謝佩珊、馮文庭、涂榮庭 (2022),「遊戲化能否提升用戶對健身 app 的持續使用意願？比較內在和外在遊戲化元素的有效性」,*資訊管理學報*,第二十九卷，第三期，頁 277-301。

遊戲化能否提升用戶對健身 app 的持續使用意願？比較內在和外在遊戲化元素的有效性

謝佩珊
東海大學企業管理學系

馮文婷
海南大學管理學院工商管理系

涂榮庭*
東海大學企業管理學系

摘要

許多健身應用程序開發人員透過將服務傳遞過程遊戲化,讓用戶更具參與度和忠誠度。儘管如此，現有研究對於健身應用程序中遊戲化的有效性提出了矛盾的證據。我們認為，不同的遊戲元素可能會觸發不同類型的動機，從而對用戶的使用產生不同的影響。從自我決定理論推斷，我們將遊戲元素分為內在和外在兩種類型，並驗證這兩種類型的元素對使用行為和忠誠度的影響。田野實驗結果表明，與外在遊戲元素相比，內在元素可以更有效地增加用戶的使用和持續使用意圖。

關鍵詞：遊戲化、健身應用程序、使用行為

*本文通訊作者。電子郵件信箱： rungting@thu.edu.tw

2022/04/16 投稿； 2022/05/23 修訂； 2022/06/16 接受

Hsieh, P.S., Feng, W.T. & Tu, R.T. (2022). Can Gamification Increase Users' Continued Use Intention of Fitness App? Compare the Effectiveness of Intrinsic and Extrinsic Game. *Journal of Information Management*, 29(3), 277-301.

Can Gamification Increase Users' Continued Use Intention of Fitness App? Compare the Effectiveness of Intrinsic and Extrinsic Game Elements

Pei-Shan Hsieh
Department of Business Administration, Tunghai University

Wenting Feng
Department of Business and Administration, Hainan University

Rungting Tu*
Department of Business Administration, Tunghai University

Abstract

Many fitness app developers have gamified the service delivery process, aiming at making users more engaging and loyal. Nonetheless, the existing research provides ambivalent evidence on the effectiveness of gamification in fitness apps. We argue that various game elements may trigger different types of motivation, rendering different impacts on users' usage. Drawing an inference from Self-Determination Theory, we categorize game elements as two types, intrinsic and extrinsic, and examine their influence on usage behaviors and loyalty. Results from a field experiment indicate that compared with extrinsic game elements, intrinsic ones can increase users' usage and continued use intentions more effectively.

Keywords: Gamification, Fitness app, Usage behaviors

* Corresponding author. Email: rungting@thu.edu.tw

2022/04/16 received; 2022/05/23 revised; 2022/06/16 accepted

1. INTRODUCTION

The adoption of health apps has increased rapidly in recent years. However, after initial adoption, many users soon feel bored and give up (Li et al. 2021): a study indicates that apps get deleted in 8.8 days after they're last used (Benes 2018). For fitness app developers, a crucial question is how to motivate users to sustain (Karapanos et al. 2016). To that end, a majority of fitness app developers have invested heavily in gamification (Edward et al. 2016; Lister et al. 2014; Stragier et al. 2016), integrating game elements in the service delivery process (Huotari & Hamari 2017). Many make efforts in providing users with various external incentives, including digital rewards, badges and points (Xu et al. 2022; Lewis et al. 2016; Sailer et al. 2017; Tabak et al. 2015). For instance, Habitica allows users to level up their own in-game characters by points earned from workouts; Walkup awards users according to their step counts with virtual badges. Through gamification, fitness app developers hope to enhance service experiences, make users more engaging, and eventually, increase their continued use.

Despite the prevalence of using game elements as external incentives in fitness apps, some research indicates that the motivation to attain extrinsic outcomes, such as gaining badges and points, may not be strong enough to encourage users to sustain (Mekler et al. 2017). They suggest that the excitement of earning points may wear off and the curiosity towards various badges may fade away; eventually, in the long run, using game elements as extrinsic incentives may not increase users' actual usage or continued use as companies hoped for.

In the meantime, a few fitness app developers tried to differentiate and took a different approach. Instead of utilizing game elements as extrinsic incentives, they use the element to enhance service experiences and better satisfy users' intrinsic needs. Considering users' increasing need for social relatedness with the explosion of social media (Peters et al. 2018; Zhou & Krishnan 2019), some app developers try to use game elements to create a sense of belonging and connectedness to others. For example, Strava, one of the most popular fitness apps, provides a leaderboard operated on its online social networks: users can compete with one another on their workout performances, share their exercise experiences and get "likes" from friends. Such an approach has yielded surprisingly good results. Strava had gained 27 million users and over 1 billion exercise posts by the end of 2017, outperforming other apps of the same kind on iTunes Store (Strava 2017). Also, on social media platforms, the pursuit of the intrinsic need for social relatedness encourages users to sustain their efforts for longer: joggers actively sign up for marathons every year to feel belonged to their online communities on Twitter; gym fanatics persistently workout every day to get "likes" on their gym selfies on Facebook and feel socially included. These cases show that the

intrinsic need for social relatedness can be effective in motivating users to engage.

Nonetheless, prior research on gamification generally discusses whether or not companies should use gamified apps (Hamari 2017; Sailer et al. 2017; Zuckerman & Gal-Oz 2014), and insights on the relative effectiveness of different game elements have focused on motivating customers' usage intention and engagement (Maher et al. 2022; Xu et al. 2022; Yang & Koenigstorfer 2021; Li et al. 2021; Feng, Tu, & Hsieh 2020).

Some of these studies manipulated the amount of game design elements in experiments, and examined which gamification features motivate users' engagement the most (Maher et al. 2022; Mazarakis & Bräuer 2022; Groening & Binnewies 2021; Chapman & Rich 2018). However, it is difficult and inefficient to examine game design elements respectively, because different gamified apps will have different combinations of game design elements. Other scholars define the categorization of game design elements by type. For example, Feng, Tu, & Hsieh (2020) define an incommensurate game element that the effort required in attaining which is not directly associated with consumers' performances in a task, and further indicate that those adopting an incommensurate game element have stronger intrinsic motivation in keep using the app than those adopting commensurate game elements.

However, we argue that Feng, Tu, & Hsieh (2020) focused on intrinsic motivation (autonomy, competence, and relatedness) and ignored the effect of extrinsic motivation on users' engagement behavior. Therefore, drawing inference from Self-Determination Theory (SDT) (Ryan & Deci 2000a), this study aims to examine the effectiveness of different game elements on users' usage behavior of fitness apps and continued use intentions. First, based on the previous studies, we propose to distinguish between two types of game elements based on the motivation triggered: *extrinsic* game elements, which motivate users by providing external incentives (Lewis et al. 2016; Sailer et al. 2017; Tabak et al. 2015), and, *intrinsic* game elements, which motivate users by satisfying their psychological need, such as social relatedness (Aparicio et al. 2012). Moreover, we suggest that compared with using extrinsic game elements, intrinsic game elements may be more effective in motivating users to engage, and consequentially, helping app developers to retain users.

2. LITERATURE REVIEW AND HYPOTHESES

2.1 Self-Determination Theory

Motivation guides the performance and persistence of many behaviors (Ryan & Deci 2000a). Many companies have the long-standing aim to encourage users to be more loyal and keep using the products or services they provided (Brodie et al. 2011; So et al. 2016). To help companies fulfill this pursuit, recent research sheds light on

motivation and proposes to investigate users' usage of technology-enabled services (e.g. apps) with SDT (Peters et al. 2018).

