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An Experimental Analysis of Gamification's Impact on Customer Engagement and Retention in Subscription-Based Business Models

This study investigates the impact of gamification on customer engagement and retention in subscription-based business models through a six-week quasi-experimental field study. Using a streak-based gamification mechanism, we compared user behaviour between a gamified experimental group (n = 1,994) and a non-gamified control group (n = 2,107) within a live iOS subscription application. As group assignment followed onboarding status rather than randomisation, the design is quasi-experimental, and the results are interpreted as gamification-associated effects under real-world conditions rather than as strict causal estimates. Results show that gamification was associated with significantly higher engagement frequency, more stable retention, greater time investment per session, and higher conversion to paid subscriptions. At the level of daily aggregates, the experimental group exhibited 3.7 times higher daily goal completion, 4.5 times greater time investment per activity, and a 6.9-fold higher trial-to-paid conversion rate than the control group; complementary user-level analyses confirmed that these effects were broad-based rather than driven by a small number of highly active users. These findings provide ecologically valid evidence for the association between gamification and improved customer loyalty and business performance in digital subscription services. This study contributes to the literature by providing quasi-experimental field evidence linking gamification, engagement, and retention within subscription-based digital services and by demonstrating how engagement functions as a behavioural mechanism through which gamified experiences relate to conversion and long-term user value. Managerially, the results suggest that strategically integrated gamification features can serve as effective tools for improving customer lifecycle outcomes in digital subscription environments.

Keywords: gamification, customer engagement, customer retention, subscription business models, digital marketing, behavioural economics.

Introduction

The rapid growth of subscription-based digital services has fundamentally transformed how organisations create and capture customer value. As platform-based business models increasingly rely on recurring revenue streams, sustained user engagement and behavioural continuity have become critical determinants of long-term performance (Kerschbaumer et al., 2023; Jacobides

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et al., 2024). However, many digital services face a persistent challenge: while initial adoption rates may be high, user activity often declines after onboarding, threatening retention and monetisation. Consequently, firms are seeking design strategies capable of reinforcing habitual interaction and enhancing experiential value within digital ecosystems.

Gamification – defined as the application of game design elements in non-game contexts – has emerged as a promising approach for increasing engagement, motivation, and user participation (Deterding et al., 2011; Hamari et al., 2014). By incorporating elements such as progress tracking, feedback loops, and reward systems, gamification aims to influence behavioural patterns and encourage sustained platform use. Empirical research suggests that gamification can positively affect engagement and loyalty across digital environments (Koivisto & Hamari, 2019; García-Jurado et al., 2021). From a theoretical perspective, these effects are often explained through Self-Determination Theory (Ryan & Deci, 2020), which highlights the importance of competence, autonomy, and relatedness in motivating behaviour, as well as through technology adoption frameworks that emphasise perceived usefulness and experiential value (Mohd Amir et al., 2020; Babayev & Israfilzade, 2023).

Despite growing scholarly attention, the literature contains an unresolved tension rather than a simple absence of evidence. On one hand, motivational accounts predict that gamified mechanics sustain engagement well beyond initial novelty by satisfying competence and autonomy needs (Ryan & Deci, 2020; Tyack & Mekler, 2024); on the other, a parallel stream warns that gamification effects are frequently short-lived novelty responses that decay once the initial stimulus fades, and that poorly integrated mechanics can even depress engagement (Nyström, 2021). This tension remains unresolved largely because most evidence relies on cross-sectional surveys, laboratory experiments, or short-term behavioural observations rather than behaviour observed over time in real commercial platforms. Moreover, while prior studies have examined engagement outcomes, fewer have investigated the downstream economic consequences of gamification, particularly within subscription-based digital business models where monetisation depends on sustained behavioural participation. In addition, many studies focus on complex gamification systems involving multiple mechanics, leaving open questions regarding whether minimalistic features – such as streak-based consistency incentives – can produce meaningful behavioural and commercial effects.

Addressing these limitations, the present study examines the impact of a streak-based gamification mechanic implemented within a live subscription-based digital application. Using a quasi-experimental field design and behavioural analytics data, the study investigates how gamification relates to engagement frequency, retention stability, time investment, and trial-to-paid conversion outcomes. By analysing real-world user behaviour rather than self-reported intentions, the research provides ecologically valid insights into how gamification functions as a behavioural

structuring mechanism within digital marketing environments.

The research object of this study is the behavioural engagement of users in a subscription-based digital application, examined through the lens of a streak-based gamification mechanism and its relationship to participation consistency, depth of interaction, and monetisation performance.

The aim of this study is to examine the behavioural and commercial effects associated with a streak-based gamification mechanic on user engagement and conversion within a real-world digital subscription environment under quasi-experimental conditions, thereby advancing theoretical and practical understanding of gamification effectiveness.

