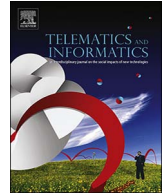


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Gamification and serious games in depression care: A systematic mapping study

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ABSTRACT

Depression is a common mental disorder that causes sadness and loss of interest. It affects 350 million people in the world and its most severe state can lead to suicide. Many technologies are being used to aid the depression treatment and gamification has been used as an approach to improve adherence and engagement in the treatment. This systematic study aimed at identifying how gamification and serious games have been applied to support the treatment of depression, what technologies are being used currently and what gaps are still left unexplored. Eight scientific repositories were used to search for papers in the area of depression and a filter process was used to remove bias. As a result of this search and filter process, 28 works were completely reviewed, analyzed and categorized in this paper. In the reviewed papers the technologies found for treatment of depression were mobile, computer, wearables and web applications. These technologies are applied in gamification, serious games, virtual reality and speech analysis. Some papers used Cognitive Behavioral Therapy as an intervention and other papers used gamification as a way to promote engagement and adherence to treatment.

1. Introduction

World Health Organization (WHO, 2017a) defines depression as a common mental disorder, characterized by sadness, loss of interest or pleasure, feelings of guilt or low self-worth, disturbed sleep or appetite, feelings of tiredness, and poor concentration. Globally, depression has reached 350 million people of all ages and it was the leading cause of disability worldwide, affecting more women than men. At its worst, depression could lead to suicide (Simon and VonKorff, 1998). In addition, depression can be long-lasting or recurrent, thus impairing individual's ability to function at work or school or to cope with the daily life. The diagnostic and the treatment can be done reliably by non-specialists as a part of primary health care and when diagnosed as mild, people can be treated without medicines but when depression is moderate or severe, the people diagnosed may require medical monitoring and the use of medicines (WHO, 2017a).

There are many treatments for depression. Antidepressants, for example, can be an effective form of treatment for moderate-severe depression, however, they are not the first line of treatment when the cases are of mild depression. Antidepressants should not be used as the first-line treatment for children and teenagers (in this case, antidepressants should be used with caution (WHO, 2017b)). Besides the use of medicines, experts recommend that friends and family should participate in the treatment of patient who suffers from depression.

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Non-drug treatments such as exercises, psychotherapy or counseling (Association, 2010) and mindfulness-based interventions (Strauss et al., 2014) are being used to treat depression. Furthermore, technology, such as serious games, mobile systems and gamification, has been used to support mental health, which is why gamification can also be used to support an increase in social engagement. According to Barrios (Barrio et al., 2015) the term “gamification” is relatively recent, it was used for the first time in a paper in 2010 (Inc, 2010), and it is known for the use of game dynamics and mechanics in computer applications to change user’s behavior.

Although the terms game dynamics and mechanics are closely related, they are also used interchangeably. Game mechanics relate to gameplay, such as score, levels, dialogs, tips, progress, challenges and classification, whereas game dynamics focus on results that the game mechanics lead to, such as the sense of reward, achievement, competition and altruism. Gamification has become a strategy to motivate and engage users of educational applications, business and health (Brown et al., 2016).

Serious games are an example of non-entertainment games, they are designed to improve some specific aspect of learning or training, to be used in education area or in health care. Their genres, complexity, and platforms are as varied as in entertainment games.

This paper uses the systematic mapping study methodology in order to show the usage of gamification and serious games on depression treatment. Other systematic studies were already conducted to gauge how mobile applications have been used for supporting Cognitive Behavioral Therapy (CBT) and Behavioral Activation (BA) (Huguet et al., 2016) and to check the acceptability of interventions delivered online and by mobile phones (Berry et al., 2016).

Given that the subject in question is relatively new, the motivation of this study is to find out what are the databases most relevant to the research area of gamified depression treatment. This work also focuses on discovering who are the main authors of the area, which are the most relevant papers, the shortcomings and challenges in the area. This study presents the current theoretical state of the art, serving to support future researches.

The paper is organized as follows: in Section 2 is presented how the mapping study was assembled and executed. The text selection process is presented in more detail in Section 2.3. In Section 3, the most relevant papers found are organized in the respective search questions and Section 4 exposes the threats to the validity of the work. Finally the last two sections, namely Section 5 and Section 6, conclude this paper by introducing a discussion regarding the works found, followed by a brief presentation of future work.

2. Methodology

This paper uses systematic mapping study as methodology, which eliminates or greatly reducing bias when compared to single reference reviews, thus getting more reliable results (Cooper, 2016). This type of methodology does not discuss just the final finding but all activities related to the finding. Thus systematic mapping study collects data about locations where activity occurs and media where it was published, mapping that linkage. Mapping often focuses on published papers but can be used with other medias like books, newspapers and grant proposals. The methodology consists in the execution of the following steps:

- Elaboration of the research questions.
- Design the search process.
- Defining the criteria for filtering results.

2.1. Research question

The research questions led this study to find out works that could be linked with gamification and serious games on depression treatment. For this work, three General Questions (GQ), two Focused Questions (FQ) and two Statistical Questions (SQ) were defined. The purpose behind the GQs is to understand how technologies are aiding in mental health. The purpose behind the FQs is to identify how specific technologies are used to treat depression. Lastly, the purpose behind the SQs is to find statistical data about the area being studied. These questions are presented in Table 1.

Table 1
Research Questions.

References	Questions
<i>General Questions</i>	
GQ1	What technologies are being used to support mental health disorder?
GQ2	How technologies are being applied to mental health treatment?
GQ3	How gamification is being used to support mental health?
<i>Focused Questions</i>	
FQ1	How smartphone is being used to aid depression treatment?
FQ2	How gamification can support motivation of people with depression?
<i>Statistical Questions</i>	
SQ1	Where have the researches been published?
SQ2	What is the number of publications by year?

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