Chapter 15
Employment Practices with People with Autism Spectrum Disorder in the Digital Age

Elias Mpofu, Timothy Tansey, Ngonidzashe Mpofu, Wei-Mo Tu and Qiwei Li

Abstract Autism Spectrum Disorders (ASD) is a high-incidence condition affecting approximately one out of 68 of people. Adults with ASD are three to four times less likely to be employed than peers who do not have a disability. The high rate of unemployment of adults with ASD suggests a gap in employment development theory and practice knowledge addressing the specific needs of this population. This chapter provides new insights on theoretical framing of employment support interventions for people with ASD, including the interface between behavioral-gradient, structural-infrastructure, and psychosocial factors in vocational development with individuals with ASD. Practical implications of this chapter include taking into account level of functioning with ASD, structural-infrastructural supports, and the use of digital technologies in career counseling of people with neurodiversity.

15.1 Introduction

Autism spectrum disorder (ASD) affects approximately one out of 68 children (American Psychiatric Association: APA, 2013). ASD is a set of neurologically-based developmental disorders characterized by difficulties with planning and sequencing tasks, social communication, and presence of perseverative or repetitive behaviors (APA, 2013). Furthermore, individuals with ASD have social skill deficits, a tendency to fixate on certain tasks or topics, difficulty adhering to routines, and process visual information more efficiently than verbal information (Standifer, 2009).

E. Mpofu (✉) · T. Tansey · N. Mpofu · W.-M. Tu · Q. Li
University of North Texas, Denton, USA
e-mail: elias.mpofu@sydney.edu.za

Consistent with other adults in society, work is of intrinsic value to people with ASD in enabling them to express their interest and their skills in self-fulfilling ways (Baldwin, Costley, & Warren, 2014). Research findings indicate that approximately 6–25% of people with ASD are employed (Newman et al., 2011; Nicholas, Attridge, Zwaigenbaum, & Clarke, 2015; Roux et al., 2012)—suggesting that they are three to four times less likely to be employed than working-age adults who do not have a disability (Hedley et al., 2016; Taylor & Seltzer, 2012).

The high rate of unemployment of adults with disabilities persists despite an increase in the number seeking vocational rehabilitation services (Burgess & Cimera, 2014). Individuals with ASD are likely to be underemployed with unfulfilling repetitive or routinized work tasks and to be passed over for job training opportunities (Baldwin et al., 2014) and to be skipped for job training opportunities (Baldwin et al., 2014). About 56–76% of adults with ASD with employment are with facility-based work setting rather than competitive employment (Migliore, Mank, Grossi, & Rogan, 2010; Taylor & Seltzer, 2011). For those who obtain employment, a variety of difficulties in work participation may arise such as issues with managing time and transitioning between work tasks (Gentry, Kriner, Sima, McDonough, & Wehman, 2015; Gentry, Lau, Molinelli, Fallen, & Kriner, 2012; Hill, Belcher, Brigman, Renner, & Stephens, 2013). These challenges lead to high turnover rates among this population (Gentry et al., 2015; Taylor & Seltzer, 2012). Findings of studies based on the National Longitudinal Transition Study-2 (NLTS2) dataset (e.g., Roux et al., 2012) and the Rehabilitation Service Administration (RSA-911) dataset (e.g., Burgess & Cimera, 2014) indicate a marginal-to-poor employment rate for persons with ASD. With a majority of the literature on employment participation by people with ASD has examined antecedents rooted in social inequality (Chiang, Cheung, Li, & Tsai, 2013; Hillier & Galizzi, 2014; Holwerda, Van der Klink, Groothoff, & Brouwer, 2012) or behavioral limitations (Bishop, Donald, & Lindsey, 2007), there is disappointingly little evidence on effective structural-infrastructural interventions to assist adults with ASD to obtain and retain employment (Howlin & Moss, 2012). This is despite the increasing use adoption of digital assistive technologies for employment participation.

Assistive technology refers to "any item or piece of equipment or product system acquired commercially, off the shelf, modified, or customized, and used to increase, maintain, or improve functional capability for an individual with disabilities" (Beard, Carpenter, & Johnson, 2007, p. 4). Digital Assistive devices (DADs) such as computer tablet devices, personal digital assistants (PDAs), and smart phones may help improve the job performance of individuals with ASDs (Baxter, Pike, & Reece, 2013; Burke et al., 2013; Gentry et al., 2012, 2015; Hill et al., 2013). Research on the utilization of PDAs by workers with ASDs is limited (Cihak, Fahrenkrog, Ayres, & Smith, 2009; Gentry, Wallace, Kvarfordt, & Lynch, 2010). Only a few studies have considered digital age technologiesfor employment support interventions utilizing digital age technologies (e.g., Baxter et al., 2013; Gentry et al., 2015; Hill et al., 2013). DADs are assistive technology devices that

compensate for or augment human work performance such as increased productivity and inclusiveness of persons with neurodevelopmental impairments in workplace diversity. DADs are increasingly ubiquitous in the work place. Mobility device (e.g., wheelchairs), computer modifications, and electronic devices are some examples of structural-infrastructural resources increasingly utilized to enhance the work participation of people with intellectual and developmental disabilities, including those with ASD.

Structural-infrastructural resource approaches to employment participation are those that address modifiable proximal factors to employment participation by proposing strategies, technologies and interventions premised on their evidence to improve work participation on the spectrum. For instance, a frequently cited barrier to accessibility in the workplace is a lack of job accommodations supporting adequate functioning of individuals with ASD (Khalifa, Sharif, Sultan, & Di Rezze, 2019). Job accommodations play a critical role in increasing and maintaining productivity for individuals with ASD in the workplace (Hagner & Cooney, 2005; Rashid, Thompson-Hodgetts, & Nicholas, 2018). Job accommodations refer to any adjustment or change to the job environment, actual job, or the way of doing things to allow a person with a disability to secure a job or acquire access to benefits available to other individuals in the workplace. By definition, they are structural-infrastructural resources for enabling people with ASD to engage in gainful employment. Empirical studies have supported the use of assistive technology for individuals with ASD in the workplace (e.g., Cullen, Alber-Morgan, Simmons-Reed, & Izzo, 2017; Gentry et al., 2012, 2015; Hendricks, 2010; Hill et al., 2013; Smith, Atmatzidis, Capogreco, Lloyd-Randolfi, & Seman, 2017).

