A Comprehensive Review of Gamification in Healthcare: Incentives in Mobile Healthcare App

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Abstract - *Gamification is a systematic approach for using game features and methods to make non-game processes more engaging. Gamification is a motivational technique that uses game mechanics, game dynamics, and components to encourage users to complete challenging tasks. Nowadays, examining existing relevant studies to uncover a collection of game features and approaches increases the chances of success in the exciting process. The main goal of this work is to conduct a literature evaluation utilizing descriptive statistics of game aspects in conjunction with a review technique. We looked at much research on gamification in healthcare. The viewpoint was pivoted after each publication was reviewed for the analysis, and additional analyses were done concept-centrally. To enable the creation of more successful applications in the future, we identified individual behaviour change strategies and combinations of techniques widely employed in smartphone games. Smartphone games that attempt to change people's health habits are widespread, although the methods for doing so are unclear. We examined the integrated behaviour modification strategies in health applications with gaming aspects in a systematic way.*

Keywords—Gamification, Game Elements

1.INTRODUCTION

Even though games come in a variety of forms and genres, they all have four common characteristics: a goal that players attempt to accomplish, rules that limit how they may achieve the goal, a feedback system that tells players how they might achieve the goal, and players' voluntary involvement. The application of game design features in the context of positive health motivation is referred to as gamification of healthcare. Gamification is a strategy that aims to have a beneficial influence on a variety of wellness and health-related situations, not only because it can increase people's engagement and responsibility for their health-related decisions, but also because it can improve healthcare personnel' performance. Gamification has been explored in several illness conditions and can be used to drive patient-controlled activities. In the field of healthcare,
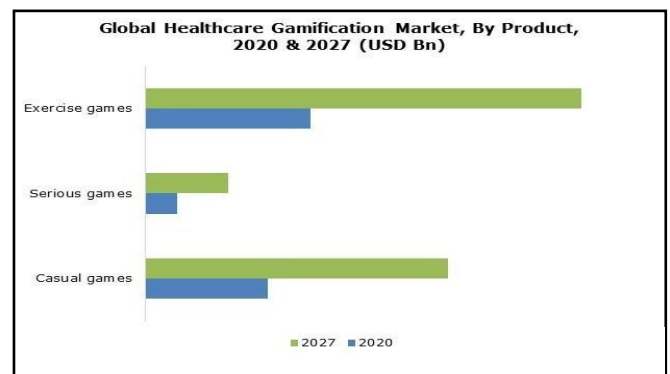
gamification is quickly gaining popularity. With the rapid growth of smartphone use, there has been a significant surge in the number of apps focused at health and health-related activities. There are over 53,054 health applications (apps) as of 2021, available for smartphones throughout the world, with exercise, diet, and weight management apps being the most popular. From the first quarter of 2015 to the first quarter of 2021, the number of mHealth applications accessible in the Google Play Store increased. The healthcare gamification industry's revenue share surpassed USD 25.3 billion in 2020, and it's expected to grow at a CAGR of around 14.6 percent through 2027. In 2020, exercise games accounted for about 51% of the healthcare gamification market share, and their appeal among young adults and the working population would continue to increase [1].

Fig. 1. Exercise games to increasingly influence the demand for gamification in the market

Over the last five years, there has been a roughly tenfold rise in peer-reviewed research publications on gamification in this field. Gamification concepts have been proven to be useful in several healthcare circumstances, including motivating people to live healthier lives, assisting rehabilitation processes, and improving healthcare professional education. Simultaneously, there appears to be no consensus on what defines gamification and how it varies from other, similar concepts. For some successful cases of gamified context, there is still a gap in the definition and measurement of game elements; in this paper, we aim to understand the key game elements and

propose a term of game elements that can be implemented in the healthcare context.
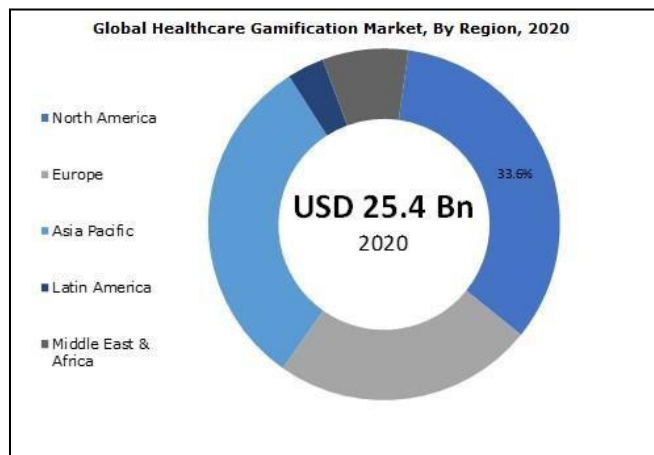

