a Critical Time Period for Individuals with ASD**

Literature demonstrates that people of all backgrounds and abilities benefit from postsecondary education and the college experience (Dowrick, Anderson, Heyer & Acosta, 2005; Grigal, Neubart & Moon, 2001; Hart, Grigal, & Weir, 2010; Zafft et al., 2004). One benefit includes an increased likelihood of obtaining competitive employment following a college education, resulting in better financial outcomes. College students with autism have an increased likelihood of obtaining employment after graduation than individuals with autism who do not attend college (Dowrick et al., 2005; Hart et al., 2010;), in addition to utilizing less work-related supports (like job coaches; Zafft et al., 2004). Thus, supporting students with ASD in college settings may result in less money needed in government-assisted income and on-going support. Furthermore, college is a time for personal and emotional growth, where students have the opportunity to develop their personal identities and develop meaningful relationships outside the classroom (Kuh, 1998). It is important that individuals with ASD receive supports to attend college in order to increase opportunities for success in employment and be included in an important stage of human development.

Although there are numerous benefits for attending college, many young adults with ASD feel they lack the confidence and support to obtain a degree. While 78% of
typical high school graduates pursue some type of postsecondary education, only 14% to 37% of individuals with significant disabilities enter postsecondary education (Grigal et al., 2006; Zafft et al., 2004). Students with disabilities frequently remain in special education programs or enter sheltered work environments after high school as their typically developing peers advance into postsecondary education or competitive employment (Zafft et al., 2004). With limited access to and success in postsecondary education, the chance of independent living later in adulthood is diminished as well (Stodden, Whelley, & Harding, 2001). Since college students with autism make up a significant portion of the student population (White, Ollendick, & Bray, 2011), it is critical that researchers begin to understand barriers to their success.

**Mental Health Outcomes in College Students with ASD**

Autism has a significant impact on individuals and populations and often co-occurs with other conditions that are associated with lifelong impairments. Anxiety and depression are two common mental health challenges faced by individuals with autism. Individuals with ASD are at a much higher risk of developing depression in their lifetime than the typically developing population (Ghaziuddin, Ghaziuddin, & Greden, 2002; Billstedt, 2000; Bradley, Summers, Wood, & Bryson, 2004), with prevalence rates as high as 50% in individuals with ASD, and higher among those without ID (Matson & Williams, 2014). Depression is characterized by a persistent sad or “empty” mood, irritability, changes in activity level or appetite, and a loss of interest or pleasure in things that were previously enjoyed (American Psychiatric Association, 2013). It is hypothesized that high-functioning individuals with ASD are more likely to receive a depression diagnosis due to more awareness of deficits than individuals with ID, and due
to better ability to express depressive symptoms to professionals or caregivers (Sigman, Dissanayake, Arbelle, & Ruskin, 1997; Turygin, 2016).

Additionally, individuals with autism are also more likely to have an anxiety disorder, with rates estimated between 40-84% (Mayes, Calhoun, Murray, Ahuja, & Smith, 2012). Specific phobias have been reported in as many as 44-63% of youth with ASD, in addition to a large proportion with Obsessive-Compulsive Disorder (OCD) and symptoms of social anxiety, including sensitivity to increased social pressures, social skills deficits, and social avoidance (Mayes, et.al., 2012). Some researchers argue that anxiety diagnoses in this population may be describing the core features of ASD rather than a separate, co-occurring disorder, but closer analysis that controlled for ambiguous symptoms demonstrated that these symptoms are in fact distinct from one another (Gadow, DeVincent, Pomeroy, & Azizian, 2005; Kerns & Kendall, 2012). The findings on social anxiety are interesting, given that the general population largely assumes that individuals with ASD are less interested in social interaction than their typically developing peers. In fact, a diagnosis of social anxiety suggests that this population may be acutely aware of how others view them.

The college student population is at an increased risk of developing anxiety and depression due to the challenges associated with pressure to succeed, social isolation, uncertainties about post-graduation plans and academic stress (Beiter, Nash, McCrady, Rhoades, Linscomb, Clarahan, & Sammut, 2015). Since college students with ASD are already at an elevated risk of developing anxiety or depression due to their ASD diagnosis, the prevalence rates are further increased when they start school (White,
Ollendick, & Bray, 2011; Buck, Viskochill, Farley, Coon, McMahon, Morgan, & Bilder, 2014). In fact, these were the most commonly reported problems reported by college students with ASD (Gelbar, Smither, & Reichow, 2018; Jackson, Hart, Brown, & Volkmar, 2018). Anxiety and depression are serious issues for college students, since they are correlated with problematic behaviors such as drug use, poor diet, and poor sleep habits as well as an overall lower quality of life. In the autism population with anxiety and depression, there is also an increase in self-injurious behavior, suicidality, and somatic symptoms (Cassidy, Bradley, Robinson, Allison, McHugh, & Baron-Cohen, 2014; Kerns, Kendall, Zickgraf, Franklin, Miller, & Herrington, 2014; Jackson, Hart, Brown & Volkmar, 2018), and students with ASD report an increased pressure to fit in, and manage social demands (Van Hees, Moyson, & Roeyers, 2015). With the severity of co-occurring symptomology, college students with ASD are faced with even more barriers to success in their academic and social pursuits.

**Daily Living Skills as a Major Transition Issue for College Students with ASD**

Daily living skills have been identified as a major transition issue for college students with ASD (Adreon & Durocher, 2005; Glennon, 2001; Accardo, Kuder, & Woodruff, 2018). Some common daily living issues may include personal hygiene, dressing appropriately, waking up to an alarm clock, shopping, understanding meal plans and following the rules for using them, using a campus ID, handling fire and safety drills, using shared restrooms, and acquiring transportation (Adreon & Durocher, 2005). These difficulties can impact the college student’s ability to get to class on time, make good impressions in social situations, and navigate the college structure.
The reasons for these challenges are thought to be associated with ASD symptomology. For example, sensory sensitivities can significantly impact the transition into the college environment due to sensitivity to loud noises, lighting, physical comfort of furniture and taste (Adreon & Durocher, 2005; Accardo, et. al., 2018). Additionally, many individuals with autism have very specific food preferences, which may make the campus cafeteria a challenging place to maintain a healthy diet (Perner, 2002; Adreon & Durocher, 2005). Along with sensory sensitivities, deficits in executive functioning may lead to challenges in problem solving and decision making skills. For example, budgeting, managing bank accounts, and other organizational aspects of daily living may be more challenging for this population. Other areas, like using social media and email, and managing medication may be negatively affected by problem-solving difficulties.

Students with ASD also report that the lack of structure and change in routines related to a new environment made time management and organization stressful and more difficult (Van Hees, et.al., 2015). Part of this change in structure is due to the Individuals with Disabilities Education Act (IDEA; Public Law, 1997), which mandates support services for students between three years and twenty-one years old, or until high school graduation. Unfortunately, this support system disappears as soon as this population enters the college setting. Many students report that having a sudden decrease in supports, or no supports at all, can be “extremely frightening,” resulting in poorer health and academic performance (Glennon, 2001; p. 188).

As academic coursework and social demands increase and become more complex, college students with ASD are facing more pressure to succeed and balance social lives without applying the daily living skills to do so successfully. It is possible that these
challenges with daily living skills may also be a factor in development of co-morbid disorders like anxiety and depression, such that pressure to succeed and social isolation are exacerbated when a student is not able to maintain a manageable schedule, follow through on important appointments, make time to attend social activities with peers, or satisfy their basic personal needs. When these challenges are considered along the research suggesting that students with ASD receive excessive adult prompting in elementary and secondary school settings, it possible that many enter college without the ability to complete daily living tasks. However, due to the challenges associated with executive functioning, ASD symptomology and major life transitions, many college students with ASD do not perform daily living tasks once they are in an unaided setting like a dorm room or apartment. This may contribute to increased anxiety regarding everyday tasks, increased loneliness and less social integration with the community. Interventions to improve daily living skills that consider these unique contexts and organizational and social challenges are needed.

**Interventions to Improve Daily Living Skills in College Students with ASD**

Despite the reported challenges related to daily living skills among college students with ASD, few studies appear to target improving daily living skills among this specific population. However, one common strategy used to improve daily living skills in adults with ASD is self-management. Self-management teaches individuals to independently evaluate, record, and be reinforced for their own appropriate behaviors, and has been shown to increase generalization and maintenance of target goals when programmed to occur in community settings (Boettcher, 1977; Koegel, Koegel, Hurley, & Frea, 1992; Hughes et al., 2012; Koegel, Koegel, & Parks, 1995). Specifically, when
using self-management strategies, a treatment provider must work closely with the individual to ensure that they are accurately discriminating the occurrence of a target response, reliably self-recording elements of the response in accordance to scale or standard established prior to intervention, evaluate performance in relation to this standard, and then self-reward contingently upon response. It has also been shown to facilitate self-determination, which has shown to impact measures of quality of life in individuals with ASD (Lee, Simpson, & Shogren 2007).

When combined with visual components, self-management has led to increases in daily living skills and adaptive behavior in children with ASD (Wilkinson, 2008; Pierce & Schreibman, 1994). For example, Pierce and Schreibman (1994) developed a program in which children severely affected by ASD were given picture prompts of specific daily living tasks, then self-managed completion of those behaviors. The researchers found that this type of intervention was successful in increasing target daily living behaviors, decreasing inappropriate behaviors, all without the presence of an adult treatment provider. Similar strategies have been used successfully in severely affected adults and adolescents with ASD (Wacker & Berg, 1984; Pérez-Fuster, Sevilla, Herrera, 2018), but less appears to target these skills in high functioning adults with ASD.

The use of Daily Living Checklists, a type of visually cued self-management intervention, is a common clinical technique for improving daily living skills in high functioning adults with ASD (Engstrom, Ashbaugh & Ford, 2018). A Daily Living Checklist is comprised of multiple daily living skills and can be adjusted based on the current needs of the individual and his or her skill level. An individual will track completion of specific tasks on the checklist every day, earning some type of
motivational reward, such as a preferred activity or item. Specific tasks may be broken down into multiple parts. For example, an individual may need to self-manage multiple components of showering (such as washing hair, washing body with soap, and drying off with a towel), while simply including “showering” on a Daily Living Checklist may suffice for others. This type of intervention has not been evaluated directly within the college student population, but evidence of efficacy in adults in other settings suggests that it would be successful in increasing daily living skills for this group.

