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Gamification in Health Promotion in the Context of Creating the Concept of Health 2.0 - A Comparative Analysis of Selected Health Mobile Applications

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Abstract:

Purpose: *This article aims to explore and explain the importance of gamification in health promotion within the framework of the Health 2.0 concept based on a comparative analysis of selected health mobile apps.*
Design/Methodology/Approach: *The following research methods were used in this paper: content analysis of health mobile apps and their comparative analysis. Based on the 2023 rankings, 12 apps were selected from the Apple App Store and Google Play Store, the most interesting, in the author's opinion, in terms of gamification elements. The chosen apps were tabulated in terms of purpose, target group, gamification elements, and use benefits. The study consists of the following sections: introduction, literature review, research methodology, results, discussion, limitations, conclusions, and practical implications.*
Findings: *The utilisation of gamification in the promotion of health possesses the potential to captivate audiences, furnish amusement, and bring forth motivational and cognitive advantages, consequently potentially serving the objectives of Health 2.0. Implementing gamification in mobile health applications can enhance user involvement and cultivate specific health-related behaviours. Furthermore, gamification can be pivotal in inspiring individuals within higher education establishments, thus contributing to the goals of Health 2.0 by endorsing healthy environments and lifestyles among students and educators. Moreover, gamification can effectively provoke employee engagement, stimulate customers, and enhance learning in healthcare institutions.*
Limitations: *Limitations of the study that may have affected the overall picture of considerations were identified. Firstly, only selected health mobile apps were taken for comparative analysis. Secondly, the collation and comparative study of the mobile apps in question focused on the most popular gamification elements, which aligns with the results of the literature review. Thirdly, only mobile health apps appearing simultaneously in the Apple App Store and Google Play Store were taken for comparative analysis. These three limitations may have limited the study with additional findings and suggestions.*
Originality/value: *The comparative analysis of mobile health applications is based on applications resulting from the 2023 rankings of such applications. The inclusion of issues treating gamification in health promotion in the context of creating the concept of Health 2.0 is based on the latest literature on the subject, Polish and foreign, enriching the previous*

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scientific output concerning the healthcare industry and management, signalling the author's contribution to the development of the discipline of management and quality sciences.

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1. Introduction

Gamification, the application of mechanisms known from games to areas outside of them, is becoming increasingly popular in various fields, including health promotion. In the context of the concept of Health 2.0, which involves the active involvement of patients in managing their health through digital technologies, gamification can play a crucial role. Health programs, including mobile apps, based on gamified elements such as points, levels, challenges, rankings, and rewards can increase motivation to lead healthier lifestyles, improve adherence to medical recommendations, and increase patient involvement in treatment.

Gamification can also help in health education, making it easier to understand complex health issues in a friendly, exciting, and interactive way. Indeed, according to a report compiled by (Wolny and Wojtasik, 2023), health education and health promotion have become a necessary educational and educational process in the 21st century, which responds to the threats caused by consumerist lifestyles - especially among children and adolescents.

In addition, the document's authors emphasise that health promotion can effectively support health education at the practical level by promoting healthy lifestyles in all educational areas. According to (Włodarczyk, 2019), health promotion involves a carefully designed process to protect and promote human health through health education and public health strategies. On the other hand, health education plays a crucial role in setting health priorities and demonstrates methods for achieving them.

However, despite its promising potential, gamification in health promotion is still a relatively new field that requires further research. It is essential to understand how to design and implement gamification-based health solutions to be practical, attractive, and accessible to different populations. In addition, it is also essential to understand the potential challenges and limitations of gamification in health, such as privacy and data security, equity of access to technology, or, finally, the risk of oversimplifying complex health issues.

Despite these barriers, gamification has excellent potential in the context of Health 2.0, but its practical use requires further exploration and innovation.

This study aims to understand and clarify the role of gamification in health promotion in the context of the Health 2.0 concept through a comparative analysis of selected health mobile applications. The following research questions were developed to verify this objective:

- What gamification elements are most commonly used in health mobile apps, and how do they affect user engagement and motivation?
- What are gamification's key benefits and limitations in health promotion?
- How can gamification contribute to the goals of Health 2.0?