Fig. 2. Early- acceptance and technology-savvy user base propels the demand in the different region

The goal of this systematic review is to give a thorough overview of gamification's use and efficacy in the healthcare sector, as well as to contribute to existing gamification research in various areas. We first made a clear and rigorous distinction between gamification research and other forms of game-based learning studies. Then we outlined the circumstances in which the gamification interventions took place, as well as the ideas that underpin them. Furthermore, we looked at the impact of individual game features using a conceptual framework created by Landers et al. to organize game elements in non-educational contexts.

2. RELATED WORK

2.1 Gamification

In 2008, Bret used the word "Gameification" in a blog post titled "My Coverage of Lobby of the Social Gaming Summit," in which he defined the term as "taking game mechanics and applying them to other web properties to increase engagement." In 2009, information systems (IS) scholars and practitioners began to pay attention to the idea of gamification. The following are the most frequent definitions of "gamification": Gamification, as defined by Deterding, Dixon, Khaled, and acke (2011), is the use of game elements in non-game contexts [2].

2.3 Self Determination Theory

According to Edward L. Deci and Richard M. Ryan's Self Determination Theory (SDT), the essential psychological requirements that compose Self- Determination are autonomy,

Gamification, according to Bunchball.com (2010), is the use of game mechanics in non-game activities to influence people's behaviour. Gamification, according to Zichermann and Cunningham (2011), is the process of using game thinking and game mechanics to engage audiences and solve problems [3]. To simplify the concept of gamification, consider it the application of the key aspects that make games enjoyable and engaging to activities that aren't often considered games. Gamification appears to be a viable method for overcoming interest loss, increasing user engagement, improving the quality of health habits, and motivating users to use Health apps for an extended amount of time. It refers to the broad spread of games in culture, society, and technology, as well as how technology is being altered and developed to provide pleasant experiences, motivating enforcement, and skill acquisition.

The motivational and engaging potential of games can potentially be harnessed for supporting this behavior by supporting the emergence of these gameful experiences in the context of health behavior by employing gamification in the form of game elements and affordances (Hamari & Koivisto, 2015; Högberg et al., 2019) [4]. The anticipated health consequences may ultimately materialize if an individual engages in a specific health activity and continues to do so.

2.2 Health Behaviour Change Theory

Health behaviour, according to Gochman, encompasses personal qualities, psychological traits, behavioural patterns, behaviours, and habits that are related to health maintenance, restoration, and improvement. Health behaviour change is a complicated and challenging process, impacted by a variety of elements such as emotion, social influences, and awareness of a health problem. As a result, a variety of theories have been used to develop effective health treatments and encourage a better understanding of health behaviour change. These health behaviour change theories (HBCTs) are widely utilised in the healthcare industry or are derived from it. We refer to an HBCT as a potentially relevant, currently existing explanatory model that has shown to give useful knowledge to explain and forecast health behaviour change, in agreement with previous research on theoretical considerations of gamification [5].

According to the HBM (Health Belief Model), a person's belief in a personal risk of illness or disease, as well as their belief in the effectiveness of the suggested health activity or action, can predict whether they would engage in the practice.

competence, and relatedness. To fulfil selfdetermination requirements. To satisfy the ability's requirements. to satisfy the desire for social connection [6].

Forde, Mekler, and Opwis (2015) compared autonomy,

competence, and intrinsic motivation between an informative and a control condition on gamification work, and Forde, Mekler, and Opwis (2016) found thatinformational game components such as points in the form of scoreboards were disregarded [7]. Self- regulation in a non-digital context, according to Hiniker, Lee, Sobel, and Choe (2017), may be applied effectively to children's use of technology by providingtools for preschoolers and parents to organise their device-based play-time [8]. Huang (2017) used robotics competitions as a test bed to look for evidence of people's desire for autonomy, competence, relatedness to other humans, and intrinsic motivation and emotions while interacting with robots, utilising the Self-Determination Theory in Human-Robot Interaction [9]. Noll, Razzak, and Beecham (2017) investigated the effects of misalignment between needed and real autonomy on motivation in the context of global software development [10].

