

Chapter 9

Gamification in Stroke Rehabilitation

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ABSTRACT

Stroke rehabilitation aims to improve patients' abilities to realize daily life activities and, consequently, regain their self-confidence and improve independence and quality of life. Gamification can be defined as the application of game-design elements, dynamics, and principles such as competition, narratives, point-scoring, and awards in non-game contexts, including rehabilitation. It has emerged as a therapeutic alternative or complement to traditional rehabilitation to make motor practice more intense and increase a person's motivation, interest, and satisfaction by bringing meaningful and intrinsically motivational playful experiences. Compared to the same amount of conventional therapy, gamification can increase the number of movements and involve safe and intensive rehabilitation exercises, essential for a successful rehabilitation process.

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INTRODUCTION

The main goal of this chapter is to explore the effects, advantages, and disadvantages of the use of serious games in post-stroke upper limb rehabilitation. We also aim to compare the obtained results between the use of conventional therapy and gamification. Every year, stroke affects about 15 million people worldwide and in Europe are registered close to one million new cases (de Castro-Cros et al., 2020; Elsner et al., 2017). It is considered to be one of the most common causes of death and the primary cause of adult disability around the world (Achacheluee et al., 2018; Draaisma et al., 2020; Elsner et al., 2017; Phipps & Cronin, 2020; Simonetti et al., 2017; Unibaso-Markaida et al., 2019). Given the size of this problem, the authors felt the need to study this topic. Besides that, the need for innovating rehabilitation methods that promote therapeutic compliance, clients' involvement, and motivation throughout the rehabilitation process could lead to better results.

BACKGROUND

1. Stroke and functional impairments

Stroke is a focal neurological lesion, with a sudden onset, lasting more than 24 hours, induced by the abrupt interruption of blood flow to the brain due to either a vessel occlusion or, less frequently, an intracerebral hemorrhage (Lefebvre & Liew, 2017; Unibaso-Markaida et al., 2019). Both can induce direct damage of brain tissue at the lesion site, along with the potential for additional damage in the adjacent tissue and long-term dysfunction through the interruption of structural and functional pathways in the brain (Lefebvre & Liew, 2017). This also leads to a deregulation of cortical excitability and abnormal interhemispheric interactions (Lefebvre & Liew, 2017).

There are risk factors that increase the possibility of having a stroke that can be divided into controllable and uncontrollable risk factors (de Castro-Cros, 2019). Controllable risk factors are directly associated with a person's lifestyle and affect blood pressure, arterial fibrillation, cholesterol, diabetes, and blood circulation. These include diet and nutrition, physical activity, tobacco smoking, alcohol, and many others. Uncontrollable risk factors are intrinsic and essential to determine the overall risk. These include age, gender, race and ethnicity, family history, history of previous strokes, fibromuscular dysplasia, patent foramen ovale, and transient ischemic attack.

An ischemic stroke is a sudden loss of blood flow to an area of the brain. It can be caused by arteriosclerosis (chronic inflammation of the arteries that causes hardening and accumulation of cholesterol plaques on the walls, which helps the arteries obstruction and the formation of the thrombus), cardio-embolism (a blood clot that travels from the heart to the brain, causing an obstruction, that is caused by the disruption of the cardiac rhythm, cavity dilation, and a cardiac valve alteration) and a brain venous thrombosis (this does not allow blood to go back to the brain, reducing blood flow and making irrigation difficult). Ischemic stroke can also be caused by unusual causes, like a blood clot formed due to an arterial dissection or undetermined causes (Boehme et al., 2017; Koh & Park, 2017; Phipps & Cronin, 2020).

A hemorrhagic stroke is caused by the rupture of a blood vessel or an abnormal vascular structure in the brain. It can be classified as an intracerebral hemorrhage or subarachnoid hemorrhage (Boehme et al., 2017; Koh & Park, 2017). It can be caused by high arterial pressure, which can produce either an obstruction or arterial rupture, a degenerative process, it happens when amyloid plaques are placed

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