Research methods. To achieve this aim, the study employs a quasi-experimental field design conducted within a live digital platform. Behavioural analytics data were collected from experimental and control user groups over a six-week period. Quantitative statistical analyses were applied to evaluate differences in engagement frequency, retention patterns, time investment, and conversion rates between gamified and non-gamified user segments. The methodological approach prioritises ecological validity by analysing actual user behaviour rather than self-reported perceptions.

The main objectives of the article are:

1. To evaluate the impact of a streak-based gamification mechanic on user engagement frequency and behavioural consistency.
2. To analyse the relationship between gamification and retention stability within a subscription-based service environment.
3. To assess whether gamification increases the depth of interaction, measured through time investment per activity.
4. To examine the relationship between gamification-driven behavioural engagement and trial-to-paid conversion outcomes.
5. To contribute to theoretical development by integrating behavioural analytics with motivational and technology adoption frameworks within digital marketing research.

Literature Review

Conceptual foundations of gamification

Users of mobile devices in today's world expect more from their applications than just utility. What they are looking for are experiences, something that is interesting, rewarding, and even entertaining. Meanwhile, the majority of apps have difficulty keeping users interested after they have installed the app for the first time. *Gamification*, on the other hand, adds fun, goal-setting, and even a sense of accomplishment to otherwise routine behaviours.

Understanding gamification requires a multidisciplinary lens that brings together psychological, behavioural, and technological theories to explain why game elements influence user behaviour.

The term "gamification" refers to the process of applying elements and principles of game design to contexts that are not traditional games (Hofacker et al., 2016; Zhao, 2024). In the context of mobile applications, this refers to the incorporation of features such as points, badges,

leaderboards, challenges, and rewards in order to motivate users and improve their experience as a whole. Gamification is a technique that helps retain users by making the app more fun and engaging for them. It also encourages users to interact with the app more frequently.

The design of gamification systems is commonly guided by the Mechanics-Dynamics-Aesthetics (MDA) framework, which separates how game elements function (mechanics), how users interact with them (dynamics), and how these interactions produce emotional responses (aesthetics) (Hunicke et al., 2004). Mechanics such as *points* and *badges* offer quantifiable markers of progress, while *leaderboards* and *streaks* introduce competitive or habit-forming elements. These components work dynamically to provide users with feedback loops that reinforce desired behaviours (Zhao, 2024).

Game aesthetics are equally important. As Hewapathirana and Caldera (2023) noted, emotional engagement – such as excitement, anticipation, challenge, or curiosity – can be intentionally designed into gamified systems.

Gamification also leverages basic psychological drivers, such as achievement, autonomy, purpose, and social connection. Bunchball (2010) identified five core desires that gamification can trigger: reward, status, achievement, self-expression, and competition. For example, *badges* fulfil the need for recognition and achievement; *avatars* support identity and expression; and *leaderboards* appeal to social comparison and status.

A crucial feature of effective gamification is progressive challenge. Users are most likely to remain engaged when tasks are neither too easy nor too difficult – striking a balance that continuously tests and improves their competence (Tyack & Mekler, 2024). This principle underpins many successful gamified systems, from fitness apps to learning platforms.

Importantly, gamification is not limited to entertainment; it is increasingly viewed as a ***strategic tool*** in marketing, user experience design, and digital product development. As noted by Sharma and Sijariya (2024), gamification contributes not just to engagement metrics but also to customer lifetime value, satisfaction, and brand loyalty.

However, the implementation of gamification must be context-sensitive. While well-designed gamification can deepen engagement, poorly executed or overly superficial systems risk user fatigue or disengagement (Nyström, 2021). Therefore, understanding the psychological foundations and aligning game elements with user goals and expectations is key to sustainable success.

Its success is dependent on using motivational principles and game-based mechanics to turn boring experiences into rewarding and engaging interactions. As digital platforms grow, particularly in subscription-based models, gamification represents a growing opportunity for organisations to increase engagement, reduce churn, and influence user behaviour on a large scale.

Gamification in subscription-based business models

Gamification has evolved from a marketing tactic into a strategic mechanism for increasing customer engagement,

particularly within subscription-based business models. In such environments, where customer retention is just as critical as acquisition (Israfilzade, 2021, 2025a), gamification offers a dynamic set of tools to sustain user interest, encourage habitual usage, and increase the perceived value of a service over time.

Subscription-based business models rely heavily on sustained customer engagement and long-term retention to generate recurring revenue and maximise customer lifetime value (Kerschbaumer et al., 2023). Unlike one-time purchases, these models depend on users' continued interaction with a platform or service, making churn a critical threat. Gamification has emerged as a powerful mechanism to address this challenge by embedding game elements such as streaks, points, badges, and progress tracking to encourage habitual use and reward ongoing participation (Stan & Dobrota, 2022). These elements stimulate behavioural reinforcement and create micro-incentives that increase users' perceived value of the service over time (Babayev & Israfilzade, 2023).