3. METHODOLOGY

3.1 Research

A systematic review was conducted by us for this research. The procedure for doing the systematic review was as follows: First, we determined which electronic databases were being investigated in relation to the study's objectives. Second, we determined the target keywords and create the search string. Third, we identified the inclusion/exclusion criteria, i.e., the mandatory eligibility conditions for documents to be included in the current study. Fourth, using the title and abstract, we screened those documents that previously met the eligibility criteria. Fifth, based on the content of the papers, we chose those that provide information about game elements; sixth, we defined the metrics to characterise them and then we delivered the results of this systematic review.

3.2 Data Collection

We looked at the NHS Health Applications Library, the mHealth apps, and other top-rated medical, health andwellness, and fitness apps (as defined by the Apple andGoogle Play stores based on revenue and downloads).

Google Scholar, Journel of Medical Internet Research Publications (JMIR), IEEE (Institute of Electrical and Electronics Engineers), ResearchGate, and CiteseerX were the electronic databases that were searched.

We utilized the following factors to make our decision:

(1) To discover phrases related to gamification, gamified, and gamifying, we used the search terms "gamif*." (2) After that, we used the following criteria for inclusion: one of the search strings relates to the name a conference or a journal from 2019 through 2021, The papers those were written in English, and the following were the exclusion criteria: publications that didn't have anything to do with gamification; Only the abstracts of papers are accessible; The workshop presentation; The usage of gamification in a non-health environment; Research that has already been done. In addition, in the first phase, we collected data from the title, abstract, and keywords, and in the second step, we extracted data from the introduction, methods, and conclusions.
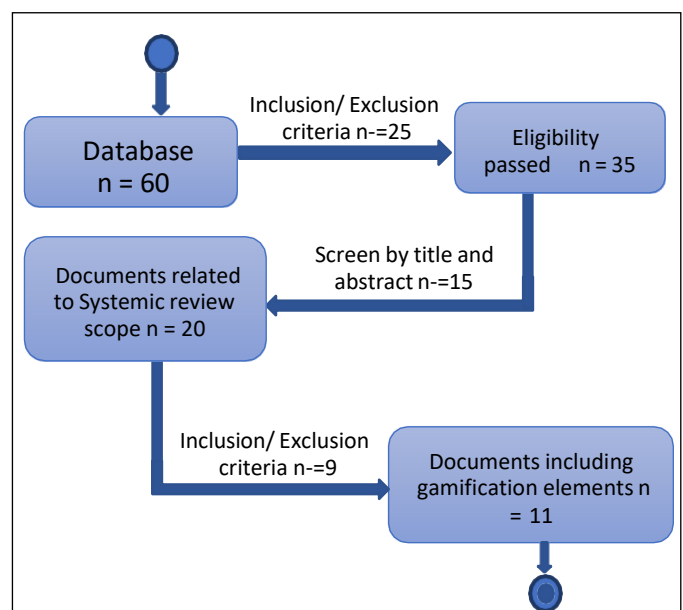

Fig. 3. Flow diagram of systematic review process

4. RESULTS

Table 1 summarises the extracted data from the selected publications, including the year of publication, authors, problem points, proposal, studydesign type, and performance evaluation.

Table 1. Summary of the extract data from the selected papers

Year	Authors	Problem Points	Proposal	Type of Studies Design	Performance Evaluation
2021	Mitra Zolfaghari, Mina Shirmohammadi Houra Shahhosseini, Mehrshad Mokhtaran and Simin Z. Mohebbi	To encourage healthy oral health-related Behaviors and to design electronic apps with educational content for oral health instruction of mothers.	The authors design a mobile app and assess the effect of gamification of the app on quality of oral health instruction of mothers regarding oral healthcare of theirchildren.	Correlational Study	The result shows that apps effectively promoted the oral health of their children. However, reduction of PI, as the main cause of dental caries, was greater in children of mothers who used the gamified app [11].
2021	Persson J, Clifford D, Wallergård M, Sandén U	Cancer rehabilitation is central for helping patients and relatives create a functional everyday life based on the changes in life conditions. The needs are highly individual and include physical, mental, and social challenges. Cancer rehabilitation programs offer coping strategies, including guidelines on how to handle emotions.	The author design, the virtual smash room at the request of a patient with cancer who wanted a tool for venting frustration In this virtual environment, the user can break porcelain, vases, and plates. Patients participating in a week-long cancer rehabilitation program tested the virtual smash room.	AppliedStudy	This study presents a concept of using virtual reality in the cancer rehabilitation process and exemplifies activities of patient participation in the design process. Virtual reality has potential in being both distracting and enjoyable, while certain aspects of cybersickness might be especially important to consider for a user group already experiencing physical and mental issues. The results will act as input in the process of further designing virtual applications in digitally reinforced cancer rehabilitation [12].

