

# Use of Gamification for Adult Physical Rehabilitation in Occupational Therapy; A Novel Concept?

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## Abstract

**Aim:** This commentary discusses the concept of ‘gamification’ as referred to implicitly or explicitly in the occupational therapy literature. Although occasionally noted to be a new frontier for occupational therapy, our analysis suggests that game mechanics and gamification elements are, in fact, a ‘road long traveled’ by occupational therapists and that gamification evokes the core aims and vision of occupational therapy. Gamification has been implicitly incorporated into the occupational therapy literature for years, and its benefit of enhancing therapeutic outcomes is evident in many instances. We contend that a more explicit use of the term gamification within the occupational therapy literature will lead to a framework in which both practitioners and researchers can structure and evaluate therapeutic outcomes.

## Keywords

gamification, adults physical rehabilitation, occupational therapy, game mechanics, serious games

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## Introduction

Games as a motivating tool have been used for centuries (D’Angour, 2013). In recent years, and mainly regarding technology-based interventions, efforts have been made to engage users by embedding the motivating qualities of games into a range of rehabilitation systems, in order to improve participation of people with performance deficits and disabilities (Charles & McDonough, 2014).

With the advent of virtual reality-based games and wearable devices for rehabilitation, new opportunities in rehabilitation have arisen that enable the evaluation and treatment of specific motor, cognitive and meta-cognitive skills in controlled environments (Rizzo & Kim, 2005). The emerging popularity of commercial computer games such as Microsoft’s Kinect and Nintendo’s Wii that make use of gamification elements (Levac et al., 2018) to deliver therapeutic tasks that are more difficult to control via daily activities in the real environments. One limitation of these

commercial products in that they were developed for the public population and can be difficult to adapt to the motor and cognitive difficulties experienced by rehabilitation populations. However, an experienced occupational

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therapist is often able to overcome this limitation by using external devices (e.g., splints, levers) to support the acquisition of movement patterns, postural, balance and locomotor control and upper limb recovery for motor disabilities such as stroke, Parkinson's disease, cerebral palsy and multiple sclerosis (Weiss et al., 2014).

*The American Occupational Therapy Association (AOTA) created guidelines to help further its vision towards "...an inclusive profession [that] maximizes health, well-being, and quality of life for all people, populations, and communities through effective solutions that facilitate participation in everyday living". (American Occupational Therapy Association, 2017).*

Occupational therapists continually search for such solutions to enhance client motivation and performance. One potential solution that has yet to be adequately explored is the concept of "gamification". The objectives of this commentary are to define gamification and its elements, to describe its historical evolution, and to provide examples of how it has been practiced in occupational therapy.

### Definition of Gamification

Gamification is defined as a process that entails adding games or game-like elements to non-game activities in order to encourage participation and engagement (Richter et al., 2015). 'Gamified solutions' are the use of game design elements and mechanics, such as the interaction between a player and the game through its rules, in order to face and overcome challenges in learning, training, knowledge sharing and other contexts. Gamification also refers to the way in which 'game thinking' can engage participants and change behavior in 'real world' contexts (Dewick & Stanmore, 2017). For example, Glännfjord et al. (2017) found that among a group of older adults aged 64–98 years, the Wii Sports Bowling game induced a flow-like state which they found to be an enjoyable and meaningful way to socialize with peers. Gamification elements are building blocks that can be applied to and combined with school curricula, workplace activities, healthcare, as well as everyday leisure pursuits, in order to imbue these activities with greater enjoyment and motivation. In the clinical context, these elements appear to be effective regarding the (re)learning of skills such as providing enhanced, game-like feedback to support the practice of new skills (Sillaots, 2014).

Since people respond differently to both intrinsic and extrinsic motivational elements in relation to their needs, values, goals and immediate context (Gnauk et al., 2012), a range of gamification elements can lead to attainment of diverse task goals, encourage performance, reward achievement, guide improvement, personalize a task, and

ensure a challenging yet feasible "just the right" level of difficulty (Montola et al., 2009). For example, a display of levels of difficulty that reflect a player's changing proficiency while playing a game provides a sense of accomplishment and has been shown to increase player self-efficacy (Gnauk et al., 2012).