Research in digital services – including fitness, education, and productivity apps – has shown that gamified features significantly enhance user engagement metrics and reduce attrition rates (Edney et al., 2019; Poondej & Lerdpornkulrat, 2016). In particular, mechanics like daily challenges or streak counters are effective in triggering consistent behaviour and fostering psychological ownership of the service (Litvin et al., 2020). For instance, mobile learning platforms that include badges for course completion and leaderboards for performance ranking often experience higher course completion rates and longer user retention compared to non-gamified alternatives. These effects are attributed to gamification's ability to invoke users' intrinsic motivations while also offering extrinsic feedback through visual indicators of progress.

Despite its potential, gamification in subscription-based models must be strategically implemented to avoid diminishing returns. Poorly designed gamified systems – those that lack personalisation or overwhelm users with superficial rewards – can lead to disengagement or burnout (Nyström, 2021). Furthermore, the dynamic nature of subscription services means that gamification must evolve with user expectations. Recent trends suggest the growing importance of adaptive gamification, where elements are tailored to individual user behaviour through AI and data analytics (Bezzina & Dingli, 2023). As such, gamification is not merely an add-on but a core strategic component that, when well-executed, can increase user loyalty, reduce churn, and enhance customer satisfaction in subscription-driven digital ecosystems.

Impact of gamification on user engagement and retention

Gamification has been shown to significantly influence key behavioural outcomes such as user engagement and customer retention, both of which are essential for the sustainability of subscription-based services (Hamari et al., 2014). Engagement refers to the user's cognitive, emotional, and behavioural investment in interacting with a system, while retention reflects the user's continued

participation over time. Game elements such as daily streaks, points, and reward systems have been widely used to enhance engagement by creating micro-goals and progress feedback, which in turn reinforce continued usage behaviours (Zhao, 2024). These mechanics introduce a sense of accomplishment, challenge, and predictability, all of which contribute to a user's willingness to return to a platform regularly (Tyack & Mekler, 2024).

Studies have demonstrated that gamification positively influences user motivation, satisfaction, and engagement through the mediation of psychological needs satisfaction, including autonomy, competence, and relatedness (Suh et al., 2015; 2016). Game dynamics such as rewards, competition, and self-expression play a crucial role in satisfying these psychological needs, ultimately leading to increased enjoyment and user engagement (Suh et al., 2015; 2016). In e-commerce, gamification has been found to have direct effects on user engagement, with specific elements like points and challenges emerging as key drivers (García-Jurado et al., 2021; Persada, 2023).

Empirical studies support the claim that gamification positively affects these behavioural metrics across a range of industries. For example, in mobile health (mHealth) and education applications, gamified features have been found to increase the frequency and duration of user sessions, as well as reduce dropout rates (Edney et al., 2019; Poondej & Lerdpornkulrat, 2016). In e-commerce and subscription-based services, gamification has been associated with higher conversion rates from free to paid plans, greater long-term usage, and deeper user involvement in platform features (Suh et al., 2015; 2016). These outcomes are often attributed to increased motivation, habit formation, and psychological investment fostered by game mechanics. Moreover, retention is further reinforced when users receive timely and meaningful feedback about their progress, which can enhance perceived competence and long-term commitment to the platform (Ryan & Deci, 2020).

However, the effectiveness of gamification in promoting engagement and retention is contingent upon thoughtful design and contextual alignment. Over-gamification, or the use of game elements without meaningful integration into the user experience, may lead to fatigue or disengagement (El Hafidy et al., 2021). Additionally, users differ in their responsiveness to gamified features depending on their personality traits, usage goals, and prior experiences. For this reason, personalisation and adaptivity are increasingly emphasised in gamification design. Emerging approaches integrate real-time user data to dynamically adjust challenges and rewards, thereby maintaining optimal engagement without overburdening the user.

Theoretical framework

Self-Determination Theory (SDT) provides a robust theoretical lens for understanding gamification's psychological effects (Ryan & Deci, 2020). SDT posits that human motivation is driven by three fundamental psychological needs: autonomy (the desire for self-directed

action), competence (the need to feel effective and capable), and relatedness (the desire for social connection). Gamification satisfies these needs by providing users with choices (autonomy), feedback and achievement recognition (competence), and social features (relatedness).

The Technology Acceptance Model (TAM) further explains how gamification influences user behaviour through perceived usefulness and ease of use (Mohd Amir et al., 2020). When gamified elements enhance the perceived value of a service while maintaining usability, users demonstrate increased willingness to engage and continue usage. Together, SDT and TAM provide complementary perspectives on how gamification influences both intrinsic motivation and behavioural intention, offering a comprehensive theoretical foundation for this study.

Hypotheses development

Based on the theoretical framework and prior empirical evidence, we developed four hypotheses examining gamification's effects on different dimensions of user behaviour. Given the quasi-experimental design, hypotheses are framed in terms of expected behavioural differences between the gamified and non-gamified groups rather than as strict causal claims.