2. Literature Review

Gamification, inspired by computer games, aims to increase people's interest and involvement in products or situations that are not games. Gamification works by setting goals for the user and rewarding them for achieving them. The goals can be set by the user or the developer of the program or application. Sometimes, the goals are hidden, and the reward surprises the user, motivating him to continue using the application. Gamification uses the principle of positive reinforcement and rewards for effort, using the app and engaging family and friends to work together (Łosiak-Pilch, 2018).

Gamification elements are increasingly being used in mobile applications (Zichermann and Cunningham, 2011). These include, but are not limited to, tasks and challenges, known as missions; progress bars, which show how much of a task has already been completed and how much is still missing to earn a reward; badges and trophies awarded for completing a single task; rankings, which allow users to compare achievements with other app users or with the community; points, which can be collected to unlock additional app features; virtual items, which can be gifted to friends after they are earned (Dan and Lai, 2013).

As a mobile application based on gamification elements, these health applications are perfect for health promotion activities that encourage individuals to monitor their health regularly, take steps towards a healthier lifestyle (increasing physical activity, modifying their diet, eliminating unhealthy habits), and consistently counteract a variety of conditions and diseases that often have an unfavourable prognosis (Korczak, 2016).

Research indicates that health mobile apps positively impact the health behaviour of their users, provided that the apps are used regularly. Regularly using health apps leads to changes in daily habits, shaping those that positively affect health (Eyles *et al.*, 2014; Safran Naimark *et al.*, 2015). However, it was found that most e-health apps studied engage users only briefly through the rewards offered.

Therefore, it is essential to create e-health solutions based on sound theories that leverage the experience and psychological effects of game mechanics (Sardi *et al.*, 2017a) because satisfying basic psychological needs as a result of interaction with game elements increases user engagement, which in turn leads to positive marketing results (Bitrián *et al.*, 2021).

The issue of user involvement is crucial in the context of interaction with subsequent challenges within a given health application; hence, using the potential of gamification mechanisms for health promotion processes, which is one of the critical issues in the creation of the Health 2.0 concept, health awareness is raised, and health-promoting behaviour is created in society.

Health 2.0 can be defined as the integration of health data and health information into the patient's experience through information and communication technologies (ICT), which allows active and responsible participation in the process of taking care of one's health and receiving health care (eHealth Solutions – rozwiązania informatyczne w ochronie zdrowia, n.d.).

In other words, and to put it more deeply, the idea combines mHealth with the latest advances in intelligent sensors, 5G communications, and advanced Web 2.0, cloud computing, and social media technologies to create personalised health services that are patient-centred (Istepanian and Al-Anzi, 2018; Istepanian and Woodward, 2016).

According to (Duplaga and Szulc, 2019), Health 2.0, by creating online communities and publishing their health content, represents another dimension of the development, after e-health, of ICT systems in health care. In general, Health 2.0 is still an evolving concept, and the results of a systematic review (Van De Belt *et al.*, 2010) highlighted 46 unique definitions of Health 2.0, with the following keywords recurring: Web 2.0, patients, professionals, social networks, health information, collaboration, health care change.

Despite the credit given to health mobile apps working in developing the Health 2.0 concept, it is important to note various barriers, including those related to the use of these apps. According to (Smarżewska, 2018), all barriers related to their use can be divided into four groups: those related to oversight (e.g., the lack of specific interoperability standards or the lack of clear regulations on the protection of personal data), those related to the structure of health care systems (e.g., the lack of consistency in terms of cooperation between different levels and sectors of health care or the change in the way the processes of implementing a given app are managed); technical (e.g., the lack of standardised data transmission protocols or the too-late involvement of physicians in the design of apps); economic (e.g., the lack of reimbursement mechanisms for specific solutions for patients or the limited awareness of health care providers about the benefits of using a given app).

According to Kajzer and Szlachetka (2017), the most significant barrier preventing the spread of a given health app is its unfamiliarity. Therefore, education is urgently needed to inform patients, particularly those in the 65+ age group, who could successfully use such solutions daily.