SDT distinguishes between two types of motivation: *extrinsic* and *intrinsic* motivation (Ryan & Deci 2000a). (1) Extrinsic motivation refers to the inclination to perform an activity *"in order to attain some separable outcomes* (Ryan & Deci 2000a, p.71). Under extrinsic motivation, users are encouraged to take actions to attain incentives that are instrumental towards other things of value. For instance, users may be motivated to use a fitness app in order to attain digital rewards provided in the app. (2) Intrinsic motivation is defined as the tendency to conduct an activity *"for its inherent satisfaction rather than some separable consequences"* (Ryan & Deci 2000b, p. 56). In contrast with extrinsic motivation, intrinsic motivation encourages users to engage in an activity not for the external incentives, but for the satisfaction of their own psychological needs, which include the need for *autonomy*, the need for *competence*, and the need for *social relatedness* (Buckworth et al. 2007; Ryan & Deci 2017; Aparicio et al. 2012). For instance, users may be motivated to use a fitness app for the fulfillment of accomplishing a personal goal, or, the feeling of being socially included. Nonetheless, the basic psychological needs are rarely taken into account in the current research on users' usage behaviors in mobile technologies (Peters et al. 2018). In this study, we draw inference from SDT to examine the influence of different game elements on users' usage behaviors and continued use of fitness apps.

2.2 Gamification and Motivation

Gamification is the application of game elements for the purpose of changing individuals' behaviors in non-gaming contexts (Deterding et al. 2011). The approach of gamification has been widely applied in many services (Huotari & Hamari 2017), such as e-commerce sites (Xu et al. 2020; Li, Lee, & Fu 2022), live-streaming (Li, Fang, & Wun 2019), mobile banking apps (Baptista & Oliveira 2017), online travel sites (Sigala 2015), and fitness apps (Hamari & Koivisto 2015b). Recent marketing research highlights the merits of gamification and suggests that it can help to increase users' cross-buying intention (Li, Lee, & Shiu 2020), usage behaviors, and continued use (Berger et al. 2018; Hammedi, Leclerq, & Van Riel 2017; Kim & Ahn 2017; Liu, Santhanam, & Webster 2017). For instance, gamified interactions in service encounters can increase self-brand connection (Berger et al. 2018) and usage behaviors in services (Hammedi et al. 2017; Sigala 2015). In fitness apps, a variety of game elements, such as badges, digital rewards and leaderboard, have been widely applied to encourage users to be more engaging, and hence, keep using the apps for longer (Hamari & Koivisto 2015b; Koivisto & Hamari 2014; Lewis et al. 2016; Zhu et al. 2017).

Despite the pervasiveness of gamification in fitness apps, previous studies provide ambivalent evidence on its effectiveness. Empirical results from some studies show that

certain game elements can effectively motivate users to use fitness apps (Hamari & Koivisto 2015a; Koivisto & Hamari 2014; Zuckerman & Gal-Oz 2014). For instance, previous research suggests that leaderboards and "likes" from friends can encourage users to adopt fitness apps and engage in exercise for longer (Hamari & Koivisto 2015a; Lee & Cho 2017; Stragier et al. 2016; Zhu et al. 2017). However, some studies provide contradictory evidence showing that some game elements are ineffective in motivating users (Hamari 2013; Mekler et al. 2017). Findings from these studies suggest that the novelty effect of points and badges may not be sustainable, and thus, fail to increase users' usage behaviors (Lee & Cho 2017; Mekler et al. 2017).

Given the conflicting evidence on the effectiveness of gamification in fitness apps, we argue that one possible explanation is that various game elements may have different impacts. Most previous studies manipulated the amount of game design elements in experiments, and examined which gamification features motivate users' engagement (Maher et al. 2022; Mazarakis & Bräuer 2022; Groening & Binnewies 2021; Chapman & Rich 2018). Moreover, some scholars define categorization of game design elements by different types (Feng, Tu, & Hsieh 2020; Li et al. 2021; Yang & Koenigstorfer 2021; Xu et al. 2022). The author's efforts to organize the categorization of game design elements from the literature are presented in Table 2.

Recent studies by Xu et al. (2017) and Wong & Kwok (2016) indicate that different game elements may trigger different types of motivation: some game elements (e.g., digital rewards) are more likely to be perceived by users as external incentives and arouse extrinsic motivation; whereas some other elements (e.g., leaderboard) are more likely to be considered by users as means to satisfy their psychological needs and trigger intrinsic motivation. Based on the previous studies, we adapted from Xu et al. (2017) to propose that game elements can be categorized into the following two types: (1) *extrinsic game elements* that award users according to the performance of a certain activity and function as external incentives, and; (2) *intrinsic game elements* that stimulate the feelings of competence, autonomy, and/or social relatedness in the experience of the activity, and, satisfy users' psychological needs. We categorize the game elements examined in previous research as intrinsic and extrinsic (as shown in Table 1) and further examine how these two types of game elements differ in their impacts on usage behaviors and continued use intentions.

Table 1: Game elements and related types of motivation

Motivation	Game elements	Definition	Literature
Extrinsic Motivation	Badges	Iconic element indicating achievements	Koivisto & Hamari (2014)
	Points	Numerical element indicating achievements	Walsh & Golbeck (2014)
	Digital rewards	Virtual incentives, prizes, or gifts	Lewis et al. (2016); Zuckerman & Gal-Oz (2014)
Intrinsic Motivation			
Autonomy	Role	Character or avatar performing a task	Bielik et al. (2012)
Competence	Leaderboard	Ranks for comparison of task performance	Allam et al. (2015); Zhu et al. (2017)
	Progression	Milestones indicating progress of a task	Brauner et al. (2013); Rose et al. (2013)
Relatedness	Like	Social interactions (e.g. give "likes") among people performing a certain task	Hamari & Koivisto (2015b); Lee & Cho (2017); Stragier et al. (2016)

Table 2: A review of categorization of game design elements and outcomes

Categorization of game design elements	Description	Examples of game elements	Outcomes	Theory	Source
Categorization of game design elements by quantity					
Four game design elements	A leaderboard that allows participants to compare their performance with their friends. Virtual gifts, such as gold running shoes. Hierarchical status, such as, bronze, silver, and gold. Challenges intended to enhance social support and program novelty.	Leaderboard, virtual gifts, hierarchical status, challenges	Physical activity, anxiety, depression, and stress	none	Maher et al. (2022)
Four game design elements	Badges and in particular narratives usually require a lot of effort, feedback and progress bars summarize information, which is usually easier to implement.	progress bar, narrative, feedback, and badges	an increase in motivation	SDT	Mazarakis & Bräuer (2022)
None vs. one vs. two vs. three game design elements	the amount of game design elements	points, story & bonus points	Motivation and performance	SDT	Groening & Binnewies (2021)
15 game elements	Points for assignments, due date bonuses and penalties, due date flexibility, etc.	barchart, freedom time, bonus, leaderboard, etc.	Increase students' perceived motivation in learning	SDT	Chapman & Rich (2018)

Table 2: (Continued)