**Peer Mediated Interventions within College Contexts**

Peer mentors are a useful strategy in the support of college students with ASD, as a plethora of data shows that incorporating typically developing peers can be beneficial in behavioral treatment programs for individuals with ASD (Chan et al., 2009; Hart et al., 2010; Koegel et al., 2013). Peer mentors have been shown to be useful in a variety of contexts, including academic support, social support, and have been helpful in promoting self-advocacy (Adreon & Durocher, 2007). They also have the added benefit of being a non-stigmatizing support in the natural environment, and can be more flexible and adaptable to the unique characteristics and experiences of the college student with ASD (Dillon, 2007).

Peer mentors have largely been used within the context of social support (Gelbar et al., 2014). For example, in a study by Koegel, Ashbaugh, Koegel, Detar, & Regester (2013) participants were matched with a similarly aged typically developing peer to attend structured social activities on the college campus. This particular structured social planning intervention required only one hour per week of direct intervention by a clinician in a university clinic. This small amount of intervention resulted in widespread
improvements in academics, employment, number of friends and peers with whom participants socialized, reported satisfaction with their college experience, and their confidence in peer interactions. It is likely that by integrating a peer mentor, there is ongoing social assistance in social settings that contributes to these effects (Koegel, et.al., 2013). Thus, integrating peer mentors into behavioral treatment programs may result in less time in clinic settings, less money spent on treatment, more time in the natural environment, and collateral improvements on target goals.

**Peer-mediated Interventions to Target Daily Living Skills**

It is surprising that there appear to be fewer efforts investigating a peer-mediated approach to improve daily living skills in college students with ASD, despite the increasing research supporting its application. This specific population of young adults with ASD faces unique cognitive, social-communicative, behavioral, and social-emotional challenges that will impact success in adaptive behavior. Additionally, college students are under increased academic and social schedules that impact their ability to spend time in therapy. Therefore, a peer-mediated approach may be a more beneficial and time-efficient method to improve daily living skills in this specific setting.

Additionally, there is some hope that improving daily living skills may also help mitigate the effects of co-morbid depression or anxiety. More specifically, a new environment and schedule is likely to exacerbate symptoms of anxiety among college students with ASD, leading to more challenges in being able to complete daily living tasks (VanBergeijk, Klin & Volkmar, 2008). By targeting daily living skills, individuals with ASD are able to create a more predictable and familiar routine that may ease discomfort in these novel settings. A peer-mediated approach has also been shown to
increase connectedness with the campus community and number of hours spent with friends, resulting in a decrease in depressive symptoms (Koegel, et al., 2013; Jackson, et al., 2018). Furthermore, by creating a more manageable routine at home, individuals with ASD are more likely to feel comfortable, attend appointments, and make time for and follow through on social activities with peers, which in turn may improve depression symptoms associated with loneliness.

If this type of intervention is capable of improving adaptive behavior and mental health, then it is also possible that quality of life will improve as well. Quality of life (QoL) is a multidimensional construct, which includes a broad set of factors that comprise personal well-being. The World Health Organization defined QoL as an “individual’s perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns” (Eapen, Cryнее, Walter, & Tay, 2014, p. 1). Few studies have sought to understand quality of life in adults with ASD, and have primarily focused on specific mental health, employment, academic or outcomes as singular dimensions. However, the minimal research that has been conducted on QoL in adults with ASD has shown that increasing the available social network and professional supports are more significant factors in improving quality of life compared to ASD symptom severity. Therefore, it is possible that increasing social support to help college students live independently and manage campus life may increase students’ quality of life in a college environment.

**Purpose and aims of the study**

Research indicates that current outcomes for adults with ASD are poor compared to typically developing individuals and other disability groups. A college education and
college experience have been shown to increase the quality of life for individuals on the spectrum; however, students with ASD have adaptive functioning deficits that can create barriers to success in higher education settings. Little research and programming efforts are being made on the development and examination of effective interventions to address the unique support needs of this population in the area of daily living skills, despite peer-mediated behavioral interventions showing promising effectiveness. It is not yet known whether peer-mediated behavioral interventions can improve daily living skills in this population.

Due to these issues, the purpose of this study is to assess, within the context of a multiple-baseline across participants experimental design, whether a peer-mediated daily living checklist intervention will improve daily living skills among college students with ASD. Data was collected to systematically examine if a peer-mediated daily living checklist intervention will lead to improvements in the following areas: (1) Percentage of targeted daily living checklist activities per week; (2) Adaptive behavior functioning (3) Symptoms of depression; (4) symptoms of anxiety; (5) Quality of life; and (6) Quarterly grade reports. Results from this study seek to address a gap in the literature by examining and documenting an intervention focused on the independent functioning needs of college students on the autism spectrum.

Specifically, this study seeks to address the following research questions. Does a structured peer-mediated daily living checklist intervention for college students with ASD result in:

1. An increase in the number of completed daily living tasks per week?
2. An increase in adaptive behavior skills as measured by the Vineland Adaptive Behavior Scales-III?

3. A decrease in symptoms associated with depression as measured through the Beck Depression Inventory?

4. A decrease in symptoms associated with anxiety as measured through the Beck Anxiety Inventory?

5. An increase in quality of life as measured by the Quality of Life Assessment for Adults with ASD?

6. An improvement in academic outcomes as measured by participants’ quarterly grade point averages (GPAs)?

Methods

Participants

This study was approved by the University of California, Santa Barbara Institutional review Board in 2018. All participants and their parents involved in this study were legally independent adults and signed consent forms explaining the purpose of the study. Because videos of sessions with participants and clinicians were recorded for coding of fidelity of implementation (see Fidelity of Implementation), participants also signed video consent forms. All participants and their parents were informed that they could refuse or withdraw their consent at any time, and they were explained the limits of confidentiality.

Inclusion criteria for participation in the study included the following: (a) participants needed to have a diagnosis of an Autism Spectrum Disorder by an outside agency or confirmed by our clinic according to criteria in the Diagnostic and Statistical
Manual of Mental Disorders-5 (American Psychiatric Association, 2013) using the Autism Diagnostic Observation Schedule, 2nd Edition (ADOS-2; Module 4 for verbally fluent adults); (b) had normal intellectual functioning (IQ of 85 or above) as measured by the Kaufman Brief Intelligence Test- 2nd Edition, (c) be full-time students in a higher education setting; (d) be between 18-26 years of age, so that they represent the range of the typical college student; (e) had a cell phone and demonstrated ability to read and write text messages; and (f) demonstrated difficulties in daily living skills as seen as a standard score of 85 or below (moderately low to low range) within the Daily Living domain or 12 or below (moderately low to low range) on the Personal, Domestic, or Community subdomains of the Vineland Adaptive Behavior Scale- Third Edition (VABS-III); direct observation, peer-reports, and a lack of self-reported daily living skills (e.g. lack of hygiene, missing appointments frequently, lack of completion of household duties). Participants for this study were individuals receiving behavioral intervention from the University Autism Center or were referred to the Center by an outside agency for difficulty with daily living skills. Each participant is identified by a pseudonym. See Table 1 for additional details on participant characteristics.

**Participant 1.** Valerie was a 20-year-old female who identified as White. At the time of the study, she was a first year student at a local four-year university and she had not yet declared her major. She was referred to the University Autism Center by the Disabled Students Program at her university due to a previous educational identification of ASD. She lived independently in a dorm on campus with a roommate. She enjoyed reading, and playing video games in her spare time. Her mother reported significant concerns regarding her ability to live independently. Specifically, she reported that
Valerie had difficulty with managing her time, and completing her schoolwork. She also reportedly had a very messy room and backpack. During the intake interview, she reported that she would frequently become overwhelmed by large school assignments, and would not complete them on time. She stated that she would like additional support to be successful academically, independently and socially.

**Participant 2.** David was a 19-year-old male who identified as White. He was a first year student at a local community college and his major was Biological Sciences. He was self-referred to the Autism Center after seeing an advertisement for the study on the Autism Center’s website. He lived independently with roommates at the time of the study. He reported that he enjoys video games, board games, and role-play games in his spare time. His mother reported that David had difficulty with eating healthy meals, time management, and organization. She reported concern that his difficulties were impacting his ability to be successful in school, as well as making friends. David reported that he frequently forgot about school assignments and deadlines, organizing his belongings, and eating regular, healthy meals. He reported that he hopes to acquire more effective skills to manage the demands of his schoolwork as well as balance an active lifestyle and making friends.

**Participant 3.** Milo was a 20-year-old male who identified as Asian. At the time of the study, he was a first year transfer student at a four-year university (beginning his third year of college), and his major was economics. He was self-referred to the Autism Center after seeing an advertisement for the study on the Autism Center’s website. At the time of the study, he had recently moved into a single college dorm room (no roommates), but had previously lived with his parents one month prior to beginning the
intervention. In his spare time, he enjoyed creative writing, video games, and spending time outside. Both Milo and his mother reported significant concerns regarding his time management and organizational skills, as well as daily living tasks such as taking medication regularly, remembering to complete assignments, and tidying. He reported that he had a previous diagnosis of Major Depressive Disorder and had experienced anxiety about his school performance. He requested support in being better able to stay on top of his school work and living independently for the first time, as well as make time for other activities he enjoys.

**Characterization Measures.** The following measures were administered to understand intellectual and social characteristics of each participant, as well as verify that each participant met the inclusion criteria. Please see Table 1 for a summary of each participant’s characteristics.