There are also many other barriers to the development of the mobile health app ecosystem, among which, according to Jagiela *et al.* (2023), the following can be mentioned: low digital maturity of a given society, digital exclusion, paternalistic model of health care, advanced age of doctors and their resistance to change, insufficient financing of the health app market.

On the other hand, from a global perspective, significant barriers may be (Kuczabski, 2019) political factors, investment expenditures and the risk associated with their return, reduction of direct contact between doctor and patient, trust in modern technologies, specifics of the market. In contrast, there are unique barriers to using mobile health apps for low-income populations, including a lack of or low familiarity with mobile apps, limited health literacy, and a historical lack of trust in healthcare systems (Liu *et al.*, 2020).

Other barriers identified in the literature based on its review include lack of interpersonal communication and encouragement from medical professionals, fear of less communication due to lack of support and non-verbal cues that could be picked up when interacting with a doctor in person, fear of wasting time due to high engagement (Ahmad *et al.*, 2022).

3. Research Methodology

The article first uses a content analysis of health mobile apps as a research method. Secondly, a comparative analysis was used, in which, based on foundational data, selected health programs in the form of gamification-based mobile applications were reviewed, evaluated, and compared in terms of their characteristic elements and usability. The focus was on gamified health-related mobile apps from the Apple App Store and Google Play Store. The key to selecting apps was their various 2023 rankings, based on which 12 apps were selected that, according to the author, seemed most interesting in terms of gamification elements.

4. Results

A selection of gamification-based health mobile apps that appear simultaneously in the Apple App Store and Google Play Store was reviewed. Key to the selection of apps was the 2023 rankings of gamification-based health mobile apps (Top 10 health apps in 2023 - ITpoland, 2023; App Gamification, 2023; Best *et al.* in Poland - Itech360, 2023; Gurram, 2022; Kasraszwili, 2023; Monkey, 2023) of which twelve were selected for analysis. Table 1 summarises these apps based on purpose, target audience, gamification elements, and user benefits.

Table 1. *Summary of selected health gamification-based mobile applications*

Application name	**Purpose(s) of the application**	**Target group(s)**	**Gamification elements**	**Benefits of use**
Rzuć palenie! / Rzucić palenie	- Continuously maintaining motivation in the process of quitting smoking; - Increase user engagement and improve their chances of quitting; - Quit smoking forever	- People addicted to smoking cigarettes: - Adult smokers who smoke at least one cigarette a day and intend to quit within a self-imposed timeframe	- Tracking progress; - Advancement system: the ability to unlock more levels; - Motivating by pointing out the benefits of quitting smoking; - Prizes; - Progress monitoring log	- Getting inspired by the benefits of quitting smoking; - Greater engagement with gamification elements associated with a greater likelihood of quitting smoking in the short term; - Support in quitting smoking by providing users with daily reminders and motivational messages
Lifesum Food Tracker and Planner	- Personalized nutrition; - Weight management	- Those wishing to lose weight; - Those planning to build muscle; - Those wishing to adopt a healthier diet	- Food journal with convenient barcode scanner; - Calorie counter; - Macro (protein, carbohydrate and fat) tracking and food evaluation; - Water monitor; - Diet plans for weight loss and body composition; - Intermittent fasting plans; - Meal plans with shopping lists; - Life Score test for personalised dietary recommendations	- Building healthy eating habits for life; - Supporting personal goals through a personalised nutrition plan; - Selecting the proper diet for users' taste and lifestyle from among the following: ketone diet, Mediterranean diet, high protein diet, Clean Eating diet, Scandinavian diet, climate diet
Runtastic	Provide tools to unlock the potential of running and cycling	- Joggers - Cyclists	- Distance tracking; - Speed measurement; - Duration measurement; - Measurement of calories burned; - Voice coaching; - Live tracking; - Sharing their successes with the global community; - Seamless integration with other fitness platforms	- Taking running and cycling performance to a new level - Opportunity to join various challenges to increase motivation for action

