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GAMIFICATION CAN HELP CONSUMERS REACH THEIR SAVING GOALS

Technical Report

Nethal Hashim
Irene Scopelliti
Janina Steinmetz

THINK FORWARD INITIATIVE

GAMIFICATION CAN HELP CONSUMERS REACH THEIR SAVING GOALS[1*]

Technical Report

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Abstract

Individuals often have difficulty saving money because they discount the long-term benefits of saving. Thus, they prefer the immediate pleasure of spending over the delayed reward of having savings. We hypothesize that the use of gamification can increase one's propensity to save by adding immediate psychological rewards to an otherwise unpleasant behavior such as saving. In a field study, we tested whether a gamified version of a web app to track savings enhanced participants' likelihood to achieve their saving goal compared to a control (non-gamified) version of the same web app. In the study, participants initially set a saving goal to be achieved in four weeks. They were then randomly assigned to either the gamified or the control version of a web app on which they logged any savings toward their goal over the four-week period. Our results showed that participants in the gamified condition were more likely to achieve their saving goal than participants in the control condition.

***Keywords*:** Gamification, saving behavior, intertemporal choice, game elements, immediate rewards

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[*] This report has been prepared by the authors for the Think Forward Initiative.

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1. Introduction

People often find it difficult to save. In Europe, over 60% of people do not have more than three months-worth of their monthly income saved (ING, 2017). Low savings leave individuals susceptible to financial shocks and poverty. Therefore, it is important to develop and test interventions to help consumers save more. The aim of this research is to test whether gamified saving tools can improve saving behavior. To this end, we ran a field experiment (N = 331) over a four-week period.

In this field experiment, we tested whether the use of gamification in a web application to track savings produces an increase in participants' likelihood to achieve a saving goal over a four-week period. We also examined whether this effect persisted when we included several covariates in the analysis such as participants' tightwad vs. spendthrift tendencies, debt aversion, propensity to plan for money, self-control, future orientation, and financial literacy. We also tested whether using the gamified (vs. the control) version of the web app was more enjoyable.

To test whether consumers have insight into the potential benefits of using a gamified saving app, we also ran a prediction study. We asked a separate sample of participants (N = 212) to what extent they expected a web app to track their savings that was either gamified or non-gamified to be useful and enjoyable, and how often they would use it.

This report is structured as follows: First, we discuss the theoretical background of our research, positioning it within the literature on saving behavior and explaining why gamification can be an effective tool to help consumers reach a saving goal. Second, we report the results of the prediction study and of the main field study in subsequent sections. Finally, we discuss the implications of our results for research and practice. Additionally, we discuss the limitations of our study as well as directions for future research.

2. Theoretical Framework

Gamification uses elements typical of games such as badges, leaderboards, and narratives to motivate a desired target behavior (Deterding, Khaled, Nacke, & Dixon, 2011) by increasing the likelihood that actors experience responses typical of games, such as mastery, competition, and escapism within otherwise 'serious' activities (Huotari & Hamari, 2017). Typical examples of gamified environments are applications such as Duolingo (which motivates users to learn a new language) and Zombie Run (which motivates users to be physically active). Both apps utilize elements of games to make studying or running more enjoyable. Within the Duolingo app, users can track their progress and win rewards for doing well. In the Zombie Run app, users are virtually transported into a post-apocalyptic world in which they need to go on running missions for their base.

Beyond fostering studying and running, gamification could potentially also be used to motivate other behaviors that improve consumers' lives, including financial saving behavior (Kim, 2015). This hypothesis builds on the notion that behaviors such as studying, exercising, and saving share a common motivational difficulty: Although these behaviors can offer long-term rewards (such as the mastery of a language, health, or a secure retirement), they often lack immediate gratification.

The difficulty for consumers to save has been widely studied (see, for example, Thaler, 1994; Thaler & Shefrin, 1981; Dur, Fleming, van Garderen, & van Lent, 2021). To save money, consumers experience a conflict between their "present" and "future" selves (Ainslie, 1975). The conflict arises when the goals of their "present" and "future" selves do not align. The "future" self would benefit from the "present" self's pursuit of important long-term goals such as saving money (Vosgerau, Scopelliti, & Huh, 2020). However, for the "present" self, the appeal of an immediate purchase disproportionately outweighs the appeal of saving for the future, as characterized by hyperbolic discounting (Frederick, Loewenstein, & O'Donoghue, 2003), leading consumers to make decisions that they would not normally make with enough planning (Hershfield et al., 2011).

Research has tested the effectiveness of interventions to help people save, such as automatic enrollment in employee retirement saving programs (Thaler & Benartzi, 2004), and the use of age rendering to help consumers build a connection to their "future" self through virtual reality (Hershfield et al., 2011). Despite such successful interventions, many consumers still struggle to save (Hershfield, Shu, & Benartzi, 2020). Possible reasons are that automatically enrolling employees in a retirement plan does not help them save in other circumstances, and connecting to one's "future" self is not always feasible in day-to-day financial decision making. Recent research has suggested that another way to help consumers save consists of framing savings in more granular terms (i.e., daily vs. monthly), which makes the act of saving less painful in the short-run (Hershfield, Shu, & Benartzi, 2020).

Building on the idea that reducing the short-term pain associated with saving is crucial to motivate saving behavior, we suggest an alternative intervention. We propose that the act of saving can be made more enjoyable (and hence less painful) by introducing immediate psychological rewards through the use of gamification. We argue that gamification can help consumers placate their "present" self by allowing individuals to experience pleasurable psychological responses typical of games such as mastery, competition, and escapism. These experiences make adhering to long-term goals more immediately enjoyable and therefore help consumers to achieve them.

Besides our proposed mechanism that gamification adds immediate rewards to a behavior that is not inherently enjoyable, there are several other reasons why gamification could improve consumers' likelihood to achieve a saving goal. Medium maximization theory, for example, posits that using a medium such as the award of points for making a certain choice (e.g., saving for the future) will make that choice more appealing, compared to a choice where individuals would earn fewer or no points (such as spending in the present; Hsee, Yu, Zhang, & Zhang, 2003). According to medium maximization theory, individuals aim to maximize the medium (such as earning the most points). Maximizing the medium can thus override one's usual preferences, such that the desire to earn points overrides the desire to make a purchase. Based on this argument, gamification can incentivize saving behavior if by doing so individuals maximize their score in the game.

In addition to medium maximization, recent research has shown that immediate rewards are better than long-term rewards at predicting long-term goal achievement (Woolley & Fishbach, 2016, 2017). For example, having a more enjoyable workout is a better predictor of workout persistence than having a more effective (and therefore less enjoyable) workout (Woolley & Fishbach, 2016). In this case, the long-term reward (healthier lifestyle) would be better served by choosing the effective workout. However, choosing the more immediately rewarding enjoyable workout was a better predictor of goal achievement (Woolley & Fishbach, 2016). This result suggests that making the long-term goal more immediately gratifying can improve goal achievement. Based on this notion, we argue that gamification can make tasks that are difficult to enjoy per se (there is no fun way of saving), enjoyable in the short-term.

Gamification can make the pursuit of a long-term goal more enjoyable by associating the target behavior with the experience of rewarding psychological responses typical of games such as mastery, competition, and escapism. For example, consumers may compete on a leaderboard with each other on the amount they save toward a given goal, experiencing the benefits of competition. Or they may win badges by reaching pre-set, intermediate targets, experiencing the benefits of mastery. These psychological benefits can be immediately rewarding for consumers and can favor the pursuit of a behavior such as saving by making it more enjoyable in the short-run.