*Kaufman Brief Intelligence Test- Second Edition (KBIT-2; Kaufman & Kaufman, 2004).* The Kaufman Brief Intelligence Test- Second Edition (KBIT-2) was administered in order to measure verbal and nonverbal intelligence. This test is a brief, individually administered measure that takes approximately 15 to 30 minutes to complete. It yields 3 scores across verbal, nonverbal, and an overall IQ composite score by assessing a person’s word knowledge, range of general information, verbal concept formation, and reason ability. The KBIT-2 has strong internal consistency, test-retest reliability, and construct validity (Kaufman & Kaufman, 2004). Additionally, the KBIT-2 correlates well with the Wechsler Abbreviated Scale of Intelligence (WASI), the Wechsler Adult Intelligence Scale- Fourth edition (WISC-IV), Wide Range Achievement Test- Third Edition (WRAT-III), and Kaufman Test of Educational Achievement, Comprehensive
Form, Second Edition (KTEA-II). Since the average college student with ASD has intellectual functioning within the average to above average range (White, Ollendick, & Bray, 2011; VanBergeik, Klin & Volkmar, 2008), this measure was used to determine if the participants represent the average to above average intellectual functioning level typical of this population (IQ of at least 85 or above).

Social Responsiveness Scale-2 (SRS-2; Constantino & Gruber, 2012). In order to understand severity of social deficits associated with ASD symptoms, each participant was given the Social Responsiveness Scale-2 (SRS-2). This scale provides an overall measure of social deficits associated with ASD, as well as deficits in the following five areas: (1) Social Awareness; (2) Social Cognition; (3) Social Communication; (4) Social Motivation; and (5) Restricted Interests and Repetitive Behavior (Constantino & Gruber, 2012). It includes a self-report form and allows for ratings by parents, spouses, friends, or relatives who have known the individual for at least 1 month. Results are reported as T-scores (M=50, SD=10), with a score of 66 or above indicating clinically significant social deficits. The SRS-2 has strong inter-rater reliability, internal consistency, and convergent validity with the Autism-Diagnostic Interview-Revised, Autism Diagnostic Observation Schedule-Revised, and the Social Communication Questionnaire (Wilkinson, 2013). This measure was used to understand severity of autism symptoms among participants prior to beginning the intervention.

Behavior Rating Inventory of Executive Functioning- adult version (BRIEF-A; Roth, Isquith, & Gioa, 2005). The Behavior Rating Inventory of Executive Functioning-adult version (BRIEF-A) assesses an array of executive functioning (EF) tasks and how they impacted daily life over the past 4 weeks. This test contains both informant rating
and self-report items assessing the frequency of problems related to executive functioning, and takes approximately 10 minutes to complete. The BRIEF-A yields an overall scale (Global Executive Composite, GEC), which is a composite of two index scores (Behavioral Regulation Index, BRI, and the Metacognitive Index, MI). The BRI consists of 4 subscales, including Inhibit, Shift, Emotional Control and Self-Monitor, and the MI consists of five subscales, including Initiate, Working Memory, Plan/Organize, Task Monitor, and Organization of Materials. Additionally, it includes three validity scales that assess for negativity, infrequency, and inconsistency in responses. This test has good ecological validity as it assesses EF difficulties in relation to real world tasks. T scores of 65 or higher are indicative of clinically significant problems associated with executive functions (M=50; SD=10). The BRIEF-A has strong inter-rater reliability, internal consistency, and has been validated in a variety of clinical and non-clinical populations (Roth, et.al., 2005). Additionally, it has been used in the assessment of EF in high functioning autism in adults with co-morbid anxiety and depression (Wallace, Kenworthy, Pugliese, Popal, White, Brodsky, & Martin, 2016).
Table 1. Participant Characteristics

<table>
<thead>
<tr>
<th></th>
<th>Valerie</th>
<th>David</th>
<th>Milo</th>
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<tbody>
<tr>
<td>Age</td>
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<td>19</td>
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<td>Independent</td>
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<td>Residence</td>
<td>(Dorm room with roommates)</td>
<td>(Apartment with roommates)</td>
<td>(Single dorm room)</td>
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<td>BRIEF Global</td>
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<tr>
<td>Executive Composite T-Score</td>
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<td>65 (Clinically Significant)</td>
<td>70 (Clinically Significant)</td>
</tr>
<tr>
<td>SRS-2 Adult T-score</td>
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<tr>
<td></td>
<td>73 (Moderate)</td>
<td>64 (Mild)</td>
<td>71 (Moderate)</td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Taking medications</td>
</tr>
</tbody>
</table>
• Physical exercise
• Household chores

*Confirmed by the University Autism Center using the ADOS-2, Module 4

Note. ASD= Autism Spectrum Disorder
Settings and Materials

All baseline and intervention sessions for Valerie and David were implemented in a University Autism Center on the University Campus, in a clinic room that includes large chairs, couches, and a television. Milo’s baseline and intervention sessions took place via video conference call. Milo called from the setting of his dorm room, and the clinician called from a private office setting. Video conferencing with Milo was chosen due to an available clinician unable to meet in person during Milo’s desired session times. Check-ins from peer mentors were provided in person or via phone call, depending on the participant’s preference. Valerie’s check-ins from her peer mentor took place at her place of residence. David’s check-ins took place via phone call while David was at home. Milo’s check-ins by his peer mentors took place in a community setting, such as a table on campus or at a coffee shop.

To ensure fidelity of implementation and reliability, baseline and intervention clinic sessions were video recorded with a video camera that was placed unobtrusively in a corner of the clinic room. The video conference call was recorded through the software’s recording service. Additionally, peer mentors filled out a contact log that tracks the frequency, type of contact and components of the intervention that were addressed. This contact log, along with all recordings of clinical sessions, were kept on a private and secure online file sharing system that is compliant with the Health Insurance Portability and Accountability Act (HIPAA), Family Educational Rights and Privacy Act (FERPA), and Human Subjects Committee guidelines.

Experimental Design
A multiple baseline design across participants experimental design was used to assess the effects of the peer-mediated self-management intervention program on daily living skills. This design was chosen for its strength in its ability to provide an in-depth examination of the effectiveness of a specific intervention (Heppner, Kivlighan, & Wampold, 2007). Due to the varying of symptom severity across the current participants and the necessity to individualize each checklist to each participant, this design also allows within participant analysis (Heppner, et.al., 2007).

The number of baseline points was staggered by 3 points across participants, with 3, 6, and 9 points respectively. By staggering the baseline, each participant was able to serve as their own control, thereby eliminating possibility of an effect of time on the target behaviors (Bailey & Burch, 2002).

**Procedure**

Each participant met with a clinician weekly throughout baseline and intervention sessions. In both conditions, organizational skills were targeted during sessions with the clinician, and a daily living checklist intervention was present. It was necessary to integrate organizational skills within the intervention, since lack of organization skills appear to impact daily living skills in college students with ASD (Adreon & Durocher, 2007). Check-ins and social reward activities with peer mentors were introduced at the start of the intervention phase. Please see below for more information on these components.

**Clinicians.** Participants met with a clinician each week in both baseline and intervention conditions. All clinicians in this study were advanced doctoral students in clinical psychology who worked at a university autism center. Clinicians had at least 4
years of experience working with young adults and college students with ASD. They received weekly supervision by a licensed clinical psychologist. One clinician in this study, who provided services to David, was the researcher. The other clinician, who provided services to Valerie and Milo, was not involved in data collection or data analysis.

Organizational Skills. Each weekly session, the clinician trained the participant how to manage appointments and coursework. The purpose of the instruction in organizational skills was to assist the participants with attending scheduled appointments and classes. Many college students with ASD report that they have difficulty attending appointments because they were busy playing on the computer, did not recall the details of the appointment, and had difficulty time managing their other responsibilities. To target this, participants were instructed to bring a daily planner or phone planner to the weekly intervention sessions, and the clinician assisted them in documenting the time, place, and activity for important appointments for the week. When appropriate, clinicians also provided prompting for participants to set alarms and reminders in their digital calendars to ensure they would receive reminders shortly before appointments. Appointments included lectures, study group hours, medical appointments, social activities, and office hours with a professor, and so forth. If relevant, they organized all course materials in their laptop and/or backpacks, to ensure that all academic materials are in a secure and consistent location for feasibility of transport and assignment completion.

Baseline: Checklist intervention without peer-mediation. During baseline, the participant was instructed to fill out a daily living checklist each week with no check-ins
from the clinician or peer mentor outside of the weekly session with the clinician. The Daily Living Checklist included items such as housekeeping, hygiene, and organization skills that are derived from items in the VABS-III Daily Living domain. Specifically, clinicians and participants chose specific tasks from the following options:

1. Shower: wash body with soap, wash hair with shampoo, and dry off with a towel.
2. Brush and floss teeth: apply toothpaste to tooth brush, brush teeth for 60 seconds, rinse toothbrush, rinse mouth, floss teeth.
3. Plan and prepare meals: prepare basic foods (rice, vegetables, soup, etc), eating 3 meals per day.
4. Take prescribed medication: take pills according to prescription.
5. Laundry: separate clothes into light and dark colors, place clothes into wash with detergent, place into dryer, and fold and put away clothes in closet or dresser.
6. Wash dishes: scrape off food into trash, wash dishes with water and soap, dry dishes with towel or set on drying rack, and put away dishes when dry.
7. Tidy living space: take out trash/recycling, sweep/mop floors, vacuum carpets, pick up clutter off counters and floors, and wipe down countertops.
8. Check email: sign-in to email account, read unread emails, and respond to emails as necessary.
9. Keep track of appointments in calendar: add new appointments into calendar; check appointments every day; attend scheduled appointments.
10. Complete coursework: complete required readings, complete required assignments, and submit assignments when due.
11. Manage monthly expenses: keep money in account, track account balance, pay expenses on time, and budget for utilities, rent, etc.

In collaboration with the clinician, the participant determined the specific tasks that were most needed on the checklist, based on lack of reported performance, responses to the VABS-III, and the participants’ personal preference. Participants had the option to choose a general task (e.g. showering) or list each steps of the task (e.g. wash body with soap, wash hair with shampoo, shower, etc.) on their checklist. The language included on each participant’s checklist was listed using the language the participant chose to describe each task (e.g. “read textbook” vs. “complete required readings”). Examples of each participant’s checklist with selected tasks can be found in Appendices A, B, and C.

During this condition, the participant was instructed to fill out the daily living checklist to identify targeted tasks for the intervention. The participant and clinician reviewed the previous week’s daily living checklist during each weekly session, and established new weekly goals based on the participant’s performance. Each participant was instructed to fill out the checklist by marking an “X” inside the box associated with that task as each task is completed (see Appendices A, B and C).

