Health and Fitness Apps: An Analysis of Gamification Elements in Austria

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Abstract

Gamification has been recognized as an important factor driving user engagement and satisfaction. However, few studies have conducted an in-depth analysis of gamification elements in health and fitness apps. The fundamental objective of this research study was to fill this gap by providing insights into the prevalence of gamification in health and fitness apps. To achieve this, a list of 24 gamification elements has been determined based on a systematic review of the literature and 38 health and fitness apps from the Austrian App Store have been analysed for their implementation of gamification.

The results show that 37 of the reviewed apps in Austria include some form of gamification, however the elements considered crucial by research for ensuring high customer satisfaction and retention were found to be sparingly integrated. This research incentivizes app providers to make more use of gamification in apps and tailor its implementation to better meet customers' needs.

Keywords 1

Gamification Elements, Health Apps, Fitness Apps

1. Introduction

One of the main driving forces behind the rise of health apps is a worldwide health issue. According to the World Health Organization, around 500 million people are expected to develop health issues between 2020 and 2030 due to a sedentary lifestyle [1]. This comes with a cost, as the same report estimates that the lack of physical activity will cost the health system 300 billion dollars by 2030 compared to 27 billion dollars in 2022. The most prevalent reason behind an unhealthy lifestyle appears to be a motivational issue, as many individuals find it challenging to sustain a healthy way of living [2].

For this reason, health and fitness apps have been enjoying rising popularity since the launch of the first fitness app, "FitPhone", in 2010. Nowadays, more than 20 million fitness apps are being downloaded worldwide in a month [3]. Most people start using them because they are looking for external advice on how to eat and work out, tailored to their individual needs [4]. Although being well received amongst consumers, the retention rate was found to drop to 9% almost a month after an app has been downloaded [5]. Hence, to maintain users motivated, gamification has emerged as an alternative and promising concept. The notion is based on behavioural economics which explain the motivational impact of gamification using two mechanisms. Firstly, gamification is based on the "loss aversion" concept, as it uses elements, such as "badges" and "points", that people will not be willing to easily let go once they collected them, and,

secondly, the "endowment effect" is applicable in the context of gamification as well, as it refers to people being more attached to items they own compared to those they do not possess [6].

As the global size of the gamification market has been estimated at more than 12 billion dollars in 2023 [7], the gamification concept gained attention amongst researchers across various disciplines and contexts. While a handful of studies have attempted to compile a list of gamification elements [8, 9], several questions remain unanswered, especially when it comes to exploring the performance of different elements [10]. There have been only a limited number of studies that examined the outcomes of gamification, focusing on the effects of key elements, such as "badges" [11], "points" [12], and "leaderboards" [13], and they found that all three of them result in positive effects, such as user engagement and motivation. However, Yin et al. [9] and Kotsis et al. [14] point out that most studies so far have only focused on a few gamification elements, neglecting an analysis of their mutual effects in different combinations. Implementing elements in certain configurations has been found to enhance user engagement [8, 15]. Consequently, the first research objective (RO) of this paper is to:

RO1: Compile a list of gamification elements identified in the relevant literature.

While a few studies analysed the presence of gamification in health and fitness apps in different countries [8, 16, 17], there is limited research conducted in Austria. In addition, Esmaeilzadeh [18] draws attention to the potential of health apps usage to vary across countries. Therefore, to further understand the situation of gamification in practice and expand the research in Austria, the second objective of this study is to:

RO2: Investigate which gamification elements are present in the most popular health and fitness apps in Austria and how effective they are in terms of user satisfaction and retention.

According to these goals, the remainder of this paper is structured as follows. Section 2 highlights the list of gaming elements derived from the literature. Based on this theoretical foundation, Section 3 covers the analysis of gamification elements within the most popular health and fitness apps in the Austrian App Store, along with a comparative analysis against two previous research studies, with the aim of understanding their impact on user satisfaction [9] and retention [15]. Section 4 delves into the discussion of results, including both theoretical and practical contributions, addressing limitations, and providing recommendations for future research. Finally, Section 5 outlines the conclusion.