To provide a background our discussion on the significance of structural-infrastructural oriented approaches to work participation of persons with ASD, we briefly discuss the work participation needs of people with ASD and the potential benefits of digital technologies to address low participation in employment. Next, we provide an overview on digital age tools that may improve the work participation of people with ASD. Finally, we propose implications for vocational rehabilitation interventions in which digital technologies are used as structural-infrastructural interventions and their potential to make a positive difference in employment outcomes of people with ASD.

15.2   Chapter Objective

Against the backdrop of the discussion above this chapter sets out to provide new insights on theoretical framing of employment support interventions for people with ASD, including the interface between behavioral-gradient, structural-infrastructure, and psychosocial factors in vocational development with individuals with ASD.

15.3   Barriers and Facilitators to Employment Participation with ASD

Personal perceptions of disability-related restrictions, and options to circumvent those limitations (say with accommodations), add a level of control by people with ASD over their social outcomes and employment participation. However, the severity of these restrictions is greater for people who have Low-Functioning Autism (LFA), particularly in the area of communication. In contrast, people with High-Functioning Autism (HFA) tend to have greater social and adaptive skills. Behavioral predisposition theories would explain differences in social outcomes with disability in terms of a social-behavioral gradient or continuum in which higher functioning with disability would portent lower supports to attain the same social outcomes as typical others (Mpofu & Mpofu, 2018). Persons with LFA generally present with more severe communication difficulties and secondary disability than persons with HFA; and for which they would require accommodations in more life domains than their high functioning peers.

In contrast, people with HFA may require accommodations in fewer life domains than their peers with LFA. High cognitive functioning is a better predictor of employment success in persons with ASD than any other personal attribute (Baldwin et al., 2014; Holwerda et al., 2012). Even within a level of ASD functioning, permutations on communication and others behavioral skills will vary significantly among individuals (Hendricks, 2010). Behavioral theory-oriented studies have considered the role of training persons with HFA in social and vocational skills (Hiller, Fish, Siegel, & Beversdorf, 2011; Palmen, Diden, & Lang, 2012) as well as employment preferences (Migliore, Mank, Grossi, & Rogan, 2007; Taylor et al., 2012). However, work preference measures may be of limited value for persons with low-functioning ASD who typically experience significant language and communication problems but be relatively appropriate with individuals with high functioning ASD.

Individuals with ASD are heterogeneous population and that no two individuals with ASD are identical in their employment support needs. With this caveat, we now consider barriers to successful employment outcomes by people with ASD for which structural-infrastructural interventions applying digital technologies would be a solution: atypical social skills, executive functioning and opportunity structure.

15.4   Social Skills

Individuals with ASD often experience communication and social difficulties with colleagues and supervisors (Camarena & Sarigiani, 2009; Müller, Schuler, Burton, & Yates, 2003; Ruef & Trumbull, 2002; Sperry & Mesibov, 2005). For that reason, individuals with ASD are at elevated risk of social exclusion at the workplace

(White, Keonig, & Scahill, 2007). Social skills are critical to workplace satisfactoriness, or how one gets along with co-workers and supervisors, which determines the fit with the work setting as well as likelihood to retain employment. Individuals with ASD who have social skill deficits tend to fixate on certain topics and to process visual information more efficiently than verbal information (Standifer, 2009). Teaching social scripts and social stories is effective for developing social skills in people with ASD (Reichow & Volkmar, 2010). Although individuals with ASD can learn social skills from social scripts, they may still require prompting as not to miss out on social cues for the actions to engage (Loveland & Tunali, 1991).

The social engagement of people with ASD may be effected by comorbid mental health needs which are often undiagnosed within this population (Gotham, Bishop, Brunwasser, & Lord, 2014; Hassiotis & Turk, 2012), adding to workplace disadvantage associated with lack of social participation skills (Gotham et al., 2014). Social skills programs, peer groups and self-management strategies have also been used to assist in improving social functions in structured school environment settings (Rogers, 2000), but much less so in employment settings. People with ASD are at elevated risk for exclusion from employment by implicit discrimination by employers, work colleagues and/or employment networks (Gewurtz, Langan, & Shand, 2016; Meyer, 2016), starting with the hiring process (Baldwin et al., 2014; Richards, 2012). With social skills deficits, the behavioral gradient effectively limits work opportunities of individuals with ASD due to perceptions of impairment-related restrictions and limitations that would cause undue hardship to prospective employers (Nesbitt, 2000).

15.5   Executive Functioning

People with ASD frequently have trouble in executive function-related tasks involving prospective memory, organization, planning, and goal-direction (Gentry, Wallace, Kvarfordt, & Lynch, 2010) that can diminish their work engagement with tasks that require simultaneous self and task monitoring. However, use of smart technology devices to compensate for these limitations can enhance task perseveration and completion by people with ASD in competitive or ordinary settings (Baldwin, Costley, & Warren, 2014; Parr & Hunter, 2014; Scott, Falkmer, Girdler, & Falkmer, 2015).

Task accessibility, a function of ergonomic or workflow qualities, can influence the success that individuals with ASD in completing tasks in the expected time without disrupting the workflow or work unit performance (Benedyk, Woodcock, & Harder, 2009; Boff, 2006). These personal and task-structure qualities can present limitations to successful work performance and are amenable to utilizing technology assisted workplace accommodations for improving organisational skills, navigation and providing information in a way that is easy to understand and process (Burke et al., 2013; Gentry et al., 2012, 2015; Hill et al., 2013).