Engagement Frequency: Prior experimental and empirical research provides strong theoretical and behavioural support for the expectation that users exposed to gamified systems will demonstrate higher engagement through repeated goal-oriented actions. Experimental evidence by Bravo et al. (2023), based on a controlled study with 315 participants comparing gamified and non-gamified loyalty programs, shows that gamification enhances perceived playfulness and reward satisfaction, which in turn increases user engagement behaviours and interaction frequency. Complementing this experimental perspective, Gullshenas and Shirazi (2025) reported a strong and statistically significant positive relationship between gamification and customer engagement, thereby demonstrating the substantial behavioural influence of gamified mechanisms. From a theoretical standpoint, Koneti et al. (2025) argue that common gamification elements – such as points, badges, leaderboards, challenges, and progress tracking – satisfy core psychological needs for achievement and competence, reinforcing habitual usage patterns and motivating repeated task completion. Together, these findings suggest that gamification strengthens intrinsic motivation and reinforces consistent behavioural engagement, which is expected to manifest in higher frequencies of daily goal completion events among users in the gamified experimental group compared to those in the control group over the study period. Therefore:

H1: *Users in the gamified experimental group will exhibit significantly higher engagement, measured by the frequency of daily goal completion events, compared to the control group over the study period.*

Retention: Prior research strongly suggests that gamification not only stimulates initial engagement but also fosters sustained participation and

long-term user retention through reinforcing behavioural consistency. Empirical evidence from Gullshenas and Shirazi (2025) demonstrates that gamification significantly influences customer loyalty both directly and indirectly through engagement mediation. Jacobides et al. (2024) identify retention as a central pathway through which gamification creates value, emphasising the role of virtualisation, social comparison, and reward structures in sustaining user participation. Extending this literature, prior studies note that gamification sustains user interest beyond initial novelty effects by providing continuous motivation through achievement systems and progress tracking (Koivisto & Hamari, 2019), with streak mechanisms in particular fostering psychological commitment to maintaining uninterrupted participation. While retention is often treated as a unidimensional outcome, this study conceptualises retention as a composite construct encompassing both sustained engagement levels over time and the consistency of daily participation, leading to the expectation that users in the gamified experimental group will exhibit significantly improved retention outcomes compared to those in the control group.

H2: *The experimental group will demonstrate significantly improved retention, evidenced by sustained engagement levels over time and more consistent daily participation patterns, compared to the control group.*

Existing literature suggests that gamification can foster deeper forms of engagement by increasing the amount of time users dedicate to goal-oriented activities, reflecting more immersive and cognitively involved interactions. Empirical evidence from Paschmann et al. (2024), based on a large-scale study of 18,952 mobile app users, demonstrates that game-based rewards substantially increase engagement time, with proximity to rewards increasing gameplay duration and reward attainment leading to an increase in time spent, indicating that gamified incentives can significantly intensify user involvement. Lin et al. (2022) report that gamification elements positively influence perceived playfulness and customer engagement, suggesting that users are more likely to immerse themselves in tasks when interactive and motivational features are present (Israfilzade, 2021, 2025a). While some research notes that increased time spent may not always translate into higher-quality participation under certain flow conditions (Paschmann et al., 2024), the overall body of evidence indicates that gamified environments generally encourage users to devote more sustained attention and effort to tasks. Accordingly, it is expected that users in the gamified experimental group will spend significantly more time engaging with daily goals – measured by average time per completion event – compared to those in the control group, reflecting deeper engagement with the activity.

H3: *Users in the gamified group will spend significantly more time engaging with daily goals (measured by average time per completion event) compared to the control group, indicating deeper engagement.*

Prior research indicates that gamification can drive meaningful improvements in conversion outcomes by

enhancing user engagement, perceived value, and motivation to continue using digital services. Jacobides et al. (2024), in their analysis of 40 gamification projects, identify validated pathways through which gamified systems facilitate customer acquisition, demonstrating that the combination of virtualisation and tangible rewards creates competitive and immersive experiences that attract and convert new users, while reward-based loyalty mechanisms alone can effectively stimulate participation and adoption. The study (Farace et al., 2025), based on quasi-experimental field data from 4,896 e-commerce users over two years, reveals that socially gamified behaviours significantly increase monetary outcomes, with liking and sharing activities leading to notable increases in spending per purchase occasion and total customer expenditure, highlighting the role of engagement-driven interactions in influencing purchasing behaviour. From a theoretical perspective, Liu, Santhanam, and Webster (2020) argue that increased engagement and satisfaction derived from gamified experiences elevate perceived value and willingness to pay, establishing a causal pathway from gamification to engagement, perceived benefits, and eventual monetisation outcomes. Building on this chain of effects, it is expected that users exposed to gamified features will be more likely to transition from free trials to paid subscriptions, leading to the hypothesis that the gamified experimental group will exhibit a significantly higher conversion rate compared to the control group, driven by increased engagement and sustained interaction with the platform.