2021	Patrícia Paula Bazzanello Henrique, Perez FMP, Becker OHC, Bellei EA, BiduskiD, Korb A, Pochmann D, Dani C, Elsner VR, De Marchi ACB Kinesiotherapy	To evaluate the effects of kinesiotherapy with exergaming on older women's epigenetic marks and cognitive ability, as well as on their clinical functional variables.	The author develops a virtual clinic exergame with 8 types of kinesiotherapy exercises. Afterward, they conduct a 1:1 randomized clinical trial to compare the practice of kinesiotherapy with exergames (intervention group) against conventional kinesiotherapy (control group).	AppliedStudy	Research on this topic is likely to significantly expand the understanding of kinesiotherapy and the impact of exergames. To the best of our knowledge, this may be one of the first studies exploring epigenetic outcomes of exergaming interventions. The project was funded in October 2019. Game development took place in 2020. Patient recruitment and clinical trials are planned for 2021 [13].
2021	Michelle Berger Carolin Jung	To contribute to a better understanding of contextual differences of Gamification elements preferences and provide starting points for further research on gamification	It was discovered that users prefer meaningful GEs in a nutrition-related context. The findings have a wide range of practical applications in the field of nutrition. Implementing GE narratives, for example, which is supposed to increase user engagement, is not preferred in the nutrition context.	Correlational Study	Results of the study were limited, as the selection of GEs examined differs in some respects. The use of a physical reward distorted the structure of the experiment. It would be interesting to see if the implementation of virtual rewards, for example, free healthy recipes, would lead to a different rank position [14].
2021	Stéphanie Carlier Dries Coppens Femke De Backere Filip De Turck	Investigating the Influence of Personalised Gamification on Mobile Survey UserExperience	This study investigates the impact of a reusable mobile survey application that employs personalized gamification on user experience. The gamified application provides a better overall user experience than the traditional survey. 37.5 percent of	Correlational Study	A study has found that the overall user experience is slightly higher than that of the non-gamified version of the Hexad Player Type Framework. The results of the study were obtained from 28 participants who took part in a series of surveys about their use of the app [15].

			gamified users thought the survey lasted less time than it did.		
2021	Timea Németh AlexandraCsongor Erika Marek Gabriella Hild	The study aimed to gain an understanding of the use of gamification in languages for Medical and Healthcare Purposes (LMHP) classes.	Over 1000 medical and healthcare students were surveyed via an online questionnaire. The survey included both closed and open-ended questions designed to gain a better understanding of students' perception of in-class gamification techniques.	Correlational Study	Student's voice is an essential and asset to a university. This is even more so in healthcare and medical education, where the sink or swim attitude is still present. Gamification may provide another method through which instructors motivate students to learn the target they are aiming for. The authors conclude that the success of Gamification lies in making the learning experience engaging and interactive [16].
2020	Hamidur Rahaman Pial	To make the healthcare/fitness app more interesting for the user.	The authors developed a mobile App that uses game-based learning characteristics and human-cantered design to attract and better suit the user.	Exploratory Research Study	The result proved that implementing gamification in Health and fitness apps have become widely popular, using gamification elements. It also shows that there is a lack of integrating important elements of changing health behaviour theory from the modern app industry, that may fall impact to gamification apps to change health behaviour [17].
2020	Paul Tamayo-Serrano Samir Garbaya Saida Bouakaz Pierre Blazevic	The patients' motivation and adherence to a rehabilitation regime is still a problem. To address this problem, this article proposed a game-based in-home rehabilitation approach for post stroke patients.	Game-based systems have been developed as a tool to maintain motivation and achieve rehabilitation goals in patients who are undergoing stroke rehabilitation therapy.	Research Paper	Traditional poststroke therapy is useful but patients' motivation and adherence is still a problem. This article proposes a game-based in-home rehabilitation approach for poststroke patients. The results showed that the system as a whole was usable regardless of gender or previous experience with video games[18].