Treatment goals may be achieved by elements such as feedback of results (e.g., badges, trophies, gifts, Points progression scale, rank, and/or award status), feedback of performance (e.g., visual and audio displays of user actions), task personalization (e.g., avatars; display of personal progress), peer competition (e.g., avatar peers, leaderboard, golf handicap), setting of intermediate goals and final deadlines (e.g., charts, progress scale), socialization, autonomy, flow state and choice; all these elements lead to a sense of engagement (Marczewski, 2015).

### Emergence of Gamification

The term "gamification" is relatively new (McCallum, 2012), however, the concept was alluded as far back as Plato who wrote extensively about the role of games in society as a means of educating children to become "successful" adults (D'Angour, 2013). The first use of game elements in an online system is attributed to Bartle (Bartle, 2009) who, in the early 1980s, developed a text-based online system comparable to a multi-player virtual game, encouraging educational scholars to explore the use of video games within learning paradigms. Since the early 2000s, game-like enhancements have also been applied to various instances, for example, in simulations to train medical personnel and to free public educational purposes such as in Khan Academy ([www.khanacademy.org](http://www.khanacademy.org)) and Coursera ([www.coursera.org](http://www.coursera.org)). For more elaborated examples of gamification systems in business and education see (Richter et al., 2015).

### 'Serious Games' for Healthcare

A parallel branch of game-like applications that embodies the attributes of gamification emerged in the form of 'Serious Games', that is, games for purposes other than pure entertainment (Susi et al., 2007). In the healthcare context, the application of serious games has included simulation of real-life events as a means of engaging clients to improve their health outcomes through training and education (Young, 2014). Historically, healthcare games were targeted at children. For example, Zheng et al., (2021) conducted a systematic review regarding the use of serious games to assist children with Attention Deficit and Hyperactive Disorder (ADHD) in both diagnose and treatment. They concluded that in contrast to traditional intervention methods, the use of serious games for treatment has greatly contributed to the engagement and enthusiasm of children

with ADHD. Moreover, due to its ability to reflect a realistic experience, a serious game may enable users to more readily transfer their learned behaviors and responses to real life (Zheng et al., 2021)

Over the years serious games have become increasingly adapted for the adult population such as treatments of upper extremity range of motion and strength (Lange et al., 2010). Also, they are used to supplement or replace conventional rehabilitation training to enhance engagement of treatment of mild cognitive impairments (Lau & Agius, 2021). Another example for mental health conditions such as anxiety and depression, has been the subject of a review of 20 serious games results which emphasize the importance of input and feedback from users (both therapists and clients) regarding the serious game design process (Dekker & Williams, 2017).

The increasing prevalence of serious games within adult rehabilitation is due, in part, to the pervasive penetration of video gaming on personal computers and tablets as well as the ubiquitous availability of online apps on smartphones (Johnson et al., 2016).

### *Gamification in Occupational Therapy Focusing on Adult Physical Rehabilitation*

The term gamification was formally introduced in the occupational therapy literature only in recent years (Fox, 2013). In the context of functional daily performance, gamification has been defined as “the use of game design to engage people in meaningful occupation in their everyday lives” (Fox, 2013, p 25). While rarely referred to explicitly as gamification, it can be argued that the concept has been an integral part of occupational therapy since its inception. Malick (1975) provided an early documented example in which an electrical transducer was used to operate appliances (e.g., a television) to motivate a patient to exercise and to increase joint range of motion.

