# Gamification Frameworks and Models for Health Contexts: An integrative review

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## Abstract

***Objective:*** *identify in the literature the state of the art of gamification frameworks and models developed for health contexts.* ***Methods:*** *an integrative literature review of articles indexed in the LILACS, SciELO, PubMed, CINAHL, Scopus and Web of Science databases, in english and published between January 2010 and July 2020.* ***Results:*** *among the 10 studies included in the analysis, nine were published in journals and one in conference proceedings. As well as 100% of the analyzed studies were published between the years 2015 and 2020. Thus, among the articles are studies related to three health contexts, where six*

*frameworks and two models were identified.* ***Conclusions:*** *it is noteworthy that the main gap related to the development of gamification frameworks and models for health contexts is the validation process. As well as, the trend and the possibility of observing the use of participatory approaches in models and frameworks of gamification for some health contexts was evidenced.*

**Keywords:** Gamification; Health; Frameworks; Models.

## 1. Introduction

The growing success that permeates the games industry and its ecosystem has significantly attracted the attention of other areas of study that are gradually adopting the implementation of game mechanics in activities that originally do not belong to this scope (SOUZA et al., 2018). However, applying gamification concepts and principles to projects is a challenging task (SCHOECH et al., 2013). Gamification requires a specific and formal design process, mainly due to the need to involve different contexts, unlike games, which have entertainment as their main objective (MORA et al., 2017).

Some spheres have been slower to adopt gamification strategies and techniques for reasons such as lack of available knowledge and difficulty in developing evidence on the effectiveness of gamification strategies (SCHOECH et al., 2013). For this reason, the need for frameworks and models to guide and streamline the processes of gamification implementation and design contexts is evidenced (MORA et al., 2017).

In their review of previous empirical studies on gamification in the educational context, Huang and Hew (2018) indicated several gaps pointed out by different authors about gamification models, for example, insufficient description of the context and implementation process, inadequate exploration of theoretical foundations, gamification design structures not tested and without any theoretical foundation, and insufficient evidence for gamification effectiveness due to methodological limitations of study designs.

Due to the significant increase in the number of gamification projects developed for health contexts (PEREIRA et al., 2014), it is necessary to review the state of the art of frameworks and models that can help the implementation of gamification projects for health contexts. In this work, we conducted an integrative literature search to investigate the gamification frameworks and models used for the implementation of gamification projects in health contexts. The following are the guiding questions for the development of this review:

- **Q1 – What is the state of the art of gamification frameworks and models applied to health contexts?**
- **Q2 – Which areas of health have made the greatest progress in relation to the application of gamification frameworks and models?**
- **Q3 – What are the main gaps evidenced in gamification frameworks and models applied to health contexts?**

## 2. Background

Gamification consists of using mechanics and strategies present in games in environments unrelated to games, emerging as an alternative for problem solving, increased motivation and acquisition of engagement (BUSARELLO, 2016; VIANNA et al., 2013). Gamification also focuses on capturing "building blocks" of games and applying them in real-world situations in order to motivate some specific behaviors of the individual (SAILER et al.2017). Its viability of application in several areas is evidenced, mainly in the adoption of new behaviors, in the habit with new technologies and the transformation of tedious activities in pleasant ones (MENEZES, 2018).

In the health sphere, the studies carried out on gamification are relatively recent (FERREIRA, 2019). The use of gamification strategies is becoming frequent in health-related contexts, with efforts focused on people's well-being and health, for example, physical activity, diet and weight loss, personal hygiene, hand hygiene for healthcare workers, medication and medical treatment (PEREIRA et al., 2014).

There is no knowledge about the existence of studies that present an overview on the development of gamification frameworks and models for health contexts. In order to contribute to filling this gap, the next topics of this review describe the methodology, results, discussions and conclusions acquired through this investigation. It is noteworthy that this type of research is important to advance the development of gamification in the sphere addressed.

## 3. Methods

To answer the questions elucidated in this work, an integrative literature review was carried out, a review approach that is characterized by redeem and summarizing publications in a broader way, admitting experimental and non-experimental studies, and the combination of theoretical and empirical literature, in order to synthesize knowledge, which may have different purposes (ROMAN, 1998; SOUZA, 2010).