3. Prediction Study

3.1 Introduction

We conducted an exploratory prediction study to examine whether participants anticipate differences in the perceived usefulness, expected enjoyment, and the expected frequency use of a web application to track and monitor savings, depending on whether the application featured gamification or not. The study used a one-way between subjects design with two conditions. We did not pre-register any prediction for the study, but the design and analysis plan were preregistered (see link: https://aspredicted.org/6b5k4.pdf). In total, 212 members of Prolific UK completed the study for financial compensation (£0.88). The average age of participants was 35.47 years (*SD* = 1.72), 68.40% of participants identified as female, 30.19% of participants identified as male, and three participants preferred to not disclose their gender.

3.2 Method

3.2.1 Materials and Procedure

Participants were first asked to set a realistic saving goal that they could achieve over the next four weeks. They were then told to imagine that they could use a web app to track and monitor their progress toward their saving goal over the subsequent four weeks. Next, they were randomly assigned to one of the two conditions (gamified vs. control). In both conditions, participants saw a screenshot of a web app that allowed users to monitor and track their savings progress toward the saving goal they had set (Appendix 1). They also read a description of the web app that explained how users could log their savings and see how much progress they had made in relation to their saving goal as often as they liked (i.e., multiple times per day, daily, or weekly). In the gamified condition the web app also featured game elements (badges, a leaderboard, and a progress bar), which were not featured in the control condition. The description in the gamified condition also explained how the game elements worked. Participants were told that by using the app they could compete on a leaderboard, win badges, and track their progress on a progress bar. The control condition did not feature any game elements, which were instead replaced with placeholders to maintain a similar level of visual appeal to the gamified condition.

3.2.2 Measures

As dependent variables, we measured perceived usefulness, expected enjoyment, and expected frequency of use of the web app. We measured perceived usefulness with two questions: “How likely would a web app like the one described in this study help you achieve your saving goal?” on a 7-point scale (1 = not at all; 7 = very likely) and “To what extent would a web app like the one described in this study make it easy for you to achieve your saving goal?” on a 7-point scale (1 = not at all; 7 = very much). The Cronbach’s α for perceived usefulness (0.80) was above the standard 0.70 aggregation cut-off so we aggregated the items into one measure. We measured expected enjoyment as “To what extent would a web app like the one described in this study make it enjoyable for you to track your savings towards your saving goal?” on a 7-point scale (1 = not at all; 7 = very much). Finally, we measured expected frequency of use as “On average how frequently would you log your savings on a web app like the one described in this study?” (multiple times per day, once per day, multiple times per week, once per week, less than once per week).

As manipulation checks, we examined whether participants perceived any differences between the gamified and control web app conditions with respect to the game elements used in the gamified condition. To do so, we asked

participants in both conditions “I feel like the web app allows me to compete with other users” and “I feel like the web app rewards me for reaching specific saving milestones” measured on 7-point scales (1 = not at all; 7 = very much).

3.3 Results

3.3.1 Manipulation Checks

To test the effectiveness of the gamification manipulation, we ran two independent samples t-tests on the manipulation check items. The results showed that participants in the gamified condition were more likely to think that the web app allowed them to compete (M = 4.46, SD = 2.05) than participants in the control condition (M = 2.28, SD = 1.54; $t(210) = 8.74$, $p < .001$, $d = 1.20$), and were more likely to think that the web app rewarded them for reaching specific saving milestones (M = 4.47 SD = 1.83) than participants in the control condition (M = 3.43, SD = 1.80; $t(210) = 4.16$, $p < .001$, $d = 0.57$).

3.3.2 Main Results

We conducted independent samples t-tests to examine whether participants expected differences in the usefulness and enjoyment of the web app across the two conditions. The t-tests showed that there were no differences in participants’ perceived usefulness ($M_{gamified}$ = 4.20, SD = 1.62; $M_{control}$ = 4.21, SD = 1.68; $t(210) = - 0.02$, $p = .980$) and in expected enjoyment ($M_{gamified}$ = 4.78, SD = 1.88; $M_{control}$ = 4.51, SD = 1.95; $t(210) = 1.01$, $p = .312$). We did not pre-register that we would aggregate the measures for perceived usefulness, however an analysis of the two items (helpfulness and ease of use) separately also showed no significant differences between the conditions. We conducted a chi-square analysis to analyze differences in the expected frequency of use of the web app. The analysis showed no difference between conditions ($\chi^2(4, N = 212) = 1.78$, $p = .776$).

The results of the prediction study showed that participants correctly perceived the differences between the gamified and control versions of the web app in terms of ability to compete with other users and receiving rewards for reaching specific saving milestones. But participants did not perceive differences in the usefulness, expected enjoyment, and expected frequency of use of the web app.

4. Field Study

4.1 Introduction

We ran a four-week field study in which we asked participants to set a saving goal and track their savings on a web app. Participants were randomly assigned to either a gamified version of the web app or a control condition, in which the web app was not gamified. We measured participants' savings, participants' satisfaction with their savings, the enjoyability, and the perceived usefulness of the web app at the end of each week; at the end of the four weeks, we also measured frequency of use, likelihood to recommend, and likelihood to continue using the web app. The study was conducted between November 9th and December 6th, 2020. We timed the study to end at the beginning of the winter holiday season because people are likely to want to save during this period in order to buffer the typical extra spending incurred during the holidays. The design of the study, the main predictions, and the analysis plan were preregistered (see link: https://aspredicted.org/jb3v5.pdf).

4.2 Method

4.2.1 Participants and Recruitment

We recruited 509 participants on Prolific in the UK through an initial survey. The participants that took part in the prediction study were prevented from taking part in the main field study. This is because in the prediction study, participants may have been exposed to the other version of the web app (i.e., gamified vs. control) than they would be assigned to in the field study. However, since there were over 52,000 eligible participants for the field study, preventing participation of those 212 participants that took part in the prediction study is unlikely to have had a significant impact on the nature of the sample recruited for the field study.

All participants who completed the initial recruitment survey answered a set of demographic questions and questions about their behavior in relation to saving and habit tracking. Participants' average age was 35.77 years (*SD* = 12.30), 66.73% of participants identified as female, 33.07% of participants identified as male, and one participant did not disclose their gender. In terms of education level achieved, one participant had a qualification lower than GCSE, 9.45% of participants had GCSE or equivalent, 28.54% had A-levels or equivalent, 39.37% had an undergraduate degree, and 22.44% had a post-graduate degree. In terms of individual monthly income, 20.86% of participants earned less than £500 a month, 14.17% earned between £500 and £999 a month, 21.65% earned between £1,000 and £1,499 a month, 20.87% earned between £1,500 and £1,999, 14.57% earned between £2,000 and £2,499 a month, and 7.87% earned more than £2,500 a month. On average, participants spent 68.66% (*SD* = 25.62%) of their monthly income. Finally, participants on average tracked 1.03 (*SD* = 1.18) habits (i.e., they used an app or web platform to, for example, track health related habits, such as their daily water intake).

After completing the first part of the initial survey and receiving compensation, all participants were offered the opportunity to take part in a four-week study on saving behavior for additional compensation. Participants were asked if they wanted to find out more about the four-week study or if they wanted to leave the study. Out of 509 participants, 457 participants chose to find out more (whereas 52 did not). These participants were given detailed information about what participation in the study would entail and how much they would be compensated. Out of these 457 participants, 332 decided to enroll and take part in the study and were asked to set a saving goal for the subsequent four-week period. One of these 332 participants failed to set a saving goal (i.e., set a saving goal of £0). We therefore had 331 participants in our final sample. In terms of sample size, our pre-registered goal was to recruit 250 participants, but our final sample size was larger at 331 participants. This is because we underestimated

how many participants who took the initial recruitment survey would decide to participate in the four-week study (i.e., we forecasted that 50% of the participants who took the initial survey would enroll, whereas 65.23% did).

The 331 participants who enrolled in the study completed a second survey that measured a series of individual differences (see section 4.2.4 for details of the measures). Participants were then directed to the web app (justsavemore.net), on which they set a four-week saving goal. Participants were randomly assigned to either the gamified version (n = 169) or the control version (n = 162) of the web app (after they had set their saving goal). Participants agreed to log and track their progress toward their saving goal for the subsequent four weeks. In addition to tracking their savings on the web app, participants were required to complete an additional survey each week.

