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Gamification Mobile Applications: A Literature Review of Empirical Studies

Liping Yang*

IT Service Center, Technical University of Munich, Arcisstr. 21, 80333, Munich, Germany

***Corresponding Author:** Liping Yang, IT Service Center, Technical University of Munich, Arcisstr. 21, 80333, Munich, Germany.

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Abstract

In the last decade, research on gamification increased in various fields such as mobile apps, e-health, human resource management, business development, and e-learning. However, research on gamified mobile applications is still fragmented, and a systematic overview of gamification in education engineering is missing. Thus, we conducted a systematic literature review of 43 empirical studies to explore state of the art in integrating gamification approaches into mo- bile apps. The literature review covers gamification design elements, psychological outcomes, behavioral outcomes, research areas, and the effect of gamification. The results show that rewards are the most commonly used design element of gamification in mobile apps. Gamification has a potential impact on psychology and behavior and provides positive benefits. The review's findings extend the knowledge base by providing insight for further studies and the design of gamified education engineering systems.

Keywords: Gamification; Mobile apps; Systematic literature review

Introduction

In recent years, gamification has gained traction in various fields (e-health, human re- source management, business development, e-learning), and the number of research articles is increasing [44]. For example, it has become a new trend in education, especially in the online education environment caused by the epidemic [22]. Gamification has many benefits. In addition to increasing playfulness and creativity, it can also motivate people and promote positive growth [45].

Meanwhile, mobile phones have become highly ubiquitous, and mobile applications are becoming increasingly important [46]. However, research on gamification mobile apps is still fragmented and underexplored. There has been a lack of research into the most widely used gamification design elements and their influence. Therefore, we answer the research question: *What is the state of the art in integrating gamification approaches into mobile apps?*

We executed a systematic literature review of 43 empirical studies under the term gamification mobile application to answer this research question. In this review, we mainly focused on (1) gamification design elements, (2) psychological outcomes, (3) behavioral outcomes, (4) research areas, and (5) the effect of gamification. This article provides insight for further research on gamified mobile apps as well as on the design of gamification.

The remainder of the study is structured as follows: we present the conceptualization of gamification in Section 2, which contains gamification design elements, and psychological and behavioral outcomes. Section 3 shows the methodological approach. Section 4 and section 5 present our findings and discussion, respectively. Finally, we provide the conclusion and give an outlook and the limitations of this study.

Conceptualization of Gamification

Gamification has been defined as "the use of game design elements in non-gaming contexts" [47]. Gamification design elements are the essential components of gamified systems [48]. The psychological and further behavioral outcomes resulting from gamification are also an essential part of the term [49].

As the definition suggests, Gamification uses some game design elements. These can be classified as follows: stories, virtual identity, collections, exchanges, leader- boards and points, levels, currencies, social points, and game points. These elements have a specific impact on human needs, namely: rewards, status, self-actualization, competition, and selflessness [50].

The psychological impact of gamification is mainly focused on motivation, enjoyment, and attitude [51]. For example, Duolingo, an app for teaching foreign languages, uses the gamification approach to motivate students and enhance learning and it has been confirmed by many experiments, such as in a study about teaching Spanish to elementary school students [52].

Another purpose of gamification is to affect behavior. It is comparable to persuasive technology, which is intended to influence rather than force a user's behavior [53]. Gamification can enable behavior change and intervention [54], such as in the fields of health [8, 16], education [24], and environmental protection [20].

Methodological Approach

In order to assess the state of the art in integrating gamification approaches into mobile apps, we executed a systematic literature review according to the guidelines established by Brocke et al. [55]. Figure 1 presents the applied methodology and the obtained results.

First, we identified the search string and primary data sources. We used the keywords: "Gamification" and "Mobile apps". To focus on the different methods of gamification we added the keyword "Methods" for further refinement of the query. We composed the search string with terms from the categories of the keywords above:

1. Those relevant to "Gamification", such as gamifying and gamified;
2. Those applicable to "Mobile apps", such as mobile applications, phone apps, and smartphone apps; and
3. Those relevant to "Methods" include approaches, technique, design, and strategy.

Thus, we conducted the search string: gamif* AND ("mobile app*" OR "smartphone app*" OR "phone app*") AND (method* OR approach* OR technique* OR design OR strateg*) was applied with the databases: Scopus, Web of Science Core Collection, ScienceDirect, and IEEE Xplore. Each database has unique properties that necessitate modest changes to the search under the following conditions:

1. Scopus: search in the title, keywords, or abstract.
2. Web of Science: search in the topic (In this case, the topic represents a title, author keywords, keywords plus, and abstract).
3. ScienceDirect: search in the title, keywords or abstract.
4. IEEE Xplore: search in the metadata.