Targeted goals were identified as any skill that maintained an average completion below 75% during the baseline phase. An average of 75% was selected to demonstrate mastery of the skill. For specific skills that maintained below 75% completion on average, these skills were analyzed at intervention (see Table 2). Participants continued to complete the checklist with both untargeted and targeted daily livings skills (see Appendices A, B, and C).
**Intervention: Checklist intervention with peer-mediation.** During intervention, baseline conditions remained the same, but the participants received regular reminders from their peer mentors as well as a preferred social activity with their peer mentor (such as going out to a preferred restaurant or seeing a movie). The frequency of these prompts was individualized to each participant’s personal need, but coincidentally was 2 times per week for each participant. This was determined through clinician observation of severity of need, and in collaboration with the participant’s preferences and level of comfort with peer mentor contact. During check-ins, peer mentors were instructed to provide verbal praise to the participants for completed tasks, and prompt participants to complete any unfinished tasks. Additionally, peer mentors assisted the participants in problem solving organizational issues in order to achieve their weekly goals (e.g. identifying a place and time to complete a study hour; identifying a day and time to take a shower). Since Participants 1 and 3 went out of town for a holiday break during intervention, phone contact with peer mentors was provided instead of in-person check-ins.

**Peer mentors.** Participants were assigned a typically developing peer to provide the in-person prompting. The peer mentors were similarly aged undergraduate research assistants who were receiving practicum course units at the university at the time of the study. All peer mentors were upper division undergraduate students that had taken an undergraduate course in autism or helping skills. They also received specific education and training in the symptoms and treatment of college students with ASD by the university Autism Center faculty and staff. Peer mentors received a 1-hour training with the researcher to learn the intervention components and ensure fidelity of implementation. Each week during intervention, peer mentors were required to send the
researcher and clinician weekly updates with questions or comments about the participants’ performance, as well as sending the researcher the peer mentor contact log (see description below). Peer mentors also attended weekly group supervision with a graduate level clinician who was supervised by a licensed clinical psychologist.

**Follow Up.** To assess for maintenance of daily living skills and organization after intervention has been completed, follow-up data was collected at least one week (one week for David, four weeks following intervention for Valerie and Milo). Weekly data was collected at least one week after the completion of intervention on the primary dependent measure to examine if changes made in the intervention stage generalized across time and maintained after the intervention was terminated.

**Fidelity of Implementation**

Advanced doctoral students conducted all interventions, and attended weekly supervision with a doctoral-level licensed psychologist. All intervention sessions with the clinician were videotaped, and peer mentors were instructed to fill out a contact log, which recorded frequency and type of contact with participants, as well as content of each contact. These requirements were necessary in order to ensure consistency of the peer-mediated daily living checklist intervention. A naïve observer scored videotapes of 33% of the sessions with the clinician for the presence of the following intervention components: (a) discussing performance on the previous week’s daily living checklist (b) setting target goal points for the upcoming week (c) instructing the participant to organize the details of any appointment in their calendar or planner and organizing materials as necessary; (d) establishing preferred social activity with peer mentor if target goal from previous week is achieved. 80% or above correct use of each of component was required
in order to consider a clinician to be effectively implementing the intervention procedures. The clinicians in this study met fidelity of implementation on all scored sessions, with all scored sessions at 100%.

A naïve observer also analyzed frequency of contact, content of each contact, as well as the type of contact (in-person, text, or phone call) made by the peer mentor. Since level and type of contact varied based on the participant’s individual need, the observer compared the contact log to the stated intervention plan and determined that contacts matched at least 80% of the time during intervention. For example, if the participant required in person prompting by the peer mentor two times per week, then the contact list should have indicated that the peer mentor met with that participant two times that week of intervention. Additionally, each peer mentor was scored on the presence of the following components of each contact, (1) general check in of the previous week; (2) identified tasks that have been completed so far; (3) identified tasks still yet to be completed; (4) set a plan to complete unfinished tasks; and (5) scheduled a social activity if previous week’s goal was achieved. Peer mentors filled out a checklist that outlines each of these components on the contact log (see Appendix D). The observer determined if the peer mentors met components 1 through 4 with each meeting at least 80% of the time, and component 5 at least 80% of the time each goal was met. Finally, the observer determined whether the peer mentor attended a social activity with the participant at least 80% of the time after the participant successfully completed a weekly goal on their Daily Living Checklist. The peer mentors met fidelity of implementation on all scored sessions. Please see Appendix D for an example of the contact log. All peer mentors met fidelity of implementation on all scored sessions, with all sessions at 100%.
Dependent Measures

This study is aimed to assess the effects of a peer-mediated daily living checklist intervention focused on improving daily living skills, in regard to whether the targeted intervention will lead to increasing number of daily living skill tasks completed per week and additional measures relating to adaptive behavior skill, mental health, and overall quality of life. Data was collected each week during the baseline and intervention phases on the number of daily living skill activities completed each week. Additionally, data was collected for the following measures pre and post intervention: (1) Vineland Adaptive Behavior Scales- 3rd Edition (2) Beck Depression Inventory-II; (3) Beck Anxiety Inventory; (4) Quality of Life Assessment for Adults with ASD; and (5) Quarterly grade report. Each data category is defined below.

Percentage of daily living skills per week. To assess the effect of the peer-mediated daily living checklist intervention, data was collected each week on the percentage of completed daily living skills per week in both baseline and intervention. A daily living skill was defined as any skill related to household maintenance, money-management, organization, self-care, use of time, and personal hygiene, and are selected based on the list of tasks described above.

The goals (number of times per week the behavior was completed) were developed after analyzing the participant’s performance collected during the baseline measures and through responses of specific tasks on the VABS-III and with collaboration between the participant and clinician. Goals were listed in the final column and represented small incremental steps that will improve each targeted behavior. When goals were met, the goal increment was gradually and systematically increased.
Percentage of goals completed per week was calculated by dividing the completed tasks per week by the total weekly goal, then multiplied by 100.

**Adaptive behavior, mental health, and quality of life.** To further examine the effects of a peer-mediated daily living checklist intervention on adaptive behavior, mental health, and overall quality of life, the following measures were collected at baseline and post intervention. Data were collected on these measures to provide multidimensional outcome domains, and allow for additional assessment on global outcomes for each participant.

*Vineland adaptive behavior scales-3rd edition (VABS-III).* The Vineland Adaptive Behavior Scales- 3rd Edition (VABS-III) is an informant based semi-structured interview that measures adaptive behavior for individuals from birth to 90 years old. It measures adaptive behavior skills across Daily Living, Communication, and Socialization domains, and includes an Adaptive Behavior Composite (ABC) score of overall adaptive functioning. The Daily Living subdomain includes practical, everyday skills related to hygiene, household care, money management, use of time and some vocational skills. Interpersonal and coping skills make up the Communication subdomain, while play and leisure activity are defined within the Socialization subdomain. Rather than focusing on overall ability, the VABS-III focuses on what the individual actually does in daily life, which can give a more accurate description of current performance across these domains. Scores of 85 or below on specific domain or the ABC score indicate a low level of adaptive behavior skill in that area (M=100; SD=15). It demonstrates high validity and reliability, and has been normed for individuals with ASD, intellectual disability, learning disability, and visual and hearing impairments (Sparrow, Cicchetti, & Saulnier, 2016).
Relevant to the present study, it has been used to assess adaptive behavior among young adults with high functioning ASD without cognitive impairment (Sparrow, et. al., 2016).

The VABS-III is typically conducted with third-party respondents, such as parents or a roommate who has known the individual closely for at least three months. Since the 3rd edition of the VABS can be completed online, it is the ideal format for parents who live out of the local area, which was true of all participants’ parents. Since data were collected via self-report of specific daily living skills, the addition of this measure also served as verification by a third party of the participants’ self-reported performance of tasks.

*Beck depression inventory-2nd edition (BDI-II)*. Currently there are no scales specifically designed to assess depression in individuals with ASD, despite prevalence being above that of typically developing individuals (Stewart et al., 2006). However, the BDI-II is one of the most widely used scales to assess the severity of depression in individuals 13 and older and may be an effective measure of depression among this specific population. The BDI-II consists of 21 multiple-choice items, which compose of self-report items relating to symptoms of depression, such as hopelessness and irritability, cognitions such as guilt or feelings of being punished, and physical symptoms such as fatigue, appetite, changes in sleeping patterns, and lack of interest in sex. Individuals are asked to respond to each question based on the previous two-week time period.

This measure has demonstrated high validity and reliability on the measurement of depressive symptoms, and numerous studies provide evidence for its reliability and validity across different populations and cultural groups (Beck, Steer, & Brown, 1996). It has demonstrated high internal consistency and construct validity among college students.
(Dozois, Dobson & Ahnberg, 1998; Steer & Clark, 1997), and has been used previously in research studies in the assessment of depression in adults with High Functioning Autism (Koegel, et al., 2013), making it a promising scale for the assessment of depression among the population of college students with ASD.

Beck anxiety inventory. To examine the effects of the intervention on symptoms of anxiety and to differentiate anxiety symptoms from depression, the Beck Anxiety Inventory was administered. Similar to the BDI-II, the BAI is a self-report survey with 21 multiple-choice items relating to physiological, emotional, and behavioral symptoms of anxiety. The BAI has demonstrated high internal consistency and reliability, and has been shown to be less confounded with symptoms of depression than other anxiety measures (Fydrich, Dowdall, & Chambless, 1992). Additionally, it has been used in the assessment of anxiety in college students and high functioning adults with ASD (Russell, Jassi, Fullana, Mack, Johnston, Heyman, & Mataix-Cols, 2013; Koegel et. al., 2013), though currently there does not exist a specific measure of anxiety normed on adults with ASD.