Fitbit	Improve health and well-being	People who want to take care of their health and well-being	- Pop-up notifications to encourage further effort; - Badges for achieving milestones; - Tracking progress on charts and graphs; - Leaderboard to compete with friends; - Personalized health information - Hydration measurement	- Monitoring activity, training, sleep, nutrition, and stress levels; - Weight management - the ability to connect wirelessly to the Aria Wi-Fi Smart Scale to track weight, BMI, lean mass, body fat percentage, and trends
MyFitness Pal	- Encouraging smarter food choices; - Motivation and support in achieving health goals	People who want to develop good habits and understand the principles of nutrition	- Diet tracking; - Meal planner; - Monitoring physical activity; - Progress charts; - Goal setting; - Food journal; - Monitor water and nutrient consumption; - Tracking posts; - Calorie counter; - Protein counter; - Personalized dashboard; - Joining communities in active forums	Support healthy eating and weight loss by monitoring diet and recording physical activity.
Zombies Run + Marvel Move	Going from zero running experience to being able to run an entire 5 km	Runners - beginners and advanced	- At each run, automatic collection of necessary supplies; - Building the post-apocalyptic community; - Immersive audio stories that turn workouts into epic adventures; - Running together with their favourite superheroes; - Training logs shared with episode banners	- The ideal combination of game design and physical activity tracking module; - A mix of uplifting audio drama and pulsating tracks from the playlist
Habitica	- Turning daily habits and to-do lists into a game; - Motivation to stick to healthy habits	People who want to increase their motivation to perform daily, boring activities	- Rewards for their efforts in the form of experience, food, eggs and potions; - Dynamic progress bars; - A pixelated avatar on the watch face; - A flexible module for tracking task habits; - Color-coded tasks and series counters; - A levelling system to visualise overall progress; - Customizable avatars; - Regular content releases and seasonal events; - Cooperation with friends;	- Automatic repetition of tasks scheduled as part of daily, weekly, or monthly routines; - Plenty of collectable equipment and animals to match the user's style

			- Reminders and widgets; - Customizable colour themes with dark and light modes	
SuperBetter: Mental Health	Improve mental health, resilience, and social-emotional skills.	- Youth; - Teens; - Young adults; - Secondary school teachers promoting social-emotional learning; - Small groups, teams, and clubs to support youth mental health and resilience; - Universities that ensure student success and well-being; - Small businesses	- Challenges; - Assuming a secret identity; - Tasks; - Activating reinforcements; - Contacting allies; - Tracking strengths in the game; - Building resilience of the whole person - mental, social, emotional and physical	- Using the same strengths that appear naturally in the game to face challenges in real life, develop skills, deal with stress, and practice self-care; - By implementing the 7 principles of active living, the user becomes more robust, happier, braver, and more resilient to everyday life
Mindbloom	- Encouraging users to practice mindfulness and adopt positive life habits; - Help with anxiety or depression	- People experiencing anxiety; - Depressed individuals; - Persons with mental disorders	- Development path: Users can choose their therapeutic goal and track their progress on an interactive map; - Points and badges that can be exchanged for rewards such as guided sessions, extra doses of ketamine, or access to additional resources; - Badges for achieving specific goals or levels; - Rankings and community; - Storyline and feedback: The user's story as a hero travels through fantastic worlds to discover his true power and heal his soul. The app also provides the user with quick and positive feedback to highlight their progress and encourage them to continue working on themselves	Building mental toughness on the progress
Happify / Happify: for Stress and Worry	Helping users get in touch with their thoughts and feelings using positive psychology skills and cognitive	People who want to improve their emotional well-being	- An advancement system that allows to unlock more levels; - Activity logs; - Awards	- Higher engagement with gamification elements associated with a higher likelihood of improved well-