The weekly surveys were released at the end of each week, specifically on Sunday afternoon, and were available until the following Monday night at 23:59. Out of the 331 participants who agreed to take part in the study, 319 answered the first weekly survey, 310 answered the second weekly survey, 315 answered the third weekly survey, and 296 answered the final weekly survey. The final survey was answered by 89.43% of the participants that initially enrolled in the study. The number of missing observations did not significantly differ across conditions in week one (χ^2 (1, N = 331) = 1.21, p = .271), in week two (χ^2 (1, N = 331) = 0.11, p = .745), in week three (χ^2 (1, N = 331) = 0.36, p = .549), or in week four (χ^2 (1, N = 331) = 0.10, p = .756). Note that if participants did not participate in one of the weeks, they were nevertheless able to take part again in the following weeks. Hence, in week two, there were fewer participants than in week three. Because not all participants answered all the weekly surveys, the number of participants in the different analyses that feature the variables measured through the surveys may differ slightly, either because the data was missing or because we excluded them from the analysis (as highlighted in the pre-registration). The missing observations are only relevant for the variables measured in the weekly surveys. Measures taken directly from the web app (i.e., weekly savings and frequency of use) had no missing observations. If participants did not log any savings in a given week, then their saving progress was recorded as £0 in that week and if participants did not log into the web app in a given week, then their frequency of use was recorded as 0 in that week. Thus, in both cases, no observations were counted as missing.

4.2.2 Compensation

All participants received £0.20 for completing the first part of the initial recruitment survey (regardless of whether they decided to learn more about and enroll in the four-week study or not). If participants decided to enroll and take part in the four-week study, they received additional £1.30 for completing the second part of the initial survey.
Each week, participants further received £1.00 for logging their savings on the web app and completing the weekly survey. Participants were incentivized to complete all the weekly surveys with a bonus of £2.00 to be received in the final week (week four) and entry in a lottery to win one of two £50 Amazon vouchers. Over the entirety of the study, participants could therefore earn £7.50 in compensation for taking part in the study in addition to the lottery entry. An overview of the compensation scheme (which participants also received when signing up for the study) is reported in Appendix 2.

4.2.3 Materials and Procedure

Participants who opted to read more information about the study were provided with an overview of what they would be required to do if they agreed to participate. Specifically, they were told they would set a saving goal to be reached over four weeks and track their savings toward that goal on a web app (justsavemore.net). Participants were told that their saving goal could be linked to a specific purchase (for example, a new phone or pair of shoes), or that it

could be a good opportunity to save some money for the upcoming winter holiday season. Participants were told that if they took part in the study, they would be required to log their savings on justsavemore.net each week (that could also be £0 if they did not save anything that week or a negative amount if they spent some of their savings) and to complete a weekly survey each week. We did not expect participants to spend more than 10 minutes in total on the study each week. At this stage, participants also received detailed information about the compensation scheme of the study (as outlined in section 4.2.2).

If participants agreed to taking part in the four-week study, they were directed to a second survey. At the end of the survey, participants had the opportunity to download a PDF with an overview of the entire study (Appendix 2) and an .ics file that they could add to their electronic calendar. The .ics file included reminders to log savings and fill out the weekly survey over the next four weeks. Participants were then directed to the justsavemore.net web app on which they could create an account using their Prolific IDs and set their four-week saving goal. As they accessed the web app, participants were randomly assigned to one of two conditions: gamified vs. control.

The web app showed participants the goal they had set and how much they had already saved toward that goal. Participants were able to use an add-savings button and a decrease-savings button to adjust and monitor the amount of money they had saved. The web app also showed participants an indicator of how many days were left to achieve their goal.

The gamified version included a leaderboard on which participants competed with other participants on their savings goal achievement (participants were identified by their Prolific ID and competed against 9 randomly selected participants in the same condition), a progress bar, and badges that participants could achieve for reaching savings milestones (e.g., reaching 50% of their goal). Once achieved, the badges changed from grey versions to colored versions. In the control condition, the web app did not feature any game elements. In order to maintain comparable levels of visual appeal with the gamified condition, the leaderboard and progress bar were replaced with equally sized, colored objects, and the badges were replaced with non-interactive images (i.e., there were no milestones that when achieved changed the color of the images) of some of the badges from the gamified condition. Appendix 1 includes screenshots of both versions of the web app (gamified and control).

After signing up for the study, each participant was contacted through Prolific by means of their de-identified ID. Attached to the email was the same .ics file and PDF that participants could download from the initial survey. Additionally, the email included a guide on how to be better at saving money and a guide on how to setup a virtual piggy bank. Both guides could also be found on the justsavemore.net web app and were intended to help participants achieve their saving goal. However, downloading or reading these guides was not a mandatory part of the study. Each Sunday, for the four weeks of the study, participants received an email to remind them to log their savings on justsavemore.net and to complete the weekly survey.

4.2.4 Measures

The main dependent variable was the percentage of the saving goal participants reached each week. This percentage was calculated by dividing the total amount saved in that week by the goal set by the participant at the beginning of the study. The amount saved was directly retrieved from the logs of the web app. We also observed the frequency with which participants accessed the web application and the total percentage of saving goal achieved at the end of the study.

Each week, participants completed a survey and self-reported:

- Their satisfaction with the amount saved "How satisfied are you with the amount of money you have saved this week?" measured on a 7-point scale (1 = not at all; 7 = very much).
- How enjoyable they found the web app using three items (aggregated with an α cutoff of 0.70): "Is tracking your savings on the web app something that provides you with a positive experience?", "Is tracking your savings on the web app enjoyable for you to do?", and "Is tracking your savings on the web app engaging for you to do?" measured on 7-point scales (1 = not at all; 7 = very much). The average Cronbach's α for the three enjoyment items was 0.94. We therefore combined the items into one weekly measure.
- The perceived usefulness of the web app using two items (aggregated with an α cutoff of 0.70): "To what extent has using the web app made it easy for you to track your savings this week?", "To what extent has using the web app helped you save this week?" measured on 7-point scales (1 = not at all; 7 = very much). The average Cronbach's α for the two perceived usefulness items was 0.84. We therefore combined the items into one weekly measure.
- How much they had saved that week and how often they had logged their savings in the web app that week (as a self-reported backup measures in case technical issues arose with the web app data logging of these measures).

In the final weekly survey administered at the end of the fourth week, we measured participants' likelihood to recommend the web app "How likely are you to recommend this web app to someone else?" and likelihood to continue using the web app "How likely are you to continue using this web app for the next four weeks?" on 7-point scales (1 = not at all; 7 = very likely).

In the initial survey, we measured a host of individual differences that can contribute to explaining differences in saving behavior. In part one of the initial survey, we asked all participants (including those who decided not to enroll in the main study) how satisfied they were with their ability to save money on a 7-point scale (1 = not at all; 7 = very satisfied), how likely they were to set saving goals on a 7-point scale (1 = not at all; 7 = very likely), whether they used any apps to track behaviors such as saving (participants chose which behaviors, if any, they tracked), what their net personal monthly income was, and what percentage of that income they typically spent each month, as well as demographic questions (age, gender, and education).

In part two of the initial survey, we measured individual differences in the pain of paying (tightwad vs. spendthrift scale, Rick, Cryder, & Loewenstein, 2008), debt aversion (Callender & Jackson, 2005), propensity to plan for money in the short- and in the long-run (Lynch, Netemeyer, Spiller, & Zammit, 2010), self-control (Tangney, Baumeister, & Boone, 2004), financial literacy (Lusardi & Mitchell, 2017), and future orientation (Bartels & Rips, 2010). We also measured participants' trait playfulness (Proyer, 2012) in the final weekly survey.