H4: *The gamified group will exhibit a higher conversion rate (trial-to-paying user upgrades) compared to the control group, driven by increased engagement.*

Research Methodology

Research design

This study investigates how gamification relates to customer engagement and retention within subscription-based business models, where sustaining user interest is critical amidst increasing market competition and evolving consumer expectations. Gamification strategies – such as challenges, rewards, and interactive experiences – are examined for their potential to enhance brand loyalty by maintaining motivation and interest over time. The study employed a quantitative quasi-experimental field design conducted within a live iOS subscription application. A field-based design was selected to maximise ecological validity by observing actual user behaviour in a live commercial environment. The study ran from January 5 to February 15, 2025 (six weeks), enabling observation of both short-term reactions and emerging retention patterns. Consistent with conventions for field studies that lack full randomisation, we describe the design as quasi-experimental and, accordingly, interpret group differences as gamification-associated effects rather than as strict causal estimates.

Participants were divided into two groups: a control group (n = 2,107) consisting of existing app users without gamification features, and an experimental

group (n = 1,994) comprising newly onboarded users exposed to a streak-based gamification mechanism. The streak feature provided visual feedback (a streak count) for consecutive daily goal completions, serving as the treatment variable. This design allowed for a direct comparison of user behaviour under gamified versus non-gamified conditions while maintaining ecological validity through implementation in a live service environment.

Internal validity and group composition

Because the study ran within a live application rather than a laboratory, assignment was not randomised: it followed the platform's onboarding logic, so the experimental (streak-active) group consisted of newly onboarded users and the control (streak-inactive) group of existing users. We treat this as a defining feature of the design, since it directly shapes how the results should be read.

This composition raises two threats to internal validity. New and existing users may differ in baseline motivation and usage, and new users may show a temporary novelty effect that lifts early activity on its own. Both threats push in the same direction – inflating the experimental group's apparent advantage – so the absolute size of the differences should not be read as a clean treatment effect.

We address this in three ways. First, we describe the design as quasi-experimental throughout and avoid causal language. Second, because the bias inflates rather than suppresses the experimental group's engagement, the observed differences represent an upper bound on the true effect; even after discounting for novelty, the direction holds, as the effects are large and consistent across all behavioural dimensions and the full six weeks – including the later weeks, when a novelty spike would already have faded (see section *Retention*). Third, we add user-level analyses (see section *Measures and Data Analysis*) to confirm the effects are broad-based rather than artefacts of group composition. The quasi-experimental assignment is a real constraint but a deliberate trade-off for ecological validity, discussed further in the Limitations section.

Sample and data collection

This study used a quasi-experimental field design to collect primary data on how a gamification feature relates to user behaviour. The "*streak*" feature, which rewards users with a visual indicator for completing daily goals on a consistent basis, was the specific gamification element tested. The streak feature serves as the experiment's treatment: users who enable it receive feedback (such as a streak count or badge) for maintaining consistent engagement day after day. The purpose of introducing this feature was to see if it changes online user behaviour and improves key performance indicators such as engagement and retention.

A total of N = 4,101 users participated, with inclusion criteria limited to English language settings on iOS devices. No demographic filtering was applied, resulting in a diverse sample representative of the application's user base. The sample

size provides adequate statistical power (>.80) to detect medium effect sizes at the conventional alpha level of .05.

Group assignment was determined by onboarding timing (existing vs. new users), a practical approach in live app environments. While this quasi-experimental design introduces limitations discussed in the Internal Validity and Group Composition section, the automated, rule-based procedure ensured consistent, non-arbitrary assignment. All users in both groups had access to identical core application features; the only difference was the presence of the streak gamification element for the experimental group.

User behaviour data were collected automatically through Amplitude analytics integrated with Google Firebase, capturing event logs for daily goal completions, session durations, and subscription conversions. This instrumentation ensured high accuracy and consistency without introducing self-report bias or social desirability effects. The automated data collection also eliminated observer effects and ensured uniform measurement across all participants.

Measures and data analysis

Four key constructs were measured to test the hypotheses. Engagement was operationalised as the frequency of "view_daily_goal_completed" events, providing an objective count of user interactions with the application's core functionality. Retention was assessed through two indicators: sustained engagement patterns over the six-week period (measured as weekly activity levels) and consistency of daily participation (measured as the proportion of days with at least one completed goal). Time investment was calculated as the average seconds spent per completion event, indicating the depth of user engagement. Conversion was measured as the percentage of users upgrading from a free trial to a paid subscription during the experimental period.