Quality of life assessment for adults with ASD (QLAA). Standard Quality of Life (QoL) measures are often inconsistent in measuring QoL in adults with ASD due to the variation within ASD among adults and its common characteristics (social communication impairment and difficulty with adjustment to change; El-Nageh, 2016; McConachie, Mason, Garland, Wilson, Petrou, Rodgers, & Parr, 2017). The Quality of Life Assessment for Adults with ASD (QLAA) was developed to resolve this gap. The QLAA measures six domains of quality of life, including physical well-being, psychological well-being, social well-being, independence, education, and employment derived from five validated quality of life instruments, including the World Health
Organization’s Quality of Life (WHOQOL), Quality of Life Questionnaire, Comprehensive Quality of Life Scale, the Personal Outcomes Scale, and the Overall Outcome Rating (El-Nageh, 2016). In addition to these six subdomains, it takes the values, goals, aspirations and current life circumstances of the adult into consideration. It appears to demonstrate good validity and reliability and is effective in the evaluation of interventions and client progress in clinical settings (El-Nageh, 2016).

*Quarterly grade report.* Since deficits in adaptive behavior may impact academic performance among the college student population with ASD (Adreon & Durocher, 2007), data were also gathered on the participants’ quarterly GPAs before and after intervention. It was expected that some improvement in academic performance would be made as a result of this intervention, due to the proposed increased attendance in lectures, study hours, and office hours, and better organization of course materials and assignments.

**Reliability**

Reliability should be calculated across conditions and on at least 20 percent of data points in each condition (Kratchowill, et.al., 2010). Thus, two observers independently coded 30% of the continuous data (the participants’ weekly daily living checklists and peer mentor contact lists). Observers coded randomly selected data from all experimental conditions presented in a random order to control for experimental bias and observer drift. Reliability was calculated using percentage agreement, the most commonly used measure of inter-observer agreement (Kratchowill, et.al., 2010). It was calculated by dividing agreements by the sum of agreements plus disagreements, and then multiplied by 100 to generate a percentage. For the number of daily living skill
tasks, an agreement was scored when both raters coded within one total number of daily living tasks per week. Percent agreement was 100% for percentage of completed daily living skills per week across all participants.

**Results**

**Daily Living Skills**

The first research question investigated the impact of the peer-mediated self-management intervention on the percentage of daily living skills completed weekly. Before answering this question, it was first necessary to identify targeted tasks for intervention that did not improve during baseline in order to be certain which tasks improved as a result of the peer-mediated condition. All tasks that maintained below 75% completion during baseline were included in the analysis. Please see Tables 2, 3 and 4 for details on average percentage of daily living skills completed weekly during baseline for each participant. Descriptively, each participant’s targeted daily living tasks included skills related to the Domestic and Community Subdomains on the VABS-III, as well as skills related to academic organization, a priority target area for many college students with ASD (Adreon & Durcher, 2007). All non-targeted tasks remained above 75% during intervention across the three participants.
<table>
<thead>
<tr>
<th>Daily Living Checklist skill</th>
<th>Mean percentage of tasks completed during baseline</th>
<th>Mean percentage of tasks completed during intervention</th>
<th>Cohen’s $d$ effect size (level)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shower</td>
<td>83.2% (SD=12.60%)</td>
<td>95.0%</td>
<td>0.5 (medium)</td>
</tr>
<tr>
<td>Tidy Room*</td>
<td>16.67% (SD=28.87)</td>
<td>100%*(SD=0.00%)</td>
<td>4.08* (large)</td>
</tr>
<tr>
<td>Check email*</td>
<td>14.3% (SD= 14.29%)</td>
<td>97.39%</td>
<td>9.33* (large)</td>
</tr>
<tr>
<td>Respond to texts and phone calls*</td>
<td>20.0% (SD=20.00%)</td>
<td>43.57%</td>
<td>0.77* (large)</td>
</tr>
<tr>
<td>Delete junk mail*</td>
<td>0.00% (SD=0.00%)</td>
<td>57.14%</td>
<td>1.51* (large)</td>
</tr>
<tr>
<td>Complete assignments*</td>
<td>33.33% (SD=33.33%)</td>
<td>40.46%</td>
<td>0.18* (small)</td>
</tr>
<tr>
<td>Attend all classes</td>
<td>93.33% (SD=11.55%)</td>
<td>80% (SD=30.55%)</td>
<td>-0.57 (medium)</td>
</tr>
</tbody>
</table>

*Indicates targeted task during intervention
Table 3. David’s mean percentage of skills completed weekly at baseline

<table>
<thead>
<tr>
<th>Daily Living Checklist skill</th>
<th>Mean percentage of tasks completed during baseline</th>
<th>Mean percentage of tasks completed during intervention</th>
<th>Cohen’s $d$ effect size (level)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homework/Study for 1 hour</td>
<td>91.67% (SD=13.94%) (SD=5.89%)</td>
<td>97.92%</td>
<td>0.58 (medium)</td>
</tr>
<tr>
<td>Check Syllabi*</td>
<td>66.67% (SD=51.64%)</td>
<td>100.00% (SD=0%)</td>
<td>0.91 (large)</td>
</tr>
<tr>
<td>No junk food*</td>
<td>66.67% (SD=24.22%)</td>
<td>75.00%</td>
<td>0.31 (small)</td>
</tr>
<tr>
<td>Eat when cafeteria is open*</td>
<td>57.62% (SD=27.67%)</td>
<td>87.50%</td>
<td>1.21 (large)</td>
</tr>
<tr>
<td>10 minutes of exercise*</td>
<td>51.04% (SD=44.79%)</td>
<td>92.91%</td>
<td>1.29 (large)</td>
</tr>
<tr>
<td>Outdoor physical activity*</td>
<td>50.00% (SD=44.72%)</td>
<td>93.75%</td>
<td>1.29 (large)</td>
</tr>
</tbody>
</table>

*Indicates targeted task during intervention
Table 4. Milo’s mean percentage of skills completed weekly at baseline

<table>
<thead>
<tr>
<th>Daily Living Checklist skill</th>
<th>Mean percentage of tasks completed during baseline</th>
<th>Mean percentage of tasks completed during intervention</th>
<th>Cohen’s $d$ effect size (level)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input new tasks and</td>
<td>64.84% *(SD=34.55%)</td>
<td>98.21%</td>
<td>1.34 (large)</td>
</tr>
<tr>
<td>appointments in calendar*</td>
<td>(SD=5.05%)*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complete all tasks in</td>
<td>76.57% *(SD=34.07%)</td>
<td>98.21%</td>
<td>0.87 (large)</td>
</tr>
<tr>
<td>calendar</td>
<td>(SD=5.05%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Submit complete</td>
<td>44.44% *(SD=52.70%)</td>
<td>100.00%</td>
<td>1.49 (large)</td>
</tr>
<tr>
<td>assignments on</td>
<td>(SD=0.00%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>time*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Read textbook for 30</td>
<td>59.04% *(SD=46.53%)</td>
<td>94.64%</td>
<td>1.07 (large)</td>
</tr>
<tr>
<td>minutes*</td>
<td>(SD=10.63%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Study hour with</td>
<td>0.11% *(SD=0.33%)</td>
<td>71.42%</td>
<td>2.17 (large)</td>
</tr>
<tr>
<td>study buddy*</td>
<td>(SD=48.76%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Respond to emails within 48</td>
<td>50.00% *(SD=43.30%)</td>
<td>96.43%</td>
<td>0.67 (medium)</td>
</tr>
<tr>
<td>hours*</td>
<td>(SD=25.88%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Take medication in the</td>
<td>93.65% *(SD=10.34%)</td>
<td>96.43%</td>
<td>0.32 (small)</td>
</tr>
<tr>
<td>morning</td>
<td>(SD=6.61%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pick up clutter in bedroom*</td>
<td>38.88% *(SD=41.67%)</td>
<td>81.25%</td>
<td>1.65 (large)</td>
</tr>
<tr>
<td></td>
<td>(SD=10.34%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Track food in food journal*</td>
<td>61.24% (SD=43.04%)</td>
<td>96.24% (SD=10.63%)</td>
<td>0.63 (medium)</td>
</tr>
<tr>
<td>----------------------------</td>
<td>-------------------</td>
<td>-------------------</td>
<td>---------------</td>
</tr>
</tbody>
</table>

*Indicates targeted task during intervention
Results of total targeted daily living skills tasks were analyzed with both visual and statistical analyses. Visual analysis, within the context of single subject research, allows data to be examined in an efficient and detailed way and is ideal for analysis of individualized treatment and outcomes (Zhan & Ottenbacher, 2001). Its methods are based on the interpretation of the level, trend, and variability of performance occurring during baseline and intervention conditions (Horner, et.al., 2005). The level refers to the mean performance of the participant during each condition of the study. Variability refers to the degree of fluctuation around the mean during a condition, and trend will refer to the rate of change (increase or decrease) of the best-fit straight line of the dependent measure within each condition (Horner, et.al., 2005). Visual analysis was also used in judgment of the immediacy of the effects of the independent variable, overlapping of adjacent variables across conditions, and consistency of data patterns across the conditions (Horner, et.al., 2005).

Results from analysis indicated that the intervention was effective in improving percentage of completed targeted daily living skills across all 3 participants (see Tables 2, 3, and 4 and Figure 1). In particular, Valerie increased from a mean of 24% total targeted daily living skill tasks at baseline, to a mean of 69% at intervention. However, it is important to note that Valerie did not submit her daily living checklist for the final week of intervention, despite multiple attempts to contact her by her clinician and the project investigator. David increased from a mean of 59% during baseline, to a mean of 89% during intervention. Likewise, Milo increased from a mean of 49% during baseline to a mean of 95% during intervention. Follow up data on Valerie and Milo maintained within
the intervention range four weeks after completion of the intervention. David did not respond to multiple attempts to collect follow up data.
Figure 1. Percentage of Completed Targeted Daily Living Skill Checklist tasks

Participant 1: Valerie

Cohen’s d = 2.67
PND = 87.5%

Participant 2: David

Cohen’s d = 1.52
PND = 75%

Participant 3: Milo

Cohen’s d = 2.57
PND = 87.5%
Kazdin (1982) pointed out that the variability of treatment conditions in applied settings might in fact weaken internal validity; thus, in addition to visual analysis, it is necessary to statistically calculate the effect size between conditions to understand the magnitude of the effect (Olive & Smith, 2005). Cohen’s $d$ index, a type of Standard Mean Difference analysis was used to demonstrate the standardized difference between the two means (baseline and intervention). Specifically, this was calculated by the difference of the means divided by the pooled standard deviation ($Cohen's\ d = \frac{M_1 - M_2}{s_{pooled}}$, where $s_{pooled} = \sqrt{\left(s_1^2 + s_2^2\right) / 2}$; Cohen, 2013; Olive & Smith, 2005). This method was chosen because it provides a means to compare treatment outcomes within and between individual participants, as well as compare the relative strength of the two treatment conditions (Beeson & Robey, 2006). Effect sizes greater than 0.5 indicate a medium-sized effect, while effect sizes larger than 0.8 indicate a large effect. In terms of total percentage of targeted daily living skills tasks completed weekly all participants demonstrated large effect sizes, with Cohen’s $d$ values of 2.67, 1.52, and 2.57 respectively (see Figure 1 above).