Individuals with ASD may experience difficulties managing work time; activity scheduling with use of digital assistive devices, such as computer tablets, personal digital assistants (PDAs), and smart phones may overcome those limitations (Baxter et al., 2013; Burke et al., 2013; Gentry et al., 2012, 2015; Hill et al., 2013). Assistive devices may also be utilized to promote independence among workers with ASD by prompting transitions between tasks, supporting on-task behavior and assisting with time management (Gentry et al., 2012; Hill et al., 2013). However, there is evidence to suggest that some individuals with ASD may fixate on the assistive technology, which may increase the amount of time to perform job tasks and be over-stimulating (Burke et al., 2013; Hill et al., 2013).

15.6 Opportunity Structure

Antecedent social inequalities can influence employment participation opportunities. As Shattuck and Roux (2015) aptly observe, "unemployment is not just an individual predicament", it is a social problem and research must address, "…the social environment and the impact of interventions targeting a community or policy level" rather than being overly "modifying individual behaviors and abilities" even though also "an important pursuit" (p. 246). Moreover, labor market dynamics such as the availability of works positions in communities and neighborhoods both sustain and drive social inequalities. Further, more than 75% of young adults with ASD lived with their families (Taylor & Seltzer, 2011). Families, in providing support to adult member with ASD, invest material, emotional and personal effort to access and retain employment for their family members (Hillier & Galizzi, 2014). Therefore, young adults with ASD from high income families had superior work participation compared to those from low socioeconomic status (SES) backgrounds suggesting the importance of social equity context in addressing employment of persons with ASD (Chiang et al., 2013; Hillier & Galizzi, 2014; Holwerda et al., 2012).

The use of digital age technologies to address these structural opportunities contingencies has not been adequately studied for their capacity to bridge work exclusion from social disadvantage. For instance, social support by family and peers may also assist people with ASD to achieve a range of job related functions, such as attaining and retaining employment as well as navigating workplace task assignments requiring collaboration (Cimera, 2010; Gentry et al., 2015; Hill et al., 2013). Likewise, impoverished communities have less social capital through community-based social networks to provide employment opportunities and development (Granovetter, 1995). Social inequality due to deprivations in access to general amenities (e.g., transportation, health care services, social services, personal safety) diminish employment opportunities in the communities or neighborhoods overall; and especially for people with historical social disadvantage such as people with disability. Structural-infrastructural type theory may explain employment outcomes for people with ASD by enabling the examination of latent social capital

effects on employment outcomes (see also Migliore, Gross, Mank, & Rogan, 2008). Conceivably, with use of digital technologies such as online or mobile app employment services with social media networked others, people with ASD may be able to access the larger market of hidden jobs often not advertised by employers.

15.7   Digital Technologies for Work Participation on the Spectrum

The use of DADs for job accommodations among individuals with ASD has recently gained increased attention from vocational rehabilitation (VR). DADs of interest are those characterized as portable, customizable, capable of handling large amount of data storage, and accessible with touch screens and multimedia input and output (Hill et al., 2013). Given those features, digital technologies not only provide an interface to promote independence for individuals with ASD and increase accessibility in the workplace (Myles, Ferguson, & Hagiwara, 2007; Stock, Davies, Davies, & Wehmeyer, 2006), but also demonstrate cost-effective potentials by reducing job coaching hours (Gentry et al., 2015).

15.8   Personal Digital Assistants (PDAs)

PDAs can improve the job performance of people with ASD across a range of job related functions, such as navigating around the workplace and performing tasks accurately (Gentry et al., 2015; Hill et al., 2013). PDAs have been utilized successfully in school settings with students who have ASD to improve their performance in a number of areas (Cihak et al., 2009; Gentry et al., 2010; Mechling & Savidge, 2011). PDAs support independent task completion and task transitioning of students with ASD (Cihak et al., 2009; Mechling & Savidge, 2011). PDAs also facilitate task acquisition and maintenance by children and adolescents with ASD (Bellini & Akullian, 2007). The acquired skills could also be generalized across a range of settings (Bellini & Akullian, 2007), suggesting that PDAs could be utilized successfully within workplace settings to support adults with ASD to improve their job performance.

PDAs with video modelling and prompting may be an effective strategy for training adults with ASD to support and maintain accurate task performance (Burke et al., 2013; Kellems & Morningstar, 2012). Individuals with ASD can perform tasks, such as filling shelves or shipping tasks, with a higher level of accuracy if they are provided with a PDA that have video modelling and prompting of the task (Burke et al., 2013; Kellems & Morningstar, 2012). Furthermore, evidence suggests that individuals with ASD utilised PDAs with video modelling and prompting to maintain skills they had learnt by viewing the material before and during task

completion (Kellems & Morningstar, 2012). Notable in these studies was that the participants were individuals with HFA. As such, there is a lack of evidence to support the utility of PDAs to improve the task performance of individuals with LFA. In workplace settings there are other areas PDAs could potentially be utilized to provide job supports.

PDAs can be utilized as a workplace accommodation to support on-task behaviour, task transitioning, navigation, behavioural management and thus overall job performance (Gentry et al., 2012, 2015; Hill et al., 2013). For instance, PDAs with alarm and verbal reminder applications significantly reduced the amount of supervision that was required to ensure individuals with ASD stayed on task and moved from one task to the next (Gentry et al., 2012, 2015; Hill et al., 2013). The number of times individuals who became lost in a workplace was also reduced with way finding videos recorded on a PDA (Gentry et al., 2012). Furthermore, PDAs significantly reduced anxiety experienced by workers with ASD and related problematic behaviour (Gentry et al., 2012). The available research supports the use of PDAs by individuals with HFA to improve their job performance in areas such as task performance, way-finding and behavioural management. However, the following case examples are illustrative of the implementation of PDAs for this purpose:

Case Example #1: Mr. Paul Southern, with Work iPad and Digital Calendar

Mr. Paul Southern is a 42-year-old with high functioning autism spectrum disorder, living independently. He is employed as a furniture mover by a local contactor delivery service. His essential job functions include loading and offloading furniture from the truck, as well as helping customers place delivered furniture pieces in their desired locations at home. Paul Southern experiences difficulty following work routines, initiating social interactions, and picking up on social ques in conversations with both coworkers and customers. As a means to assist his work task compliance, Paul was issued a company-sponsored tablet containing daily updates of his assigned tasks for the day. His employer is currently in the process of synchronizing the company's online booking software with Paul's iPad digital calendar. The new calendar task reminder would list Paul's daily tasks over the course of a week with an attached pdf of images that would describe his roles. If successful, then the digital calendar will replace the need for daily reminders emails from the secretary outlining Paul's tasks for the following day. This approach gives Paul the opportunity to prepare for his work routines days in advance, instead of the night before or the day of the move. Non-technology accommodations for Paul include being paired with delivery partners to model and learn from means that Paul has a consistent team from whom to learn and further develop social cues through modeling.

Case Example #2: Ms. Jennifer Scotts, with Smartphone for Flexible Work Scheduling

Miss Jennifer Scotts is a 37-year-old woman with moderate symptoms of autism spectrum disorder. She is employed part-time as a janitor in an office building, responsible for cleanup duties on a single floor. Her essential job functions include cleaning the office kitchenette, sweeping the floors, and emptying the desk-side trashcans. Jennifer has trouble coping with sudden changes to her routine and surroundings and communicates with a combination of physical gestures and overly simple sentences. Jennifer's employer provided her with a company smartphone that she frequently uses to call into work and find out if any cleaning routines have changed and if anyone was absent or left early from work that day. She then uses that information to prepare for any changes to her routine she might experience as she arrives on shift, such as having one less trashcan to empty, working with a new office cleaner, and avoiding sections of the office building going through renovations. The structured routine at work means that Jennifer consistently meets her daily personal goals at work, establishing her positive social and practical integration into the office culture and environment. A non-technology accommodation for Jennifer includes having her homecare support staff present at her work with her to provide a consistent familiar face and to help manage behavioral issues on days when adjustment to change is difficult for her.

These two case illustrations make the point that DADs alone will not address workplace adjustment of people with ASD. Making the work environment neurodiversity friendly includes training of co-workers and supervisors on work participation with neurodevelopmental disorder and without stigmatizing the employees with ASD. Providing technology accommodations but neglecting the training of co-workers and supervisors in inclusive work practices would be harmful to people with ASD and be failing to address the quality of the work environment. Employees on the spectrum with workplace social isolation by peers would likely be less productive and with avoidable work absenteeism from work-related mental health distress (Hendricks, 2010).

The following are illustrative research studies on the use of DADs for improving on employment outcomes with ASD (see Boxes 1 and 2).

Research Box 1

Gentry et al. (2012) in their case studies, for example, adopted Apple iPod Touch as an assistive device for participants with ASD to manage their job tasks (e.g., switching tasks) and transportation schedule. The job coach provided initial training and setup of an iPod Touch for the participants with ASD after gaining insights into their needs. In their randomized control trial

(RCT) study, Gentry et al. (2015) adopted an Apple iPod Touch as a vocational support to reduces personal support needs on the job and improve work performance for adults with ASD who were beginning a vocational placement support by a job coach. The features used in the iPod Touch was to facilitate task management (e.g., task reminders and task lists), visual modeling (e.g., picture prompts and video-based task-sequencing prompts), behavioral self-management adaptations (e.g., way-finding tools), and communication (e.g., communication with job coach via Wi-Fi when the job coach available on the jobsite. The finding demonstrated the use of iPod Touch as an assistive technology significantly reduces the need of workers with ASD in job coaching support without compromising functional performance on the job.

Research Box 2

Hill et al. (2013) in their attempt adopted the Apple iPad as an assistive technology to increase the independence and success of young adults with ASD and other development disabilities in the workplace. The features utilized in the iPad were for the participants to manage job tasks, reduce anxiety, facilitate self-monitoring, manage medications, and facilitate positive coping behaviors. The results from this study exemplify the use of iPad as an assistive technology to enhance functioning needed to contribute to a positive work experience and successful outcomes. Cullen et al. (2017) also yielded similar findings providing additional support for adopting an iPad as a vocational support device for individuals with ASD.

From these research studies, it is apparent that use of DADs has beneficial multiplier effects on the work participation of individuals with ASD with regard to their productivity through enhanced on-task behaviors. DADs use by people with ASD also reduces demands on co-workers and supervisors to provide coaching support, making for a more disability inclusive work environment.

15.9 Virtual Reality Environments

In addition to PDAs and tablets, the use of virtual reality technology in promoting participation in the workplace for individuals with ASD is an emerging area (O'Sullivan & Kearney, 2018). Unlike PDAs and tablets that are mainly used by individuals with ASD as a personal assistive technology, virtual reality technology not only serves as a vocational support device for individuals with ASD, but also helps empower human resource (HR) managers or supervisors to manage workers with ASD and increase accessibility within their workplace (O'Sullivan & Kearney,
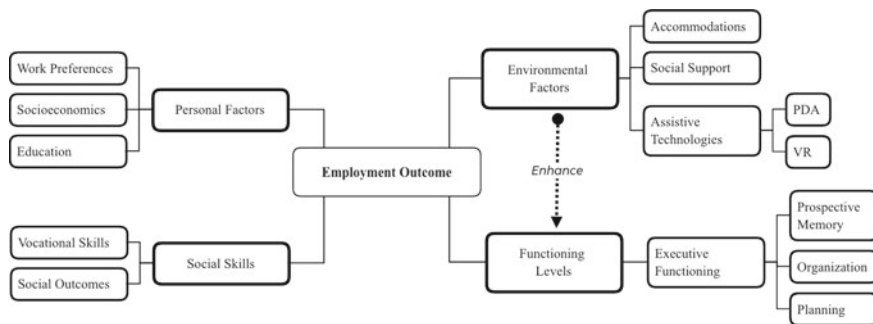
Fig. 15.1 Person x environment interactions on employment outcomes with digital technologies (*Source* own work)

2018). For example, virtual reality technology can simulate an environment that illustrates the sensory stimulation perceived by individuals with ASD from aspects of the work environment lay out and lighting. On the evidence from virtual technology, HR managers can adjust the sensory stimulation (e.g., environment layout and lighting) to be neurodiversity inclusive (O'Sullivan & Kearney, 2018). Work environments with neurodiversity inclusive sensory stimulation enhance the quality of work life for individuals with ASD by minimizing work distractions.

