

# Framing the Development of a Gamified App for m-Health and Well-Being

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**Abstract:** This paper outlines the rationale behind the development of a gamified mobile-application for the promotion of mental health and wellbeing of health professionals. The application aims to provide constantly available support for healthy lifestyles and to promote behavioural change. Indeed, while the health literacy of professionals may be high, their implementation of healthy behaviours is hindered by several factors (work schedules, workload, etc.) and requires changes that are difficult to put into practice for people who have to reconcile complex life and work demands. For these reasons, boosting awareness and motivation is necessary to initiate and maintain health-promoting behaviours. Design of the gamification for the application was based on the literature regarding both gamification for mental health and behavioural change to identify the most appropriate game elements to implement. In particular, the design was built on existing intersections of gamification principles and digital health-behaviour-change science. Motivational aspects were factored in, since the aim was to promote the internalisation and integration of the regulation of health behaviours. Such a complex and intertwined system of references was geared to ensure the robustness of the result and give the application the capacity to support long-term changes. The application was designed with a customised approach based on an initial assessment that the user undergoes at his/her first access, so as to provide an initial scaffolding that dwindles after conclusion of a predefined set of activities. This supports familiarisation with the app and the acquisition of increasing autonomy by the user. In this way, goals are initially set by the application and then autonomously. Progress displays and feedback prompt self-monitoring of behavioural outcomes, to increase the user's sense of competence. A narrative metaphor was implemented to guide the user to progress in the app activities: in the guided paths the user follows the growth of a tree, from a seed in a greenhouse to flowering outdoors, in the open air the tree blossoms and bears fruit. The rewarding mechanics were aligned with the narrative so as to make them meaningful and informative.

**Keywords:** Gamification, m-Health applications, Behaviour change, Healthcare professionals, Self-determination theory, and gamified health interventions

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## 1. Introduction

Health professionals make up a population in need of meaningful interventions in mental health and well-being. In recent years, and especially after the pandemic, they have had to work in conditions that are harder than ever: a lack of personnel, the traumatic situations they constantly face, their workload and the frequent aggressions they suffer are all aggravating the mental and physical burden they bear (Søvdal et al., 2021). Despite their knowledge of the importance of healthy lifestyles, they often have difficulty in putting what they know into practice since they struggle to reconcile life and work demands (Holtzclaw Arlinghaus, and Johnston, 2020).

The WE CARE project (Erasmus plus) aimed at supporting health care professionals in adopting a healthier lifestyle, and to this end identified a mobile application as the optimal solution to create a kind of “companion” continuously available and flexible enough to adapt to the needs of these people. Indeed, the increasing availability of smart technology devices (smartphones, smartwatches, etc.) has facilitated seamless healthcare interventions; a broad range of applications to monitor and manage one's own health and well-being have been developed (Martínez-Pérez et al., 2013; Middelweerd et al., 2014). Web-based applications are widely recognised as a cost-effective means to deliver proven and effective interventions (that were traditionally face-to-face) and to improve mental health and well-being outcomes. That said, dropout and nonadherence are,

unfortunately, often high and vary widely (they range between 35% and 99%) (Brown et al., 2016). Approaches that seem to be able to help improve adherence to interventions foresee the development of applications such as games or the integration of gamification into them (Wattanasoontorn et al., 2013; Kharrazi et al., 2012). Nevertheless, developing an attractive game is a cost- and time-intensive process that cannot easily be afforded. Gamification is a way to overcome the above-mentioned problems, since game elements able to trigger user motivation can be applied to different kinds of applications that can be used in everyday life. For this reason, we decided to implement gamification in the WE CARE application.

According to Cheng (2020) gamification has been increasingly used in digital health services, especially in the field of physical health, while it seems less adopted for mental health and well-being. A review of stress management apps in the Google Play Store (Hoffman, Christmann and Bleser, 2017) found low levels of gamification, with only 32% of the sampled apps employing gamification. Some literature reviews in the field have explored the effectiveness of gamification in e-health services; the results of the studies are often inconsistent (Aschentrup et al., 2024; Johnson et al., 2016) or do not show any effect (Six et al., 2021). This may be due to different reasons, including a missing analysis of the game elements at play.