2. Gamification Elements in Health and Fitness Apps

Johnson et al. [19] place gamification at the "intersection of persuasive technology, serious games and personal informatics". Therefore, gamification refers to the deployment of elements with the aim of changing people's behaviour, resembles the nature of serious games as it targets the intrinsic motivation of users, and contains elements from personal informatics because it records users' activities to help them improve their health and keep them engaged.

A handful of studies tried to categorise gamification elements [8, 9, 18], however, most authors agree that additional research is needed to understand which combinations of elements achieve the best outcomes. For instance, Al-Rayes et al. [8] concluded that more research is required to understand the impact of gamification on user behavior, while Yin et al. [9] explain that most studies tend to investigate only the most popular elements and omit the remaining ones, hence failing to get a comprehensive view. Similarly, Hofacker et al. [20] highlight that some elements which are deemed trendy to use, such as "points" or "rewards", are more predominant across research, while others, such as "challenges" or "narrative stories", are seemingly overlooked by both the academia and practitioners. Furthermore, Miller et al. [10] emphasize the need for providers to fully understand gamification elements to be able to maximize the implementation efforts.

To compile the gamification elements in relation to health and fitness apps, a literature review was carried out. The information was retrieved from the libraries that the University of Vienna has access to, such as: SpringerLink, ProQuest, ScienceDirect, SAGE Journals, IEEE Xplore and Mary Ann Liebert

Publisher. To find the relevant papers, the search terms "gamification fitness" and "gamification wellness" were used. Figure 1 depicts the process of screening the literature.

The two search terms generated a total of 4,431 results ("gamification fitness" = 2,838, "gamification wellness" = 1,593). After excluding non-English publications, the sample was reduced to 4,274 research papers. Subsequently, studies that were not peer-reviewed were eliminated, further reducing the sample to 2,174 articles. The titles of the remaining papers were assessed for their relevance to the topic, resulting in 211 publications. The abstracts of these short-listed papers were then screened to determine whether they specifically focused on gamification in health and fitness. This screening process yielded 51 papers, which were further reviewed and considered for elimination if they only mentioned the gamification elements but did not provide lists or descriptions. The final search resulted in 11 relevant papers. An elimination based on publishing year was not deemed as necessary as most studies were conducted within the last 10 years.
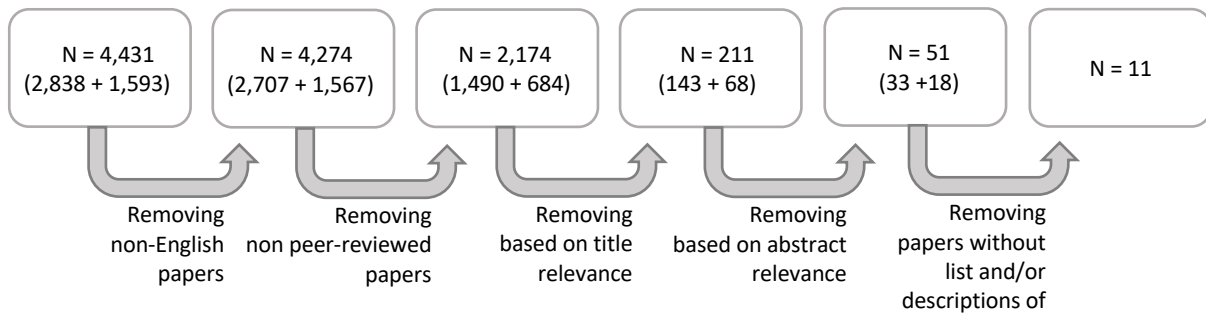

Figure 1: Process of Screening the Literature on Gamification Elements

From the 11 research papers, a total of 24 gamification elements could be identified. Table 1 presents the elements, including a description based on literature, and the frequency of occurrences across the publications, denoted with "F".