Categorization of game design elements by type					
1. **Achievement and progression** 2. **social interaction** 3. **immersion**		1. Challenges, goal-setting, feedback, progress bars, points, levels, leaderboards, badges, rewards 2. Competition, collaboration, social support 3. Story or theme, avatars	daily step counts and time spent in physical activity	none	Xu et al. (2022)
Narrative path agility and narrative target clarity	Static narrative path design, users do not have the right to choose among different paths and can only experience a series of events in a predetermined sequence.	storyline	enhanced persistent usage intentions	Goal priming theory	Li et al. (2021)
1. Motivation related **2. education-related** **3. gamification-related app features**	Gamification-related features use game design elements to make the user experience playful and enjoyable.	Tracking, feedback, social support, goal setting, and reward features, etc.	behavioral intentions to use fitness apps	Unified Theory of Acceptance and Use of Technology 2	Yang & Koenigstorfer (2021)
1. **Commensurate** 2. **incommensurate game elements**	The game element that the effort required in attaining is (not) directly associated with consumers' performances in a task.	1. badges, points, progression, digital rewards 2. role, leaderboard, likes	Increase engagement behavior, intrinsic motivation, and loyalty	SDT	Feng, Tu, & Hsieh (2020)

2.3 Hypotheses Development

A primary aim of gamifying services is to motivate users (Berger et al. 2018; Hammedi et al. 2017; Robson et al. 2016). The experience of using a gamified service can trigger psychological states that motivate desirable behavioral outcomes, such as usage behaviors (Högberg et al. 2018). Usage behavior is considered as the important outcome that reflects users' usage behavior with mobile technologies (Vishvanathan et al. 2017) and the key effect of gamification that increase value in service delivery (Robson et al. 2016).

Furthermore, we draw inference from SDT to investigate the differential impacts of two types of game elements on users' usage behavior. Previous research on SDT suggests that users who are motivated intrinsically may engage in the task for longer, compared with those motivated extrinsically (Cerasoli, Nicklin, & Ford 2014; Ng et al. 2012; Woolley & Fishbach 2015). Sometimes, extrinsic motivation may even undermine users' intrinsic motivation (Deci et al. 1999), because it conduces users more to an external perceived locus of causality (Ryan & Deci 2000a). For example, facing gamified loyalty programs with rewards imposed with explicit requirements, customers' intentions to engage in the loyalty program are decreased (Kim & Ahn 2017). Based on these findings, we argue that while many studies show that extrinsic game elements (e.g., digital rewards) in fitness apps can motivate users to start exercising, the extrinsic motivation may not be sufficient to encourage users to sustain; in contrast, intrinsic game elements (e.g., leaderboard) can provide more enduring motives, and hence, encourage users to be more engaging. Thus, we propose:

H1: Compared with users using the fitness app with extrinsic game elements, those using the fitness app with intrinsic game elements have *higher usage* of the app.

Moreover, more frequent usage behaviors can often boost the continued use of an app. Recent research suggests gamification is associated with continued use (Xu et al. 2017). While Xu et al. (2022) describe that intrinsic motivation or extrinsic motivation has different effects on behavior change, existing research reveals that intrinsic motivation can promote not only behavior change in a more stable manner (Johnson et al. 2016). In addition, Li, Fang, & Wun (2019) explore the impact of game elements in the live-streaming context, and find out that when customers have high levels of perceived autonomy, the positive influences of a sense of belonging on continuance intention would be strengthened. Moreover, Windasari & Lin (2021) investigated the context of wearable devices for healthcare, and proposed interactivity embedded in wearables that is related to the intrinsic game elements leads to higher continued use

intentions. Given the empirical evidence on the positive impacts of usage behavior on loyalty, we argue that intrinsic game elements are more effective in increasing users' continued use intentions and encouraging them to keep using the apps. Hence, we propose:

H2: Compared with the fitness app with extrinsic game elements, users have *higher continued use intentions* towards the fitness app with intrinsic game elements.

3. FIELD EXPERIMENT

3.1 Design and Procedure

Prior to the field study, we asked 90 participants to evaluate both fitness apps on a five-point Likert scale for a manipulation check. The results show that the participants consider game elements (badges, points, digital rewards) in Walkup more focused on extrinsic motivation ($MWalkup_{extrinsic} = 3.82$, $MWalkup_{intrinsic} = 3.44$, $p = 0.001$) and game elements (role, leaderboard, progression, and like) in WeRun more focused on *intrinsic* motivation ($MWeRun_{extrinsic} = 3.54$, $MWeRun_{intrinsic} = 3.76$, $p = 0.014$).

To test our hypotheses, we conducted a field experiment. We adopt convenience sampling (the researcher announces the study and participants self-select if they wish to participate) to recruit 198 students in a university, and 22 participants via snowball recruiting (participants are referred to the researcher). After recruitment, we provided detailed instructions of the experiment and ensured the protection of the participant's privacy and confidentiality of their responses. Each participant signed a written consent form, and was instructed to download a specific fitness app and use the app to track their daily physical activity in a designated period, and in exchange, the participants received running armbands as gifts.

Among the 220 participants, 189 of them completed the study. We measured participants' exercise habits prior to the fitness-tracking study. The results showed no significant difference on participants' current exercise habits between those in Walkup and WeRun groups (Mean $_{Walkup} = 3.58$, $Std_{Walkup} = 0.88$, Mean $_{WeRun} = 3.65$, $Std_{WeRun} = 0.89$, $t\ (128) = -0.46$, $p = 0.64$). In addition, we test the robustness of the results, the effect of covariates on demographics was estimated, namely age ($F = 0.31$, $p = 0.58$), gender ($F = 1.77$, $p = 0.19$), health status ($F = 0.23$, $p = 0.63$), exercise habit ($F = 2.08$, $p = 0.15$), exercise frequency ($F = 2.66$, $p = 0.11$), and experienced in using an exercise gamification application ($F = 0.47$, $p = 0.49$). ANCOVA results of the analysis of covariance suggest that all covariates had no significant effect ($p > 0.05$) on the relationship between game elements group and continued use intention.

The demographic information of the participants is shown in Table 3. The

participants were randomly assigned into two groups (intrinsic vs. extrinsic game elements) and were asked to track their daily exercise using one of two fitness apps: one is "Walkup" (n = 91), a stimulus in the *extrinsic* game elements group; another is "WeRun" (n = 98), a stimulus in the *intrinsic* game elements group. The screenshots of these two apps are shown in Figure 1 and 2. (1) Walkup is a gamified fitness app that tracks users' exercise and awards them with badges, points, and digital rewards according to their step counts. (2) WeRun is an app integrated with a social media platform "WeChat" that has over 963 million active users (Statista 2017); WeRun includes the following intrinsic game elements: role, leaderboard, progression, and like. Users can see their rankings on step counts among friends, their progression of exercise performance, and give "likes" to the performance of other users.

The participants were told to track their exercise activities with the assigned fitness app for a month. Since a majority of field studies on gamified health apps were with durations of a month or less (Sardi, Idri, & Fernández-Alemán 2017; Seaborn & Fels 2015), we chose the duration of five weeks. Participants' usage behavior was measured on each day of the month; One week after the fitness tracking task, we contacted the participants to fill out a follow-up survey and measured their intentions to continue using the app.