Virtual environments are being used to model interactions and provide social skills practice for individuals with ASD (Mitchell, Parsons, & Leonard, 2007) as well as providing assistance with understanding emotions (Moore, Cheng, McGrath, & Powell, 2005). The use of virtual realities provides stable and predictable environments which make it easier for individuals with ASD to learn.

Although the use of technology is promising, research is still required to support social understanding of adults with ASD (Silver & Parsons, 2015). Novel technology approaches, which support the use of social awareness and develop social interaction skills for individuals with ASD when interacting with others, requires further investigation. Figure 15.1 illustrates person and environmental considerations in use of smart technology tools as workplace accommodations.

15.10 Implications for Vocational Rehabilitation with People with ASD in the Digital Age

The number of individuals with ASD in the VR programs in the United States has significantly increased over the past years. The cost spent on supporting individuals with ASD in the workplace is higher than that on supporting groups of persons with other disabilities (Cimera & Cowan, 2009). However, the employment outcomes remain unsatisfactory despite the high cost on vocational support for individuals
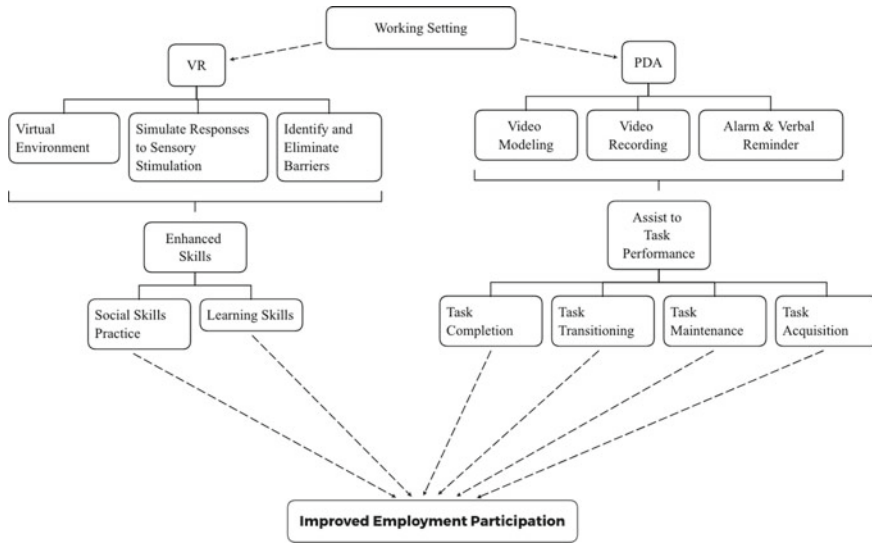
Fig. 15.2 Logic model for improved employment participation with use of digital technologies (*Source* own work)

with ASD (Cimera, 2012). Use of digital technologies may provide serviceable model for improving on employment placement and retention of people with ASD. The use of such digital technologies not only promotes independence for individuals with ASD and increase accessibility in the workplace, but also has potential in reducing job coaching hours and promote cost-effectiveness of VR services. Given these advantages, VR programs should consider provision of digital technologies as a service option for individuals with ASD in meeting their unique needs in the workplace. Figure 15.2 summaries key considerations in use of digital technologies as workplace supports for people with ASD.

Success in using DADs to bridge employment outcomes with ASD may vary according to context, individual behavioral competencies and the specific employment outcome. For instance, for individuals with HFA (a behavioral gradient variable), work participation may depend more on the area-level employment opportunities and services available (structural-infrastructural variables) than of any other personal factor attribute (Howlin, 2000; Howlin Goode, Hutton, & Rutter, 2004) and with supported employment options (behavioral-structural variable) (Wehman, Lau, Molinelli, & Brooke, 2012). Similarly, the policy implications of prioritizing specific digital technology interventions would be different. For instance, task focused digital technology workplace intervention support of adults with ASD may likely neglect the relational aspects of work participation as addressed by social media networking, which if used with perseveration, may also harm successful work outcomes. Similarly, prioritizing to address the opportunity

structure may lead policymakers to undervalue or overlook relevant digital technology support innovations that may add to the social capital of those with marginalization to access work participation.

15.11   Summary and Conclusion

Vocational rehabilitation services need to identify evidence-based practices specific to serving individuals with ASD. Structural interventions supported with digital technologies may improve employment participation with adults with ASD. Increased understanding of smart technologies for workplace supports by employment agencies may enhance the employment participation by people with ASD. In consideration of the high turnover rates among employed individuals with ASD, it is essential to utilize digital technologies as workplace accommodations to support and improve their job performance. While research on the utility of digital technologies by workers with ASD is limited, the emerging evidence suggests that digital technologies are viable and feasible as workplace accommodation to improve the job performance of individuals with HFA.

Adopting structural-infrastructural approaches to evaluate and promote employment participation by people with ASD could enhance employment outcomes with ASD better than relying solely on impairment status (a behavioral variable) or social inequality (a structural variable) as outcome predictors. A focus on modifiable structural-infrastructural affordances applying digital technologies to employment participation with people with ASD would better support these individuals to lead productive work lives.

References

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, DC: Author.