Several studies and reviews of e-health applications have sought to identify the most prevalent game design elements used in this context. However, the majority of these papers do not differentiate between distinct domains—such as physical health, chronic illness management, mental health and general well-being—nor do they consistently distinguish between mobile and desktop platforms. An additional limitation concerns the use of the term *gamification*, which is, at times, extended to include fully developed games; consequently, some reviews incorporate actual games within their scope. Moreover, the absence of a universally accepted definition and categorisation of game design elements has led individual studies to adopt, and in some cases formulate, divergent terminologies, classifications or taxonomies. These inconsistencies substantially constrain the comparability of the findings, although they do allow for the emergence of some general insights. It is also worth noting that, as highlighted by several researchers, many of the applications analysed appear to have been developed without reference to established theoretical frameworks related to motivation or behavioural-change strategies. The predominant approach in many of the gamified health and well-being apps reviewed tends to emphasise positive reinforcement mechanisms, primarily through the use of rewards (Hoffman et al., 2017; Johnson et al., 2016). In line with the above-mentioned results, Sardi, Idri and Fernández-Alemán (2017) report that most of the e-health applications and serious games analysed have been shown to support short-term engagement through extrinsic rewards. For this reason, the authors advocate theory-based e-health solutions that exploit the central experience and psychological effects of game mechanics.

The work reported in this paper aimed to overcome these limitations, by framing the development of an e-health application, dedicated to health professionals, in solid theoretical foundations. In the following sections we firstly discuss the theoretical foundations to which we referred to select the game elements to integrate. Then, we present the design of the WE CARE application and its development, highlighting the link between the decisions taken in terms of game elements to integrate and the theoretical references.

## 2. Theoretical Foundations: Motivation and Behavioural Change

As said in the introduction, the idea of gamifying an application rose from the consideration that, although web-based interventions for m-health and well-being are recognised as powerful tools, users' adherence to the proposed applications is often low. The rationale behind gamification is to exploit the universally recognised motivational power of games in real world situations; in this sense we wanted to boost health professionals' motivation to make them adhere to the proposed health-oriented activities. Moreover, we also aimed to increase their awareness of the importance of assuming specific mindsets and behaviours to increase their physical and mental well-being. To achieve these objectives, we had to identify theoretical frameworks to guide us in identifying the game elements to be implemented in the application. In the following subsections, we present them to pave the way for the description of the design process.

### 2.1 Motivation

The motivational theory we referred to is the most used in the field of gamification studies, the Self Determination Theory (SDT; Deci and Ryan, 1985). Ryan and Deci (2000) highlight that motivation is not a unitary phenomenon but differs not just in the amount in which it is present (being more or less motivated) but also in the *orientation* of motivation (the type of motivation). For example, a person may want to do something because they think that it is interesting or to have something in return (an acknowledgement or a reward). The authors distinguish between '*intrinsic motivation, which refers to doing something because it is inherently interesting or*

*enjoyable, and extrinsic motivation, which refers to doing something because it leads to a separable outcome'* (Ryan and Deci, 2000a, p. 54).

Extrinsic motivation is often viewed as potentially being able to undermine intrinsic motivation; however, Ryan and Deci (2000a) argue that it is not inherently an impoverished form. It becomes relevant in activities that lack inherent enjoyment, driving individuals to value and self-regulate such behaviours. This issue is dealt with in SDT in terms of fostering the internalisation and integration of values and behavioural regulations (Deci and Ryan, 1985). Within SDT, Organismic Integration Theory (OIT) differentiates types of extrinsic motivation along a continuum of autonomy, from external to integrated regulation (Ryan and Deci, 2000a). These forms are dynamic; for instance, an individual may initially engage in an activity due to external regulation (e.g. receiving a reward), if the reward is not perceived as overly controlling, the individual may come to appreciate the activity's inherent interest, thereby facilitating a shift toward integrated regulation. Conversely, the imposition of external control may diminish the perceived personal value of an activity, potentially leading to a regression toward a less autonomous form of motivation. As a consequence, Deci, Koestner and Ryan (2001) conclude that it is essential to foster an understanding of the importance of what is being done and, therefore, the internalisation of its regulation so that people are motivated to perform a specific action or behave in a certain way. This conclusion offered theoretical support to our goal of raising awareness in health professionals through gamification.

Another mini theory within SDT is the Basic Psychological Needs Theory (BPNT). Ryan and Deci (2000b) identify three specific psychological aspects (needs) that facilitate internalisation of regulation:

- Relatedness: sense of belongingness and connectedness to the persons or to a group
- Competence: sense of accomplishment or mastery
- Autonomy: sense of control

Based on this theory Przybylski, Rigby, and Ryan, 2010 proposed a model, the 'player experience of need satisfaction'(PENS) model, suggesting that both the attractiveness and well-being effect of video games are based on their potential to satisfy basic psychological needs for competence, autonomy and relatedness. These theoretical principles provided us with lenses to 'read' and analyse the effects of different mechanics on motivation that will be discussed in the section dedicated to design of the WE CARE application.