Results of individual targeted tasks were also analyzed with Cohen’s $d$ index (see Tables 2, 3, and 4 above). Across participants, all individual tasks that were below 75% at baseline improved with a significant effect size during intervention. Specifically, Valerie had medium to large effect sizes across each targeted tasks, except for “Complete homework assignments,” which was a small effect ($d=0.18$). David similarly had medium to large effect sizes in improvements across all targeted tasks, except for “No junk food” which was a small effect ($d=0.31$). Milo demonstrated medium to large effect sizes across all individual targeted tasks.
Percentage of Non-Overlapping Data (PND) was also used to quantify effect size of total targeted daily living checklist tasks. PND first identifies the highest baseline point and then calculates the number of intervention points that fell below the highest baseline point. The number of non-overlapping data points is divided by the total number of intervention points to yield PND (Olive & Smith, 2005). A PND <50 indicates no observed effect, PND=50-70 is a questionable effect, and PND >70 indicates that the intervention was effective (Lobo, Moeyaert, Cunha & Babik 2017). The PND for Valerie and Milo were commensurate and indicated that the intervention was effective for both participants (87.5%; see Figure 1). PND for David similarly indicated that the intervention was effective (75%; see Figure 1).

**Adaptive Behavior**

The second question in this study investigated how this intervention impacted participants’ adaptive behavior. Results were measured through the VABS-III and are presented in Table 5. Two of the 3 participants demonstrated improvement in overall adaptive behavior. Specifically, Valerie had an Adaptive Behavior Composite (ABC) standard score of 68 (Low range) at baseline, and increased to 78 (Moderately Low range) following intervention. David had an ABC score of 77 (Moderately low range), which increased minimally to 79 following intervention. Similar to Valerie, Milo improved overall ABC, with a score of 84 (Moderately Low) at baseline, and increased to 98 following intervention (Adequate range).

On the Daily Living Domain of the VABS-III, participants had mixed results overall. Only 1 out of the 3 participants increased their standard score significantly between baseline and intervention. Specifically, Valerie had a standard score of 73 (Moderately
Low range) at baseline, and increased slightly to 82 (Moderately Low range) at post-intervention, but was below the cutoff for clinical significance. David had a standard score 76 at baseline and maintained with a standard score of 75 post-intervention. Milo maintained standard scores within the Adequate range, with a standard score of 100 at baseline and a standard score of 108 post-intervention.

Among the subdomains (Personal, Domestic, and Community), there were similarly mixed results. Valerie demonstrated no change between baseline and post-intervention on the Personal and Domestic subdomains. She had a scaled score of 11 (Moderately Low range) at both baseline and post-intervention on the Personal subdomain. While there was a slight increase between baseline and post-intervention on the personal subdomain (ss=8 at baseline, ss=9 at post-intervention), this was not a clinically significant change. However, her scaled scores increased substantially between baseline and post-intervention on the Community subdomain (ss=12 at baseline, ss=17 at post-intervention). David demonstrated a decline between baseline and post intervention on the Domestic subdomain (ss=10 at baseline, ss=8 at post-intervention) and Community subdomain (ss=13 at baseline, ss=12 at post-intervention). His score slightly improved between baseline and intervention on the Personal subdomain (ss=10 at baseline, ss=12 at intervention). Similar to Valerie, Milo demonstrated no significant increase on the Personal and Domestic subdomains, maintaining a scaled score of 17 (Adequate range) across time points on the Personal subdomain, and a small increase from 16 (Adequate range) at baseline to 17 (Adequate range) at post-intervention on the Domestic subdomain.
Table 5. VABS-III pre-post scores

<table>
<thead>
<tr>
<th></th>
<th>Valerie Baseline</th>
<th>Valerie Post- Intervention</th>
<th>David Baseline</th>
<th>David Post- Intervention</th>
<th>Milo Baseline</th>
<th>Milo Post- Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Daily Living</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Domain (SS)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personal (ss)</td>
<td>11</td>
<td>11</td>
<td>10</td>
<td>12</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td>Domestic (ss)</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>8</td>
<td>16</td>
<td>17</td>
</tr>
<tr>
<td>Community (ss)</td>
<td>12</td>
<td>17</td>
<td>13</td>
<td>12</td>
<td>12</td>
<td>15</td>
</tr>
<tr>
<td><strong>Adaptive Behavior</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Composite (SS)</td>
<td>69</td>
<td>78</td>
<td>77</td>
<td>79</td>
<td>84</td>
<td>98</td>
</tr>
</tbody>
</table>

Adequate range: Standard Scores = 86-114; scaled score = 13-17
Moderately Low range: Standard Score = 71-85; scaled score = 10-12
Low range: Standard Scores=20-70; scaled score= 1-9
Depressive Symptoms

One aim of this study was to investigate the impact of this intervention on depressive systems as measured by the Beck Depression Inventory-II. Results of the BDI-II are presented in Table 6. Overall, there was some variability in depressive symptoms across participants at baseline, but the two participants who reported scores in the mild and above range experienced improvements in depressive symptoms. Specifically, Valerie reported a score of 11 (minimal depressive symptoms) at baseline and post-intervention. David reported a score of 28 (moderate depressive symptoms) during baseline, and decreased to mild range with a score of 14 at post-intervention. Milo reported a score of 14 (mild depressive symptoms) during baseline, and decreased to the minimal range post-intervention with a score of 7.
Table 6. BDI-II Pre-post total scores

<table>
<thead>
<tr>
<th>BDI-II Total Score</th>
<th>Baseline</th>
<th>Post-intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valerie</td>
<td>11 (minimal)</td>
<td>11 (minimal)</td>
</tr>
<tr>
<td>David</td>
<td>28 (moderate)</td>
<td>14 (mild)</td>
</tr>
<tr>
<td>Milo</td>
<td>14 (mild)</td>
<td>7 (minimal)</td>
</tr>
</tbody>
</table>
Anxiety symptoms.

To answer the research question of how this intervention affects anxiety symptoms in participants, results of the BAI are presented in Table 7. Similar to depressive symptoms, participants reported some variability in the anxiety symptoms at baseline. Valerie and David both reported scores within the moderate range, with scores of 17 and 20 respectively. At post-intervention, both participants decreased anxiety symptoms to the mild range with scores of 16. Similar to his responses on the BDI-II, Milo reported a score of 14 (mild anxiety symptoms) during baseline, and decreased to the minimal range post-intervention with a score 9.
<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Post-intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valerie</td>
<td>17 (moderate)</td>
<td>16 (mild)</td>
</tr>
<tr>
<td>David</td>
<td>20 (moderate)</td>
<td>16 (mild)</td>
</tr>
<tr>
<td>Milo</td>
<td>14 (mild)</td>
<td>9 (minimal)</td>
</tr>
</tbody>
</table>

*Table 7. BAI pre-post total scores*
Quality of Life

The fifth question asked in this study regarded the possible impact of this intervention on the participants’ overall quality of life. Results for participants’ self-reported quality of life as measured through the Quality of Life for Assessment for Adults with ASD (QLAA) are presented in Table 8. Overall, participants reported a relatively consistent level of quality of life within the Average range across time points. There were no observed increases or decreases in overall quality of life. Specifically, Valerie reported a score of 131 during baseline, and maintained within the average range post-intervention with a score of 127. David reported a score of 119 during baseline, and maintained within the average range post-intervention with a score of 130. Milo reported a score of 128 during baseline, and maintained within the average range post-intervention with a score 129.
Table 8. QLAA pre-post total scores

<table>
<thead>
<tr>
<th></th>
<th>QLAA Total Score</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline</td>
</tr>
<tr>
<td>Valerie</td>
<td>131 (Average)</td>
</tr>
<tr>
<td>David</td>
<td>119 (Average)</td>
</tr>
<tr>
<td>Milo</td>
<td>128 (Average)</td>
</tr>
</tbody>
</table>
Academic Performance

The last research question asked how this intervention impacts overall academic performance, which was measured by a comparison between quarter or semester grade reports. Data were recorded on the participants’ grade reports in the term prior to implementation of the peer-mediated daily living checklist intervention, and the term following completion of the intervention (see Table 9). The first two participants were in poor academic standing at baseline. Specifically, Valerie had received a GPA of 2.0 during the academic quarter prior to beginning the study. In the academic quarter following the study, she received a GPA of 0.0. It was noted that she did not complete her final exams and opted to accept F grades so that she may retake the courses for a higher grade in the future. David received a 0.71 GPA and was on academic probation at the start of baseline. Following intervention, he received 3.7 GPA. Milo maintained good academic standing across time points. Specifically, he had a 3.5 GPA at baseline, and following intervention he maintained good academic standing with a GPA of 3.42. It is important to note that Milo transferred from a community college to a four-year university in between time points.
Table 9. Pre-post grade point averages

<table>
<thead>
<tr>
<th></th>
<th>Grade Point Averages (GPA)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline</td>
</tr>
<tr>
<td>Valerie</td>
<td>2.0</td>
</tr>
<tr>
<td>David</td>
<td>0.71</td>
</tr>
<tr>
<td>Milo</td>
<td>3.5</td>
</tr>
</tbody>
</table>
Discussion

Summary of Findings

The findings of this study suggest that this type of intervention can be effective in increasing the quantity of daily living skills for college students with ASD. Specifically, all participants increased their targeted daily living checklist tasks during the peer-mediated intervention significantly more than when peer mentors were not present. Participants improved in specific skills related to academic organization, household chores, and hygiene, and were able to consistently meet with a peer mentor multiple times per week. Follow up data showed maintenance of made during treatment and generalization of completing daily living skills weekly without support from a peer mentor.