Table 3: Demographic Information of the Participants

Demographics		
Gender	Male Female	56.9% 43.1%
Age	Below 20 20-25 Above 25	13% 77% 10%
Health status	Very good Good Acceptable Poor Very poor	31.7% 48.6% 17.6% 2.1% 0%
Have exercise habit	Strongly agree Agree Neither agree or disagree Disagree Strongly disagree	16% 19.8% 25.5% 21.7% 17%
Exercise frequency	more than three times a week at least three times a week at least twice a week at least once a week less than once a week	9.5% 22.4% 21.6% 6.8% 39.7%
Experienced in using an exercise gamification application	Yes No	27.1% 72.9%

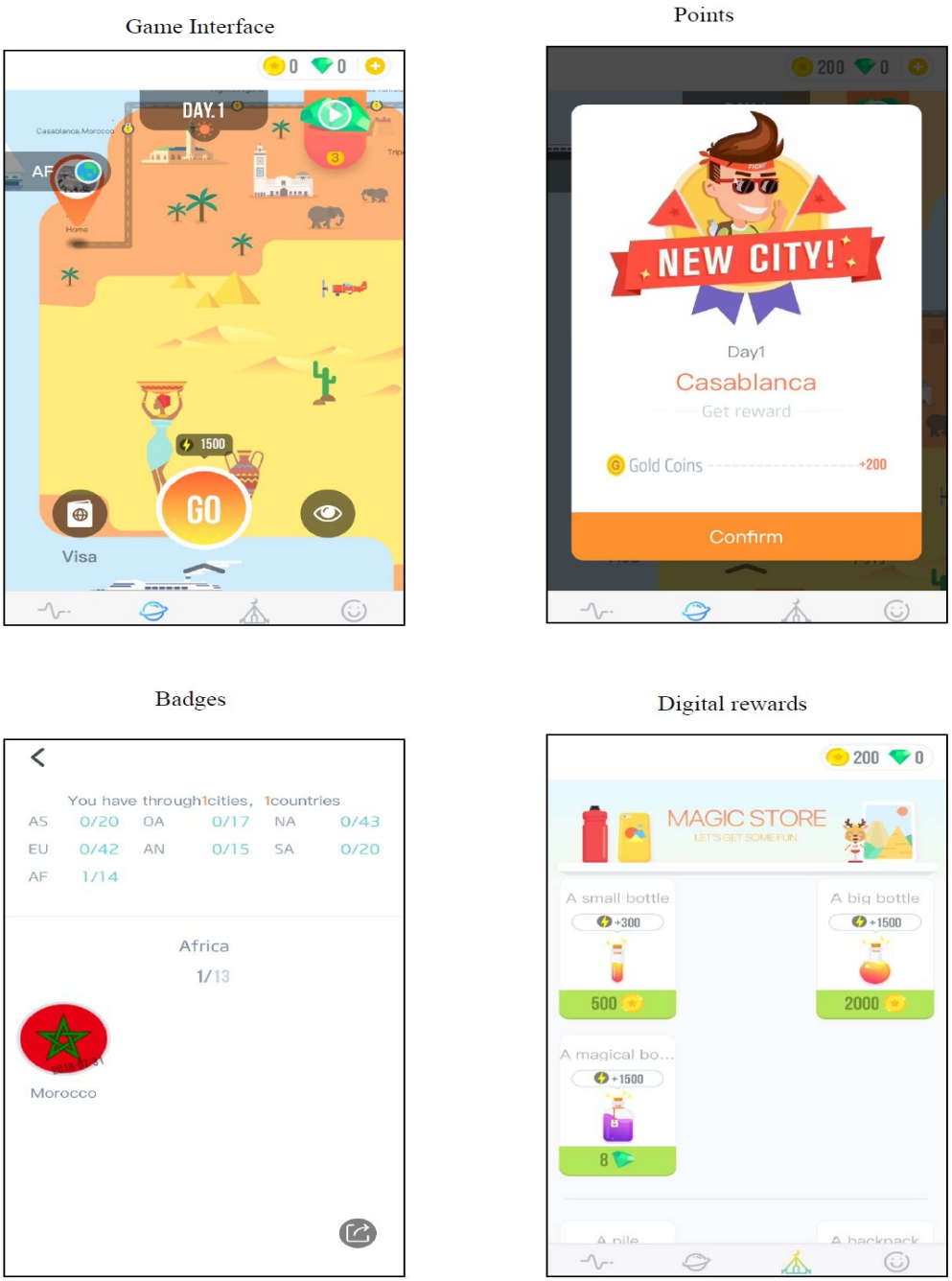

Figure 1: The Screenshots of Walkup

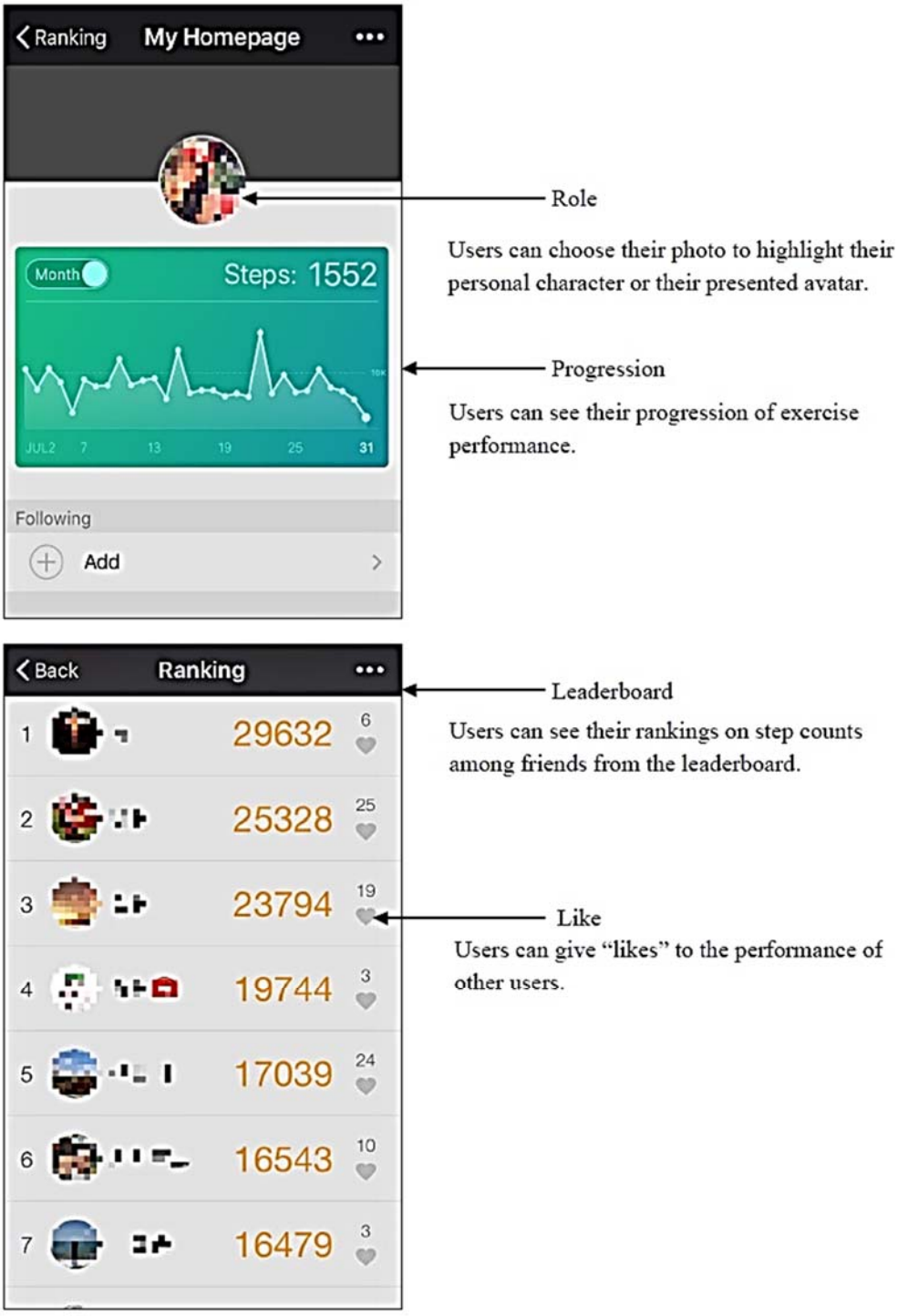

Figure 2: The Screenshots of WeRun

3.2 Measures

Users' usage behavior and continued use intentions were measured as follows. Usage behavior was measured by participants' daily step counts tracked by the fitness app. The number of step counts of each participant was collected through API and recorded every day at 11:00 PM. Two research assistants recorded the screenshots of the fitness app with a display of the number of each participant's step counts on a daily

basis without disturbing participants. In addition, during the experimental period, we did not impose other requests on participants to avoid introducing additional pressure or stress. We expected that participants would feel like they were not in control, so the procedure will be closer to the natural experiment. Continued use intention was measured with six items: (1) "If I can, I will keep using this app", (2) "I tend to continue using this app in the foreseeable future", (3) "I expect I will keep using this app", (4) "Compared with other fitness apps, I tend to this app more", (5) "I will use this app more frequently than before", (6) "every time I exercise, I will open this app" (*Cronbach's* α = 0.942). The above items were measured on a five-point Likert scale, ranging from 1 ("strongly disagree") to 5 ("strongly agree").

4. RESULTS

4.1 Usage Behavior