Baldwin, S., Costely, D., & Warren, A. (2014). Employment activities and experiences of adults with high-functioning autism and asperger's disorder. *Journal of Autism Developmental Disorders, 44,* 2440–2449. https://doi.org/10.1007/s10803-014-2112-z.

Baxter, J. H., Pike, G., & Reece, S. (2013). Legalisation: An unhealthy choice. *Of Substance: The National Magazine on Alcohol, Tobacco and Other Drugs, 11*(2), 12.

Beard, L. A., Carpenter, L. B., & Johnson, L. B. (2007). *Assistive technology: Access for all students.* Upper Saddle River, NJ: Pearson.

Bellini, S., Akullian, J., & Hopf, A. (2007). Increasing social engagement in young children with autism spectrum disorders using video self-modeling. *School Psychology Review, 36*(1), 80–91.

Benedyk, R., Woodcock, A., & Harder, A. (2009). The hexagon-spindle model for educational ergonomics. *Work, 32*(3), 237–248.

Bishop, M., Donald, M. S., & Lindsey, S. (2007). Psychosocial adaptation and quality of life in multiple sclerosis: Assessment of the disability centrality model. *Journal of Rehabilitation, 73* (1), 3–12.

Boff, K. R. (2006). Revolutions and shifting paradigms in human factors & ergonomics. *Applied Ergonomics, 37*(4), 391–399.

Burgess, S., & Cimera, R. E. (2014). Employment outcomes of transition-aged adults with Autism Spectrum Disorders: A State of the States report. *American Journal on Intellectual and Developmental Disabilities, 119*(1), 64–83.

Burke, R. V., Allen, K. D., Howard, M. R., Downey, D., Matz, M. G., & Bowen, S. L. (2013). Tablet-based video modeling and prompting in the workplace for individuals with autism. *Journal of Vocational Rehabilitation, 38*(1), 1–14. https://doi.org/10.3233/JVR-120616.

Camarena, P. M., & Sarigiani, P. A. (2009). Postsecondary educational aspirations of high-functioning adolescents with autism spectrum disorders and their parents. *Focus on Autism and Other Developmental Disabilities, 24*(2), 115–128.

Chiang, H., Cheung, Y. K., Li, H., & Tsai, L. Y. (2013). Factors associated with participation in employment for high school leavers with autism. *Journal of Autism and Developmental Disorders, 43,* 1832–1842.

Cihak, D. F., Fahrenkrog, C. D., Ayres, K. M., & Smith, C. (2009). The use of video modeling via a video iPod a system of least prompts to improve transitional behaviors for students with autism spectrum disorders in the general education classroom. *Journal of Positive Behavior Interventions, 12*(2), 103–115.

Cimera, R. E. (2010). Can community-based high school transition programs improve the cost-efficiency of supported employment. *Career Development and Transition for Exceptional Individuals, 33*(1), 4–12.

Cimera, R. E. (2012). The economics of supported employment: What new data tells us. *Journal of Vocational Rehabilitation, 37*(2), 109–117.

Cimera, R.E., & Cowan, R.J. (2009). The costs of services and employment outcomes achieved by adults with autism in the U.S. *Autism, 13*(3), 285–302.

Cullen, J. M., Alber-Morgan, S. R., Simmons-Reed, E. A., & Izzo, M. V. (2017). Effects of self-directed video prompting using iPads on the vocational task completion of young adults with intellectual and developmental disabilities. *Journal of Vocational Rehabilitation, 46*(3), 361–375.

Gentry, T., Kriner, R., Sima, A., McDonough, J., & Wehman, P. (2015). Reducing the need for personal supports among workers with autism using an iPod touch as an assistive technology: delayed randomized control trial. *Journal of Autism and Developmental Disorders, 45*(3), 669–684.

Gentry, T., Lau, S., Molinelli, A., Fallen, A., & Kriner, R. (2012). The Apple iPod Touch as a vocational support aid for adults with autism: Three case studies. *Journal of Vocational Rehabilitation, 37*(2), 75–85.

Gentry, T., Wallace, J., Kvarfordt, C., & Lynch, K. B. (2010). Personal digital assistants as cognitive aids for high school students with autism: Results of a community-based trial. *Journal of Vocational Rehabilitation, 32*(2), 101–107.

Gewurtz, R. E., Langan, S., & Shand, D. (2016). Hiring people with disabilities: A scoping review. *Work, 54*(1), 135–148.

Gotham, K., Bishop, S. L., Brunwasser, S., & Lord, C. (2014). Rumination and perceived impairment associated with depressive symptoms in a verbal adolescent–adult ASD sample. *Autism Research, 7*(3), 381–391.

Granovetter, M. (1995). *Getting a Job: A study of contacts and careers*. Chicago, IL: University of Chicago Press.

Hagner, D., & Cooney, B. F. (2005). "I do that for everybody": Supervising employees with autism. *Focus On Autism And Other Developmental Disabilities, 20*(2), 91–97.

Hassiotis, A., & Turk, J. (2012). Mental health needs in adolescents with intellectual disabilities: Cross-sectional survey of a service sample. *Journal of Applied Research in Intellectual Disabilities, 25*(3), 252–261.

Hedley, D., Uljarević, M., Cameron, L., Halder, S., Richdale, A., & Dissanayake, C. (2016). Employment programmes and interventions targeting adults with autism spectrum disorder: A systematic review of the literature. *Autism.* https://doi.org/10.1177/1362361316661855.

Hendricks, D. (2010). Employment and adults with autism spectrum disorders: Challenges and strategies for success. *Journal of Vocational Rehabilitation, 32*(2), 125–134.

Hill, D. A., Belcher, L., Brigman, H. E., Renner, S., & Stephens, B. (2013). The Apple iPad™ as an innovative employment support for young adults with autism spectrum disorder and other developmental disabilities. *Journal of Applied Rehabilitation Counseling, 44*(1), 28–37.