Results of the impact on a peer-mediated daily living checklist intervention in collateral areas demonstrated positive outcomes across participants as well. As reported by parents on the VABS-III, Valerie and Milo increased their adaptive behavior composite scores, indicating an overall improvement on adaptive behavior. Similarly, Valerie and Milo demonstrated significant improvements in the Community subdomain, even though these skills were not directly targeted in this intervention. David did not demonstrate improvements in adaptive behavior as measured by the VABS-III. In addition to increasing adaptive behavior, follow up data showed that two of the three participants improved depressive symptoms, and all three participants improved in their self-reported anxiety symptoms. All participants maintained good quality of life across time points. Valerie’s academic performance decreased following intervention, but she and her mother cited a personal emergency leading her to not take her final exams during
the post intervention academic quarter. David improved his academic standing from probationary status to good standing. Milo maintained good academic standing following intervention.

There are several important theoretical and applied implications of these findings. It is also important to discuss the limitations of this study and these findings, warranting further research on this type of intervention.

**Implications**

**Theoretical Implications.** There are several theoretical implications of the results of this study. First, it is possible that difficulties with daily living skills may relate to different cognitive styles between individuals with ASD and the typically developing population. One way of conceptualizing these cognitive differences is explain by Embodied Cognition Theory, which posits that the motor system affects the cognitive system in a similar way that that mind affects the cognitive system (Wilson, 2002). The motor system’s effect on cognition also includes the body’s manipulation of the environment. Daily living skills require constant manipulation of physical objects in the environment, such as the interaction between soap and water when washing one’s hands, or using a spoon to mix ingredients for a recipe. Such manipulation and interaction between objects requires both a spatial awareness of objects as well as understanding the object’s possibilities for action, a culturally based perception which Gibson (1986) called affordances. However, individuals with ASD appear to have difficulty with perceiving affordances, and instead use objects in stereotyped or idiosyncratic ways (Loveland, 1991). For example, an individual with ASD may adhere to specific routines and use the same objects in everyday life (eating the same meal from the same dish every day).
Loveland suggests that individuals with ASD may not perceive, misperceive, or reject cultural affordances that typically developing individuals easily acquire (i.e. a specific plate for eating vs. all plates for eating).

In a detailed analysis of ECT, Wilson (2002) suggested six claims of embodied interaction. Claim 3 suggests that we off-load cognitive work onto the environment to reduce cognitive workload and increase efficiency in cognitive tasks. Examples of offloading include counting with fingers and doing a math problem on pencil and paper, or leaving car keys next to the front door so as not to forget them later. Off-loading can be used symbolically for non-spatial tasks as well, such as creating Venn diagrams in a decision making process. Since individuals with ASD appear to have atypical perception, attention, and working memory, it is possible that individuals are not offloading cognitive tasks in the same way as typically developing individuals (Mottron & Burack, 2011). However, it is possible that increasing the interaction with environment will improve cognitive workload.

The Daily Living Checklist can be thought of as a symbolic offloading task that helps individuals with ASD better plan and organize their daily lives using a spatial strategy of a chart. By combining these strategies with increased interaction with the environment through direct completion of daily living tasks, it can be theorized that this intervention increases opportunities for cognitive offloading. The intervention may reduce cognitive work load and limit difficulties with executive functioning by limiting the amount of information they need to memorize (a simple skill description on a checklist) and reminding them where to look for that information. The benefits of visual
schedules and checklists on cognitive offloading in adults with ASD have been described in previous research (Pérez-Fuster, et. al., 2018)

This intervention may also be reducing learned helplessness related to overloaded cognition. The theory of learned helplessness states that an individual will see themselves as helpless when they learn that attempts at a behavior is independent of reinforcement. Thus, they will initiate fewer attempts at a behavior due to the expectancy that they will not be reinforced for their efforts (Maier & Seligman, 1976). In line with this theory, individuals with ASD may be less likely to engage in tasks of daily living due to lack of reinforcement of previous attempts to engage in these behaviors, thereby reducing rate of initiations and overall motivation to engage in daily living skills. Since many individuals with ASD have difficulties with executive functioning, perception of affordances, and excessive adult prompting in childhood (Pérez-Fuster, et. al., 2018; Hume, Loftin, & Lantz, 2009), they may attempt a daily living skill task (i.e. taking a shower), but forget to complete or require direct intervention to complete the task. As a result, they may feel discouraged, frustrated, or incapable of completing the task independently. Additionally, they may get bad grades or face negative social interactions with professors and peers related to poor hygiene, organization or self-help skills (bad grade for not turning in homework, teasing for body odor).

Over time, repeated failures have been shown to decrease overall motivation, continuously worsen performance and increase task avoidance (Koegel & Mentis, 1985). This intervention may have directly targeted motivation by incorporating choice in the specific tasks that were targeted, as well as integrating preferred interests in social activities earned with the peer mentor (Koegel & Koegel, 2006; Dillon, 2007). It is also
possible that the check-ins with peer mentors increased the response-reinforcement contingency by having the peer mentor provide verbal reinforcement (praise for completed tasks), as well as encouragement and support to achieve weekly goals. Since follow-up data indicated that individuals maintained improvements in completing targeted daily living skill tasks without support of a peer mentor, their motivation to engage in these tasks may have increased. Since no direct teaching of daily living skill tasks were included in this intervention, the findings of this study suggest that it is possible to increase motivation and success in completing daily living skills in a less stigmatizing and intrusive way for college students with ASD.

**Applied Implications.**

These findings add to the literature on increasing individualized supports for college students with ASD. As more research seeks to address the needs of this population (Gelbar, Smith, & Reichow, 2014; Jackosn, Hart & Volkmar, 2018), considerations are needed in development of effective interventions that are both practically and financially feasible within existing college support systems. This particular intervention taps into a largely unused resource of undergraduate peer mentors who can deliver a much-needed intervention. Peer mentors are now being used in a variety of interventions across higher education settings (Gelbar, Smith & Reichow, 2018), but most universities do not yet offer peer mentor programs for students with ASD. This particular intervention required 1 hour or less per week of contact with a clinician and student with ASD. It is possible that by increasing contact with peer mentors and reducing direct intervention by a clinician, this type of intervention may reduce costs of services for both universities and students receiving the services. This is a
critical area of consideration for universities, due to the high cost of supporting individuals with ASD (Cimera & Cowan, 2009). Universities may consider offering peer mentor opportunities as a practicum experience within disabled student programs, counseling services, student health, etc. Some peer mentor programs offer paid opportunities or course credit for participation, so it is possible for universities to be creative in the structure of these programs.

This study may also suggest that daily living skills are a critical target area in improving mental health outcomes in individuals with ASD. This population experiences higher levels of stress and loneliness than their typically developing peers (Van Hees, et.al., 2015; Gelbar, Shefcyk & Reichow, 2015), and they consistently express a desire for more services targeting these areas (Accardo, et.al., 2018; Gelbar, et. al., 2015).

Despite this intervention not directly targeting mental health, all participants demonstrated improvements or maintained below clinically significant self-reported symptoms of anxiety and depression. Previous research on the experiences of college students with ASD highlighted that these individuals often feel socially isolated and desire supports that increase social integration on campus (Accardo, et. al., 2018).

Interestingly, the three participants in this study had skills on their checklists related to increased involvement in their communities. For example, these skills included attending classes, eating in the dorm cafeteria, and attending a study hour with a study buddy. They also had increased contact with same-age peers through these skills as well as through check-ins with peer mentors throughout the week. In combination, it is possible that this type of intervention indirectly increased opportunities for socialization while decreasing a sense of isolation, which has been shown to improve mental health in college students.
with ASD (Ashbaugh, et. al., 2017; Gelbar, et. al., 2014). Additionally, it is possible that by increasing academic and independent living success, the participants improved their self-confidence and sense of self-efficacy, thereby reducing learned helplessness.

Valerie’s results may also have implications regarding the effects of mental health on the effectiveness of this intervention. In particular, Valerie experienced a significant drop in her daily living skills at week 7 of the intervention, and then did not return her daily living checklist to her clinician during week 8. Week 8 was also finals week at her university, which likely caused an increase in stress during this time. Per client observation and parent report to Valerie’s clinician, Valerie experienced a sharp increase in depressive symptoms (irritability, loss of motivation, and increased social isolation) during this time. She did not respond to her clinician to meet during that week, and it was reported that she left home before completing her finals, thus failing her classes that quarter. It is possible that Valerie was significantly more depressed than she reported on the BDI-II. The limits to the BDI-II are described below, but these findings may imply that this intervention may not be as beneficial to those who are more significantly depressed. While it is promising that Valerie maintained her skills at follow up, it is likely that direct intervention on depressive symptoms may have been needed to maintain her mental health, rather than this intervention alone. Consideration and analyses of these factors are needed in future research.

Limitations and Future Directions

This study is not without limitations. First, there are several limitations related to the measures used in this study, including adaptive behavior, mental health, and quality of life. In terms of measurement of adaptive behavior, a third party report by a parent or
former caregiver was selected because adults with ASD may inaccurately report their own experiences (Mazefsky, Kao, & Oswald, 2011). However, no participants lived with their parents at the time of the study, so it is possible that parents’ perceptions of their child’s adaptive behavior were not accurate depictions of each participant’s current skillset. While it is possible to gather subjective ratings from a roommate or objective ratings through live observation by researchers, such methods may violate the individual’s confidentiality and privacy. Future research may consider integrating measures on adaptive behavior from a variety of sources.