This review was held between August and September 2020 and involved the following steps: Identification, Selection, Eligibility and Inclusion. The identification step occurred after defining the research questions that helped define the scope of this review, guiding the choice of databases used in this article. Thus, six databases were chosen to carry out this review. In the diagram shown in Figure 1, we can observe all the processes carried out in this study in a structured way.

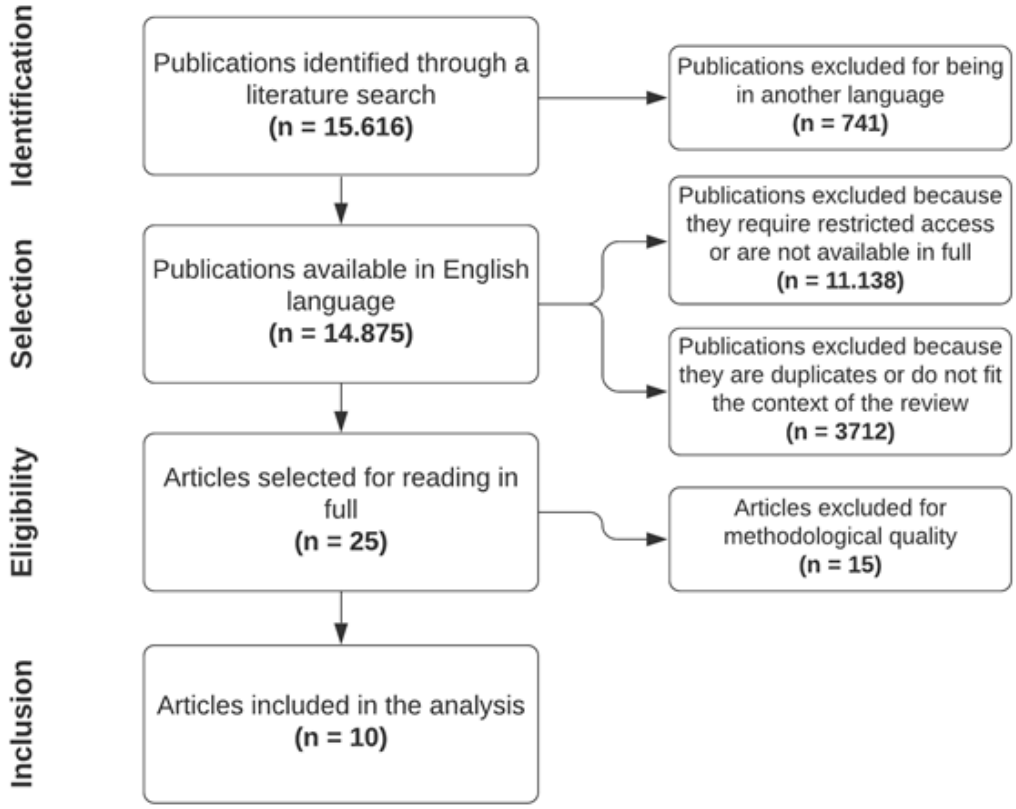



Figure 1. Diagram of the steps performed.

After identifying the topic and research questions, in the months of August and September 2020, searches were carried out in the SciELO, LILACS, PubMed, CINAHL, Scopus and Web of Science databases. The descriptors used in the research were "gamification" (descriptor 1), "gamification" AND "health" (descriptor 2) and "gamification" AND "health" AND "framework" (descriptor 3). Table 1 shows the primary results of the consultation of publications indexed in the selected databases.