## 2.2 Gamification for Behavioural Change

The use of gamification to support behavioural change has been addressed by several researchers (Bassanelli et al., 2020). To design the gamification of the WE CARE application we referred mainly to the work of two different authors. The first was Nicholson, who approached the issue in the light of SDT. In his chapter 'A Recipe for Meaningful Gamification' (2015) the author highlighted the general tendency to rely on a reward-based gamification to drive subjects to engage in real world settings and perform specific actions that are, indeed, rewarded. Nicholson emphasises the limits of this kind of gamification that clearly supports extrinsic motivation and that may be suitable for a short-term change or to get a user initially engaged. The problem resides in the fact that, usually, when a reward is no longer given the desired behaviour may stop contextually. To overcome these limits, Nicholson studied how to make gamification 'meaningful' (2012). The term "meaningful" was taken from Mezirow (1991) and his model of *transformative learning*, that links a change in beliefs and behaviours with a connection of an experience to previously held beliefs. From this perspective, what is meaningful is not universally fixed but varies from person to person.

Considering these premises, to design a meaningful gamification system it is necessary to include a variety of experiences and ways of engaging to reach the goal that different participants will find meaningful. In 2015, Nicholson operationalised the conclusions reached in 2012 and identified six elements from the game design field for meaningful gamification: [1] 'Play' – allow users to explore and fail within boundaries, [2] 'Exposition' – create stories for participants integrated in real world-settings and allow them to create their own, [3] 'Choice' – empower users by giving them control over their experiences, [4] Information – use game-like design elements to help users understand real-world issues, [5] Engagement – foster collaboration and shared learning among participants, [6] 'Reflection' – encourage users to connect new experiences with their personal interests and past knowledge for deeper learning. Despite these premises, Nicholson (2015) is not completely negative about reward-base gamification: it can be used both to reach a short-term change but also for a long-term change; in the latter case the design of the gamification should be very attentive, and rewards must be used parsimoniously.

Given the specific focus of the WE CARE application, we also relied on the findings of Cugelman (2013) who deepens the existence of links between gamification principles and digital health behaviour-change science. The author started from the consideration that from the point of view of evidence-based behavioural medicine, gamification could be considered useful only if it is possible to identify links with principles and strategies that are proven to influence health outcomes. The author compared 7 persuasive strategies of gamification identified from the literature ([1] Goal setting, [2] Capacity to overcome challenges, [3] Provide feedback on performance, [4] Reinforcement, [5] Compare progress, [6] Social connectivity, [7] Fun and playfulness) to behavioural-change techniques that have been proven to work in digital health behaviour-change interventions (Cugelman, Thelwall and Dawes, 2011). As for the capacity to overcome challenges, for example, Cugelman found a match with two behavioural-change techniques: ‘time management’ and ‘action planning’; another interesting match was found between two gamification strategies (Feedback on performance and progress comparison) and three behavioural-change techniques: ‘prompt self-monitoring of behavioural outcome’, ‘prompt self-monitoring of behaviour’ and ‘provide normative information about others’ behaviour’. The only gamification strategy for which the author did not find any correspondence was ‘Fun and playfulness’. The parallelism identified is not considered conclusive by the author to endorse the effectiveness of gamification in digitally mediated interventions, but it undoubtedly offers an overview of what gamification elements need to be implemented to align with behavioural-change strategies.

### 3. Gamification Design and Implementation in the WE CARE Application

#### 3.1 Gamification Design

The gamification of the WE CARE application was designed in such a way that it will be consistent with the findings of SDT for motivation (Deci and Ryan, 1985) and Cugelman’s studies (2011, 2013). Moreover, Nicholson’s (2015) indications about meaningful gamification were brought into the equation. The game elements to be integrated in the application were selected referring to a taxonomy proposed by Hervas et al. (2017). Starting from a review of the literature, the authors developed a classification of the most common gamification mechanics and put them in relation with psychological fundamentals on behavioural change. The taxonomy includes 7 categories of gamification mechanics with subcategories:

1. Goals (e.g. achievement, challenges, levels)
2. Status (e.g. ranking, leaderboard, social sharing)
3. Randomness (e.g. luck, surprise)
4. Appointment (e.g. countdown, schedule)
5. Scoring (e.g. points, bonus)
6. Immersion (e.g. role, narrative)

To the game elements listed in this taxonomy we added elements from other taxonomies, in particular:

- Feedback and progress from the categories proposed by Hamari, Koivisto and Sarsa (2014)
- Personalisation and customisation (Cheng, 2019)

We mapped these elements against the three basic psychological needs (Deci and Ryan, 2000b) and behavioural-change techniques (Abraham and Michie; 2008, Cugelman et al., 2011) and selected a subset of the elements. As shown in Table 1, to address the need for competence, various elements were identified including levels, points, badges, challenges, feedback and a display of progress. Autonomy was to be supported by enabling customisation of the user experience and allowing individuals to set their own challenges and corresponding goals. As for need for relatedness we decided to use narrative; although desirable, social sharing mechanisms were not considered due to privacy constraints. Among the behavioural-change techniques, we addressed self-monitoring, but we also wanted to support goal setting and action planning through challenges, and to provide users with graded tasks through levels. Rewards for successful behaviour were included.

**Table 1: Game elements in relation to the BPNT and behavioural-change techniques**

Game element	BPNT	Behavioural change
Personalisation and customisation	Autonomy	
Levels	Competence	Setting graded tasks
Points/badges	Competence	Provide rewards contingent on successful behaviour

Game element	BPNT	Behavioural change
Challenges (Goals)	Competence/Autonomy if self-set	Goal setting Action planning
Narrative	Relatedness	
Feedback	Competence	Prompt self-monitoring of behavioural outcome
Progress display	Competence	Prompt self-monitoring of behavioural outcome

As for Nicholson’s six elements (2015), we included ‘Choice’ since we decided to implement levels and also the opportunity to skip them and freely explore the contents, and ‘Exposition’ and ‘Information’ by integrating a narrative.

### 3.2 Implementation of Gamification

The description of the process of development of the application as a whole is beyond the scope of this paper, but some key points are reported here to explain the integration of gamification elements.

Several theoretical references in the field of psychology guided the development of the application, among which the transtheoretical model (TTM) and its stages of change (Prochaska and DiClemente, 1983). To identify the contents to address in the application, users’ requirements were collected through a preliminary questionnaire developed on purpose, that was administered to a sample 161 health professionals from different countries. The questionnaire, divided in seven parts, had the aim of profiling the target group (parts 1-5) and investigating the interest in an app supporting mental health and well-being (parts 6-7). In particular, part 6 investigated needs of the target group for the app and part 7 the intention of use.

To tackle the topics that emerged from part 6, physical and mental exercises - derived from existing approaches such as mindfulness, self-compassion, etc. - and information, were included in the app.

**Personalisation and customisation** were the general principles guiding the development of the application. Cheng et al (2019) assimilate them with the term tailoring (commonly used in health behaviour-change literature), and state that this offers users increased levels of autonomy, which, according to the OIT, would contribute to increased likelihood of internalised motivation.

To personalise the experience with the application, we set an initial assessment through a questionnaire, which orients the first approach. The questionnaire includes two parts. Part A covers stress and well-being and includes a couple of questions on current stress level and the WHO-5 well-being index (WHO, 1998), part B includes questions on familiarity with m-health applications and intention to adopt healthy behaviours. The preliminary research led us to the creation of a matrix that took into account TTM stages (Prochaska and DiClemente, 1983) and stress levels: the matrix included 4 conditions, and the exercises presented within the app were allocated to the different conditions. Thus, the questionnaire results are used to place the user in one of the four conditions and to recommend a set of exercises/pieces of information that would fit best to their needs; indeed, the user is advised to follow a 14- or 7-day path - including two exercises per day - or has the option to freely use the application. This structure can be equated to **levels**, each offering varying degrees of scaffolding to accommodate users with differing levels of motivation and stress. Individuals who are less motivated and experience higher stress are provided with more extensive and prolonged guidance, whereas those who are more motivated/less stressed receive comparatively less support. Upon completion of the guided pathways, users attain the autonomy to explore all the exercises and information (open mode). Alternatively, users may opt out of the recommended pathways and directly access the open mode. As for **goals**, in the two paths these are set by the application (e.g. the user needs to complete a couple of pre-defined activities per day) while the user becomes free to self-set them in open mode. In this sense the availability of daily (optional) assessments allows one to compare the activities selected by the user with the actual needs and set personal challenges.

A **narrative** related to the theme of life and growth was implemented to enrich the experience and to increase user awareness of the effects of changes in their life habits. In the two guided paths the user is presented with the growth of a seed that becomes a tree, inside a greenhouse. This narrative is intended to communicate that that part of the pathway is somehow “protected” with a high level of support. Each day carries a motivational quote (see Figure 1 - left side). In open mode, the tree is planted in the ground and continues to grow, flourish and bear fruit (Figure 1 – right side).