Unit of analysis and effect-size computation. Because the analytics platform exported behavioural data as daily aggregated counts per group, the primary hypothesis tests (H1–H3) were conducted at the day level, with each of the 42 study days constituting one observation per group (N = 42 per group; df = 82). Independent-samples t-tests compared the two groups on the mean daily count (or mean daily time) for each goal, and Cohen's d was computed using the pooled standard deviation of the two day-level distributions, d = (M_exp − M_ctl) / s_pooled. We note explicitly that day-level aggregation reduces within-group variance relative to user-level data, and that the resulting effect-size estimates are therefore large by construction and should be interpreted as day-level rather than person-level effects. To guard against over-interpretation of these magnitudes, we report complementary user-level analyses for engagement reach and conversion, where the unit of analysis is the individual user (N = 4,101), using Cohen's h for proportions and the φ coefficient and odds ratio for conversion, alongside chi-square tests. This dual reporting directly addresses the concern that aggregate trends might be driven by a small number of highly active users.

Statistical analysis employed independent samples t-tests for normally distributed data and Mann-Whitney U tests for non-parametric comparisons. Prior to hypothesis testing, normality was assessed using the Shapiro-Wilk test. Effect sizes were calculated using Cohen's d for t-tests and r for Mann-Whitney U tests. Significance was assessed at $\alpha = .05$ with Bonferroni correction applied for multiple comparisons to control family-wise error rate. All analyses were conducted using Python (pandas, scipy) and cross-verified with Jamovi statistical software.

Results

Engagement frequency

Hypothesis H1 was supported. At the day level, the experimental group completed significantly more daily goals across all measured activities than the control group. For the primary daily goal (Goal 1), the experimental group averaged 36.3 completions per day (SD = 9.6) over the six-week period, compared to 11.5 (SD = 4.2) for the control group, $t(82) = -15.37$, $p < .001$, Cohen's $d = 3.35$. As detailed in Section *Measures and Data Analysis*, this is a day-level effect size and is large by construction; the corresponding user-level analysis is reported below.

Similar significant differences were observed for all five goal categories. For Goal 2, the experimental group averaged 17.1 completions versus 4.5 for controls, $t(82) = -13.85$, $p < .001$. For Goal 3, the comparison was 9.9 versus 2.1, $t(82) = -12.70$, $p < .001$. For Goal 4, 3.9 versus 0.6, $t(82) = -11.09$, $p < .001$. For Goal 5, 6.4 versus 1.3, $t(82) = -9.58$, $p < .001$. In aggregate, the experimental group averaged 74 total goals per user versus 20 for controls – representing a 3.7-fold increase in engagement frequency.

An independent sample t-test was performed on each goal as well as the total number of accomplished goals. *Table 1*, "*T-test for daily goals by experimental condition*," shows significant t-values for all comparisons ($p < 0.001$). For example, the total number of achieved goals per user: $t(82) \approx 15.5$, $p < 0.001$, suggesting a highly significant difference between the groups. Individual goals had t-values ranging from 9.6 (goal 5) to 15.4 (goal 1), with all $p < 0.001$. This statistic enables us to reliably reject the null hypothesis of no differences and supports hypothesis H1.

Table 1. **Independent samples t-test for daily goal completion events by experimental condition**

Variable	Statistic	df	p	Mean difference	SE difference
View daily goal completed 1	-15.37	82	<.001	-24.81	1.614
View daily goal completed 2	-13.85	82	<.001	-12.64	0.913
View daily goal completed 3	-12.7	82	<.001	-7.74	0.609
View daily goal completed 4	-11.09	82	<.001	-5.1	0.46
View daily goal completed 5	-9.58	82	<.001	-3.29	0.343
view_daily_goal_completed_total	-15.51	82	<.001	-53.57	3.453

The median number of first-goal completions for experimental users was 36 out of 42 days, markedly greater than the control group's median of approximately 12 days. This indicates that gamified users completed their initial daily goal almost every day, whereas control users did so only sporadically. The consistency of engagement in the experimental group suggests that the streak mechanism successfully created habitual usage patterns.

To assess whether the day-level differences reflect broad-based engagement rather than the activity of a few highly active users, we examined engagement at the level of the individual user. Engagement was broad rather than concentrated: 76.4% of experimental users (1,524 of 1,994) completed Goal 1 at least once during the study, compared with 22.9% of control users (482 of 2,107). A user-level test of this difference in reach was significant, $z = 34.29$, $p < .001$, with a very large effect size (Cohen's $h = 1.13$). The same pattern held at every subsequent goal level (Goal 2: 36.1% vs. 8.9%; Goal 3: 20.8% vs. 4.3%; Goal 4: 13.4% vs. 2.5%; Goal 5: 8.2% vs. 1.2%). Because the great majority of the experimental group – not a small subset – engaged with the streak mechanic, the aggregate trends cannot be attributed to a handful of power users. A complementary concentration check on the day-level series confirmed this: daily Goal 1 events were distributed evenly across the study period (Gini = 0.14 for the experimental group), with the five most active days accounting for only 16.5% of total events (against a 12% even-distribution baseline) and every one of the 42 days registering activity.