	behavioural therapy			being in the short term; - Support in improving well-being by providing users with daily reminders and motivating messages
mySugr - Diary of a Diabetic	- Helping to control and manage diabetes; - Complement the daily routine of a diabetic (type 1, type 2, or gestational diabetes) with an app that makes life easier	People with diabetes	- Personalized panel; - Automatic data logging; - A bolus calculator that provides precise dosage recommendations; - Clear graphs of blood sugar levels; - Daily, weekly, and monthly reports that can be shared directly with the doctor; - Integrations with various devices and platforms, such as pedometers, activity, blood pressure, weight, and others	- Keeping diabetes data under control by using the Diary; - Greater involvement in the process of monitoring and managing their diabetes; - Support in managing diabetes through daily reminders and motivational messages
Sidekick Health	- Helping to manage chronic diseases by monitoring and controlling disease data daily; - Partnering with pharmaceutical companies and insurers to deliver gamified, digital care programs to help patients manage disease and treatment	Persons with chronic diseases wish to make daily life more manageable.	- Automatic data logging; - Integrations with various devices and platforms; - Coaching: an opportunity to talk with a health specialist, help set goals, and stay motivated to achieve them; - Mindfulness: information on adding mindful habits to daily life to reduce stress and symptoms of anxiety and depression; - Daily lessons and tasks on fatigue, mental health, sleep, nutrition and physical activity; - Educational content on sleep habits in the context of developing healthy sleep hygiene; - medication reminders	- Greater involvement in the process of monitoring and managing their chronic disease; - Support in managing chronic disease through daily reminders and motivational messages

Source: *Own compilation based on: (Bell, 2023; Fitbit – Aplikacje w Google Play, n.d.; Fitbit, 2024; Habitica, 2023; Habitica, n.d.; Happify – Aplikacje w Google Play, n.d.; Happify, 2023; Happify, n.d.; Lifesum Food Tracker and Planner, 2023; Lifesum, n.d.; Mindbloom, 2024; Mindbloom – Aplikacje w Google Play, n.d.; Mindbloom, n.d.; MyFitnessPal – Aplikacje w Google Play, n.d.; MyFitnessPal, 2024; mySugr - Dzienniczek diabetyka, 2024; mySugr - Dzienniczek diabetyka – Aplikacje w Google Play, n.d.; Rzuć Palenie! – Aplikacje w Google Play, n.d.; Rzucić palenie, 2023; Sidekick Health, 2024; Sidekick Health – Aplikacje w Google Play, n.d.; SuperBetter, 2023; SuperBetter, n.d.; ZRX, 2024; ZRX, n.d.; Kasraszwili, 2023; Rajani et al., 2023; Runtastic, n.d.; Switzer, 2023; Takahashi, 2011, 2011; Tredrea et al., 2017).*

Table 1 above provides a comprehensive overview of various mobile apps designed to improve health and well-being in various aspects of life. Each health app presented in Table 1 has its unique approach to gamification, as manifested by different gamification elements. In addition, the effectiveness of gamification may depend on the individual user's preferences and motivations. Hence, the performance of a given app may be more or less effective depending on the specific user.

Smoking cessation apps target adult smokers who want to quit, using progress tracking, a progression system with unlockable levels, and rewards to encourage smokers to quit. They also provide a diary to monitor progress and use motivational messages highlighting the benefits of quitting smoking.

Nutrition and food tracking apps target those looking to lose weight, build muscle mass, or develop healthier eating habits, offering features such as food diaries, diet tracking, and personalised eating plans. They also offer a personalised dashboard and macro tracking. The gamification here is less about gaining levels and more about giving users a clear picture of their eating habits and progress.

In contrast, runners, cyclists, and people, in general well-being, are dedicated to fitness and activity-tracking apps. They provide performance tracking, challenges, and integration with other fitness platforms and use pop-up notifications, badges for milestones, scoreboards, and graphs to visualise progress. These elements foster a sense of competition and personal achievement.

Mental health and resilience apps are also among the tabulation. These are designed for young people, teachers, and those experiencing anxiety or depression, using gamified tasks, challenges, and therapeutic journeys to build social-emotional skills and mental resilience. In addition, these apps include promotion systems, activity logs, rewards, and secret identities. These types of health apps aim to build resilience by integrating game-like challenges that mimic real-life strategies for coping with stress.