Figure 3 describes the trends of daily step counts of the participants in both Walkup and WeRun groups. We conducted ANOVA to test the differences in daily step counts between the participants using Walkup and those using WeRun. The results show that the participants using WeRun have a significantly higher number of daily step counts than those using Walkup (M_{Walup} = 4550.52, M_{WeRun} = 7701.67, F *(1,183)* = 61.281, $p < 0.001$) on average, and, in each of the five weeks, as shown in Table 4. The results suggest that compared with users using the fitness app with extrinsic game elements, those using the app with intrinsic game elements have significantly higher usage behavior. H1 was supported.

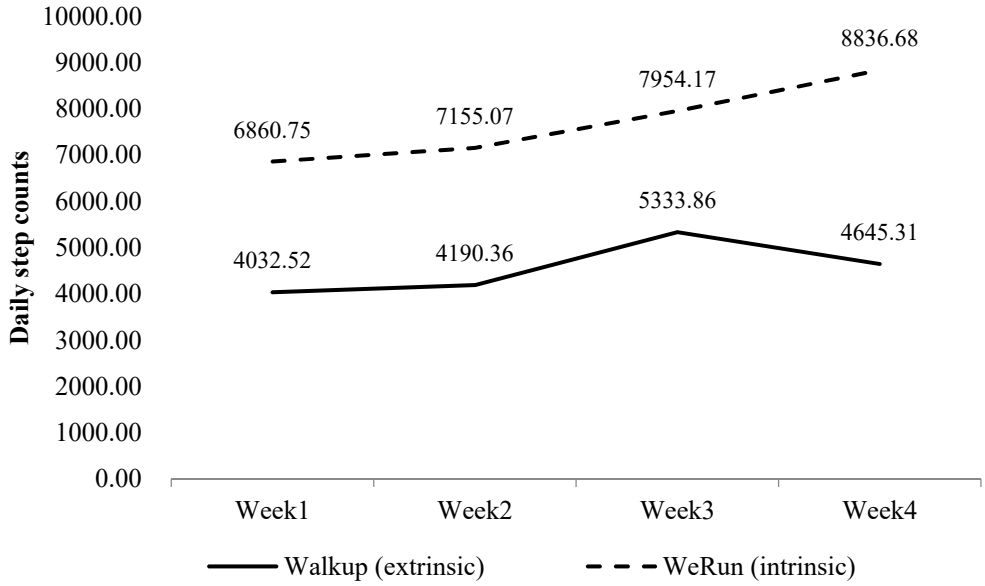

Figure 3: Trends of Step Counts of the Participants Using Walkup and WeRun

4.2 Continued Use Intention

We examined the participants' intentions to continue using the two fitness apps.

Results from ANOVA indicate that compared with the participants using Walkup (M_{Walkup} = 2.95, SD_{Walkup} = 1.00), those using WeRun show significantly higher intentions to keep using the app (M_{WeRun} = 3.65, SD_{WeRun} = 0.82, F = 26.176, p < 0.001) (Figure 4). The results indicated that the participants using the fitness app with intrinsic game elements have higher continued use intentions, compared with those using the app with extrinsic game elements. H2 was supported. In sum, the results from our field experiment indicate that compared with users using the fitness app with extrinsic game elements (i.e., Walkup), those using the fitness app with intrinsic game elements (i.e., WeRun) show significantly higher usage behavior (H1 supported) and greater intentions to continue using the fitness app (H2 supported).

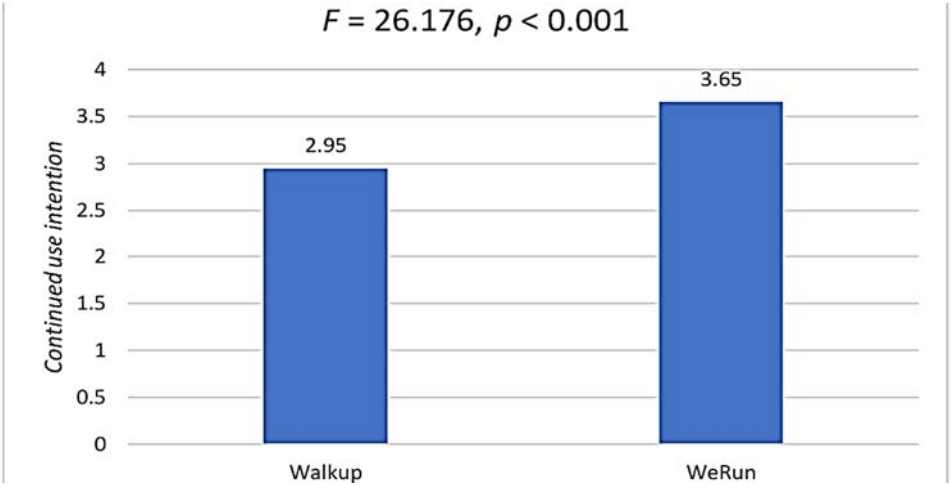

Figure 4: Continuous Use Intention

Table 4: Difference on daily step counts of the participants using Walkup and WeRun

	Walkup			**WeRun**			**Differences between the two apps**
	M	***SE***	***Differences with the previous week***	***M***	***SE***	***Difference with the previous week***	
Week 1	3128.85	341.40		5156.36	390.28		t (114) = -3.900, p < 0.001
Week 2	3737.08	445.40	t (56) = -1.767, p = 0.083	5692.77	338.51	t (58) = -1.458, p = 0.150	t (114) = -3.511, p = 0.001
Week 3	4529.48	487.98	t (56) = -1.866, p = 0.067	5808.75	413.57	t (58) = -0.290, p = 0.773	t (114) = -2.006, p = 0.047
Week 4	5410.41	512.50	t (56) = -1.875, p = 0.066	7308.85	639.06	t (58) = -3.178, p =0.002	t (114) = -2.308, p = 0.023
Week 5	5045.74	517.19	t (56) = 0.659, p = 0.512	8843.46	506.50	t (58) = -2.294, p = 0.025	t (114) = -5.247, p = 0.001