Retention

Hypothesis H2 was supported by multiple indicators of retention. The experimental group maintained consistently higher engagement throughout the study period, while the control group exhibited a steady decline in activity. Weekly analysis of Goal 1 completions revealed that the experimental group remained stable across the six weeks (between 231 and 288 completions per week), whereas the control group declined from 89 completions in week 1 to 59 in week 6. By week 6, the experimental group completed Goal 1 approximately 3.9 times more often than the control group (231 vs. 59 events).

The weekly summary data clearly demonstrate this difference. Annex 1, "Weekly Goal Completion Events: Control vs. Experimental Groups," reports how many times each goal was completed each week in both groups. For Goal 1 in week 1, the control group recorded 89 completions versus 237 for the experimental group – approximately 2.7 times more – establishing the gamified group's initial advantage. Most importantly, by week 6, the control group's Goal 1 completions had fallen to 59, whereas the experimental group remained high at 231, sustaining an advantage of roughly 3.9 to 1.

A similar pattern held for the deeper goals. For Goal 2, the control group declined from 33 completions in week 1 to 24 in week 6, while the experimental group remained substantially higher throughout (114 in week 1 and 95 in week 6). Across all five goals, the control group's weekly activity trended downward, whereas the experimental group sustained markedly higher and more

stable participation, consistent with the streak mechanic reinforcing ongoing engagement.

In general, the control group's activity decreased each week, indicating that they lost interest or did not consistently complete the tasks. The experimental group also decreased over the next few weeks (as is natural when novelty wears off), but overall participation remained relatively stable. In some cases, the gamified group's activity in week 6 exceeded that of the control group in week 1.

Furthermore, both groups remained technically active for the full 42-day period; however, the experimental group demonstrated significantly more consistent daily participation. Many experimental users were active almost every day, motivated by streak mechanics that created psychological commitment to maintaining progress. In contrast, control users frequently skipped days, with engagement becoming increasingly sporadic over time.

The findings revealed that the gamified experience not only increased initial engagement but also helped maintain engagement over time, whereas the non-gamified control group had reduced engagement. Figure 1, "Engagement Trend Over Time," depicts the two groups' daily participation trends across the 42-day trial.

The weekly engagement trajectory showed divergent patterns between groups. The control group followed a familiar decline curve: moderate initial activity followed by a gradual reduction in subsequent weeks. The experimental group, conversely, started with high participation and maintained relatively stable levels throughout the study, with only a slight decline toward week 6. This pattern suggests that gamification successfully extended the "honeymoon period" of service usage.

Time investment

Hypothesis H3 was supported, with the experimental group spending significantly more time per engagement

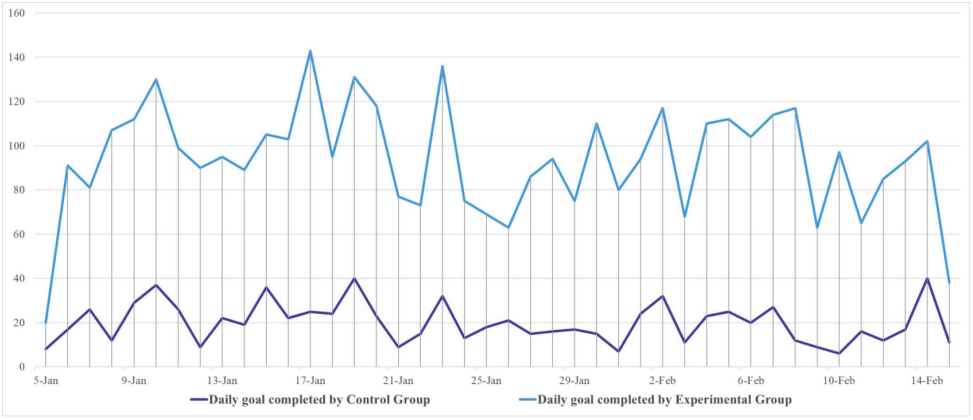

Fig. 1. **Engagement trend over time**

event. The experimental group averaged 142.4 seconds per completion event (median = 114.1 seconds), compared to 31.6 seconds (median = 30.4 seconds) for the control group. For Goal 1 specifically, $t(82) = -7.88$, $p < .001$, Cohen's $d = 1.72$, indicating a large effect size. The difference in median engagement time is also noteworthy. The control group's median of 30.4 seconds per completion event suggests brief, transactional interactions, whereas the experimental group's median of 114.1 seconds – roughly 3.7 times longer – indicates more sustained, attentive engagement with task content. This distinction suggests that the streak mechanic was associated not only with how often users engaged, but with how deeply.