The tightwad vs. spendthrift variable was computed using a score from 4 to 26. Lower scores were classified as tightwads, higher scores were classified as spendthrifts. The financial literacy variable measured whether participants correctly answered three financial literacy questions. Participants were scored out of three, as they received one point for each correctly answered question. The Cronbach's α for propensity to plan for money in the short-run (0.93), propensity to plan for money in the long-run (0.94), self-control (0.86), and playfulness (0.92) were all above 0.70, therefore we aggregated the items into respective individual measures. The Cronbach's α for debt aversion (0.64) was below the 0.70 cut off. However, removing any of the items did not increase the Cronbach's α

and because it is an established scale (Callender & Jackson, 2005), we decided to sum the items into one measure as well. Scales for all the individual difference measures can be found in Appendix 3.

In the final weekly survey, we also included two manipulation checks. Similar to the prediction study, participants indicated the extents to which "The web app allowed me to compete with other users" and "the web app rewarded me for reaching specific savings milestones" measured on 7-point Likert scales (1 = completely disagree; 7 = completely agree). Finally, we asked participants to what extent they were accurate in logging their savings and to what extent the COVID-19 pandemic might have impacted (increased or decreased) their income, ability to save, and spending over the previous four-week period on 7-point scales (1 = it significantly decreased; 7 = it significantly increased). We highlighted that the answer to the accuracy question would in no way impact compensation but was important for research purposes.

4.3 Results

4.3.1 Differences Between Enrolled and Non-Enrolled Participants

We analyzed whether there were differences in general satisfaction with ability to save, likelihood to set saving goals, usage of apps to track habits, net personal monthly income, percentage of income spent each month, and demographics (age, gender and education) between participants who enrolled in the study (agreed to take part in the four-week study on saving behavior) and those that did not enroll in the study (i.e., who left after the first part of the initial survey without taking part in the four-week study on saving behavior).

Independent samples t-tests revealed no significant differences in general satisfaction with their ability to save between enrolled (M = 4.48, SD = 1.70) and non-enrolled participants (M = 4.50, SD = 1.61; $t(506) = -0.10$, p = .922), in average percentage of monthly income spent ($M_{enrolled}$ = 68.73%, SD = 25.71; $M_{non_enrolled}$ = 68.51%, SD = 25.52; $t(506) = 0.09$, p = .925), and age ($M_{enrolled}$ = 35.88, SD = 11.88; $M_{non_enrolled}$ = 35.48, SD = 13.04; $t(506) = 0.35$, p = .728). A chi-square analysis revealed no significant differences in terms of gender (χ^2 (2, N = 508) = 1.66, p = .437).

We found that enrolled participants were more likely to spontaneously set saving goals (M = 5.24, SD = 1.58) than non-enrolled participants (M = 4.36, SD = 1.77; $t(506) = 5.75$, $p < .001$, d = 0.54). Enrolled participants also on average tracked more habits using an app or web platform ($M_{enrolled}$ = 1.14, SD = 1.24; $M_{non_enrolled}$ = 0.81, SD = 1.02; $t(506) = 2.90$, p = .003, d = 0.28), were more likely to be a in a higher income bracket (χ^2 (5, N = 508) = 16.14, p = .006), and achieved a higher level of education (χ^2 (5, N = 508) = 14.96, p = .005).

These differences between participants who enrolled versus did not enroll are not surprising, given that participants with these characteristics might be more interested in participating in a study on saving behavior. Thus, these observed differences may need to be considered when evaluating the generalizability of our results. However, it is important to highlight that although participants self-selected to participate in the study, this self-selection occurred prior to their assignment to the experimental conditions and cannot have influenced the relationship between gamification and saving goal achievement.

4.3.2 Manipulation Checks and Differences Between Participants in the Gamified and Control Conditions

To test the effectiveness of the gamification manipulation, we ran two independent samples t-tests on the items measuring whether participants felt the web app allowed them to compete with other users and whether the web app rewarded them for reaching specific saving milestones. The results showed that participants in the gamified

condition were more likely to think that the web app allowed them to compete (M = 4.01, SD = 1.90) than participants in the control condition (M = 1.92, SD = 1.46; $t(294) = 10.60$, $p < .001$, d = 1.23), and were more likely to think that the web app rewarded them for reaching specific saving milestones (M = 4.34, SD = 1.82) than participants in the control condition (M = 2.37, SD = 1.70; $t(294) = 9.62$, $p < .001$, d = 1.12).

We asked participants how accurately they had logged their savings in order to understand whether the gamified condition might have led participants to be less truthful in their reporting (e.g., because they might have wanted to reach the top of the leaderboard). We used a one sample t-test to compare reported accuracy on a 7-point scale to the scale mid-point (4) and an independent samples t-test to compare reported accuracy across conditions. In general, participants reported that they logged their savings accurately, as indicated by a mean above the mid-point of 4 (M = 6.16, SD = 1.13; $t(295) = 32.72$, $p < .001$, d = 1.90). Most importantly, there were no significant differences in the reported accuracy between participants in the gamified condition (M = 6.14, SD = 1.15) and participants in the control condition (M = 6.17, SD = 1.12; $t(294) = -0.27$, p = .788).

We also wanted to verify that participants set themselves similar saving goals in the gamified and the control conditions. An independent samples t-test on saving goal set by participants between conditions showed that the overall saving goals set by participants did not differ between the gamified (M = £243.18, SD = £305.84*)* and the control conditions (M = £210.61, SD = £325.50; $t(328) = 0.94$, p = .349).

We also examined to what extent participants' financial situation (i.e., their expenses, income, and ability to save) was impacted by the Covid-19 pandemic. We used one sample t-tests to compare their answers on 7-point scales to the scale mid-point (4, "It had no impact.") The results showed that the pandemic significantly decreased participants' expenses (M = 3.32, SD = 1.56; $t(295) = -7.49$, $p < .001$, d = -0.44) as well as their income (M = 3.62, SD = 1.11; $t(295) = -5.90$, $p < .001$, d = -0.34), while at the same time significantly increasing their ability to save (M = 4.33, SD = 1.59; $t(295) = 3.63$, $p < .001$, d = 0.21). There were no significant differences on any of the variables between the conditions (all ts (294) < 1.56, all ps >.121). The results highlighted that the Covid-19 pandemic had a significant impact on participants' financial situation. It increased their ability to save, while decreasing their expenses and their income. Thus, the pandemic created a unique financial situation for many participants, and this might have overall affected participants' ability to achieve their saving goals in the study. However, these changes do not appear to have affected participants in the two conditions differently.

4.3.3 Main Results

One observation had an extremely high score on the dependent variable (i.e., percentage of saving goal achieved was 11.88 *SDs* above the condition mean). We excluded this participant from all subsequent analyses, leaving the final sample at 330 participants.

As our main analysis, we conducted a two-way mixed ANOVA with the experimental condition (gamified vs. control) as between subjects' factor and the four weeks as within subjects. The results showed that participants in the gamified condition saved on average 27.28% (SE = 1.52) of their goal each week, whereas participants in the control condition saved on average 22.90% (SE = 1.52) of their goal each week $F(1, 328) = 4.14$, p = .043). Participants in the gamified condition on average saved a significantly higher percentage of their goal each week compared to participants in the control condition. There was no significant difference in weekly saving across the four weeks $F(3, 984) = 0.84$, p = .475), and no significant interaction effect between the experimental condition and the four weeks $F(3, 984) = 0.41$, p = .749). This indicated that participants consistently saved throughout the whole

study as opposed to saving more at the beginning or at the end of the study. See Appendix 4 for a graph that shows a clear linear trend in savings in both conditions. At the end of the study participants in the gamified condition had on average saved 108.90% (*SD* = 90.60%) of their goal compared to 91.40% (*SD* = 62.33%) for participants in the control condition ($t(328) = 2.03$, $p = .043$, $d = 0.22$)

It is important to note that we did not pre-register the exclusion of any participants. Therefore, to examine the robustness of the main result, we conducted the same analysis on several different sub-samples, in which we used more stringent criteria for the inclusion of observations. For the robustness checks, we truncated the percentage of goal saved in any week at +/-*SD* 5, +/-*SD* 7, and +/-*SD* 10 from the condition mean and replicated the analysis on each sub-sample after removing the observations above each specified threshold. All results are reported in Appendix 5. The main result reported earlier corresponds to the truncated +/- *SD* 10 sub-sample, in which only one observation was excluded, but the main result also holds when using more stringent exclusion criteria.