Gamification elements have been expressed (ideas, concepts, elements) or implemented within the occupational therapy literature for adult physical disabilities due to neurological or orthopedic conditions, regardless of whether technology was used. Since rehabilitation is very often a challenging process for clients, family members and therapists (Luker et al., 2015), gamification tools can provide solutions to support this process by increasing motivation (Richter et al., 2015). For example, in a randomized controlled trial aimed at improving upper limb function in adults following an acute stroke, using an avatar to mimic the movements of the user in a game-based task provided feedback of performance. The users were engaged and functionally improved their paretic arm. This improvement was greater than the improvement of those who received a standard occupational therapy program which included

motor tasks similar to the ones used by the game-based system (i.e., object displacement, object grasp and also object release). Hence, the game activity and its built-in personalized performance feedback provided an autonomous and individualized adaptable training regime and resulted in higher levels of motivation and compliance with conventional treatment (da Silva et al., 2011).

One example in which the term “gamification” was used explicitly within studies of occupational therapy rehabilitation was conducted by (Antal, 2013) who examined the use of social gaming to improve function among stroke patients. Another, more recent example of explicit use of the term gamified intervention is reported by Lau et al. (2022) who examined the impact of serious games in training for ageing population in nursing homes during COVID-19.

However, there are dozens of other instances in which gamification elements and game mechanics were only implicitly referred to, for example, using the term ‘motivation’ (Tamayo-Serrano, et al., 2018), ‘feedback’ (Rand et al., 2018), ‘engagement’ (Glännfjord et al., 2017), ‘game design’ (Jacobs, et al., 2013), ‘flow’ (Yoshida et al., 2013), and all of these as separate terms in Leong et al., (2022) meta-analysis. These studies all demonstrated improvement in achieving therapeutic goals and enhancement of values, feasibility and effectiveness of systems and interventions.

The benefits of using gamification elements were evident in the rehabilitation of clients with hand injuries (Ganjwale et al., 2019), Traumatic Brain Injury (Charles & McDonough, 2014) burns (Griffiths et al., 2013), muscular dystrophy (Griffiths et al., 2013), well-elderly population (Hoppes et al., 2000), multiple sclerosis (Annema et al., 2013), Parkinson’s disease (Pompeu et al., 2014), and those who are at risk of falling (Shruti et al., 2016).

Flexibility in the location of the interventions that have been gamified is another benefit. The use of game-based occupational therapy activities is well suited to autonomous usage at home since the client may be guided and supported by built-in feedback of results and/or performance. For example, combining game-based rehabilitation at home with synchronous meetings with a therapist was effective for 15 stroke patients in terms of motivation, sense of flow and engagement (Antal, 2013). Overall, community-based interventions that entail gamification qualities have a positive impact on clients autonomy by supporting their engagement in everyday, independent living (De Coninck et al., 2017).

### *Recommendations for Future Development*

Gamification elements are flexible and multi-purpose tools that can be applied using different devices, adapted to support a wide range of therapeutic goals for adult physical rehabilitation. Game mechanics are not limited to technology-based interventions but can support a variety of

client abilities and enhance their engagement and participation in daily activities when treated at the clinic, at home or as a combination of both. This unique means of enhancing an intervention reflects the adaptive solutions that occupational therapy interventions can provide.

As is regrettably often the case when new technologies appear in rehabilitation (e.g., virtual reality (Keshner et al., 2019) the lack of a uniform terminology can result in a lack of awareness of relevant literature. We strongly urge a more formal recognition and adoption of the term gamification as a substitute for a listing of elements that only imply gamification. Such an “umbrella” term will provide researchers with a terminology that succinctly describes the function and process of gamification but also helps to solidify the use of gamification as a powerful clinical intervention tool.

A more explicit use of the term ‘gamification’ within the occupational therapy literature is expected to lead to a therapeutic framework. This framework may support both practitioners and researchers in structuring and evaluating therapeutic outcomes and establish evidence for incorporating gamification elements to both conventional and technology-based interventions.

## Conclusions

Though there is much more to be done in terms of unifying the terminology of this concept, there is already evidence for the beneficial effect of gamification and gamification element within occupational therapy. This commentary paper provides support for conducting an in-depth systematic review, once enough research has been performed, to evaluate the application of gamification within occupational therapy.

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