

Adapted Physical Activity With Digital Interactive Games For Individuals With Disabilities

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Abstract

The participation of individuals with disabilities in exercise is hampered by poor accessibility, a lack of support, and established sedentary behaviors. Advanced technologies are utilized in digital interactive games to produce interactive environments in which on-screen simulations respond to user body movements. Interactive gaming platforms offer engaging, motivational, and therapeutic benefits in rehabilitation. The Nintendo Wii, Dance Dance Revolution, and Xbox Kinect serve as therapeutic tools, demonstrably improving physical activity among individuals with diverse disabilities. This study investigated the effects of digital interactive games on individuals with disabilities. For this purpose, a review of eight studies was conducted, comprising five primary investigations and three literature reviews from Greece and the United States. Results indicated enhanced social, emotional, motor, and communication skills in individuals with disabilities who participated in digital interactive gaming. In conclusion, digital interactive games represent a compelling and effective strategy for promoting increased physical activity among individuals with disabilities. In addition, the study's results indicated notable advancements in the social, communicative, emotional, and motor abilities of participants with disabilities.

Keywords: Digital Interactive Games, New Technologies, Adapted Physical Activity, Disability

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Introduction

Insufficient access to facilities, inadequate motivational support, and prevalent sedentary lifestyles impede physical activity participation among people with disabilities. Individuals with disabilities frequently experience health issues like cardiovascular disease, diabetes, obesity, and depression as a result of largely sedentary lifestyles. A primary factor contributing to this is the participants' lack of awareness regarding the advantages of exercise, resulting in decreased motivation. Moreover, participants engage in recreational activities—such as dance, walking, bowling, and weight training—that blend fitness with elements of entertainment, music, or competition (Torrado, Jaccheri, Pelagatti & Wold, 2022).

A potential solution involves investigating efficacious strategies for encouraging participation in exercise programs (Millana et al., 2022). Technological devices facilitate the self-management of chronic conditions. Digital interactive games (DIGs) represent a notable alternative to traditional exercise programs, potentially enhancing both fitness and motor skills (Silva et al., 2017). Moreover, DIGs represent innovative technologies that facilitate an interactive environment where users execute physical movements to generate corresponding in-game simulations. The Nintendo Wii (Nintendo), Dance Dance Revolution (Konami), and Xbox Kinect (Microsoft) are gaming systems with therapeutic and rehabilitative applications, enhancing physical activity levels in individuals with diverse disabilities (Patsi & Evaggelinou, 2022). User engagement necessitates physical exertion mirroring on-screen movements within the simulated game environment (Vernadakis et al., 2014).

Literature review

The Nintendo Switch video game console operates in conjunction with a television screen and its Joy-Con controllers (Kim, Lee & Yim, 2019). Moreover, the Microsoft Kinect Xbox (Washington, USA) incorporates Kinect sensors and necessitates accurate user motor control to achieve in-game objectives (Hsieh et al., 2014). In the majority of DIGs, users concurrently engage in both exercise and gameplay. Current design trends feature an asymmetric model where exercise and gameplay are discrete, yet interconnected by

systems allowing for the conversion of exercise-based energy expenditure into in-game advantages (Keeney, Schneider & Moller, 2019).

User training is facilitated by an asynchronous modality, allowing for individualized pacing (Tan, Kumar & Ralph, 2016). Tan et al. (2016) categorized DIGs into three distinct groups. 1) Indoor digital gaming systems, exemplified by the Nintendo Wii (Kyoto, Japan), often necessitate user participation in exercise routines, including dance, aerobics, and yoga, within the home environment. 2) Aerobic activities can be performed using devices such as the Fish Game, which combines a rowing machine with specialized fitness equipment. Virtual reality is a characteristic of some digital objects in this group. 3) Mobile devices equipped with accelerometers and GPS technology were utilized to track user physical activity and the game's impact (Patsi & Evaggelinou, 2022).

For individuals with autism spectrum disorder (ASD), these interventions are structured to improve social skills, communication skills, and narrative abilities (Bernardini, Porayska-Pomsta & Smith, 2014), and to cultivate appropriate posture and motor coordination (Caro, Tentori, Garcia & Alvelais, 2017). Their design employs a user-centric methodology to facilitate skill development. Furthermore, interaction is facilitated solely through the user's body movements, obviating the need for external devices. Astrojumper (Finkelstein, Barnes, Wartel & Suma, 2013) and FroggyBobby (Caro, Tentori, Martinez-Garcia & Zavala-Ibarra, 2015) are illustrative instances of such games.

Astrojumper is a dynamic exergame, utilizing virtual reality and touchless interaction to engage players in avoiding obstacles, collecting bonuses, and engaging in combat. A significant number of ASD individuals participating in this game have demonstrated increased physical activity and improvements in behavior and overall health. FroggyBobby, a Kinect-based digital intervention (Caro et al., 2015), aims to enhance visual-perceptual abilities in individuals with ASD. This method effectively motivates users to engage in exercises that enhance visual-motor coordination and improve targeted limb movements (Caro et al., 2017).

