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A Study on the Use of Virtual Reality in Teaching Independent Living Skills to Individuals with Autism Spectrum Disorder

Saime Arslan (saimeuzunn@gmail.com) - Department of Computer Education and Instructional Technologies, Fırat University, Türkiye

Abstract

The aim of this section is to examine the research on virtual reality (VR) technology used in teaching independent living skills to individuals with Autism Spectrum Disorder (ASD). Recently, an increasing number of studies have been trying to find the best way to teach independent living skills to individuals with ASD and use technology-assisted intervention methods, which is one of the effective evidence-based practices. As one of these technologies, VR can facilitate the learning of individuals with ASD due to its features such as a high degree of interaction and immersion, controlling confusing stimuli from the environment and allowing students to learn while playing. In the examination, it is seen that individuals with ASD are taught mostly driving skills, fire and hurricane protection skills, and job interview skills through VR. For this reason, it is thought that there is a need to investigate how, in which contexts and with what kind of support VR technologies will be effective and productive in teaching independent living skills to individuals with ASD.

Keywords: Virtual Reality; Independent Living Skills; Autism Spectrum Disorder; Technology-Assisted Intervention; Immersive Learning.

Diagnostic features of ASD such as lack of social interaction and communication, limited repetitive behaviors and interests, deficiencies in attention, joint attention and imitation, and excessive adherence to routines continue throughout life. These basic features of disability can be expressed as one of the biggest reasons that prevent an individual from living an independent life with ASD (Hume & Loftin, 2009).

Candio (2019) states that among disability groups, ASD individuals have the lowest rate of independent living. In the National Longitudinal Survey of Transition-2 (NLTS-2) (Sanford et al., 2011), it has been reported that 17% of individuals with ASD can lead an independent life. This means that many ASD individuals need the support of their family or an adult to survive. Families with children with ASD expect their children to acquire various skills during the transition to adulthood after school. Among these skills, independent living skills such as shopping, ordering food on the phone or in a restaurant, using public transportation and having domestic skills are primarily expressed (Bahçalı & Odluyurt, 2020). It is important to gain independent living skills during the school period because education services decrease in the after-school period and it becomes difficult to acquire new skills (Smith et al., 2012), in a longitudinal study in which they followed the development of daily living skills (DLS) in individuals with ASD and Down Syndrome, concluded that both groups had developed IDD until their 20s, but the development of individuals with ASD stalled after these years. In addition, when individuals with and without ASD matched on the basis of their mental age are compared, it is seen that the daily life skills performances of individuals with ASD are lower than the other group (Liss et al., 2001). For all these reasons, the school period in which effective educational interventions are carried out is important in helping individuals with ASD acquire independent living skills.

One of the main responsibilities of special education schools is to provide the best service necessary for the child with special needs to become an independent individual. With this vision, “Individualized Education Plans” are prepared, adequate exercises, appropriately guided repetitions and opportunities to encourage generalization are created to offer the best learning experience. However, it can be challenging to do all these in a group with heterogeneous needs, where they all need intense support (Ayres et al., 2009). At this point, one of the applications that will help educators is auxiliary personnel support. Another is assistive technologies

that will support students' individual learning without the need for adult guidance. In the report of NPDC (The National Professional Development Center, 2015) and NAC (National Autism Center, 2015), it is stated that technology-based interventions (TTM) are one of the evidence-based practices frequently used in the education of individuals with ASD. Recently, various researchers and technicians have been developing various software and hardware such as computer-based tools, virtual/ augmented reality, mobile and tablet-based applications and robotics that can support or replace standard teaching methods (Esposito et al., 2017). There are various compilation studies/systematic review studies on what kind of technologies are used in teaching independent living skills to individuals with ASD. In the first review on the subject, Mecling's (2008) research is preliminary. In this research, 22 studies were found that provide information about four types of technology used to teach food preparation to individuals with ASD between 1986 and 2006. These are expressed as picture-based systems, Palmtop personal (hand-held) computer-based systems, audio systems and video-based systems. Gardner and Wolfe (2013), on the other hand, examined the studies in which independent living skills were taught to individuals with ASD only by video model and video hinting methods. Although the focus is not on individuals with ASD, another study on technologies used in teaching independent living skills is the study of Brok and Sterkenburg (2015). In this study, mobile technologies, robots and virtual reality technologies, which are self-controlled and used with temporary help, are examined. In the study of Çattık and Ergenekon (2019), however, the use of technology was not intended, but the results show that technology-based applications are mostly used in teaching independent life skills to individuals with ASD. One of the most recent studies on this subject is Hrabal et al. (2022) is a comprehensive literature review. In this study, 27 studies examining the effectiveness of various technologies in teaching independent living skills to individuals with ASD were reached. These studies a, it is seen that most of the methodically, video models and video tips are used, in which food preparation and cleaning skills are studied the most. In parallel, it is stated that the most commonly used devices are tablets, followed by computers, televisions and smart phones, respectively. In the researches above, it is seen that the technologies used in teaching independent life skills to individuals with ASD have also changed over time with the developing technologies. One of the current technologies in this

regard is mobile devices.