Table 1. Query results.

| Database | (D1) | (D2) | (D3) |
|---|---|---|---|
| ***LILACS*** | 15 | 4 (-73,33%) | 0 (-100%) |
| ***SciELO*** | 72 | 7 (-90,28%) | 0 (-100%) |
| ***PubMed*** | 620 | 424 (-31,61%) | 30 (-92,92%) |
| ***CINAHL*** | 326 | 38 (-88,34%) | 158 (+315,79%) |
| ***Scopus*** | 7022 | 884 (-87,41%) | 105 (-88,12%) |
| ***Web of Science*** | 5220 | 619 (-88,14%) | 72 (-88,37%) |

"Gamification" **(D1)**

"Gamification" AND "Health" **(D2)**

"Gamification" AND "Health" AND "Frameworks" **(D3)**

After the primary search, the identification step was performed, in which only publications found in the English language were selected. Altogether 14,875 publications were selected and 741 were discarded in this stage. After the selection of publications found in the English language, the first part of the selection step was based on publications with unrestricted access for viewing. Altogether 3,737 publications were selected and 11,138 were discarded for requiring restricted access for viewing or were not available in full.

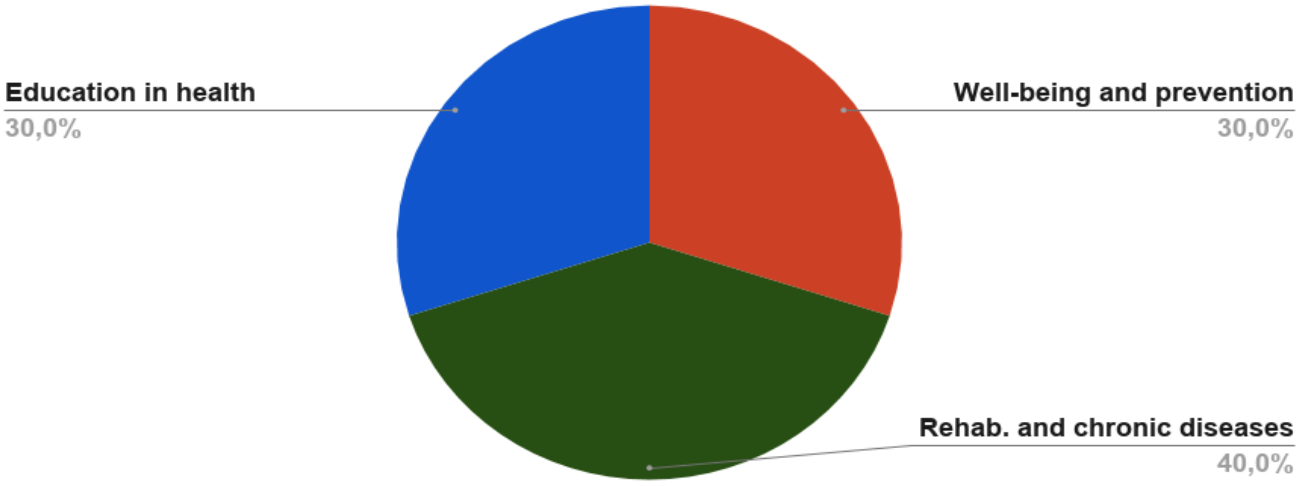
In the second part of the selection step, all duplicated publications were excluded and after reading the title, abstract or conclusion of the publications, all studies that did not fit the context addressed in the review were also excluded. After the completion of the second part of the selection stage, 3,712 publications were excluded and 25 articles were chosen to be read in full.

In the eligibility stage, 25 articles were read in full, so that all articles that did not have a well-defined methodology were discarded. At the end of this stage, 10 articles were selected for analysis and 15 were discarded. In the inclusion stage, the 10 articles included in the study were analyzed taking into account the following criteria: context, theoretical foundation, structural description and validation.

## 4. Results

Altogether 10 publications were elected for analysis, all selected publications were in article format. Among the articles chosen for this stage are experimental and quasi-experimental studies. The articles were grouped according to their thematic areas, totaling three thematic groups: "Health education", "Rehabilitation and chronic diseases" and "Well-being and prevention". Chart 1 shows the percentage of articles distributed in thematic groups.

Chart 1. Proportion of articles in thematic groups.




Among the ten articles analyzed, nine (90%) were published in journals and one (10%) in conference proceedings. Regarding the impact factor, a bibliometric method to assess the importance of scientific journals in their respective areas, it is noted that one journal did not provide its impact factor. Thus, 75% of journals have an impact factor greater than 1 and 50% of journals have an impact factor greater than 3.