Purpose

The main purpose of the present study was to scan and review related studies on DIGs technology and its impact on individuals with disabilities. This study's findings synthesize recent progress in DIGs technology and its application to interactive interventions for individuals with disabilities.

Methodology

The selected articles were research studies with intervention programs based on the engagement of individuals with disabilities with DIGs, with the exception of three studies that were literature reviews.

Data collection instruments

A comprehensive literature review encompassing eight studies was performed using Science Direct, PubMed, and Google Scholar to gather relevant articles. Publication of the selected articles occurred between the years 2016 and 2024. The review included five articles reporting original research on intervention programs and three literature reviews conducted in Greece and the United States.

Data collection

The reviewed studies were selected according to three established criteria.

1. Participants were included in the study only if they had a diagnosed disability.
2. The research involved the analysis of occupations related to digital technologies.
3. Adherence to rigorous scientific methodology was mandatory, with submissions required in both Greek and English.

Results

A selection of eight studies (2016-2024) highlights recent advancements in DIGs technology and its interactive applications for individuals with disabilities. Details are described as follows.

Table 1. Overview of main characteristics of the selected studies regarding DIGs Technology and its impact on individuals with disabilities

<i>Authors</i>	<i>Disability</i>	<i>DIGs</i>	<i>Findings</i>
Sekizli et al. (2024)	Autism Spectrum Disorder (ASD) Intellectual Disability (ID)	Nintendo Wii, Oculus Quest, Eyes Free Yoga, Wii Fit plus, Froggy Bobby, Kinect Monsters	Positive effects on mental health
Patsi et al. (2023)	ASD	Nintendo Wii, Dance Dance Revolution,	Social, emotional and motor benefits

		Astrojumper	
Patsi et al. (2022)	ASD, ID, Cerebral Palsy (CP), Mental Disorders (MD)	Froggy Bobby, Kinect Monsters, Carnival Games, Liberi, Nintendo Wii, Just Dance 2, Astrojumper	DIGs-attractive tools for improving physical activity levels
Cardenas et al. (2021)	CP	Liberi	Mental and physical benefits
Syropoulou et al. (2021)	ID	Carnival Games (PlayStation VR platform)	Recreation and positive mental state
Caro et al. (2020)	ASD	Froggy Bobby, Kinect Monsters	Maintenance of attention, positive emotional expressions, increased motivation to perform tasks
Caro et al. (2018)	Developmental Disorders	Froggy Bobby	Increased motivation from DIGs to perform visual-motor coordination exercises
Patsi et al. (2016)	MD (Schizophrenia)	Nintendo Wii Sports, Wii Sports Resort	Positive attitudes towards DIGs

Discussion

Information and Communication Technologies (ICT) have proven to be essential educational and therapeutic instruments for individuals with disabilities. Structured environments incorporating multisensory interactions and layered functionalities facilitate

meaningful engagement with technology for users with diverse disabilities (Katsari, 2016). Interactive gaming systems that encourage physical activity constitute engaging media, motivating users toward exercise and contributing positively to the management of disciplinary conditions. Research indicates the potential of utilizing gaming consoles—like the Nintendo Wii, Dance Revolution, and Xbox Kinect—in therapeutic interventions to improve physical activity for individuals across a range of disability types (Patsi, Antoniou & Yfantidou, 2017).

DIGs serve as beneficial instruments for enhancing daily physical activity among individuals with chronic physical disabilities. This study synthesized prior research on digitally-enabled interventions for individuals with disabilities. Findings indicated that digital platforms afford equitable access to gaming, regardless of academic aptitude or disability status. DIGs may provide a suitable alternative to conventional exercise programs for improving fitness and motor skills. The inherent attractiveness of these applications presents users with an alternative method for achieving enhanced fitness and health (Lam et al., 2011). They are currently utilized as rehabilitative instruments for individuals of all ages with disabilities and may offer an alternative approach to consistent physical activity.

DIGs serve as appealing and effective instruments for engaging and motivating individuals with disabilities in exercise programs, thereby promoting increased physical activity. Research by Patsi & Evaggelinou (2022) indicated that DIGs foster improvements in social, emotional, mental, and motor skills, posture, and motor coordination, leading to an improved quality of life (Patsi et al., 2016). Accordingly, interventions designed for ASD individuals aim to enhance social, communicative, and narrative abilities (Bernardini et al., 2014). DIGs serve as effective tools for motivating users to enhance visual-motor coordination and targeted limb movements (Caro et al., 2017).

Although digital interventions (DIGs) are not a complete substitute for in-person exercise programs, their integration with personalized physical activities demonstrates considerable potential. Future research should assess the long-term impact of DIGs on sustained physical activity and active lifestyles among individuals with disabilities.

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