In terms of mental health measurements, the BDI-II and BAI primarily assess subjective perspectives related to their depression and anxiety levels. Because these are not objective ratings, these measures may not capture an accurate depiction of the changes participants experienced as a result of this intervention (Moss, Howlin, Savage, Bolton & Rutter, 2015). Additionally, due to the unique symptomology of ASD, it is possible that the BDI-II and BAI, which were not normed on adults with ASD, are not accurately identifying depressive symptoms in this population (Moss, et. al, 2015; Bishop & Seltzer, 2002). As described previously, Valerie reported minimal depression on both pre- and post- measures; however, her clinician and mother reported significant depressive and anxious symptoms around the end of the intervention. Previous research has shown that self-report may indicate no change in mental health symptoms, despite third party reports identifying a significant change (White et. al., 2009). Since individuals with ASD may have difficulty with identifying and describing their own emotional experience (Berthoz & Hill, 2005), it is possible that the participants in this study were not accurately reporting their change in mental health.
Taking together the measurement issues with adaptive behavior and mental health ratings, future research should also consider gaining a more thorough understanding of the effect of this intervention on these areas. It is possible that incorporating a variety of measures, including self-report, parent-report, behavioral scales, and structured interview, may be a more comprehensive and effective method of measurement of college students with ASD.

Limitations to measurement of quality of life are also present in this study. All participants rated themselves in the Average range on quality of life as measured by the QLAA. While it is encouraging that these particular individuals did not report concerns for their overall quality of life, this particular study was not able to answer the question of how this type of intervention can improve quality of life in college students with ASD. Future research may consider requiring Below Average ratings of quality of life as inclusion criteria in the study in order to better assess this change.

Another limitation of this study is in the short-term, multicomponent nature of the intervention. 8 weeks of intervention was selected due to the length of an academic quarter and holiday schedules at the University Autism Center. It is possible that greater changes may have been observed in the secondary dependent measures of mental health, quality of life and academic performance with a longer-term intervention, such as a 12-week or full year program. Existing college support programs and services for students with ASD often vary in length of intervention, from one month to one year and beyond (Kuder & Acardo, 2018). Additionally, this intervention used a variety of intervention components (daily living checklist, organizational skills, peer mentors, reward activities, etc.) but it was beyond the scope of this study to analyze each component individually.
Similarly, peer mentor check-ins were provided both in person and via phone call, which may have impacted intervention outcomes. Future research should investigate further the most effective intervention length and type of contact with peer mentors specifically for improving daily living skills among this population, as well as include an analysis of each intervention component.

A fourth important consideration is that this study lacked a thorough examination of the relationship between peer mentors and participants. While peer mentors were selected for each participant based on participants’ preferences (i.e. gender of participant) and scheduling availability, it possible that social desirability impacted participants’ desire and willingness to meet their weekly target goals. Similarly, peer mentor qualities, such as buy-in to the intervention, or type of affect when interacting with peer mentors, may also influence intervention outcomes. Perceived friendliness and belief in the student with ASD’s ability to change may be another factor impacting social motivation and a sense of self-efficacy, thereby affecting the outcome of the intervention. More specific analyses on the interactions between the peer mentors and students with ASD as well as measures of therapeutic alliance are needed.

Peer mentor knowledge and understanding of ASD as well as impression of the strengths and weaknesses of the individual with ASD is another possible factor in the therapeutic alliance and implementation of a peer-mediated intervention. All peer mentors in this study were social science majors (Psychology) who had prior coursework on diversity, helping skills, and ASD in addition to the training received by the University Autism Center. Previous research showed that social science majors are more comfortable when interacting with other college students with ASD due in part to an
emphasis in diversity in their curriculum (Nevill & White, 2011). However, other academic majors show increased stigma and misconceptions about behavior and attitudes of their peers with ASD (Nevill & White, 2011). It would be interesting to analyze peer mentors’ attitudes and perceptions of ASD before and after the intervention to see how peer mentors are impacted by the intervention in terms of their own biases of ASD, as well as how to better identify and select peer mentors for peer-mediated interventions.

A final important limitation to note in this study is the limit of the singe-subject design. Although this design is well suited for the first phase of establishing efficacy of a new behavioral intervention, the small number of participants limits the generalizability of the outcomes to a wider range of individuals with ASD (Smith, Scahill, Guthrie, Lord, Odom, & Rogers, 2007). The next phase in establishing validity of this intervention would be to repeat the intervention in several more single-case designs, or to implement a between-group design, followed by a larger randomized controlled trial (Smith, et. al., 2007). In addition to establishing efficacy and validity of this specific intervention, it would also be interesting to examine a “package” of peer-mediated interventions that target social communication, socialization, academics, and daily living skills within the college setting, and better understand how these interventions can improve overall outcomes among this population.

Conclusions

The findings suggest that a peer-mediated daily living checklist intervention is effective for improving daily living skills in college students with ASD, and participants showed improvement in collateral areas of adaptive behavior, mental health, quality of life, and overall academic performance. It was another step in the area of developing and
examining effective behavioral interventions for college students with ASD. Future research should incorporate a breadth of dependent measures to examine adaptive behavior and quality of life, assess the most effective length of the intervention, and replicate the study across universities using additional single-subject and between subject research designs. It would also be important to disseminate information regarding peer-mediated daily living checklist interventions to help train staff and peer mentors at college campuses to provide better support for college students with ASD. By increasing the amount of knowledge and practical strategies to support these students, it is possible that college students with ASD will be more successful within higher education, leading to better long-term outcomes in employment, mental health, and overall quality of life.
References


doi:http://dx.doi.org/10.1177/1362361309103791


doi:http://dx.doi.org/10.1111/j.1469-7610.2004.00215.x


Perner, L. (2002). Preparing to be nerdy where nerdy can be cool: College planning for the high functioning student with autism. In *Autism Society of America Annual Conference, Indianapolis, IN*.


### Appendix A.

<table>
<thead>
<tr>
<th></th>
<th>Thursday</th>
<th>Friday</th>
<th>Saturday</th>
<th>Sunday</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Total</th>
<th>Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Shower</strong></td>
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<td>X/ week</td>
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<tr>
<td><strong>Tidy Room</strong></td>
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<td>X/week</td>
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<tr>
<td><strong>Check email</strong></td>
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<td>X days/week</td>
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<tr>
<td><strong>Respond to texts and phone calls</strong></td>
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<td></td>
<td>X days/week</td>
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<tr>
<td><strong>Delete junk mail</strong></td>
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<td></td>
<td>X days/week</td>
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<tr>
<td><strong>Complete assignments</strong></td>
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<td>X/week</td>
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<tr>
<td><strong>Attend all classes</strong></td>
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</table>

**This week’s goal:**  
**Total:** X points  
**Goals:** X points
## David’s Daily Living Checklist

<table>
<thead>
<tr>
<th>Date</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
<th>Saturday</th>
<th>Sunday</th>
<th>Total</th>
<th>Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homework/Study for 1 hour</td>
<td></td>
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<td></td>
<td>X hours/week</td>
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<tr>
<td>Check Syllabi</td>
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<td>X/week</td>
</tr>
<tr>
<td>No junk food</td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td>X days/week</td>
</tr>
<tr>
<td>Eat when cafeteria is open</td>
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<td></td>
<td>X/week</td>
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<tr>
<td>10 minutes of exercise</td>
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<td>X/week</td>
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<tr>
<td>Outdoor physical activity</td>
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<td>X/week</td>
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<td>Total:</td>
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<td></td>
<td></td>
<td></td>
<td>X points</td>
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<tr>
<td>This week’s goal:</td>
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<td></td>
<td></td>
<td></td>
<td>X points</td>
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</tbody>
</table>
## Appendix C.

### Milo’s Daily Living Checklist

<table>
<thead>
<tr>
<th>GOALS</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
<th>Saturday</th>
<th>Sunday</th>
<th>Total</th>
<th>X/week</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input new tasks and appointments in calendar</td>
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<tr>
<td>Complete all tasks in calendar</td>
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<td>X/week</td>
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<tr>
<td>Submit a complete assignment on time</td>
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<td>X/week</td>
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<tr>
<td>Read from textbook at least 30 minutes</td>
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<td>X/week</td>
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<tr>
<td>Study hour with study buddy</td>
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<td>X /week</td>
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<tr>
<td>Respond to important emails within 24 hours</td>
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<td></td>
<td>X/week</td>
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<tr>
<td>Take medication</td>
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<td></td>
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<td>X/week</td>
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<tr>
<td>Pick up clutter in bedroom</td>
<td></td>
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<td></td>
<td></td>
<td>X/week</td>
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<tr>
<td>Fill out food journal</td>
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<td></td>
<td></td>
<td>X/week</td>
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<tr>
<td>Total: X points</td>
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<tr>
<td>This week’s goal: X points</td>
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</tbody>
</table>
Appendix D.

Sample Peer Mentor Contact Log

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Type of Contact (in person, text)</th>
<th>Check-in or social activity?</th>
<th>If check-in, check off tasks completed</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>7/17/17</td>
<td>2:30-2:45pm</td>
<td>In-person/phone</td>
<td>Check-in</td>
<td>☑ Check in with client about previous week  ☑ Identify which tasks have been completed so far  ☑ Identify which tasks still need to be completed  ☑ Set plan to complete goal this week  ☑ If goal was met, scheduled a social activity</td>
<td>Client wasn't at home when I got there. Called him and he said he was running late from class so did check-in on the phone. Client reported all goals completed, but still needs to shower today. Set up a time to play Frisbee later this week.</td>
</tr>
<tr>
<td>7/18/17</td>
<td>5:00-5:15pm</td>
<td>In-person</td>
<td>Check-in</td>
<td>☑ Check in with client about previous week  ☑ Identify which tasks have been completed so far  ☑ Identify which tasks still need to be completed  ☑ Set plan to complete goal this week  ☑ If goal was met, scheduled a social activity</td>
<td>All goals completed for the day. Reminded client to finish homework by Friday deadline. Reminded him of Frisbee later this week.</td>
</tr>
<tr>
<td>7/20/17</td>
<td>3:00-4:00pm</td>
<td>In-person</td>
<td>Social activity</td>
<td>☐ Check in with client about previous week  ☐ Identify which tasks have been completed so far  ☐ Identify which tasks still need to be completed  ☐ Set plan to complete goal this week</td>
<td>Played Frisbee at the park</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>☐ If goal was met, scheduled a social activity</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>