5. DISCUSSION

Gamification is pervasively applied in many services (Huotari & Hamari 2017). In fitness apps, many app developers have gamified the services, aiming at increasing users' usage and retaining users. Nonetheless, using gamification in fitness apps yields mixed results: in some cases, gamification helps to increase users' usage of a fitness app; whereas in some other cases, gamification appears ineffective in increasing users' usage. In this study, we argue that various game elements may differ in their effectiveness and distinguish between two types of game elements based on the motivation triggered: extrinsic and intrinsic game elements. Moreover, by examining the effectiveness of the two types of game elements, this study indicates that compared with *extrinsic* game elements, using *intrinsic* game elements can better motivate users to engage in fitness apps. Results from a five-week field experiment confirm our hypotheses. The findings from our study suggest that compared with users using the fitness app with extrinsic game elements, those using the fitness app with intrinsic game elements are more engaged and show higher attitudinal and behavioral loyalty towards the fitness app.

5.1 Theoretical Contributions

Findings from this study provide the following contributions to the current research on gamification in services: First, the current research on gamified services generally focuses on the influence of users' perceived value of the services, but little sheds light on their *motivation*. Extant studies on users' usage of mobile apps have discussed the impacts of the utilitarian value (e.g., convenience), hedonic value (e.g., enjoyment), and social value (e.g., subjective norm) (Baptista & Oliveira 2017; Hamari 2017; Hamari & Koivisto 2015b; Yuan et al. 2015); however, only a few discuss the role of users' motivation in the research of gamified service (Sailer et al. 2017). However, SDT is a well-established motivation theory for health behavior interventions (Deci & Ryan 2012), and Xu et al. (2022) suggested that applying gamification to promote intrinsic motivation to improve users' physical activity participation. Our research draws an inference from SDT and highlights the influence of users' motivation on their usage of gamified services.

Second, previous researchers generally identify the practice of gamification as a dichotomy: *whether or not* to gamify a service (Hamari & Koivisto 2015a; Högberg et al. 2018; Berger et al. 2018). While a majority of previous studies have discussed the merits of gamification, Groening & Binnewies (2021) conclude that a high amount of game design elements benefits motivation and performance based on SDT. Most previous studies manipulated the amount of game design elements in experiments to examine users' engagement (Maher et al. 2022; Mazarakis & Bräuer 2022; Groening &

Binnewies 2021; Chapman & Rich 2018). However, we suggest that the effectiveness of gamification may depend on the specific game elements applied. Nonetheless, we argue that different game elements may arouse different motivations, rendering different effectiveness; in other words, *what* game elements companies choose matters.

Chapman & Rich (2018) adopted 15 game elements to measure the level of motivation, and concluded that four-game elements were related to autonomy and competency. However, it is difficult and inefficient to examine game design elements respectively, because different gamified apps will have different combinations of game design elements. Therefore, some scholars define categorization of game design elements by different types (Feng, Tu, & Hsieh 2020; Li et al. 2021; Yang & Koenigstorfer 2021; Xu et al. 2022). Xu et al. (2017) proposed the concept of extrinsic game elements and intrinsic game elements in exploratory research without empirical testing. Therefore, from the perspective of users' motivation, we adapted the research by Xu et al. (2017) to distinguish between two types of game elements (i.e., extrinsic and intrinsic) according to the motivation triggered and further conducted a field experiment to examine their effectiveness on users' usage and continued use intentions.

Third, whereas prior research provides ambivalent findings on the effectiveness of gamification in fitness apps, our study shows that the difference in effectiveness may be a result of different types of game elements. Specifically, previous studies on gamification in fitness apps provide contradictory empirical evidence on its effectiveness: some find that using gamification can encourage users to keep using fitness apps (Hamari & Koivisto 2015a; Stragier et al. 2016; Zhu et al. 2017), while others suggest the gamification fails to motivate users to sustain (Hamari 2013; Lee & Cho 2017; Mekler et al. 2017). In sum, there is no clear evidence about the effectiveness of gamified interventions (Mazeas et al. 2022). Therefore, how exactly different game design elements supporting motivation is still not answered sufficiently (Koivisto & Hamari 2019; Mazarakis 2021). Consequently, findings from our study indicate the effectiveness of gamification may depend on what type of game elements companies use: compared with extrinsic game element, intrinsic game element is relatively more effective in encouraging users' usage and increasing their continued use intentions towards fitness apps.

5.2 Managerial Implications

Many fitness app developers have invested heavily in gamification, hoping to motivate users to be more engaged and loyal. Nonetheless, our study indicates that not all game elements can effectively motivate users to sustain. Taking the perspective of users' motivation, we show that different game elements may trigger various types of motivation, and hence, have different impacts on users' behaviors. This suggests that gamification should not be considered by the app developers as a method that is directly

associated with desirable behavioral outcomes; rather, gamification should be treated as an approach giving rise to service experiences that can provoke users' motivation to satisfy their psychological needs by engaging in fitness apps.

Moreover, while a majority of app developers use external incentives to encourage users to keep using fitness apps, our study suggests that the effectiveness of such an approach may not sustain. The results from our study indicate that the impacts of extrinsic motivation aroused by incentives may fade and potentially not strong enough to motivate users to engage; in contrast, the game elements that arouse users' intrinsic motivation can more effectively increase their usage and loyalty. These findings underline the importance of inciting users' intrinsic motivation to retain users.

Finally, our study highlights the importance of the social aspects of gamification in stimulating users' intrinsic motivation. Given the pervasive use of social media, the need for social relatedness inarguably defines users' experience (Peters et al. 2018). Social media can represent operant resources for users in gamified services (Huotari & Hamari 2017). This study shows that compared with fitness apps providing incentives, users are more engaged in and loyal to the apps that make extensive use of social media and allow them to share their exercise. This indicates that for fitness app developers, instead of investing heavily in offering external incentives, making effort in enhancing the social aspects of gamification can be a more effective approach to retaining users.

5.3 Limitations and Future Research

Despite the above contributions, several limitations should be considered. First, this research examines the effectiveness of the extrinsic and intrinsic game elements in the context of fitness app adoption. Future research can investigate the influence of these two types of elements in other service contexts in which gamification is also pervasively applied, such as restaurants, airlines, and tourism (Huotari & Hamari 2017). Moreover, in this study, we compare the effectiveness of the game elements that arouse extrinsic motivation and those that arouse intrinsic motivation, and have not yet fully discussed the impacts of the specific psychological needs: autonomy, competence, and relatedness. Future studies can investigate the relative effectiveness of game elements in addressing the three psychological needs.

Conflict of Interest Statement

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Ethics Statement

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or

comparable ethical standards. Prior to the research, ethical approval was obtained from the Academic Ethics Committee of the University. All individual participants were required to read and sign the informed consent before participating in this research.

Data Availability Statement

The research materials and datasets that support the findings of this study are available on request from the corresponding author. They are not publicly available due to them containing information that could compromise research participant privacy.