As visible in the table, the element "leaderboards" was found in nearly every publication. This is closely followed by "points" and "social collaboration" which were found in 9 and, respectively, 8 of the 11 reviewed studies. The elements, "rewards", "levels", "challenge", "badges" and "virtual character" have been included in approximately two thirds of the papers. Other elements, such as "narrative context", "feedback", "personalised goal", "knowledge sharing", "time pressure" and "unlockable content" were mentioned in 4 out of the 11 analysed studies, whereas "marketplaces", "3D environments", "social pressure" and "parallel communication system" were found in 2 of the examined publications. The least common elements were found to be "streaks", "custom goal", "lifelines", "secondary game objectives", "agent" and "cheating".

While reviewing the literature, a few overlaps between certain gamification elements were noted. For instance, Cotton and Patel [16] used the term "high score" to define an overview of high and low performance, however, in this paper the decision was made to merge this term with the element "leaderboards" due to similar meaning. Another resemblance was found between "rewards" and "real-world prizes". Hoffman et al. [21] differentiated between "digital rewards" and "real world prizes", but in this research, the decision was taken to include these concepts under the broader category "rewards". Moreover, various articles referred to social collaboration as "teams" [22], while others defined it as "link to social networks" [23] or "likes" [15]. However, the analysis of the description suggests strong reference to teamwork, hence the terms were treated as one category. Furthermore, sharing one's experience was also described using different concepts. Altmeyer et al. [24] referred to it as "knowledge sharing", while Zhao et al. [23] used "game experience sharing" and Cotton and Patel [16] "social influences". Consequently, these terms have been considered under the same concept. Other categories that are referred to by different names in the literature but are meant to denote the same element are: "virtual character" [24], "role" [15], or "avatar" [21], and "unlockable content" [16] or "hacking mode" [23].

Table 1

Total Number of Occurrences of Gamification Elements in the Examined Publications

Element	Description	F
Leaderboards/High-Score/ Social Competition/Ranks	Reflect hierarchy of user performance, typically on a board	10
Points	Highlight user progress in numerical form	9
Social Collaboration/Teams	Collaborative/group goal achievement	8
Rewards/Real World Prizes	Gifts or vouchers received after competitions or goal achievements	7
Levels	Reflect user progress in the form of playing experience	7
Challenge	The user receives and completes a difficult task	7
Badges	After completing a certain number of levels, the user earns a badge to showcase their achievement	6
Virtual Character/Role/Avatar	Own character animation which the user can control	6
Narrative Context/Story/Theme	Stories to guide the action and provide context to the game	5
Feedback (before, during and after)	Verbal or visual performance information given to the user	4
Personalised Goal	The user gets a personalised target set by the app	4
Knowledge Sharing/Game Experience Sharing /Social Influences/Likes	Users can help each other on forums, share their performance on social media and receive moral support	4
Time Pressure	The user receives a deadline to complete a task	4
Unlockable Content/Hacking Mode	The user receives access to higher levels or new features based on previous performance	4
Marketplaces and Economies	The user gets a virtual currency to simulate a marketplace environment	3
3D Environment	Design element used to create the effect of the real world	3
Social Pressure	The user is pressured by peers to enter competitions for future quests or game invitations	3
Parallel Communication Systems	Communication through other mediums (e.g., email, headsets)	3
Streaks	A certain number of consecutive goal achievements	2
Custom Goal	The user (instead of the system) can set a specific goal	2
Lifelines	Possibility to request help or a retry after failures	2
Secondary Game Objectives	Additional, optional targets alongside the main goal	2
Agent	A character which provides instructions or moral support	2
Cheating	The user can achieve a goal using means outside the game's intent	1

Note. F = Frequency of Gamification Element across the 11 Examined Publications

3. Analysis of Health and Fitness Apps in Austria

After the theoretical framework of this study has been laid out in the previous section, the second objective of this research was to determine which gamifications elements are present and most prevalent in the health and fitness apps in Austria. The following subsections describe the study design, sample, and results.

3.1. Study Design

The most popular health apps in Austria as of January 2022 were analysed according to the list of gamification elements determined in section 2. To avoid subjectivity, a second researcher reviewed the apps. The second coder is a physician with several years of medical experience, as well as an academically educated economist and businessman. Prior to the analysis, the coder was instructed to review the list of gamification elements defined in this study with the respective description. The purpose of this was to help him with the identification of the elements and ensure that both coders have the same set of information.