Frame 1 shows information on the publication of articles and their respective relevance indicators.

Frame 1. Information about the analyzed articles.

| Thematic area | nº | Year | Journal / Conference proceedings | Impact Factor |
|---|---|---|---|---|
| Education in health | 1 | 2019 | Annals of Global Health | 2.037 |
| | 2 | 2020 | JMIR Serious Games | 3.53 |
| | 3 | 2019 | Studies in Health Technology and Informatics | 0.44 |
| Rehabilitation and chronic diseases | 4 | 2019 | Studies in Health Technology and Informatics | 0.44 |
| | 5 | 2015 | Procedia Computer Science | 1.26 |
| | 6 | 2017 | JMIR Serious Games | 3.53 |
| | 7 | 2019 | Journal of Personalized Medicine | 4.433 |
| Well-being and prevention | 8 | 2018 | AMIA Annual Symposium Proceedings | 0.73 |
| | 9 | 2015 | JMIR mHealth uHealth | 4.31 |
| | 10 | 2019 | JMIR Formative Research | NS |
| *Not Scored (NS) | | | | |

The period of publication of the analyzed articles stands out, so that 100% of the articles were published between the years 2015 and 2020, evidencing the increased interest in the development of frameworks and models for gamified projects in health contexts in the last five years. Frame 2 shows the works selected for the analysis phase and some substantial information about the publications.

Frame 2. Analyzed publications.

| Thematic area | nº | Authors and year | Article title | Framework / Model |
|---|---|---|---|---|
| Education in health | 1 | (HARUNA et al., 2019) | Initial Validation of the MAKE Framework: A Comprehensive Instrument for Evaluating the Efficacy of Game-Based Learning and Gamification in Adolescent Sexual Health Literacy | MAKE |
| | 2 | (SUPPAN et al., 2020) | Teaching Adequate Prehospital Use of Personal Protective Equipment During the COVID-19 Pandemic: Development of a Gamified e-Learning Module | SERES |

| | | | | |
|---|---|---|---|---|
| | 3 | (NYAMEINO et al., 2019) | A Model Driven Approach to the Design of a Gamified e-Learning System for Clinical Guidelines | MDE |
| **Rehabilitation and chronic diseases** | 4 | (STEINER; WOLF, 2019) | A Vision Utilizing Gamification to Enhance Patients' with Chronic Shoulder Diseases Adherence to Rehabilitation | Wasn't named by the author |
| | 5 | (ALMARSHEDI et al., 2015) | The wheel of sukr: A framework for gamifying diabetes self-management in Saudi Arabia | The Wheel Of Sukr |
| | 6 | (ALMARSHEDI et al., 2017) | Guidelines for the Gamification of Self-Management of Chronic Illnesses: Multimethod Study | The Wheel Of Sukr |
| | 7 | (SIERING et al., 2019) | A Theoretical Framework and Conceptual Design for Engaging Children in Therapy at Home—The Design of a Wearable Breathing Trainer | Design for Child Engagement (DCE) |
| **Well-being and prevention** | 8 | (EHRLER et al., 2018) | SMART-MEDS: Development of a Medication Adherence App for Acute Coronary Syndrome Patients based on a Gamified Behaviour Change Model | HAPA |
| | 9 | (CURTIS et al., 2015) | Targeting Parents for Childhood Weight Management: Development of a Theory-Driven and User-Centered Healthy Eating App | Behavior Change Wheel (BCW) |
| | 10 | (HENDRIE et al., 2019) | The Development of VegEze: Smartphone App to Increase Vegetable Consumption in Australian Adults | IDEAS + Behavior Change Wheel (BCW) |

In the synthesis of the results of this review, 6 frameworks and 2 models were identified among the 10 analyzed articles, with a total of 2 frameworks that were addressed in more than one article. In the next topic, the analyzes of frameworks and models are arranged individually, with a discussion about the dimensions and impacts in the contexts of each group

## 5. Discussion

Through the results presented, it was possible to understand the characteristics and trends addressed by the frameworks allocated in the thematic groups. The discussion proposed in this review is based on the observation of each framework and model in its respective group, in order to understand and compare the approaches more precisely. Frame 3 shows the analysis of the frameworks and models present in the articles of the group "Education in Health".