REFERENCES

Allam, A., Kostova, Z., Nakamoto, K., & Schulz, P. J. (2015). The effect of social support features and gamification on a Web-based intervention for rheumatoid arthritis patients: randomized controlled trial. *Journal of Medical Internet Research*, 17(1), e3510.

Aparicio, A. F., Vela, F. L. G., Sánchez, J. L. G., & Montes, J. L. I. (2012, October). Analysis and application of gamification. In *Proceedings of the 13th International Conference on Interacción Persona-Ordenador*, 1-2.

Baptista, G., & Oliveira, T. (2017). Why so serious? Gamification impact in the acceptance of mobile banking services. *Internet Research*, 27(1), 118-139.

Benes, R. (2018). *Most apps get deleted within a week of last use.* Insider Intelligence. https://www.emarketer.com/content/most-apps-get-deleted-within-a-week.

Berger, A., Schlager, T., Sprott, D. E., & Herrmann, A. (2018). Gamified interactions: Whether, when, and how games facilitate self–brand connections. *Journal of the Academy of Marketing Science*, 46 (4), 652-673

Bielik, P., Tomlein, M., Krátky, P., Mitrík, Š., Barla, M., & Bieliková, M. (2012, January). Move2Play: an innovative approach to encouraging people to be more physically active. In *Proceedings of the 2nd ACM SIGHIT International Health Informatics Symposium*, 61-70.

Brauner, P., Valdez, A. C., Schroeder, U., & Ziefle, M. (2013, July). Increase physical fitness and create health awareness through exergames and gamification. In *International Conference on Human Factors in Computing and Informatics*, Springer, Berlin, Heidelberg, 349-362.

Brodie, R. J., Hollebeek, L. D., Jurić, B., & Ilić, A. (2011). Customer engagement: Conceptual domain, fundamental propositions, and implications for research. *Journal of Service Research*, 14(3), 252-271.

Buckworth, J., Lee, R. E., Regan, G., Schneider, L. K., & DiClemente, C. C. (2007). Decomposing intrinsic and extrinsic motivation for exercise: Application to stages of motivational readiness. *Psychology of Sport and Exercise*, 8(4), 441-461.

Cerasoli, C. P., Nicklin, J. M., & Ford, M. T. (2014). Intrinsic motivation and extrinsic

incentives jointly predict performance: A 40-year meta-analysis. *Psychological Bulletin*, 140(4), 980-1008.

Chapman, J. R., & Rich, P. J. (2018). Does educational gamification improve students' motivation? If so, which game elements work best?. *Journal of Education for Business*, 93(7), 315-322.

Deci, E. L., Koestner, R., & Ryan, R. M. (1999). A meta-analytic review of experiments examining the effects of extrinsic rewards on intrinsic motivation. *Psychological Bulletin*, 125(6), 627.

Deci, E. L., & Ryan, R. M. (2012). Motivation, personality, and development within embedded social contexts: An overview of self-determination theory. In: *The Oxford Handbook of Human Motivation* (1 ed.). Oxfordshire, United Kingdom: Oxford University Press, 85-107.

Deterding, S., Sicart, M., Nacke, L., O'Hara, K., & Dixon, D. (2011, May). Gamification using game-design elements in non-gaming contexts. In *CHI'11 Extended Abstracts on Human Factors in Computing Systems*, 2425-2428.

Edwards, E. A., Lumsden, J., Rivas, C., Steed, L., Edwards, L. A., Thiyagarajan, A., &Walton, R. T. (2016). Gamification for health promotion: Systematic review of behaviour change techniques in smartphone apps. *BMJ open*, 6(10), e012447.

Feng, W., Tu, R., & Hsieh, P. (2020). Can gamification increases consumers' engagement in fitness apps? The moderating role of commensurability of the game elements. *Journal of Retailing and Consumer Services*, 57, 102229.

Groening, C., & Binnewies, C. (2021). The more, the merrier?-How adding and removing game design elements impact motivation and performance in a gamification environment. *International Journal of Human–Computer Interaction*, 37(12), 1130-1150.

Hamari, J. (2013). Transforming homo economicus into homo ludens: A field experiment on gamification in a utilitarian peer-to-peer trading service. *Electronic Commerce Research and Applications*, 12(4), 236-245.

Hamari, J. (2017). Do badges increase user activity? A field experiment on the effects of gamification. *Computers in Human Behavior*, 71, 469-478.

Hamari, J., & Koivisto, J. (2015a). Why do people use gamification services? *International Journal of Information Management*, 35(4), 419-431.

Hamari, J., & Koivisto, J. (2015b). "Working out for likes": An empirical study on social influence in exercise gamification. *Computers in Human Behavior*, 50, 333-347.

Hammedi, W., Leclerq, T., & Van Riel, A. C. (2017). The use of gamification mechanics to increase employee and user engagement in participative healthcare services: A study of two cases. *Journal of Service Management*, 28(4), 640-661.

Högberg, J., Shams, P., & Wästlund, E. (2018). Gamified in-store mobile marketing: The mixed effect of gamified point-of-purchase advertising. *Journal of Retailing and Consumer Services,* 50, 298-304.

Huotari, K., & Hamari, J. (2017). A definition for gamification: anchoring gamification in the service marketing literature. *Electronic Markets,* 27(1), 21-31.

Johnson, D., Deterding, S., Kuhn, K. A., Staneva, A., Stoyanov, S., & Hides, L. (2016). Gamification for health and wellbeing: A systematic review of the literature. *Internet interventions*, 6, 89-106.

Karapanos, E., Gouveia, R., Hassenzahl, M., & Forlizzi, J. (2016). Wellbeing in the making: peoples' experiences with wearable activity trackers. *Psychology of Well-being*, 6(1), 1-17.

Kim, K., & Ahn, S. J. G. (2017). The role of gamification in enhancing intrinsic motivation to use a loyalty program. *Journal of Interactive Marketing*, 40, 41-51.

Koivisto, J., & Hamari, J. (2014). Demographic differences in perceived benefits from gamification. *Computers in Human Behavior*, 35, 179-188.

Koivisto, J., & Hamari, J. (2019). Gamification of physical activity: A systematic literature review of comparison studies. In *GamiFIN*, 106-117.

Lee, H. E., & Cho, J. (2017). What motivates users to continue using diet and fitness apps? Application of the uses and gratifications approach. *Health Communication*, 32(12), 1445-1453.

Lewis, Z. H., Swartz, M. C., & Lyons, E. J. (2016). What's the point? a review of reward systems implemented in gamification interventions. *Games for Health Journal*, 5(2), 93-99.

Li, C.Y., Lee, S.M. and Shiu, S.Y. (2020). Sale from fun: The influence of gamification on brand attachment and cross-buying. *Journal of Information Management*, 27(3), 265-290.

Li, C.Y., Fang, Y.H. and Wun, G.L. (2019). Play with live broadcasts? The influence of gamification on continuance intention. *Journal of Information Management*, 26(3), 241-274.

Li, C.Y., Lee, S.M., & Fu, H.C. (2022). Game is so fun! The influence of gamified CE mechanism on purchase intention. *Journal of Information Management*, 29(1), 45-74.

Li, M., Wang, Y., Wu, Y., & Liu, H. (2021). Gamification narrative design as a predictor for mobile fitness app user persistent usage intentions: a goal priming perspective. *Enterprise Information Systems*, 15(10), 1501-1545.