The duration of the analysis varied greatly. Whereas in the case of some simpler apps which only had one or a few functions, for example Body-Mass-Index Calculator, the elements were found within one or two days, for apps with more functions, such as the ones belonging to the weight management category, the analysis lasted around a month.

The result of this process resulted in two sets of spreadsheets. The presence of a gamification element was marked with a "1" in the line of the corresponding app. Once both coders analysed the apps for implementation of gamification, the two individual spreadsheets were merged into one which only contained those values where both coders were in agreement.

3.2. Sample

The sample for this study was drawn from the Austrian Apple App Store and consisted of apps that were dominating the download charts in the health and fitness category. Cotton et al. [16] estimated that a substantial sample size in this type of analysis would consist of the top 50 apps. Along this line, 50 apps have been chosen that were listed as the Top 50 Most Popular Apps in the category of Health and Fitness in the App Store on the 2nd of January 2022. The smartphones used for the coding were an iPhone 7 and iPhone 8. Before testing, it was ensured that these devices could run all the apps planned for testing.

After the first 50 apps were chosen, a selection process was carried out to make sure that they were suited for the purpose of this study. Hence, apps that only served for information purposes, such as COVID-19 passes, were eliminated. In addition, apps which required an extra device for functioning or any kind of payment for usage were excluded from the analysis. The final sample consisted of 38 health and fitness apps.

The selected apps have further been allocated to six subcategories, based on previous research [16, 25, 26]. Apps with the primary goal of encouraging users to be physically active without providing any or few recommendations for nutrition or other lifestyle choices have been classified as "physical activity". Fourteen apps were assigned to this group. The second group comprised "nutrition" apps, which are designed to guide users towards healthier eating habits or weight loss through nutrition. Eight out of the 38 apps were allocated to this category. Moreover, apps which provide an overall package of workouts and nutrition have been labelled "weight management" and were found to be represented by six of the 38 reviewed apps. Similarly, six apps aimed at improving users' mental state, such as sleeping cycle, stress relief, meditation, or self-confidence, were categorised as "mental health". The last two categories consisted of "disease management" apps, which include help with giving up on smoking (2 apps), and "women's and reproductive health" apps, which support female with tracking their reproductive cycles (2 apps).