We searched all databases using the search string above on 16th of May 2022 and focused on studies published in 2018 or later. Figure 1 presents the literature results illustrating a total hit rate of 950 publications and the iterative steps to find the final relevant 43 articles.

Second, we determined the selection to refine the review scope further. In addition to the year of publication, the used inclusion and exclusion criteria were listed in Table. 1. Based on the first four selection criteria, 234 articles were selected. Then, the title, keywords and abstract of all these studies were reviewed, and we found 43 papers high relevant to the study.

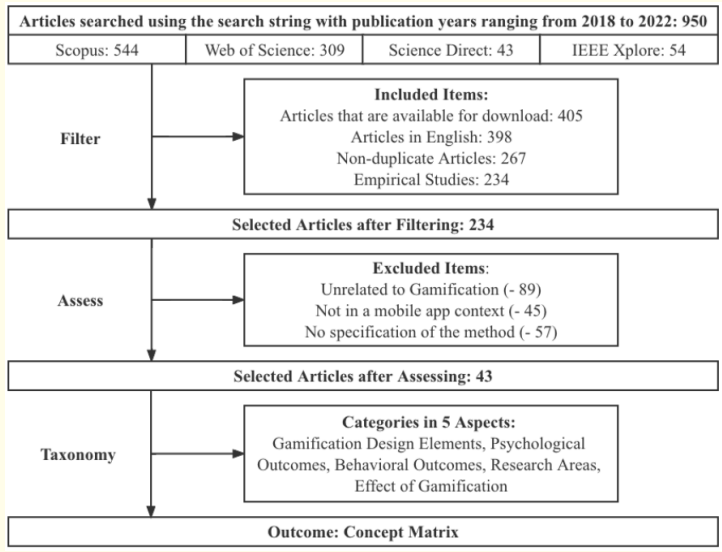

Figure 1: Diagram of Literature Review Approach.

Inclusion Criteria	*Exclusion Criteria*
Available for download	Unavailable for download
Written in English	Not written in English
Non-duplicate articles	Duplicate articles
Empirical studies	Non-empirical Research
Related to Gamification	Unrelated to Gamification
In a mobile app context	Not in a mobile app context
Articles that describe methods	No specification of the method

Table 1: Selection Criteria.

Third, we reviewed and analyzed 43 studies. With the conceptualization of gamification, we analyzed the articles from three aspects: (1) gamification design elements, (2) psychological outcomes, and (3) behavioral outcomes resulting from gamification. In addition, we also focused on the research area and the effect of gamification. Appendix A shows a concept matrix of the findings.

Results

Based on the conceptualization of gamification, Table 2 shows an overview of our findings from three aspects, namely the common game design elements and the resulting psychological or behavioral outcomes of gamification mobile applications. Rewards, points, achievements and badges were used in 42 of the 43 studies. 25 studies focused on psychological outcomes and 14 studies on behavioral outcomes. 4 studies examined both psychological and behavioral effects.

Study(s)	*Gamification Design Elements*					*Outcomes*	
	Rew	*Cha*	*Lea*	*Cgo*	*Sto*	*Pou*	*Bou*
[1], [9], [31]	X	X	X				X
[2]	X	X	X			X	
[3], [17], [30], [32], [33], [37]	X					X	
[4]	X	X		X		X	
[5], [8], [21], [40], [43]	X						X
[6]	X		X				X
[7], [19], [22], [28]	X		X			X	
[10], [11], [13], [24], [25], [26], [29], [35], [39], [41]	X	X				X	
[12], [18]	X					X	X
[14]	X	X			X		X
[15], [16], [20]	X	X					X
[23]		X				X	
[27]	X	X		X	X	X	
[34]	X	X		X		X	X
[36]	X				X	X	X
[38]	X				X	X	
[42]	X	X		X			X
Sum of Studies	42	23	9	4	4	29	18

Note. Rew = Rewards/ Points/ Achievements/ Badges, Cha = Challenge/ Levels, Lea = Leader- boards, Cgo = Clear Goals, Sto = Story, Pou = Psychological Outcomes, Bou = Behavioral Out- comes.

Table 2: Three Main Aspects of the Gamification Conceptualization.

Gamification Design Elements

All 43 studies specifically described the game design elements used. 33 of the studies implemented gamification design elements explicitly into prototypes or applications. After the overview, the most common used 8 gamification design elements were listed below:

1. Points used in 28 studies [1, 4, 5, 9, 11, 12, 14-22, 25, 27-33, 38, 39, 41-43].
2. Rewards used in 24 studies [1, 3, 6, 8, 10-15, 20, 22, 24, 26, 30, 31, 33, 36-42].
3. Achievements/ badges used in 21 studies [2, 4, 6, 7, 9, 10, 12, 15, 17-19, 22, 24, 27, 30, 32, 34-36, 38, 41].
4. Challenge used in 15 studies [2, 9-11, 13, 14, 20, 23, 25-27, 29, 31, 34, 35].
5. Levels used in 11 studies [1, 4, 10, 11, 15, 16, 24, 29, 39, 41, 42].
6. Leaderboards used in 9 studies [1, 2, 6, 7, 9, 19, 22, 28, 31].
7. Clear goals used in 4 studies [4, 27, 34, 42].
8. Story used in 4 studies [14, 27, 36, 38].