Devices such as iPod touch, iPad, and smartphones have universal design features such as being user-friendly, relatively inexpensive, and portable. The educational features provided to these devices can facilitate learning by providing the learner with the opportunity to practice as much as they want at their own pace, while providing the individual with the opportunity to be actively involved in the completion of the assigned task. These devices, which are suitable for use in daily life due to portability, self-management or greater social acceptance, also contribute to the use of technology by individuals with special needs (Mechling, 2009). Yeong et al. (2022) developed a video model-based e-book with an iPad device. This research consists of two stages. The first stage is the stage in which children with autism are taught to use the Ipad along with the sandwich and table cleaning skills. The second stage is the stage where the ASD individual learns the skills of making instant pasta, preparing a table and folding clothes by using the iPad independently. Visual differentiation is allowed on the cover pages to help them distinguish and choose from different educational e-books in the iPad design of this research. Visual cues (photos and icons), textual cues (words), audio cues/messages (voice recordings) are posted offline for easy accessibility. Mecling et al. (2009), ASD participants were given the option of touching the picture or watching the video section as a clue to perform the step in skill analysis. This design ASD provided a flexible usage feature by allowing the individual to use hints at the desired density. As can be seen, the interaction, individualization of education, accessibility, touch screen, photo, audio, video recognition features and ecological validity features of these technologies offer more customization opportunities to support the independence of ASD individuals and they are becoming more effective. One of the technologies that attracts great attention in order to gain skills is virtual reality

Hale and Stanney (2014) defined virtual reality (VR) as “a model of reality in which a person can interact, receive information from the model with ordinary human senses such as sight, sound and touch, and/or control the model using ordinary human actions such as location” (cited in. Glaser and Schmith, 2021). At the same time, VR systems that can transform the user’s experiences into a virtual environment provide a high degree of interaction and immersion (Bozgeyikli et al., 2018). It is stated that these features of VR help the ASD individual to understand the cues from the

natural environment more easily and to take action. Simulated virtual reality environments allow confusing stimuli from the environment to be controlled, allowing students to learn while playing. This situation enables individuals with ASD to learn important skills and can increase the possibility of transferring them to daily life. Research summary and synthesis studies on virtual reality environments show that this technology has a significant impact on the learning of individuals with ASD (Karami et al., 2021). The heterogeneity of the ASD group and the different possibilities and limitations of VR technologies reveal the problem of generalization in studies on this subject (Glaser and Schmidt, 2021). For this reason, it highlights the importance of design features in VR-based learning environments. In VR systems, the more realistic and real-world-like experiences VR provides, the more users behave in real-world situations. The users' perception of VR as a real experience is defined as the feeling of being surrounded and presence. Virtual reality glasses using CAVE realistic virtual graphics and interactions, producing spatial sounds or equipment that offer different realistic sensory experiences, strengthen the sense of presence (Gökoğlu and Çakıroğlu, 2019). When the studies in which independent living skills are taught to individuals with ASD in the VR environment are examined, in studies in which driving skills are taught (Bian et al., 2019; Wade et al., 2016; Zhang et al. 2017) eye tracking provides adaptive responses by the system and desktop VR technology offered with the Logitech 27 steering wheel set with add-ons such as eeg row. In the study in which fire and hurricane protection skills were taught (Self et al., 2007), desktop VR technology was used, in which software that helps to create realistic sounds and images such as 3DS Max 6.0 and EON Professional 5.0. In their study, in which job interview skills were taught (Smith et al., 2015), participants with ASD interacted with virtual characters representing the human resources manager in a large store by using desktop VR technology. In their 2008 study, Josman et al. taught the ability to cross a virtual street divided into four with desktop VR technology using fSuperscape's 3D Webmaster software. Bozgeyikli et al. (2017) designed virtual environments such as warehouses, grocery stores, open car parks, offices and streets with Unity software. In these environments, it is aimed to teach vocational skills by adding various distractors to the system. Apart from these single-user systems, there are also mobile-based VR environments that teach ASD individuals the ability to communicate with the police and job interview skills

in virtual environments that allow multi-user use (Parish-Morris et al., 2018; Strickland et al., 2013). When examining the presentation of instruction in VR studies in which independent living skills are taught to individuals with ASD, adaptive systems that give instant feedback according to the actions of users (Bian et al., 2019), video models and systems that use visual cues (Jarrold et al. , 2013; Self et al., 2007; Strickand et al., 2013), systems that provide feedback by the trainer or the system (Parish-Morris et al., 2018; Strickand et al., 2013) and virtual environments where the level of difficulty increases through distractors (Jarrold et al., 2013; Simoes et al., 2013). Generally speaking, it is seen that various devices that offer single-user or multi-user interaction are used in researches in which independent living skills are taught to individuals with ASD, the real world is simulated in the scenarios created, and feedback and interaction come to the fore. When the skills aimed to be taught to ASD individuals through VR are examined, it is seen that social skills and emotion recognition and discrimination skills are mostly studied, while daily life skills are less studied, as seen in the research of Sani Bozkurt (2021).

As a result, considering the limited number of studies on the teaching of independent living skills, the need to develop teaching tools that promote independence emerges. Another requirement arises as a result of the different effects of different technologies in the teaching of independent living skills. So much so that researchers may choose to use certain technologies to teach certain types of skills. For example, using mobile devices to teach daily life skills, robots to support interaction, VR technologies to teach dangerous skills. Therefore, there is a need to investigate how VR technologies will be effective and efficient in teaching independent life skills to individuals with ASD, in which contexts and with what kind of support.

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