3.3. Results

The results of the coding are displayed in Figure 2. A "custom goal" seems to be the most popular element amongst the providers, as it was used in 37 out of the 38 analysed apps. This high frequency of use means that most apps allow individuals to set their own targets in terms of health improvement, compared to the system setting up a goal for them, which was found to be present in only 8 apps. The result is consistent with findings from Cotton and Patel [16] who identified the element "goal" together with "social influences" to be amongst the most used gamification items in health and fitness apps in the United States.
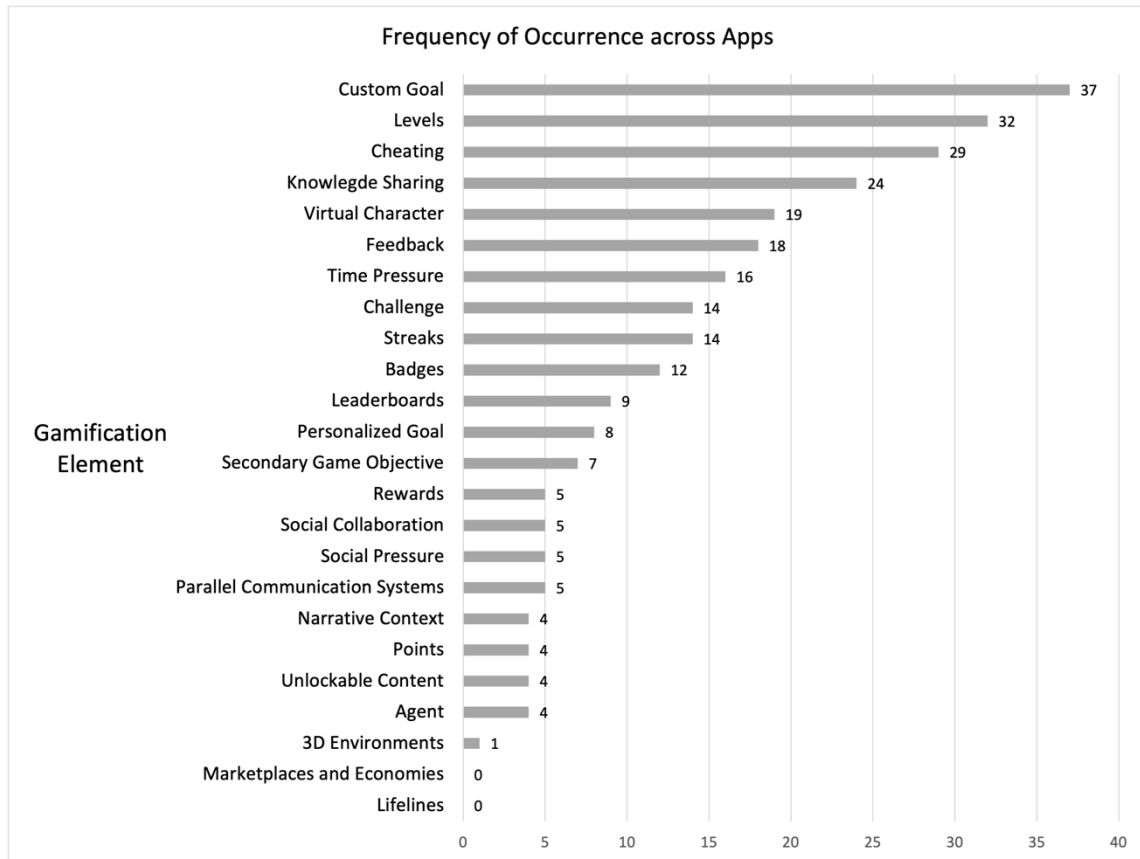

Figure 2: Most Used Gamification Elements

"Levels" which define the user progress toward a pre-defined goal were present in most apps in various forms: some apps used a progress bar, while others displayed the level in the form of a number. By contrast, Cotton and Patel [16] found "levels" to be present in only 1 of the 50 apps they analysed, while Hoffman et al. [21] in 2 of 62 apps.

Surprisingly, "cheating" appears to be amongst the most frequently used elements. Elements, such as "virtual character", "feedback" and "time pressure" were observed in half or less than half of the evaluated apps, whereas "challenge", "streaks", "badges", "leaderboards", "personalised goals" and "secondary gaming objectives" were identified in around a third or less of the 38 revised apps. "Rewards", "social collaboration", "social pressure", "parallel communication systems", "narrative context", "points", "unlockable content" and "agent" were found to be barely present in the 38 analysed health and fitness apps. Lastly, it was determined that "3D environments", "marketplaces" and "lifelines" are nearly or completely non-existent in health care apps.

Considering the number of gaming elements per app, it was found that the analysed health and fitness apps do not deploy many gamification elements. The most gamified analysed apps such as Gymondo, Garmin, Seven, Freeletics or Arise, use half of the 24 elements, while half of the examined apps deploy around 7 gamification elements or even less. The average deployment was found to be 7 gamification elements per app.

When it comes to the overall exploitation of gamification in different sub-categories, gamification elements were found to be present in one-third or less of each group. While gamification is most used in apps belonging to the "disease management" category, with 14 apps from this category using gamification elements, only 7 apps in the "mental health" category implemented gamified content.

3.3.1. Results Analysis for Customer Satisfaction

Considering the results presented in the previous section, it appears that most health and fitness apps tend to make use of gamification elements, however it is unclear which elements yield the best outcomes. To address this question, the results from the study of Yin et al. [9], which analysed the correlations between gamification and user satisfaction, were retrieved. The descriptions of the elements from the study were analysed and matched to reflect the same meaning.