Outcomes and Effect

Table 3 displays the specific psychological or behavioral outcomes resulting from gamification. 29 articles studied the psychological impact of gamification. 24 of these papers investigated motivation, and 10 investigated interests. Behavior Intervention (8), behavior

Change (6), and self-management (4) were the main aspects of the behavioral outcomes.

Outcomes		*Used in the Study*	*Sum of Studies*
Psychological Outcomes	Motivation	[2], [3], [4], [7], [10], [11], [12], [17], [18],	24
		[19], [22], [25], [26], [27], [28], [29], [32],	
		[33], [34], [35], [36], [37], [38], [39]	
	Interest	[2], [13], [23], [24], [27], [35], [37], [38],	10
		[39], [41]	
	Loyalty	[3], [17], [30]	3
	Awareness	[19], [30]	2
Behavioral Outcomes	Behavior Intervention	[5], [8], [14], [16], [34], [40], [42], [43]	8
	Behavior Change	[6], [18], [20], [21], [31], [36]	6
	Self-management	[1], [9], [12], [15]	4

Table 3: Psychological Outcomes and Behavioral Outcomes.

28 of the review papers conducted the evaluation of gamification approaches. Table 4 shows the result of the gamification effect in these studies. 25 of these studies confirmed positive outcomes for integrating gamification into mobile apps. There are two studies with no significant results, and one study [3] found the test negative.

Test	*Used in the Study*	*Sum of Studies*
Positive	[1], [2], [4], [5], [6], [10], [11], [12], [16], [20], [21], [22], [23], [25], [27], [28], [30], [31], [32], [34], [35], [40], [41], [42], [43]	25
Not Significant	[8], [17]	2
Negative	[3]	1

Table 4: Effects of Gamification.

Research Areas

The research area of gamification refers to the non-gaming context in the definition. Table 5 illustrates a wide range of contexts of performed studies. 14 Studies used gamification in the health and fitness field and 11 in education engineering, while only 2 studies focused on the business and work sectors. In addition, there are two papers using gamification in the interdisciplinary fields [13, 22].

Area	*Used in the Study*	*Sum of Studies*
Health/ Fitness	[5], [6], [8], [14], [15], [16], [25], [29], [31], [34], [35], [40], [42], [43]	14
Education/ Learning	[2], [4], [7], [10], [19], [22], [23], [24], [28], [38], [39]	11
Medicine	[1], [9], [11], [12], [13], [18], [26], [27], [36]	9
Environmental Protection/	[20], [21], [22], [32], [37]	5
Sustainable Development Tourism/ Traveling	[13], [30], [33], [41]	4
Business/ Work	[3], [17]	2

Table 5: Research Areas of Gamification.

Discussion

Overall, mobile apps' main gamification design elements are points, rewards, achievements/ badges, and challenges. Gamification design elements are seen as an essential tool to increase user enthusiasm and engagement. It can increase motivation from both intrinsic and extrinsic perspectives. For example, the "playability" feature of gamification can lead to an enjoyable experience that creates an intrinsically motivating learning environment [19]. Gamification works with one's mind, so it can influence the development of a user's interest in different skills based on system design [28]. And each element has its own specific impact on human behavior. These elements drive the possible emotional changes of users during their interactions with gaming applications [14]. However, gamification also has some negative consequences that we should pay attention to in future research, such as the negative effects produced by excessive competition [7], and overly tricky tasks [2]. We need to balance the content and fun of learning to make gamified applications engaging and effective for learning rather than pure fun [19].

The results show that gamification can positively affect both psychological and behavioral aspects, especially motivation, interest, behavioral intervention, and behavior change. The game environment is a promising medium for behavior intervention, especially in the health field [5, 14, 40]. Gamified applications also successfully motivate students and further promote positive pedagogical benefits [23].

Most of the studies have shown a positive effect on gamification. Only two had no significance and one is negative. The study with negative results reported that the previous cash rewards in mobile payment apps are more valuable than gamification with scratch cards [3]. However, it cannot mean gamification has a negative impact. Still, gamification does be no more attractive than the original cash rewards, especially when the level of uncertainty in game elements is high [3].

Health and education are the most common areas of research in gamification. Most studies in the health field focused on behavioral outcomes, while the studies in education focused on psychological effects. However, there is not much research on gamification in the business field. Only one study [3] has looked into the relationship between rewards in gamification elements and user loyalty. From the research results, gamification has many benefits, such as motivating users, which must also be beneficial to businesses. So, this is also a blueprint for using gamification.