2020	Mia Jansson, Jonna Koivisto, Minna Pikkarainen.	To identify opportunities for gamification In the elective primary fast track total hip and knee arthroplasty journey to support patient's health-related behavior.	The authors develop a mobile app for digital gamified solutions for exploring the use of gamification to lower limb joint replacement journey and other specialization.	Journal	The result shows that the effectively promoted the knee and arthroplasty journey and opportunities were in the context personalized counselling, monitor and social support [19].
2019	Mohamed Buheji	To enhance the integration of gamification in more public services and to present around the opportunities and learning that comes from gamifying the change initiatives.	The author investigates how the different gamification constructs and techniques help in re-inventing the public healthcare services.	Case Study	These findings suggest gamification is one of the important tools today in changing mindset of the stakeholders, set effective strategies for s transformation and we can recog the level of learning and achievem with relatively informal and immed feedback in relevance to day-to practice [20].
2019	Eli G. Phillips Jr, PharmD,JD; Chadi Nabhan, MD, MBA Bruce A. Feinberg DO	The role of practitioners in the era of gamification has not been well established. The need has arisen for development of clinical practice guidelines. "Digital practitioner" specializes in healthcare apps and assesses whether game apps might improve patients' health by modulating their brain activity.	Technological advancement in healthcare is in an explosive growth phase, and there is likely a role for gamification as an next approach to modify behaviour. As gamified applications for healthcare increase, the best way to protect patients is with a combination of provider and regulatory interventions.	Exploratory Research Study	A two-way gaming interface m allow the digital practitioner to w the patient's development, rectify deficiencies that are discovered, adapt the game accordingly. combination of provider and regula measures is the most effective stra to protect patients [21].

5. FUTURE SCOPE

Gamification, rather than being a simple solution of gamebased design characteristics, will become a strategic management tool in the future. Gamificationwill be about how we think, cooperate, and collaborate to co-create a new method of learning and communitydevelopment.

This review contributes to the burgeoning area of gamification in healthcare applications by providing evidence for future research and determining the best way to employ behaviour modification components in smartphone games. The link between an intervention's behaviour change method content and the subsequent health behaviour change is not straightforward. More approaches aren't always better, and more research isneeded on the precise combinations of techniques that are most likely to work in smartphone games. The following table summarizes the game elements that can be used in healthcare app design.

Table 2: Game Elements useful to healthcare app

Game Elements	Examples	Usefulness to Gamification in healthcare app design
Achievement (Progression)	• Points • Badges • Levelling • Leader boards • Progression bars Certificates	Level completion and skill improvement provide enjoyment to game players. Users appreciate the same kinds of acknowledgement. The feeling of progress encourages to keep going. Leader boards, as well as points and badges, give a social status element. The task completion certificate is a proof of accomplishment in training e.g. therapy and diet.
Rewards	• Equipment, tools and other resources to use in game • Collectibles • Bonuses • Power-ups	Rewards, which are closely connected to accomplishment, can be included into the wellbeing process. Reward schedules, both variable and fixed, are common game mechanics. Rewards can be earned by completing a series of tasks or given out at regular intervals. Extrinsic motivation and recognition are provided through rewards for time, effort, and health improvement.
Story	• Narrative arc • Quest: The hero's journey	Users interest and motivation are piqued by an adventure setting, a preventing calamity scenario, or a defeating the disease. Incorporate the once experience from the treatment of lethal diseases into a captivating story. To immerse the patient – and users' choices – into the plot, add characters, conflicts, and resolution.
Time	• Countdown • Schedule	Timers (which count total time) and countdown clocks are a popular theme in healthcare games such as fitness and nutrition. Even a timetable of events, such as "before I do B and C, I must first do A," might assist people focus on the work at hand and their diet.
Personalization	• Avatar selection • Avatar Customization • Character naming • Interactive conversation (ICI)	It's simpler than ever to provide excellent consumer experiences in real-time due to AI-based personalization. Individual preferences may be accommodated in everything from avatar selection and customization to look-and-feel settings (e.g., a dreamlike theme or a vibrant colour theme). Patients are more engaged and motivated when they are treated individually.
Microinteractions	• SFX • Toggles • Animated rollovers	When it comes to creating a memorable experience, the finer points are crucial. A hover-state animation, a sound effect, or a cut-screen narrative are all examples of pleasant moments and microinteractions in games. But watch out for too much
	• Easter eggs	flamboyance! Using music, sophisticated animations, and beautiful transition screens, provide nuanced environmental reactions to patients and users activities.

6. CONCLUSION

We have demonstrated the broad interpretation of game components in this study, as well as a new language to explain how gamification is produced. We present an overview of the use of behaviour modification approaches in the rapidly expanding field of smartphone games, with the goal of providing insights that will help developers build more successful applications to modify health-related behaviours. We've seen evidence of a broad interpretation of game components, as well as a new language to describe how gamification is formed. The benefits and risks should be assessed using established procedures to allow consumers to make informed judgments and health systems to make reimbursement decisions.

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