Yin et al. [9] divided gaming elements into four categories depending on how their presence and quality contribute to user satisfaction using the Kano model developed in 1984. The authors distinguished between "must-be quality" gamification elements, which they define as essential components without which users experience dissatisfaction. The quality of implementation, in terms of performance and integration of these elements within the app, is equally important, as low-quality execution was expected to diminish user satisfaction. Among the 38 analysed apps, the sole element found to fit within this category was "challenge". The presence of this element in only 14 of the 38 analysed apps seems low considering its high impact on user satisfaction.

"One-dimensional quality" characterizes gamification elements for which there is a linear relationship between the quality of the element and the satisfaction of the user. The more seamlessly these elements are integrated into the app, the higher the user satisfaction. The elements corresponding to this category from the analysed apps were found to be "points", "levels", "time pressure", "badges" and "feedback". Apart from the element "levels", which has been only used in 4 apps, the remaining elements appear in more than half of the 38 analysed apps.

When the quality of a gamification element is increasing with the user satisfaction, but a decrease in quality does not result in reduced satisfaction, the authors classify the element as belonging to the "attractive quality" category. To this subset, the elements "custom goal" and "narrative story" were assigned. While the former was found to be the most used element among the 38 apps, the latter only appeared in 4 apps. Given that the inclusion of these elements does not lead to decreased satisfaction, app providers should be more comfortable incorporating a narrative element into the goal achievement in their apps.

Elements that do not elicit any reaction from users are grouped in the "indifference quality" category. Based on the analysed apps, these would be "virtual character", "rewards", "leaderboards", "social collaboration" and "knowledge sharing". The gamification element "knowledge sharing" was found to be present in 24 of the 38 analyzed apps, followed by "leaderboards", included in 9 apps, and "social collaboration" and "rewards", both present in 5 apps. As these elements do not improve the satisfaction of users, their implementation should be carefully considered.

Yin et al. [9] propose a three-step approach for implementing gamification. Initially, they recommend integrating all "must-be quality" elements. In a second phase, app providers should prioritize the inclusion of "one-dimensional quality" and "attractive quality" elements. In the final phase, providers are advised to avoid using "indifferent quality" elements as they will not yield any results. Lastly, they stress the importance of meticulously implementing elements belonging to the "one-dimensional quality" group due to the inverse effect, according to which the user satisfaction decreases with the quality of the element.

3.3.2. Results Analysis for Customer Engagement

Another aspect which can help with the interpretation of this study's results provides the research of Feng et al. [15]. The authors categorised gamification into "commensurate" and "incommensurate" elements based on their ability to engage users. The first group contains those elements that directly influence external rewards, whose value users can estimate in advance. By contrast, "incommensurate" game elements are such elements that are not linked to external rewards and for which the user is not able to evaluate their internal benefit. Following a longitudinal research, Feng et al. [15] discovered that incommensurate gamification elements have a greater impact on user engagement compared to commensurate elements. Consequently, app providers using these types of elements in health and fitness apps are more likely to establish stronger relationships with their users.

Based on the analysed apps, the following elements were categorised:
- Incommensurate elements: "virtual character", "leaderboard", "knowledge sharing"
- Commensurate elements: "badges", "points", "levels", "digital rewards"

Among the 38 analysed apps, several incommensurate elements were not found to have a high presence. For instance, "knowledge sharing", which is the equivalent to the element "like" in the study by Feng et al. [15], was identified in 24 apps, while "virtual character", equivalent to "role", was discovered in around half of the apps, and "leaderboards" in only 9 apps. By contrast, the commensurate element "levels" was found to be implemented in 32 apps.

4. Discussion and Future Research Recommendations

This paper has four main findings.

Firstly, the systematic review of the literature on gamification elements in health and fitness apps resulted in 24 elements. Hence, **RO1** was achieved. Since a few elements, previously treated as separate, were consolidated into a single category, future research could focus on expanding and refining the list while providing more precise definitions.

Secondly, the implementation of gamification across the reviewed apps in Austria was found to be very high, as apart from one app, all 38 apps included some degree of gamification. Consequently, **RO2** was fulfilled. Considering previous research, it seems that gamification has become the norm, as the presence of gamification in previous studies was estimated at 64% in a study from 2019 across 50 reviewed apps [16] compared to 52.5% in a research study conducted in 2014 across 261 apps [22]. However, the study from 2019 reviewed only 13 gamification elements, which might explain the higher presence of gamification reported in this paper, while the second study, which examined a considerably larger number of apps compared to this research, was conducted in 2014 when the gamification market was still in its early stages.