Hiller, A. J., Fish, T., Siegel, J. H., & Beversdorf, D. Q. (2011). Social and vocational skills training reduces self-reported anxiety and depression among young adults on the autism spectrum. *Journal of Developmental and Physical Disabilities, 23,* 267–276.

Hillier, A., & Galizzi, M. (2014). Employment outcomes for young adults with autism spectrum disorders. *Review of Disability Studies: An International Journal, 10*(1 & 2).

Holwerda, A., van der Klink, J. J. L., Groothoff, J. W., & Brouwer, S. (2012). Predictors for work participation in individuals with an Autism Spectrum Disorder: A systematic review. *Journal of Occupational Rehabilitation, 22,* 333–352.

Howlin, P., Goode, S., Hutton, J., & Rutter, M. (2004). Adult outcome for children with autism. *Journal of Child Psychology and Psychiatry, 45,* 212–229.

Howlin, P. (2000). Outcome in adult life for abler individuals with autism or Asperger syndrome. *Autism, 4,* 63–83.

Howlin, P., & Moss, P. (2012). Adults with autism spectrum disorders. *The Canadian Journal of Psychiatry, 57,* 275–283.

Kellems, R. O., & Morningstar, M. E. (2012). Using video modeling delivered through iPods to teach vocational tasks to young adults with autism spectrum disorders. *Career Development and Transition for Exceptional Individuals, 35*(3), 155–167.

Khalifa, G., Sharif, Z., Sultan, M., & Di Rezze, B. (2019). Workplace accommodations for adults with autism spectrum disorder: A scoping review. *Disability and rehabilitation*, 1–16.

Loveland, K. A., & Tunali, B. (1991). Social scripts for conversational interactions in autism and Down syndrome. *Journal of Autism and Developmental Disorders, 21*(2), 177–186.

Mechling, L. C., & Savidge, E. J. (2011). Using a personal digital assistant to increase completion of novel tasks and independent transitioning by students with autism spectrum disorder. *Journal of Autism and Developmental Disorders, 41*(6), 687–704.

Meyer, N. M. (2016). Othering, ableism and disability: A discursive analysis of co-workers' construction of colleagues with visible impairments. *Human Relations, 69*(6), 1341–1363.

Migliore, A., Grossi, T., Mank, D., & Rogan, P. (2008). Why do adults with intellectual disabilities work in sheltered workshops? *Journal of Vocational Rehabilitation, 28*(1), 29–40.

Migliore, A., Mank, D., Grossi, T., & Rogan, P. (2007). Integrated employment or sheltered workshops: Preferences of adults with intellectual disabilities, their families and staff. *Journal of Vocational Rehabilitation, 26*(1), 5–19.

Mitchell, P., Parsons, S., & Leonard, A. (2007). Using virtual environments for teaching social understanding to 6 adolescents with autistic spectrum disorders. *Journal of Autism and Developmental Disorders, 37*(3), 589–600.

Moore, D., Cheng, Y., McGrath, P., & Powell, N. J. (2005). Collaborative virtual environment technology for people with autism. *Focus On Autism And Other Developmental Disabilities, 20*(4), 231–243.

Mpofu & Mpofu (2018). Assessment. In M. Hartley & V. Taryvidas (Eds.). *The professional practice of rehabilitation counseling* (2nd ed, pp. 201–220), New York, NY.

Müller, E., Schuler, A., Burton, B. A., & Yates, G. B. (2003). Meeting the vocational support needs of individuals with Asperger syndrome and other autism spectrum disabilities. *Journal of Vocational Rehabilitation, 18*(3), 163–175.

Myles, B. S., Ferguson, H., & Hagiwara, T. (2007). Using a personal digital assistant to improve the recording of homework assignments by an adolescent with Asperger syndrome. *Focus on Autism and Other Developmental Disabilities, 22*(2), 96–99.

Nesbitt, S. (2000). Why and why not? Factors impacting employment for individuals with asperger syndrome, *Autism, 4*(4) (2000),357–369.

Newman, L., Wagner, M., Knokey, A.M., Marder, C., Nagle, K. Shaver, D., et al. (2011). *The post-high school outcomes of young adults with disabilities up to 8 years after high school a report from the national longitudinal transition study-2 (NLTS2).* NCSER 2011–3005. [S.l.]: Distributed by ERIC Clearinghouse.

Nicholas, D. B., Attridge, M., Zwaigenbaum, L., & Clarke, M. (2015). Vocational support approaches in autism spectrum disorder: A synthesis review of the literature. *Autism, 19*(2), 235–245.

O'Sullivan, M., & Kearney, G. (2018). Virtual reality (VR) technology: Empowering managers to reduce and eliminate accessibility barriers for people with autism spectrum disorders. In transforming our world through design, diversity and education: *Proceedings of Universal Design and Higher Education in Transformation Congress 2018* (p. 253). IOS Press.

Palmen, A., Didden, R., & Lang, R. (2012). A systematic review of behavioral intervention research on adaptive skill building in higher functioning young adults with autism spectrum disorder. *Research in Autism Spectrum Disorders, 6*(2), 602–617.

Parr, A. D., & Hunter, S. T. (2014). Enhancing work outcomes of employees with autism spectrum disorder through leadership: Leadership for employees with autism spectrum disorder. *Autism, 18*(5), 545–554.

Rashid, M., Thompson-Hodgetts, S., & Nicholas, D. (2018). Building employers' capacity to support vocational opportunities for adults with developmental disabilities: A synthesis review of grey literature. *Journal on Developmental Disabilities, 23*(3), 31–45.

Reichow, B., & Volkmar, F. R. (2010). Social skills interventions for individuals with autism: Evaluation for evidence-based practices within a best evidence synthesis framework. *Journal of Autism and Developmental Disorders, 40*(2), 149–166.

Richards, J. (2012). Examining the exclusion of employees with Asperger syndrome from the workplace. *Personnel Review, 41*(5), 630–646.