E-health solutions for chronic disease management are also not absent from the benchmarking study. This situation is served by mobile apps that help people with chronic diseases or diabetes by offering monitoring tools, coaching, educational content, and integration with medical devices to manage daily life and treatment. Gamification elements include personalised dashboards, automatic data logging, and flexible task habit modules. The gamification strategy focuses on visually tracking progress and providing a sense of control over the disease management process.

The final group of health apps specified are comprehensive lifestyle apps, including points and badges redeemable for rewards, customisable avatars, story progression, feedback mechanisms, and community rankings. They turn daily habits into a game, with dynamic progress bars and regular content updates to keep users engaged.

Apps of this type have the most distinctive gamification elements, keeping users engaged and motivated for the longest. Each app in Table 1 uses gamification elements ranging from simple progress tracking and rewards to more complex systems involving levels, challenges, storylines, and personalised feedback to increase user engagement and support in achieving health-related goals. Gamification elements by category can be seen most clearly in the following applications:

- Progress tracking and diaries: Rzuć palenie! / Rzucić palenie, MyFitnessPal, Fitbit, Runtastic, SuperBetter: Mental Health;
- promotion and levels: Rzuć palenie! / Rzucić palenie, Happify, Mindbloom;
- rewards and badges: Habitica, Fitbit, Mindbloom;
- personalisation and customisation: mySugr, Sidekick Health, Habitica;
- challenges and missions: SuperBetter: Mental Health, Zombies, Run + Marvel Move;
- community and social interaction: Runtastic, Fitbit, Mindbloom;
- feedback mechanisms: Fitbit, Habitica.

By integrating the above gamification elements, apps make tracking and managing health more engaging and potentially increase the likelihood that users will stick to their health goals in the long term.

In summary, benchmarked health apps provide practical benefits by helping users build and maintain healthy habits, offering support systems, and improving the overall quality of life through interactive and personalised experiences.

5. Discussion

The health mobile apps summarised in Table 1 use gamification, or the motivational potential of video games, to increase user engagement by promoting specific health behaviours. Selected mHealth apps analysed from the Apple App Store and Google Play Store include:

- applications to support users in following a healthy diet (Choi *et al.*, 2021; Coughlin *et al.*, 2015; de la Torre Díez *et al.*, 2017; Dute *et al.*, 2016; Gilliland *et al.*, 2015; Mhd Salim *et al.*, 2017; Tang *et al.*, 2015; Vasiloglou *et al.*, 2021; Wang *et al.*, 2016; West *et al.*, 2017);
- apps that motivate users to increase physical activity (Hamper, 2015; Hosseinpour and Terlutter, 2019; Knight *et al.*, 2015; Matthews *et al.*, 2016; Middelweerd *et al.*, 2014; Pradal-Cano *et al.*, 2020; Tong *et al.*, 2018; Wang *et al.*, 2016);
- applications to help appropriately manage chronic diseases (El-Rashidy *et al.*, 2021; Fernández *et al.*, 2023; Georga *et al.*, 2014; Ownby *et al.*, 2017; Pérez *et al.*, 2019; Stinson *et al.*, 2013; Whitehead and Seaton, 2016);

- applications to support mental health and well-being (Catuara-Solarz *et al.*, 2022; Cheng *et al.*, 2019; Eisenstadt *et al.*, 2021; Kaonga and Morgan, 2019; McKay *et al.*, 2019; Ponzo *et al.*, 2020; Rathbone and Prescott, 2017; Rickard *et al.*, 2016; Stawarz *et al.*, 2019).

An example of an app that supports users in following a healthy diet and motivates them to increase physical activity is Lifesum. It is a free app that allows people to monitor their food intake and daily physical activity, providing precise and customised nutritional information (Tredrea *et al.*, 2017).

The multi-faceted app combines smartphone functions, an activity tracker wristband, and brief tips. It effectively facilitates weight loss, improving body composition, physical activity, and caloric intake among overweight and obese individuals over 12 months (Lugones-Sanchez *et al.*, 2022). Such activity-monitoring smartphone apps can effectively encourage physical activity in adults, with gamification elements, including text messaging and personalisation features, proving more effective (Laranjo *et al.*, 2021).