Frame 3. Analysis of the thematic group "Education in health".

| Thematic area | nº | Analysis |
|---|---|---|
| Education in health | 1 | The article presents the modular framework "MAKE", created from a combination of elements from other studies, MAKE aims to evaluate teaching and learning from the perspective of knowledge acquisition. The study sought to evaluate and validate the construction of the framework by exploring games-based learning and digital gamification health interventions to improve sexual health education among adolescent students in Tanzania. The framework stands out for using the participatory design approach in its development process, which also included the participation of students and a multidisciplinary team of professionals. Unlike numerous studies that evaluated sexual health education using the constructs of MAKE independently, this study integrates the constructs and verifies their validity and reliability. The context of the framework's implementation and validation process was well structured. |
| | 2 | This article presents the "SERES" framework, a framework originally conceived for the development of serious games. In order to develop a gamified e-learning module to interactively deliver concepts and information on the correct choice and handling of PPE, the authors demonstrated that the SERES framework can also be used to create gamification projects. This study does not describe the structure of the framework in detail, since this framework was not developed by the authors of this article. Despite the good theoretical foundation, the use of the framework in the context of the study presents a fragile validation process, without significant evidence of the success of this approach. |
| | 3 | This article presents the Model Driven Engineering (MDE), this model is a system development paradigm that promotes the use of models as the primary artefacts that drives the whole development process. The study describes the development of a gamified e-learning system for clinical guidelines, with the combination of an entity model for the clinical domain, a workflow model for clinical processes and a game model for managing training sessions. In this context, gamification was used to increase user motivation and involvement in training the content of the guidelines. The article does not describe in detail how gamification was implemented in the model and also does not present information about the validation of this gamification approach. The theoretical basis of this gamification approach has also not been described adequately and sufficiently for a better understanding. |

The frameworks and models of this group in general have a modular structure, highlighting the use of participatory design, an approach that presents itself as a trend for the segment of development of frameworks for health education, since this group of works stood out for collaborative practices.

Although all three studies are promising, there was a lack of theoretical foundation for two of the articles, as well as the absence of any validation in the use of the MDE and a fragile process of validation of the SERES framework. Through the analysis carried out it is concluded that the study that presented the MAKE framework describes and covers a greater number of requirements necessary for the reapplication of the framework. Frame 4 shows the analysis of the frameworks and models present in the articles of the

group “Rehabilitation and chronic diseases”.

Frame 4. Analysis of the thematic group "Rehabilitation and chronic diseases".

| Thematic area | nº | Analysis |
|---|---|---|
| Rehabilitation and chronic diseases | 4 | The article presents a proposed methodology for the development of a conceptual framework. In order to increase the patient's motivation and empowerment through game design elements in the rehabilitation process of patients with musculoskeletal diseases (DME) of the shoulder, the proposed framework has six sequential steps and describes in detail its structure, however does not clearly present the theoretical basis of gamification. As it is a proposal, the article does not present a validation experiment. |
| | 5 | This article proposes the conceptual framework “The Wheel Of Sukr”, a framework developed in order to assist in the self-management of diabetes for young adults in Saudi Arabia. The Wheel Of Sukr is a framework guided by “theories of motivation”, mainly the theory of behavior reinforcement, as well as it aims at intrinsic and extrinsic motivation. The article presents a coherent and robust theoretical foundation, as well as a detailed structure, although it does not present a validation because it is a proposal. In practice, it is a promising framework that aims to provide a guideline for designing a gamified diabetes self-management system. |
| | 6 | Like the previous one, this article presents the framework “The Wheel Of Sukr”, which this time broadened its range of action and presented guidelines for the development of gamified self-management applications and systems for chronic diseases, instead of its initial idea, directed only at diabetes. Despite not carrying out a practical experiment with patients with chronic diseases, the article presented a validation based on the evaluation of game experts and developers. As previously stated, The Wheel Of Sukr is a promising framework with a good theoretical foundation but needs more extensive validation to prove its effectiveness. |
| | 7 | This article presents the conceptual framework “Design for Child Engagement (DCE)”, DCE is a framework guided by the theories of motivation, which aims to encourage engagement in child therapy, applied to the project of a wearable breathing trainer for children with asthma and dysfunctional breathing. The article presents a well-described and coherent theoretical basis, as well as the DCE framework with a wealth of details. The DCE has an initial validation experiment and presents the necessary artifacts for its reapplication, showing itself as a promising framework. |