We also pre-registered that we would conduct week-by-week comparisons on the percentage of goal saved each week between conditions. We initially aimed to conduct the week-by-week comparisons because the ANOVA on percentage of goal saved each week would have excluded participants that had at least one missing data point. However, the web app set the value automatically to £0 if participants did not update their savings in a given week, so there were no missing data points that would have made the samples for individual t-tests different from the one used in the main ANOVA.

In addition to the percentage of goal saved each week, we also analyzed whether participants in the gamified condition found using the web app more enjoyable and more useful than participants in the control condition, and whether there were any differences in satisfaction with savings, frequency of use, likelihood to recommend the web app, and likelihood to continue using the web app across conditions. We ran mixed ANOVAs on enjoyment, perceived usefulness, and satisfaction with savings per week with the experimental condition (gamification vs. control) as the between subjects' factor and the four weeks as within subject's factor. Additionally, using independent samples t-tests, we conducted week-by-week comparisons on enjoyment, perceived usefulness, and satisfaction with savings between conditions. We also ran independent samples t-tests on frequency of use, likelihood to recommend the web app, and likelihood to continue using the web app between conditions, which were measured at the end of the four weeks.

The mixed ANOVAs revealed no differences in enjoyment ($M_{gamified} = 4.71$, $SE = 0.12$; $M_{control} = 4.61$, $SE = 0.12$; $F(1, 281) = 0.36$, $p = .552$), perceived usefulness ($M_{gamified} = 4.45$, $SE = 0.13$; $M_{control} = 4.44$, $SE = 0.13$; $F(1, 281) = 0.00$, $p = .953$), and satisfaction with savings ($M_{gamified} = 4.59$, $SE = 0.12$; $M_{control} = 4.67$, $SE = 0.12$; $F(1, 281) = 0.20$, $p = .655$) between conditions. The week-by-week comparisons of enjoyment, perceived usefulness, and satisfaction with savings also showed no significant differences between conditions and were line with the ANOVA results (all $ts < 1.17$, all $ps > .241$).

Similarly, the analyses on frequency of use ($M_{gamified} = 7.85$, $SD = 6.28$; $M_{control} = 7.74$, $SD = 8.21$; $t(328) = 0.14$, $p = .655$), likelihood to recommend the web app ($M_{gamified} = 4.53$, $SD = 1.87$; $M_{control} = 4.28$, $SD = 1.89$; $t(293) = 1.16$, $p = .248$), and likelihood to continue using the web app ($M_{gamified} = 4.34$, $SD = 1.99$; $M_{control} = 4.06$, $SD = 2.12$; $t(293) = 1.17$, $p = .243$) showed no significant differences across conditions. The number of participants in the different analyses varies because not all participants answered each weekly survey in which we measured enjoyment,

perceived usefulness, satisfaction with savings, and likelihood to recommend and continue using the web app. The data for frequency of use were instead directly gathered from the web app, which is why the sample size is higher. Although pre-registered, we were unable to conduct the week-by-week comparison on frequency of use because technical limitations of the web app did not allow us to identify participant login data by week but only cumulatively over the whole study.

4.3.4 Additional Exploratory Analyses

Using regression analyses, we examined whether the effect of gamification was robust to the inclusion of several individual differences that could be related to spending and saving behavior: tightwad vs. spendthrift tendencies, debt aversion, propensity to plan for money, self-control, future orientation, financial literacy. As the dependent variable, we used the saving goal achievement (total percentage of saving goal achieved) by participants at the end of the study (week four). The control condition was used as the baseline reference in all analyses. As additional robustness checks, we also included the goal set by participants at the beginning of the study, age, gender, and individual differences in playfulness as control variables (note that not all these analyses were pre-registered). We recoded the gender variable where the one participant who did not disclose their gender and the participants that identified as female were merged into one category. Therefore, in the regression analysis these variables capture whether being male had a significant impact on saving goal achievement. The full results for the regression analyses can be found in table 1 below.

We first conducted a regression analysis with just the condition assignment as an independent variable (Model 1; $F(1, 328) = 4.14$ $p = .043$). In the second model ($F(8, 321) = 3.06$ $p = .002$), we additionally investigated the impact of the individual difference measures on saving goal achievement (except for playfulness, which we introduced in a subsequent model). In the third and fourth models, we added the saving goal set by participants ($F(9, 320) = 2.84$ $p = .003$) and demographics (age and gender, $F(11, 318) = 2.59$ $p = .004$) as control variables, respectively. In the final model (Model 5; $F(12, 282) = 3.04$ $p < .001$) we added playfulness as the remaining individual difference measure. We added playfulness last because it led to a significant drop in observations (it was measured in the final weekly survey as opposed to the initial survey with all the other individual difference measures).

The condition assignment was significant in four out of the five models in which it was included, with participants in the gamified condition showing significantly higher goal achievement than participants in the control condition. An additional regression analysis showed that adding the condition assignment as a second block to the individual difference measures (without playfulness) significantly improved the explanatory power of the model ($\Delta R^2 = 0.01$, $F(1, 321) = 4.43$ $p = .03$).

Propensity to plan for money in the long run, debt aversion, and financial literacy had a positive and significant impact on saving goal achievement in three out of the four models in which they were included. Model 5 showed that participants who were more playful were also more likely to achieve their saving goal. However, because of the significant drop in observations, the results of Model 5 should be interpreted more cautiously. The drop in the number of observations could also contribute to explaining why condition assignment, propensity to plan for money in the long run, and debt aversion are not significant in that model.

We also conducted an exploratory process analysis on whether weekly enjoyment or perceived usefulness mediated the relationship between conditions (gamified vs. control) and participants' saving goal achievement but found no mediating effect of either variable.

In our pre-registration, we indicated that we would use a regression analysis to explore whether the leaderboard position or the badges that participants had achieved impacted the amount of savings they logged. Due to technical limitations with of the web app, we were not able to accurately measure what badges participants had achieved and what leaderboard position participants obtained when logging their savings. We were therefore unable to conduct this analysis.

Table 1: Results of regression analysis on goal achievement.