Mobile apps with integrated meal planning and shopping lists can help promote healthy food delivery to families. However, they require user engagement and behavioural support functions to achieve optimal effectiveness (Mauch *et al.*, 2018). Mobile apps emphasising diet quality have been shown to significantly improve eating behaviours and reduce the risk of heart disease among those who are overweight or obese (Kwon *et al.*, 2020), as well as effectively improving nutrition-related outcomes such as obesity rates, blood pressure, and blood lipids *(Villinger et al.*, 2019). In addition, the use of smartphone food photo features in health apps was associated with increased weight loss, mediated by more extended use of the app (Neriah and Geliebter, 2019).

Most of the peer-reviewed diet-tracking apps show good usability and have the potential to promote self-efficacy. However, some differences exist in nutrient coding and behaviour change functions (Ferrara *et al.*, 2019). In summary, existing mobile apps can contribute to healthier food purchasing behaviour; however, to maximise their effectiveness, the quality of nutrition content and user experience must be improved (Flaherty *et al.*, 2018).

In mobile apps that motivate users to increase physical activity, gamification elements such as leaderboards that promote social comparisons are positively associated with increased physical activity (Maher et al., 2022), and combining multiple gamification elements in a single app is effective in increasing user retention rates (Olivas Martinez *et al.*, 2023).

According to (Spillers and Asimakopoulos, 2014), gamification elements in mobile fitness apps can improve user motivation and lead to short-term positive behaviour change, but feature richness negatively affects user adoption. In contrast,

participating in walking competitions through mobile apps can increase physical activity by 23% and improve user engagement (Shameli *et al.*, 2017). Other gamification elements that are important to users and can increase motivation for physical activity are feedback, activity suggestions, and monetary incentives (Meixner *et al.*, 2020).

Gamification has the potential to positively influence health and well-being, particularly in terms of health behaviours. However, its impact on cognitive outcomes is mixed or neutral, as (Johnson *et al.*, 2016) indicated. Using gamification-based interventions has proven effective in promoting healthy behaviours, including elements such as points, badges, and leaderboards, potentially enhancing participant engagement in interventions targeting health behaviour change (Uechi *et al.*, 2018).

Furthermore, gamification offers strategies for health promotion, prevention, and self-management of chronic conditions, thereby increasing patient engagement in health information technology, as (Marston *et al.*, 2016) demonstrated. In workplace health promotion programs, incorporating gamification elements enhances employee engagement. It improves health outcomes, including increased physical activity and the likelihood of achieving the daily step goal of 10,000, as supported by (Harrison *et al.*, 2019).

Gamification techniques, such as badges, leaderboards, and health-related challenges in mobile applications, can motivate individuals to adopt healthier behaviours (Iurchenko, 2017). The benefits of gamification in health promotion are manifold, including promoting intrinsic motivation through high-quality game design, increased accessibility through mobile technology, and the ability to address a wide range of health challenges, as elucidated by (Edwards *et al.*, 2016).

Furthermore, gamification can foster a more motivated and engaged workforce, potentially enhancing health promotion efforts, as (Dale, 2014) posited.

Additionally, gamification can play a role in encouraging self-efficacy and normalising sustainable nutritional behaviour, thus promoting healthy habits (Berger and Schrader, 2016). However, it is essential to note that while gamification in e-health may lead to short-term engagement through extrinsic rewards, there is a lack of valid empirical evidence supporting its effectiveness, and the realisation of its full potential requires the establishment of well-founded theories, as emphasised by (Sardi *et al.*, 2017b).

Finally, gamification in the context of exercise has yielded more excellent social benefits for women. However, it is worth noting that the enjoyment and usefulness of gamification decline with prolonged use, and its ease of use diminishes with age, as highlighted by (Koivisto and Hamari, 2014).

To summarise the information above, the application of gamification in the field of eHealth has the potential to captivate audiences, provide amusement, and yield motivational and cognitive advantages, thereby potentially contributing to the objectives of Health 2.0 (Sardi *et al.*, 2017b).