This group presents four articles that explain motivation as a determining aspect for building frameworks for the context of rehabilitation and chronic diseases. The three conceptual frameworks examined highlight the use of frameworks driven by the theories of motivation in this segment. Although the three analyzed frameworks need a more extensive validation process, both are promising frameworks in relation to their respective objectives.

Through the analysis carried out, it became evident the need to aggregate the theories used to explain the need for people's motivation in gamification projects in this context. However, it is observed that article number 4 did not approach the theories in a clear and coherent way, highlighting the need to carefully

explore and delimit the theories of motivation addressed. Frame 5 shows the analysis of the articles in the group “Well-being and prevention”.

Frame 5. Analysis of the thematic group "Well-being and prevention".

| Thematic area | nº | Analysis |
|---|---|---|
| Well-being and prevention | 8 | This article presents an adaptation proposal for the “Health Action Process Approach (HAPA)” model, whose approach combines gamification and user-centered design with HAPA. A gamified application was developed with the aim of promoting adherence and supporting HAPA's behavior change processes. In this context, the adapted model addresses the barriers identified for medication adherence in patients suffering from cardiovascular diseases. Although this adaptation proposes a model oriented to theories of motivation, the theoretical basis was not well described in the article, which describes in detail the process of implementing the model but lacks a detailed validation to further evaluate the effectiveness of the proposed model. |
| | 9 | The article presents the “Behavior Change Wheel (BCW)” framework, a theory-driven framework for the development of interventions, which is combined with the user-centered design approach. The study describes the application of BCW in the development of an application to promote healthy food health for the family. The framework proposal presents a good theoretical foundation and a detailed methodological process, however the study did not present a validation experiment, which makes it impossible to assess BCW's effectiveness. |
| | 10 | Like the previous one, this article presents the “Behavior Change Wheel (BCW)” framework, however this time it is used as a fragment contained in a stage of the IDEAS framework. The study aimed to develop a smartphone application that aims to increase the consumption of vegetables. With a user-centered and theory-oriented approach, BCW is used in a larger structure, but still fulfilling its original function. In general, the article presents a good theoretical foundation and a detailed structure of the methodological process. However, although a pilot test has been carried out, more extensive validation is still required. |

This group presents a tendency regarding projects oriented by theories, as well as user-centered design. The adaptation of HAPA stands out, a model consolidated and used in multiple projects and the projection of BCW within the IDEAS framework, showing the versatility of BCW. The need to pay attention to the validation process of the proposed frameworks is evident, since all approaches lack a better structured validation.

In general, it can be seen that articles from the same groups showed similar methodological trends in the construction of frameworks and models, it is also possible to observe the areas that are most evolving in relation to these constructions. On the other hand, there is a large gap related to the validation of the approaches presented, which may be a reflection of the short time span in which frameworks and models began to be developed for health contexts.

Another relevant observation to be made is about the inclusion of participatory approaches in the process of building some frameworks and models. This is believed to be a growing trend for the next

models of the "Education in health" group, and it can also accelerate the development of frameworks and models for other health contexts that did not appear in this study.

## 6. Conclusions

In view of all that was exposed in this integrative review, we conclude that the development of frameworks and models generates notably relevant contributions to various health contexts. We also found that some health contexts have already achieved significant progress related to the development of frameworks and models and point to trends to be explored in the development of new approaches. Through a careful analysis it was identified that one of the biggest gaps presented by the studies present in the review, was the process of validating the frameworks and models, which were absent in some studies and were poorly structured in others. This analysis also indicated the trend and possibility of using participatory approaches in the process of building frameworks and models for health contexts. Therefore, it is necessary to develop a new review in order to reveal more precisely the methodologies of assessment and validation of frameworks and gamification models for health contexts.

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