	Model 1 (N = 330)		Model 2 (N = 330)		Model 3 (N = 330)		Model 4 (N = 330)		Model 5 (N = 295)	
Variable	Unstandardized Estimate *(SE)*	Standardized *β*	Unstandardized Estimate *(SE)*	Standardized *β*	Unstandardized Estimate *(SE)*	Standardized *β*	Unstandardized Estimate *(SE)*	Standardized *β*	Unstandardized Estimate *(SE)*	Standardized *β*
Intercept	100.15*** (4.30)		18.45 (40.02)		16.52 (40.06)		17.45 (40.39)		-20.99 (46.36)	
Condition	8.75** (4.30)	0.11	8.94** (4.24)	0.11	9.15** (4.25)	0.12	9.56** (4.25)	0.12	7.40 (4.48)	0.09
Tightwad vs. Spendthrift Score			-0.37 (1.01)	-0.02	-0.42 (1.01)	-0.03	-0.51 (1.02)	-0.03	-1.12 (1.13)	-0.07
Debt Aversion			7.43* (3.79)	0.11	7.59** (3.79)	0.12	7.67 * (3.83)	0.12	6.25 (4.00)	0.09
Propensity to Plan for Money in Short-Run			-2.97 (3.97)	-0.06	-2.85 (3.97)	-0.05	-3.12 (3.98)	-0.06	-1.09 (4.10)	-0.02
Propensity to Plan for Money in Long-Run			9.36** (4.47)	0.17	9.41** (4.47)	0.17	8.67* (4.49)	0.15	6.38 (4.74)	0.11
Self-Control			-2.01 (4.54)	-0.03	-1.82 (4.54)	-0.02	-1.14 (4.60)	-0.01	-2.22 (4.86)	-0.03
Future Orientation			0.22 (0.20)	0.06	0.24 (0.20)	0.07	0.27 (0.21)	0.08	0.30 (0.22)	0.08
Financial Literacy Score			8.50 (5.40)	0.09	9.54* (5.49)	0.10	12.24** (5.72)	0.13	13.00** (6.04)	0.13
Goal					-0.01 (0.01)	-0.06	-0.01 (0.01)	-0.06	-0.02 (0.01)	-0.08
Age							-0.40 (0.39)	-0.06	-0.24 (0.42)	-0.04
Male (No – Yes)							12.20 (9.40)	0.16	15.55 (9.98)	0.20
Playfulness									12.08*** (3.56)	0.20

Note: *p < .10, **p < .05, ***p < .001

5. Conclusion and discussion

5. 1 Main Results

Our main analysis provides evidence that gamification can help consumers reach their saving goal. We showed that participants in the gamified condition saved a significantly higher percentage of their saving goal each week than participants in the control condition. Arguably, our intervention was limited in scope, which is reflected in the lack of differences in enjoyment or perceived usefulness between the gamified versus control conditions. Although participants' experience using the app did not differ between conditions, we found a significant effect of gamification on participants' behavior, measured by the percentage of goal saved in each week. This effect was consistent across several robustness checks and in the exploratory regression analyses that controlled for individual differences, goal set, and demographics.

It is important to consider the potential for self-selection bias among participants. Participants who are less likely to set themselves saving goals, who have a lower income, and those with a lower qualification in education might be those that would most benefit from gamified interventions to help them save. Yet, these were also the participants least likely to join our study. We therefore cannot speak to the possibility that a gamified intervention would work as effectively for these groups of consumers. Participants that joined the study were also more likely to use web platforms or apps to track habits, arguably they were therefore more technology-savvy. It is worth considering to what extent gamification (especially if implemented through a web app) might be effective for less technology-savvy consumers. Gamification is not technology reliant (i.e., it can be implemented with or without technology), but it is often facilitated by technology (Hofacker, de Ruyter, Lurie, Manchanda, & Donaldson, 2016). Gamification may therefore be more effective when implemented in an environment typically used by more (versus less) technology-savvy consumers. Alternatively, participants in our study could have been less motivated by gamification because they were already more likely to set themselves saving goals than participants who did not enroll. In this case, our study would have provided a more conservative test of the effectiveness of gamification to motivate saving and the intervention may have been more effective for participants who were less likely to set themselves saving goals.

Although participants in the gamified condition reached a higher percentage of their goal than participants in the control condition, the two groups did not differ on a host of other measures, namely satisfaction with savings, frequency of use, likelihood to recommend and continue using the web app, enjoyment, and perceived usefulness. Each week, we asked participants how satisfied they were with their savings, and although participants in the gamified condition saved a higher percentage of their goal each week, there was no difference in satisfaction with savings across conditions. In our study, we asked participants to set themselves a realistic saving goal for the 4-week period. It could be that this led participants to set themselves a goal that was too easy to achieve, which would have led participants in both conditions to be relatively satisfied with their savings. Additionally, participants in the gamified condition could directly compare their saving goal achievement with others on the leaderboard, which could have led to lower satisfaction with savings for participants who had a low saving goal achievement. In the control condition participants were not able to compare their saving goal achievement with others and they might therefore have been more satisfied with their savings even if they had not saved as much.

We also did not find a difference in frequency of use across conditions. In both conditions, participants logged in the web app less than twice per week on average. Participants may have felt obliged to log into the web app to live

up to the perceived expectations of the study (especially because we sent around weekly reminders to participants to log their savings), which could have distorted the actual engagement levels of participants across the two conditions. It could be that participants in the gamified condition logged in because they wanted to log their savings and that participants in the control condition logged in to satisfy the expectations of the study. Alternatively, it could be that in both conditions participants decided to only log their savings once per week when they got the reminder email.

Finally, participants in the gamified condition and the control condition were equally likely to recommend the web app or indicated that they would have continued using the web app after the study was completed. It could be that because participants in both conditions on average achieved a large percentage of their saving goal, they were also equally likely to recommend the web app to others (not because one condition was more enjoyable but because the web app was effective in both conditions). Similarly, it could be that participants were equally likely to continue using the web app in both conditions because on average they all achieved or were close to achieving their saving goal at the end of the study. Finally, it could be that participants across conditions did not recommend the web app more often and were equally likely to continue using the web app, because both conditions were equally enjoyable or useful.

5. 2 Exploratory Analyses

Although we found support for our main hypothesis (that participants reached a higher percentage of their saving goal each week in the gamified than in the control condition), we did not find any significant differences in enjoyment or perceived usefulness in using the web app between conditions. However, perceived usefulness is an important factor in defining the effectiveness of technological interventions (Yang, Asaad, & Dwivedi, 2017). Thus, differences in usefulness could have been expected between the gamified and the control condition. In retrospect, our experimental design might not have allowed to find such differences in enjoyment and perceived usefulness between the conditions. The variables were measured at a fixed point in time each week in a separate survey (i.e., not through the web app). Participants' answers may not have reflected their actual levels of enjoyment or perceived usefulness while using the web app, because they were not in the same state of mind when answering the survey as they would have been when using the web app.

Alternatively, the game elements could have elicited other feelings, such as anxiety about one's performance on the leaderboard, which could have counteracted the enjoyment from the game elements. It is also possible that the web app was not gamified enough to cause significant differences in enjoyment between the conditions, but that a larger variety of immersive game elements would have been needed. This would be in line with the prediction study, in which participants did not predict the gamified condition to be more enjoyable or useful than the control condition. Although we did not find support for enjoyment as a mechanism underlying the effect of gamification on the percentage of saving goal achieved, enjoyment might nevertheless be an underlying mechanism in future gamification research.

Our exploratory regression analyses provided further support for our main effect, showing that condition assignment had a significant impact on saving goal achievement, even when controlling for goal set, demographics, and individual difference measures (such as participants' tightwad vs. spendthrift tendencies, debt aversion, propensity to plan for money, self-control, future orientation, and financial literacy). We also showed that propensity to plan for money in the long-run, debt aversion, and the financial literacy score had a significant impact on saving goal achievement, where participants with a higher propensity to plan for money in the long-run, greater debt aversion,

and higher financial literacy scores had a higher saving goal achievement. Finally, we also provided some initial evidence that playfulness may have impacted saving goal achievement in our study, where more playful participants had a higher saving goal achievement than less playful participants.

5. 3 Implications

Past research on saving behavior has highlighted that saving can be motivated through pre-commitment (Thaler & Benartzi, 2004), decreasing the perceived distance between the present and future selves of consumers (Hershfield et al., 2011), and by making saving less painful in the short-run (Hershfield et al., 2020). We argue that gamification can be a new and effective tool in motivating consumers to reach a saving goal. Our findings are in line with past gamification research that highlights how gamification can be used to motivate learning and fitness (Patel et al., 2017; Subhash & Cudney, 2018). We further expand on this research by investigating whether gamification can be used to motivate a different, yet related, behavior: saving. We show that gamification can be effective in motivating behaviors that traditionally lack immediate rewards but are beneficial in the long run. Our findings are in line with other recent research in gamification, which shows that peoples' saving intentions are higher when presented with a competitive leaderboard than when not (Zhang, van Horen, & Zeelenberg, 2021). We extend this research by showing that gamification can have a positive impact on reaching an actual saving goal over a four-week period in a web app that uses multiple game elements.