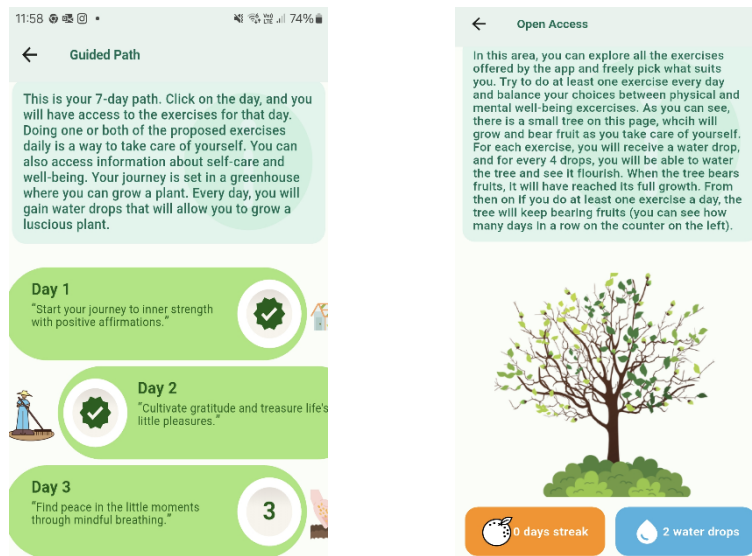


Figure 1: Guided path (left) and Open mode (right)

Achievements during and at the end of the levels are recognised with **points** and **badges**. To avoid the risk highlighted by Nicholson (2015) we integrated them with the narrative so as to strengthen their informative function: for exercise completion users receive water drops that can be used to water the plant and make it grow. In open mode, the tree is watered by the same mechanism, and when fruit appears on the tree there is a counter on the mid-left part of the screen showing consecutive days of use (see Figure 1). In the badge area the user can see his/her achievements related to pre-defined challenges (e.g. the completion of the recommended guided path). **Feedback** is implicitly given through the metaphor of the tree, the growth of which shows adherence to the path and continuity of use in open mode. Progress is displayed through progress bars in the badge area, in relation to the achievement of predefined challenges; in addition, progress is represented through the metaphor of the tree growing in different areas of the application.

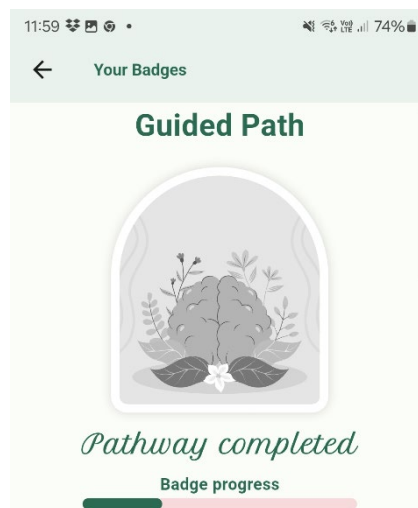


Figure 2: Badge area

#### 4. Conclusions

The WE CARE application was built resting on solid theoretical foundations. Having looked at gamification as a strategy to increase users' engagement and motivation, it was clear that the discourse on motivation could not be overlooked. Moreover, we followed the indications provided by Hoffmann and colleagues (2017), who emphasise that for behaviour-change programmes, including those delivered through applications, to be effective and lead to lasting results, they must be grounded in evidence-based principles from behaviour-change theories. For these reasons we took both the theoretical fields as references to identify the game elements to implement in the application.

In the process of designing and developing the application we stuck to the guidelines of Cheng (2020). The suitability of gamification for our target audience was investigated preliminarily with the users by collecting users' requirements. Gamification was implemented at a systemic level in the application, namely game elements interact with the other components of the technology to create a coherent system. Finally, the entire process (the design, development and evaluation) was documented comprehensively. Unfortunately, our conclusions are limited by the absence of meaningful feedback from consistent and diverse user groups. Despite the limits, our experience prompted us to identify additional recommendations for those wishing to design gamification of m-health applications, which, while not groundbreaking, seem important considering the limitations highlighted in the literature:

- Identify the game elements to be integrated in the application from existing taxonomies, which will help to consider a wide range of elements that can be included.
- Ground the gamification of the app on solid theoretical foundations, identify and implement game elements coherent with the reference theories.
- Consider providing a narrative context, which is recognised as increasing user engagement and experience and which can be used to increase awareness and reflection.

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