Lister, C., West, J. H., Cannon, B., Sax, T., & Brodegard, D. (2014). Just a fad? Gamification in health and fitness apps. *JMIR Serious Games*, 2(2), e3413.

Liu, D., Santhanam, R., & Webster, J. (2017). Toward meaningful engagement: A framework for design and research of gamified information systems. *MIS*

Quarterly, 41(4), 1011-1034.

Maher, C. A., Olds, T., Vandelanotte, C., Plotnikoff, R., Edney, S. M., Ryan, J. C., ... & Curtis, R. G. (2022). Gamification in a physical activity app: What gamification features are being used, by whom, and does it make a difference?. *Games for Health Journal*, 11(3), 1-7.

Mazarakis, A. (2021). Gamification reloaded: Current and future trends in gamification science. *i-com*, 20(3), 279-294.

Mazarakis, A., & Bräuer, P. (2022). Gamification is working, but which one exactly? Results from an experiment with four game design elements. *International Journal of Human–Computer Interaction*, 1-16.

Mazeas, A., Duclos, M., Pereira, B., & Chalabaev, A. (2022). Evaluating the effectiveness of gamification on physical activity: systematic review and meta-analysis of randomized controlled trials. *Journal of Medical Internet Research*, 24(1), e26779.

Mekler, E. D., Brühlmann, F., Tuch, A. N., & Opwis, K. (2017). Towards understanding the effects of individual gamification elements on intrinsic motivation and performance. *Computers in Human Behavior*, 71, 525-534.

Ng, J. Y., Ntoumanis, N., Thøgersen-Ntoumani, C., Deci, E. L., Ryan, R. M., Duda, J. L., & Williams, G. C. (2012). Self-determination theory applied to health contexts: A meta-analysis. *Perspectives on Psychological Science*, 7(4), 325-340.

Peters, D., Calvo, R. A., & Ryan, R. M. (2018). Designing for motivation, engagement and wellbeing in digital experience. *Frontiers in Psychology*, 9, 797.

Robson, K., Plangger, K., Kietzmann, J. H., Mccarthy, I., & Pitt, L. (2016). Game on: Engaging customers and employees through gamification. *Business Horizons*, 59(1), 29-36.

Rose, J. P., Geers, A. L., Fowler, S. L., & Rasinski, H. M. (2013). Choice-making, expectations, and treatment positivity: how and when choosing shapes aversive experiences. *Journal of Behavioral Decision Making*, 1(27), 1-10.

Ryan, R. M., & Deci, E. L. (2000a). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*, 55(1), 68-78.

Ryan, R. M., & Deci, E. L. (2000b). Intrinsic and extrinsic motivations: classic definitions and new directions. *Contemporary Educational Psychology*, 25(1), 54-67.

Ryan, R. M., & Deci, E. L. (2017). *Self-determination theory: Basic psychological needs in motivation, development, and wellness*. Guilford Publications.

Sailer, M., Hense, J. U., Mayr, S. K., & Mandl, H. (2017). How gamification motivates: An experimental study of the effects of specific game design elements on

psychological need satisfaction. *Computers in Human Behavior*, 69, 371-380.

Sardi, L., Idri, A., & Fernández-Alemán, J. L. (2017). A systematic review of gamification in e-Health. *Journal of Biomedical Informatics*, 71, 31-48.

Seaborn, K., & Fels, D. I. (2015). Gamification in theory and action: A survey. *International Journal of Human-Computer Studies*, 74, 14-31.

Sigala, M. (2015). The application and impact of gamification funware on trip planning and experiences: the case of TripAdvisor's funware. *Electronic Markets*, 25(3), 189-209.

So, K. F. K., King, C., Sparks, B. A., & Ying, W. (2016). The role of customer engagement in building consumer loyalty to tourism brands. *Journal of Travel Research*, 55(1), 64-78.

Statista (2017). *Number of monthly active WeChat users from 2nd quarter 2010 to 2nd quarter 2017.* Statista. http://www.statista.com/statistics/255778/number-of-active-wechat- messenger-accounts.

Stragier, J., Abeele, M. V., Mechant, P., & De Marez, L. (2016). Understanding persistence in the use of online fitness communities: comparing novice and experienced users. *Computers in Human Behavior*, 64, 34-42.

Strava (2017). *2017 in stats*. Strava stories. http://blog.strava.com/2017-in-stats/

Tabak, M., Dekker-van Weering, M., van Dijk, H., & Vollenbroek-Hutten, M. (2015). Promoting daily physical activity by means of mobile gaming: a review of the state of the art. *Games for Health Journal*, 4(6), 460-469.

Vishvanathan, V., Hollebeek, L., Malthouse, E., Maslowska, E., Su, J. K., & Wei, X. (2017). The dynamics of consumer engagement with mobile technologies. *Service Science,* 9(1), 36-49.

Walsh, G., & Golbeck, J. (2014, April). StepCity: a preliminary investigation of a personal informatics-based social game on behavior change. In *CHI'14 Extended Abstracts on Human Factors in Computing Systems,* 2371-2376.

Windasari, N. A., & Lin, F. R. (2021). Why do people continue using fitness wearables? The effect of interactivity and gamification. *SAGE Open*, 11(4), 21582440211056606.

Wong, C. C. K., & Kwok, R. C. W. (2016, June). The effect of gamified mHealth app on exercise motivation and physical activity. In Pacific Asia Conference on Information Systems (PACIS) 2016, 389.

Woolley, K., & Fishbach, A. (2015). The experience matters more than you think: People value intrinsic incentives more inside than outside an activity. *Journal of Personality and Social Psychology*, 109(6), 968-982.

Xu, F., Buhalis, D., & Weber, J. (2017). Serious games and the gamification of tourism. *Tourism Management*, 60, 244-256.

Xu L., Shi H., Shen M., Ni Y., Zhang X., Pang Y., Yu T., Lian X., Yu T., Yang X., Li F. (2022). The effects of mHealth-based gamification interventions on participation in physical activity: systematic review. *JMIR mHealth and uHealth*, 10(2), e27794.

Xu, Y., Lee, C.C., Tsao, Y. and Yen, K.Y. (2020). Enhancing consumer online shopping behavior through gamification. *Journal of Information Management*, 27(3), 291-310.

Yang, Y., & Koenigstorfer, J. (2021). Determinants of fitness app usage and moderating impacts of education-, motivation-, and gamification-related app features on physical activity intentions: cross-sectional survey study. *Journal of medical Internet research*, 23(7), e26063.

Yuan, S., Ma, W., Kanthawala, S., & Peng, W. (2015). Keep using my health apps: Discover users' perception of health and fitness apps with the UTAUT2 model. *Telemedicine and e-Health*, 21(9), 735-741.

Zhou, X., & Krishnan, A. (2019). What predicts exercise maintenance and well-being? Examining the influence of health-related psychographic factors and social media communication. *Health communication*, 34(6), 589-597.

Zhu, Y., Dailey, S. L., Kreitzberg, D., & Bernhardt, J. (2017). "Social networkout": Connecting social features of wearable fitness trackers with physical exercise. *Journal of Health Communication*, 22(12), 974-980.

Zuckerman, O., & Gal-Oz, A. (2014). Deconstructing gamification: evaluating the effectiveness of continuous measurement, virtual rewards, and social comparison for promoting physical activity. *Personal and Ubiquitous Computing*, 18(7), 1705-1719.