Research on gamification shows that younger consumers and those more familiar with playing games are more likely to be motivated by gamification (Bittner & Shipper, 2014; Huotari & Hamari, 2017). Additionally, engaging with gamification entails few costs for consumers and is not very costly for designers either, making a typical gamified app not significantly more expensive than its non-gamified alternative. Therefore, gamification might not only be an alternative means of making saving less painful in the short-term but might also be a cost-effective tool that can be particularly effective at motivating younger generations to save more.

Our findings also have practical implications for consumers, banks, and policy makers. Regarding consumer welfare, we show that consumers can be motivated to improve their saving behavior through intangible psychological rewards, even if these are relatively trivial (i.e., leaderboard positions or badges). To capitalize on the motivating force of such rewards, consumers should use gamified environments for their goal-pursuit efforts (e.g., for academic, health, or fitness goals). If such environments do not exist (in the form of apps or websites), then consumers could self-gamify their goal-pursuit. For example, consumers might reward themselves with badges for goal progress or compete on leaderboards with a group of friends on a goal set together.

Secondly, our research is interesting for banks and financial institutions, who can implement gamification to improve consumer welfare. App-based challenger banks (such as Monzo and Revolut) are changing the way that consumers interact with their banks. For example, these banks already allow consumers to create separate saving pots within their accounts. It would be easy for these banks to implement gamification by, for example, adding leaderboards and badges to these saving pots. Therefore, we argue that our findings are particularly interesting for, although not limited to, app-based challenger banks that are already using technology to improve the service they provide for their customers.

Finally, our findings can be of particular interest to policy makers in financial education contexts. Our findings show that gamification can help adult consumers to save. Building on our findings, inviting students to save using gamified platforms could be particularly useful for schools that want to socialize younger consumers (who are

typically more motivated by gamification) into saving. These consumers might be especially motivated by the immediate psychological rewards of saving with the help of gamification.

5. 4 Final Remarks and Future Research

In conclusion, our study provides a first step toward understanding whether gamification can be effective at motivating behaviors that help individuals achieve their long-term financial goals, but that are painful in the short run, such as saving money. We provided some evidence for the potential effectiveness of these interventions and hope to stimulate future research in this area. More research is necessary to examine the robustness of this effect and to examine whether the same results would hold for other behaviors that lack short-term rewards but are beneficial in the long-term (such as following a healthy diet). Research on gamification has shown that some consumers prefer using gamified environments more than others (Bayuk & Altobello, 2019). Future studies may also investigate which consumers are more likely to benefit from a gamified intervention. Furthermore, future studies can examine whether gamification can lead to long-term habit change. We did not measure participants saving behavior after the study ended. Thus, we cannot speak to the possibility of habit change beyond the 4-week intervention period.

Importantly, we did not find any evidence for enjoyment as a mechanism by which gamification motivates consumers to save. One possibility we did not consider is that the increased saving goal achievement was not driven by enjoyment but by anticipatory enjoyment, where participants looked forward to engaging with the app more in the gamified condition than the control condition. More research is necessary to identify the mechanisms underlying the effectiveness of gamification at motivating saving, and we hope our results stimulate future work on the effects of these promising interventions.

6. References

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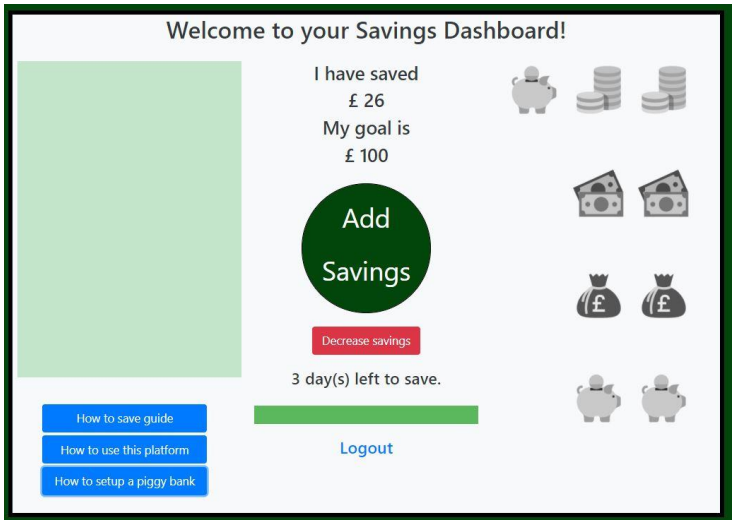
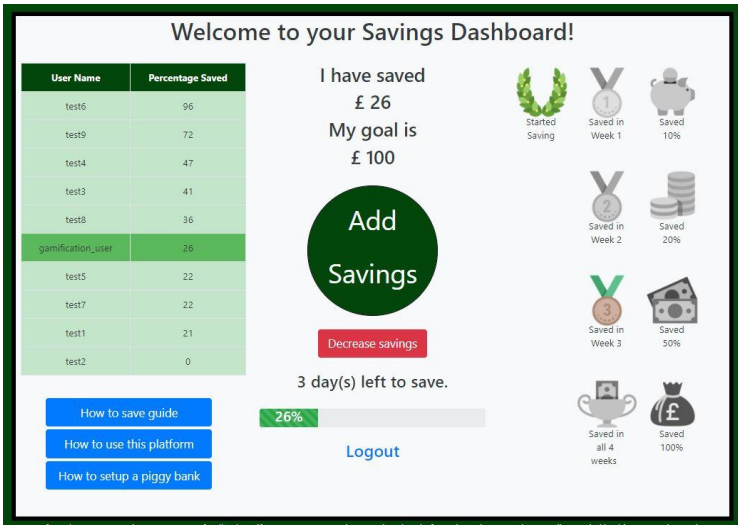
7. Appendices

Appendix 1 Screenshots of Web App Versions by Condition

Control Condition



Gamified Condition



Appendix 2 Info PDF for Participants of Study

	What do I need to do?	What do I get?
In Week 1 (This Week)	Log your savings toward your goal on the savings tracking platform at least once.	**£1.00**
	Fill out a short survey on Prolific. You will get access to the survey on Sunday. You will have until Monday evening to complete it.	

In Week 2 Starting 16th of November	Log your savings toward your goal on the savings tracking platform at least once. Fill out a short survey on Prolific. You will get access to the survey on Sunday. You will have until Monday evening to complete it.	**£1.00**
In Week 3 Starting 23rd of November	Log your savings toward your goal on the savings tracking platform at least once. Fill out a short survey on Prolific. You will get access to the survey on Sunday. You will have until Monday evening to complete it.	**£1.00**
In Week 4 Starting 30th of November	Log your savings toward your goal on the savings tracking platform at least once. Fill out a short survey on Prolific. You will get access to the survey on Sunday. You will have until Monday evening to complete it.	**£3.00** Chance to win a £50 Amazon Voucher

Appendix 3 Scales for All the Individual Difference Measures

Tightwads and Spendthrifts (Rick et al., 2008)

1. Which of the following descriptions fits you better? (measured on an 11-point scale from 1= tightwad, 6 = about the same or neither, and 11 = spendthrift).
2. Some people have trouble limiting their spending: they often spend money – for example on clothes, meals, vacations, phone calls – when they would do better not to.
   Other people have trouble spending money. Perhaps because spending money makes them anxious, they often don't spend money on things they should spend it on.
   a. How well does the first description fit you? That, is do you have trouble limiting your spending? (measured on a 5-point scale from 1 = never to 5 = always).
   b. How well does the second description fit you? That is, do you have trouble spending money? (measured on a 5-point scale from 1 = never to 5 = always).
3. Following is a scenario describing the behavior of two shoppers. After reading about each shopper, please answer the question that follows.
   Mr A. is accompanying a good friend who is on a shopping spree at a local mal. When they enter a large department store, Mr. A sees that the store has a "one-day-only-sale" where everything is priced 10-60% off. He realizes he doesn't need anything, yet can't resist and end up spending almost £100 on stuff.
   Mr B. Is accompanying a good friend who is on a shopping spree at a local mall. When they enter a large department store, Mr B. sees that the store has a "one-day-only-sale" where everything is priced 10-60% off. He figures he can get great deals on many items that he needs, yet the thought of spending the money keeps him from buying the stuff.
   In terms of your behavior, who are you more similar to, Mr. A or Mr. B? (measured on a 5-point scale from 1= Mr. A, to 3 = about the same or neither, and 5 = Mr. B)

Debt Aversion (Measured on a 7-point scale from 1=strongly disagree to 7=strongly agree, Callender & Jackson, 2005)

1. Owing money is basically wrong.
2. There is no excuse for borrowing money.
3. You should always save up first before buying something.