When analyzing the effect of gamification, we found that half of the studies applied qualitative research and the remainder were primarily descriptive quantitative research. Furthermore, most analyses are exploratory with a limited number of evaluation data. Therefore, we recommend exploring game design elements and their relationships by building prototypes and validating theoretical models in the future.

Conclusion, Limitations and Outlook

This study aims to research the state of the art in integrating gamification approaches into mobile apps. This systematic literature review identifies five common game design elements applied in mobile apps: points, rewards, achievements/ badges, and challenges. It also identifies several benefits of using the gamification approach in mobile apps, such as improving motivation and interest and promoting behavior change. In addition, the benefits are effective in many fields, especially in the health and education field. This article provides insight for further research on gamified mobile apps as well as for the design of gamification.

This review has certain limitations. We only searched articles in four databases during the literature search and added the language limitation. Thus, some papers that could be reviewed and analyzed were excluded. We also found that the process of the study followed is primarily different. It is a good direction to have a unified framework for the research on gamification. In future work, we will focus on gamification in education engineering. To further simulate if these findings are working, we will develop a mobile app using the common gamification design elements and examine the psychological outcomes.

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Appendix

Study	*Gamification Design Elements*								*Research Areas*						*Pou*				*Bou*			*Effect*		
	Poi	*Lea*	*Ach*	*Lev*	*Rew*	*Cha*	*Cgo*	*Sto*	*Med*	*Edu*	*Bus*	*Hea*	*Tou*	*Epo*	*Mot*	*Int*	*Awa*	*Loy*	*Bin*	*Bch*	*Sel*	*Pos*	*Nsi*	*Neg*
[1]	X	X		X	X				X												X	X		
[2]		X	X			X				X					X	X						X		
[3]					X						X				X			X						X
[4]	X		X	X			X			X					X							X		
[5]	X											X							X			X		
[6]		X	X		X							X								X		X		
[7]		X	X							X					X									
[8]					X							X							X				X	
[9]	X	X	X			X			X												X			
[10]			X	X	X	X				X					X							X		
[11]	X			X	X	X			X						X							X		
[12]	X		X		X				X						X						X	X		
[13]					X	X			X				X			X								
[14]	X				X	X		X				X							X					
[15]	X		X	X	X							X									X			
[16]	X			X								X							X			X		
[17]	X		X								X				X			X					X	
[18]	X		X						X						X					X				
[19]	X	X	X							X					X		X							

Stu dy	Gamification Design Elements								Research Areas						Pou				Bou			Effect		
	Poi	Lea	Ach	Lev	Rew	Cha	Cgo	Sto	Med	Edu	Bus	Hea	Tou	Epo	Mot	Int	Awa	Loy	Bin	Bch	Sel	Pos	Nsi	Neg
[20]	X				X	X								X						X		X		
[21]	X													X						X		X		
[22]	X	X	X		X					X				X	X							X		
[23]						X				X						X						X		
[24]			X	X	X					X						X								
[25]	X					X						X			X							X		
[26]					X	X			X						X									
[27]	X		X			X	X	X	X						X	X						X		
[28]	X	X								X					X							X		
[29]	X			X		X						X			X									
[30]	X		X		X								X				X	X				X		
[31]	X	X			X	X						X								X		X		
[32]	X		X											X	X							X		
[33]	X				X								X		X									
[34]			X			X	X					X			X				X			X		
[35]			X			X						X			X	X						X		
[36]			X		X			X	X						X					X				
[37]					X									X	X	X								
[38]	X		X		X			X		X					X	X								
[39]	X			X	X					X					X	X								
[40]					X							X							X			X		
[41]	X		X	X	X								X			X						X		
[42]	X			X	X		X					X							X			X		
[43]	X											X							X			X		
Sum	28	9	21	11	24	15	4	4	9	11	2	14	4	5	24	10	2	3	8	6	4	25	2	1

Note. Pou = Psychological Outcomes, Bou = Behavioral Outcomes, Poi = Points, Lea = Leader- boards, Ach = Achievements/ Badges, Lev = Levels, Rew= Rewards, Cha = Challenge, Cgo = Clear Goals, Sto = Story, Med = Medicine, Edu = Education/ Learning, Bus = Business/ Work, Hea = Health/ Fitness, Tou = Tourism/ Traveling, Epo = Environmental Protection/ Sustainable Development, Mot = Motivation, Int = Interest, Awa = Awareness, Loy = Loyalty, Bin = Behav- ior Intervention, Bch = Behavior Change, Sel = Self-management, Pos = Positive, Nsi = Not significant, Neg = Negative.

Appendix A: Concept Matrix of Reviewed Papers.

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