When looking at the presence of gamification across sub-categories, the least gamified category was found to be mental health. Given the global mental health crisis exacerbated by the pandemic, providers of mental health apps could consider making more use of gamification elements to assist individuals dealing with mental health conditions. For instance, Ibrahim et al. [27] found, through qualitative analysis, that social interaction among app users, defined as "engagement" in their study, was the most important element for users coping with anxiety. Future research could try to consolidate this finding through quantitative analyses.

The element "custom goal" was the most implemented gamification element, whilst the elements "3D environments", "marketplace" and "lifelines" were the least used. Considering that 14 of the 38 apps belonged to the "physical activity" category, it is common that the onboarding process within such apps begins with a customisation page where the user sets his individual goal. One concern with this approach is that individuals might not have a reference point to set their own health targets and could aim for health goals which are unachievable. This, in turn, might lower their motivation to continue using the app.

Consequently, it is recommended that the inclusion of the element "custom goal" in health apps includes descriptions of reasonable goals tailored to the user's situation. Across different mobile apps, a literature review of 43 studies conducted by Yang and Gottlieb [28] found that the element "rewards" was the most used gamification element. However, in the field of health, it seems more beneficial to tie users to a specific goal and subsequently offer them rewards for its attainment.

Thirdly, the analysis of the top health apps in Austria revealed that the findings from research seem to differ from the practice. For instance, in some cases, research tends to have prioritized the investigation of elements which have not been found to be predominant in the top Austrian health and fitness apps, while in other cases, elements that had a high presence across apps did not appear to have been studied by many researchers. For instance, the element "leaderboards" was present in almost all 11 reviewed research papers, however, its implementation was around one fourth of the 38 analyzed health and fitness apps. By contrast, the element "custom goal" was found in only 2 of the 11 reviewed research papers, however it appears to have been included in most of the 38 analyzed fitness apps. Similarly, "cheating" was found to be present in most apps in Austria, but the concept was only investigated in one of the reviewed studies. As described by Sardi et al. [26], cheating diminishes the purpose of health apps, as users can receive their rewards or climb up the leaderboard without investing any effort. Consequently, app providers should make sure that they implement measures to limit possibilities of cheating, as suggested by Al-Rayes et al. [8].

In addition, elements which were deemed by previous research as necessary or beneficial to ensure user satisfaction or retention were found to be less present in practice. The only "must-be quality" element was found to be "challenge", which was present in 14 of the 38 analyzed apps, while elements that do not elicit any reaction from users, such as "virtual character" or "knowledge sharing", were found in 19 and 24 of the reviewed apps. Considering the absence of a readily available implementation guide for app providers and lack of clarity regarding the prioritization of gamification elements and their effects, it is possible that the gamification elements present in the apps are still in an experimental phase and may not align with the findings from research. Moreover, the lockdown periods during the pandemic might have left businesses no other option than to invest in their digitalization strategies to keep their customers engaged. This might explain the high gamification presence in the apps and discrepancies between the implemented elements and research recommendations. Future research could try to conduct similar analyses of gamification in most popular health apps and investigate their impact using more robust measures.

The discrepancy might be further attributed to cultural variations, as the investigated apps were retrieved from the Austrian App Store. The hierarchy of gamification elements in other countries might show a very different picture. Additional analyses of top apps in other countries should be conducted to find out which elements are most predominant and how they impact performance. In a similar vein, Al-Rayes et al. [8] noted that previous research focused on the United States, however other countries might be able to benefit from these findings.

Fourthly, the average deployment of gamification elements per app was found to be 7, however there is limited research on the optimal quantity of elements. Berger and Jung [29] found five elements to be sufficient for participant's satisfaction using a nutrition app, whilst Schmidt-Kraepelin et al. [30] reported a preference for 3 game elements across the physical activity category. Undoubtedly, the implementation quality of gamification elements should be more important than the quantity, however future research could try to consolidate the number of elements that drives user engagement across the different categories of health and fitness apps.