Propensity to Plan for Money (Measured on a 7-point scale from 1=strongly disagree to 7=strongly agree, Lynch, Netemeyer, Spiller, & Zammit, 2010)

Short-Run:

1. I set financial goals for the next few days for what I want to achieve with my money.
2. I decide beforehand how my money will be used in the next few days.
3. I actively consider the steps I need to take to stick to my budget in the next few days.

4. I consult my budget to see how much money I have left for the next few days.
5. I like to look to my budget for the next few days in order to get a better view of my spending in the future.
6. It makes me feel better to have my finances planned out in the next few days.
Long-Run:
7. I set financial goals for the next 1–2 months for what I want to achieve with my money.
8. I decide beforehand how my money will be used in the next 1–2 months.
9. I actively consider the steps I need to take to stick to my budget in the next 1–2 months.
10. I consult my budget to see how much money I have left for the next 1–2 months.
11. I like to look to my budget for the next 1–2 months in order to get a better view of my spending in the future.
12. It makes me feel better to have my finances planned out in the next 1–2 months.

Short Self-Control Scale (Measured on a 7-point scale from 1=not at all like me 7=very much like me, Tangney, Baumeister, & Boone, 2004)
1. I am good at resisting temptation.
2. I have a hard time breaking bad habits. (R)
3. I am lazy. (R)
4. I say inappropriate things. (R)
5. I do certain things that are bad for me, if they are fun. (R)
6. I refuse things that are bad for me.
7. I wish I had more self-discipline. (R)
8. People would say that I have iron self- discipline.
9. Pleasure and fun sometimes keep me from getting work done. (R)
10. I have trouble concentrating. (R)
11. Sometimes I can't stop myself from doing something, even if I know it is wrong. (R)
12. I often act without thinking through all the alternatives. (R)

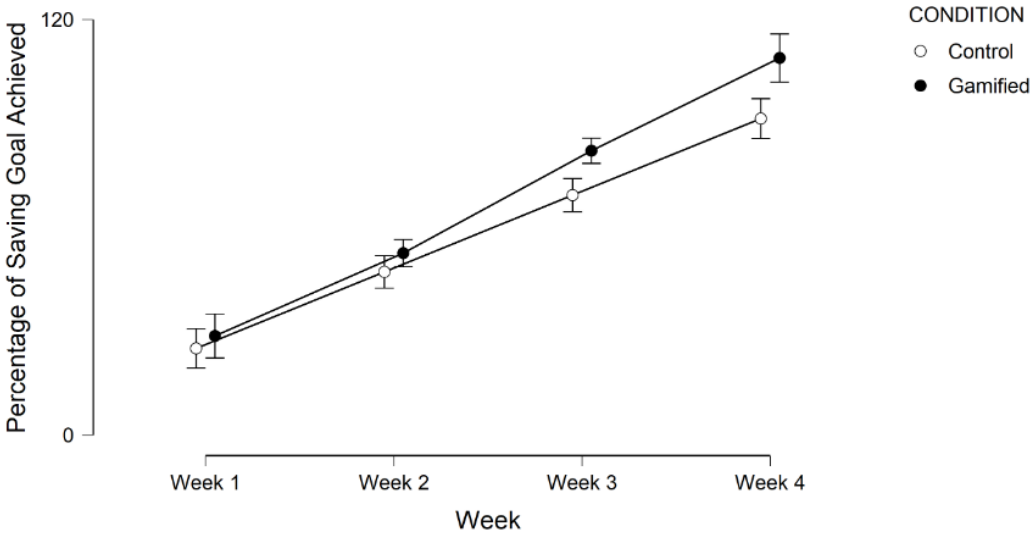
Financial Literacy (Lusardi & Mitchell, 2017)

1. Suppose you had £100 in a savings account and the interest rate was 2% per year. After 5 years, how much do you think you would have in the account if you left the money to grow: [more than £102, exactly £102, less than £102? Do not know, refuse to answer.]
2. Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, would you be able to buy: [more than, exactly the same as, or less than today with the money in this account? Do not know; refuse to answer.]
3. Do you think that the following statement is true or false? 'Buying a single company stock usually provides a safer return than a stock mutual fund.' [Do not know; refuse to answer.]

Future-Orientation (Measured on a 0-100 scale from 0=completely different to 100=exactly the same, Bartels & Rips, 2010)
Rate the similarity between your current self and the person you will be in the future. Please think of the characteristics that make you the person you are—your personality, temperament, likes and dislikes, beliefs, values, ambitions, goals, ideals—and rate the degree of connectedness between the person you expect to be in the future compared to the person you are now, where 0 means completely different and 100 means exactly the same.

Playfulness (Measured on a 7-point scale from 1=strongly disagree to 7=strongly agree, Proyer, 2012)
1. I am a playful person.
2. Good friends would describe me as a playful person.
3. I frequently do playful things in my daily life.
4. It does not take much for me to change from a serious to a playful frame of mind.
5. Sometimes, I completely forget about the time and am absorbed in a playful activity.

Appendix 4 Graph Showing Percentage of Saving Goal Achieved by Condition



Note:
Error bars represent 95% Confidence Intervals around the means.

Appendix 5 Results of Robustness Checks on Different Sub-samples

We conducted mixed ANOVA analyses, with the experimental condition (gamified vs. control) as between subjects factor and the four weeks as within subjects factor, for each sub-sample of the data on the percentage of goal saved each week. We report the results of the F-tests in the table below. We also report the marginal means by condition (i.e., the average percentage of goal saved each week) and the number of participants in each sub-sample (i.e., indicating how many participants were removed from each sub-sample).

When the main outlier in the control condition was removed (truncated +/- 10 *SD* sub-sample) the difference between the conditions on percentage of goal saved each week was significant, with participants in the gamified condition on average saving a significantly higher percentage of their goal each week compared to participants in the control condition. Furthermore, when looking at each further sub-sample, the difference on percentage of goal saved each week between conditions was also significant. In each sub-sample, participants in the gamified condition on average saved a significantly higher percentage of their goal each week than participants in the control condition. At most seven observations across both conditions were removed for the analyses (in the +/- 5 *SD* sub-sample). Overall, the analyses support our main findings that participants in the gamified condition on average saved a higher percentage of their goal each week than participants in the control condition.

Table Showing Results of Sub-sample Analyses

	F-test	*p*-value	*η2*	Marginal Mean Control (*SE*)	Marginal Mean Gamified (*SE*)	N
Full dataset	0.07	**.788**	N.S.	26.19% (2.76)	27.24% (2.76)	331
Truncated *SD* **+/-**10	4.14	**.043**	0.00	22.90% (1.52)	27.28% (1.52)	330
Truncated *SD* **+/-**7	7.07	**.008**	0.01	21.92% (1.43)	27.31% (1.43)	328
Truncated *SD* **+/-**5	4.35	**.038**	0.00	21.91% (1.26)	25.63% (1.26)	324

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