Rogers, B. (2000). *Behaviour management: A whole-school approach*. Sage.

Roux, A. M., Shattuck, P. T., Cooper, B. P., Anderson, K. A., Narendorf, S. C., & Narendorf, S. (2012). Postsecondary employment experiences among young adults with an Autism Spectrun Disorder. *Journal of Occupational Rehabilitation, 22*(3), 333–352.

Ruef, M. B., & Turnbull, A. P. (2002). The perspectives of individuals with cognitive disabilities and/or autism on their lives and their problem behavior. *Research and Practice for Persons with Severe Disabilities, 27*(2), 125–140.

Scott, M., Falkmer, M., Girdler, S., & Falkmer, T. (2015). Viewpoints on factors for successful employment for adults with autism spectrum disorder. *PLoS ONE, 10*(10), e0139281.

Shattuck, P. T., & Roux, A. M. (2015). Commentary on employments supports research. *Autism, 19*(2), 246–247.

Silver, K., & Parsons, S. (2015). Noticing the unusual: A self-prompt strategy for adults with autism. *Advances in Autism, 1*(2), 87–97.

Smith, D. L., Atmatzidis, K., Capogreco, M., Lloyd-Randolfi, D., & Seman, V. (2017). Evidence-based interventions for increasing work participation for persons with various disabilities: A systematic review. *OTJR: Occupation, Participation and Health, 37*(2_suppl), 3S-13S.

Sperry, L. A., & Mesibov, G. B. (2005). Perceptions of social challenges of adults with autism spectrum disorder. *Autism, 9*(4), 362–376.

Standifer, S. (2009). *Adult autism & employment: A guide for vocational rehabilitation professionals: Disability Policy and Studies*. School of the Health Professions: University of Missouri.

Stock, S. E., Davies, D. K., Davies, K. R., & Wehmeyer, M. L. (2006). Evaluation of an application for making palmtop computers accessible to individuals with intellectual disabilities. *Journal of Intellectual and Developmental Disability, 31*(1), 39–46.

Taylor, J. L., & Seltzer, M. M. (2011). Employment and post-secondary educational activities for young adults with autism disorders during the transition to adulthood. *Journal of Autism and Developmental Disorders, 41,* 566–574.

Taylor, J. L., McPheeters, M. L., Sathe, N. A., Dove, D., Veenstra-VanderWeele, J., & Warren, Z. (2012). A systematic review of vocational interests for young adults with autism. *Pediatrics, 130*(3), 531–538.

Taylor, J., & Seltzer, M. (2012). Developing a Vocational Index for Adults with Autism Spectrum Disorders. *Journal of Autism and Developmental Disorders, 42*(12), 2669–2679. https://doi.org/10.1007/s10803-012-1524-x.

Wehman, P., Lau, S., Molinelli, A., & Brooke, V. (2012). Supported Employment for Young Adults with Autism Spectrum Disorder: Preliminary Data. *Research & Practice for Persons with Severe Disabilities, 37*(3), 160–169.

White, S. W., Keonig, K., & Scahill, L. (2007). Social skills development in children with autism spectrum disorders: A review of the intervention research. *Journal of Autism and Developmental Disorders, 37*(10), 1858–1868.

Elias Mpofu Ph.D, DEd, CRC, FASROC, MAPS is professor of rehabilitation and health services at the University of North Texas, honorary professor of rehabilitation counselling at the University of Sydney, distinguished visiting professor at the University of Johannesburg. He is a Fellow of the Australian Society of Rehabilitation Counsellors and has an international reputation in rehabilitation and health research applying the World Health Organisation's International Classification of Functioning, Disability and Health (ICF). Elias serves as editor of the Australian Journal of rehabilitation Counselling and the Journal of Psychology in Africa. Elias has more than 200 research publications in rehabilitation and health, including four seminal book volumes.

Timothy Tansey Ph.D. Dr. Tansey is an associate professor in the Rehabilitation Counselor Education program at the University of Wisconsin-Madison. Dr. Tansey has over 20 years' experience as a rehabilitation counselor, educator, or rehabilitation researcher. He has published over 60 peer-reviewed articles in the areas of evidence-based practices in vocational rehabilitation, self-regulation and self-determination, and applying novel technology in vocational rehabilitation and rehabilitation counselor education. Dr. Tansey serves on the co-editor of the Rehabilitation Counseling Bulletin and on the editorial boards for a several other journals in rehabilitation counselling.

Ngonidzashe Mpofu M.Ed., CRC, NCC, is a doctoral candidate in Department of Rehabilitation Psychology and Special Education, School of Education, University of Wisconsin-Madison, USA. She received her M.Ed. in Counselor Education from the Pennsylvania State University, University Park, USA, with an emphasis in both Clinical Rehabilitation and Mental Health and Clinical Mental Health in Schools and Communities. She is currently a project assistant for both the RRTC and Targeted Communities research projects at the University of Wisconsin-Madison. Ngonidzashe has co-author several book chapters in leading book titles in rehabilitation and community health.

Wei-Mo Tu Ph.D, is an assistant professor of Rehabilitation and Health Services at the University of North Texas. Wei-Mo Tu completed his master's degree in rehabilitation counseling from the National Changhua University of Education in Taiwan and earned his Ph.D. in rehabilitation psychology from the University of Wisconsin-Madison in the United States. He was a supported employment specialist and vocational evaluator. His areas of research interests include vocational rehabilitation, psychosocial aspect of disability, and applications of the International Classification of Functioning, Health, and Disability (ICF) in rehabilitation.

Qiwei Li received his master's degree in Health Services Administration from the Department of Rehabilitation and Health Services at the University of North Texas (UNT), Denton, TX. He is currently a doctoral candidate in the Health Services Research program at the UNT, with a concentration in rehabilitation science. His research interests fall in the area of applications of the of World Health Organization International Classification of Functioning, Health and Disability (ICF) to understanding the community participation for older adults aging with and/or into chronic conditions and disabilities.