The present findings contribute to research and practice as follows. From a research perspective, this paper conducted a systematic review of the literature and defined a list of 24 gamification elements. Compared to previous studies which investigated between 5 and 18 elements, this paper expanded the understanding of gamified content available to app providers in the health and fitness app industry. These gamification elements have further been reviewed in practice by investigating 38 health and fitness apps in Austria for their presence. To the best of the authors' knowledge, an investigation of this scope was not conducted in Austria before. Moreover, the findings of this paper point out the high presence of "cheating" across the reviewed app and the limited research on this topic. Cheating was found in only one of the reviewed research papers on gamification elements. Furthermore, the results emphasize the limited

gamification presence in apps belonging to the mental health category, consistent with results from Cotton and Patel [16].

From a practical perspective, this study found that the gamification element "custom goal" is the most used element in the top health and fitness apps in Austria, however, to increase user satisfaction, the research recommends implementing a "must-be quality" element, such as "challenge". In the absence of a gamification playbook, app providers should review the available research and experiment with the recommended elements. In addition, app providers in Austria should aim to prioritize gamification elements, such as "leaderboards", "virtual character" and "knowledge sharing" to ensure customer engagement and retention. Considering the low gamified "mental health" category, this study recommends app providers to invest in their gamification strategies, as there is a growing body of literature highlighting improvements for app users suffering from mental health conditions.

Despite the highlighted contributions, the results of this study have a few limitations. To begin with, the sample of the research consisted of 38 apps. A higher sample might have resulted in a different hierarchy of gamification elements. Future research could try to investigate top 100 health and fitness apps. In addition, the list of apps was determined on the 2nd of January 2022. Since the top apps in terms of number downloads and their position in the App Store's hierarchy constantly changes, a different day might have resulted in a different sample. Moreover, the selected day might limit the results of this study as the start of a new year typically marks the period where people begin with their New Year resolutions, often involving lifestyle changes. As a result of this, in the sample, apps from the weight management, nutrition or physical activity categories might have been overrepresented, whereas others, for instance, from the women's and reproductive health or disease management categories, might have been underrepresented. Furthermore, the apps were downloaded from the Apple App Store. Hence, the top health apps in the Google Play Store might show a slightly different picture. Additionally, only those apps which had a freemium version or a free testing period have been included in the analysis. Nevertheless, most apps offered a trial period, so it can be safely assumed that the tested apps have the same functions as when they are paid for.

Another shortcoming of this research is the retrieval of findings from Yin et al. [9] and Feng et al. [15] to explain the impact of gamification elements on user satisfaction and retention. Future research could conduct a quantitative or qualitative analysis of the elements found in the Austrian apps and survey users to understand their actual satisfaction and engagement with the apps. This could help Austrian marketers determine how they can customise their gamification elements to meet their users' needs based on demographics or figure out which gamification elements are required in which product lifecycle.

5. Conclusion

Gamification has gained recognition as a significant catalyst for improving individuals' mental skills, shaping human behavior, and fostering the development of social communities. Most importantly, it was recognised as a tool that can help tackle the engagement issues in health and fitness apps. As previously mentioned in the introduction, a major challenge with these types of apps is the lack motivation required for sustainable lifestyle changes. Hence, gamification ensures users stay motivated and capitalises on people's inherent need to be recognised and hold on to things that they have attained.

The primary aim of this paper was to improve the knowledge on gamification within health and fitness apps by conducting a comprehensive review of previous research and practical implementation. To achieve this goal, a list of 24 gamification elements based on prior research was compiled and 38 most popular health and fitness apps in Austria were analysed for their presence.

The evidence found in this study points towards a widespread use of gamification across apps, but they also reveal untapped potential in terms of the implemented elements. Those elements that are considered crucial for ensuring high customer satisfaction and retention were scarcely integrated into the top health and fitness apps, whereas elements which were deemed as less important for app users were found to be present. In addition, this study highlights the prevalence of cheating across apps and underscores the need for providers to implement measures to limit such behaviour.

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