Using gamification in mobile health applications can enhance user engagement and cultivate specific health-related behaviours. Furthermore, a strong correlation exists between recognised archetypes and targeted health behaviours (Schmidt-Kraepelin *et al.*, 2020). In addition, gamification can serve as a driving force to encourage individuals to take charge of their health.

This situation can be achieved through challenging objectives, incentives for achievements, and exposure to social networks, which can positively influence outcomes (Yang and Li, 2021). Moreover, gamification can also play a pivotal role in motivating individuals within higher education institutions, thereby contributing to the goals of Health 2.0 by promoting healthy environments and lifestyles for students and educators (Navarro-Espinosa *et al.*, 2022). Furthermore, gamification can effectively engage staff members, inspire clients, and enhance learning in healthcare settings (Brull and Finlayson, 2016).

6. Limitations

The article contains several limitations. First, only selected health mobile apps were taken for comparative analysis, which may have omitted other valuable apps from the perspective of using gamification elements. Second, the tabulation and comparative analysis of the mobile apps in question focused on the most popular gamification elements, according to the literature review results, which may have narrowed the analysis in terms of the engagement and motivation of users of the apps in question. Third, only mobile health apps appearing simultaneously in the Apple App Store and Google Play Store were taken for benchmarking.

Health apps in other shops, such as the Amazon App Store, Galaxy Store, or Aurora Store, were not included. This situation may have limited the study with additional findings and suggestions.

7. Conclusions and Practical Implications

The purpose of the article, which was to understand and clarify the role of gamification in health promotion in the context of the Health 2.0 concept through a comparative analysis of selected health mobile apps, was achieved. To this end, three research questions were verified.

First, health mobile apps' most frequently used gamification elements are goals and mini-goals, player archetypes, interactive stories, rewards, badges and points, levels, rankings, feedback, personalisation, and social features. These can increase user

engagement, motivation, and satisfaction but face challenges and barriers related to usability, design, and privacy issues.

Secondly, regarding the second research question, the essential benefits of gamification in health promotion are stimulating and increasing patient engagement, improving health behaviour, and assisting in the self-management of chronic diseases.

In contrast, the most critical limitations of gamification in health promotion are the subjective value of reinforcement, lack of interest in health promotion on the part of users, and a mixed or neutral impact on cognitive outcomes. Finally, regarding the third research question, gamification can contribute to the goals of Health 2.0 in several ways. First, it increases user engagement and motivation to take health-promoting actions through gamification mechanisms used in mobile health apps.

Second, gamification can improve the efficiency of health processes by increasing the regularity and relevance of health-promoting activities. Third, gamification can promote healthy lifestyles by rewarding regular exercise or healthy eating habits. Finally, gamification can support the implementation of health policies by promoting health in all areas and caring for vulnerable groups.

In summary, Health 2.0 responds to the needs of today's health consumers by taking care of their health on their terms and at their own pace, using health mobile apps. Moreover, such activities increase engagement, motivation, and positive health behaviour in various contexts, such as physical activity, nutrition, mental health, and health care.

This comparative analysis contributes to a deeper understanding of gamification in mobile health, and the results could serve as a basis for future research that will expand the understanding of how gamification can positively influence health behaviour change. In addition, the analysis results could help practitioners design and develop highly motivating and effective mobile health apps.

Several practical implications have been developed based on a comparative analysis of selected health mobile apps and a literature review. First, the continuous improvement of the functionality and performance of health mobile apps opens up many opportunities to effectively promote healthy lifestyles, especially among children and adolescents who frequently use such apps. Second, the availability of digital health tools is not possible without marketing.

Hence, developing and disseminating various information channels and promotional campaigns for new mobile health e-solutions would be necessary. Third, to improve user experience, engagement, and self-management, it would be necessary to popularise the inclusion, in health mobile apps, of player archetypes, feedback,

design principles, and personalisation while focusing on therapeutic aspects and tailoring functionalities to the needs and expectations of stakeholders.

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