Significant differences were observed for Goals 1, 3, 4, and 5 (all $p < .05$). The only exception was Goal 2, where both groups showed comparable time investment (approximately 105 seconds for control vs. 116 for experimental, $p = .212$), suggesting that this particular task had inherent characteristics that determined engagement duration regardless of gamification (Table 2). Overall, the experimental group invested 4.5 times more time per interaction, indicating substantially deeper engagement.

In summary, the findings indicate that the streak mechanic was associated with greater depth and persistence of user engagement, increasing both the frequency and the duration of interactions with tasks, thus supporting H3.

Conversion

Hypothesis H4 was supported. Conversion was measured along a sequential engagement funnel. All users in both groups entered the funnel at the welcome screen (100% of each group). Users then progressed through five progressively demanding daily goals (Goal 1 → Goal 5) and finally to a paid subscription. At each stage, the stage percentage is computed as the number of distinct users in that group who reached the stage divided by the total number of users in that group (the group's welcome-screen population: n = 2,107 control, n = 1,994 experimental). The trial-to-paid conversion rate is therefore the number of users who upgraded to a paid subscription divided by the total group size; conversions were measured once per user, not repeatedly.

The data reveal that while both control and experimental groups exhibited similar initial engagement (with 100% viewing the welcome screen), the implementation of streak-based gamification dramatically increased user progression

Table 2. **Comparative t-Test results of time investment: control vs. experimental groups**

Variable	Statistic	df	p	Cohen's d
Average Time goal 1	-7.88	82	<.001	1.72
Average Time goal 2	-1.26	82	0.212	0.27
Average Time goal 3	-2.6	82	0.011	0.57
Average Time goal 4	-3.75	82	<.001	0.82
Average Time goal 5	-5.29	82	<.001	1.16

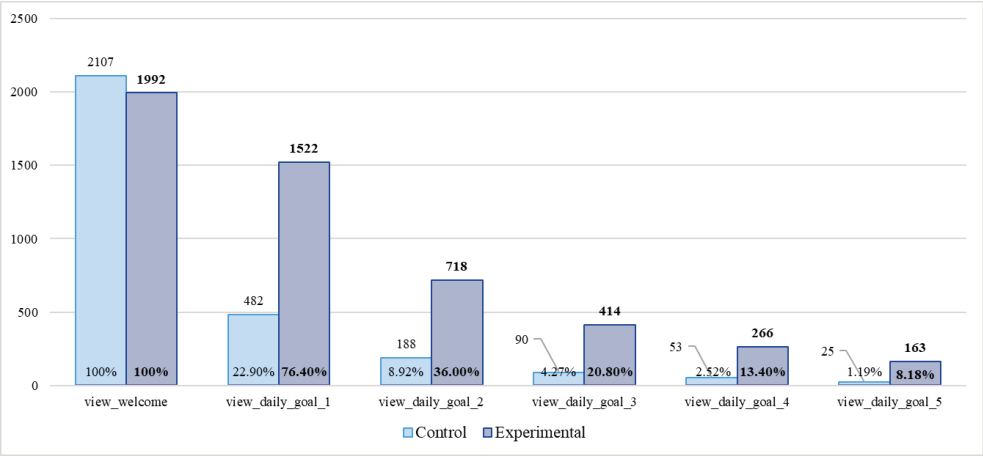

Fig. 2. **Total conversion**

through subsequent daily goals. Specifically, the experimental group demonstrated significantly higher completion rates across all five daily goals compared to the control group: Goal 1 engagement was 76.40% (1,522 users) versus 22.90% (482 users) for controls – a 3.3-fold increase – while the relative advantage grew progressively stronger for deeper engagement activities, with Goal 5 showing a 6.9-fold difference (8.18% or 163 users versus 1.19% or 25 users).

In absolute terms, approximately 1 in 12 experimental users converted to a paid subscription (8.17%, 163 of 1,994), compared with approximately 1 in 84 control users (1.19%, 25 of 2,107). A user-level chi-square test confirmed that this difference was significant, $\chi^2(1, N = 4{,}101) = 114.4$, $p < .001$, with an odds ratio of 7.41 ($\varphi = 0.17$). The φ coefficient indicates a small-to-moderate user-level association, which contrasts with the very large day-level effect sizes and underscores the importance of distinguishing the two units of analysis (Section *Measures and Data Analysis*). The pattern indicates that gamification was associated not only with higher initial participation but also with sustained commitment through increasingly demanding interaction levels.

The conversion results demonstrate that gamification's effects on engagement translated into tangible business outcomes. The chain of effects from gamification to increased engagement frequency, deeper time investment, and sustained retention ultimately manifested in significantly higher willingness to pay for the service. This finding is particularly important for subscription businesses, as even small improvements in conversion rates can have substantial revenue implications at scale.

Summary of hypothesis testing

Table 3 summarises the hypothesis testing results. All four hypotheses were supported, effects were consistent across dimensions; day-level effect sizes were large while user-level associations were small-to-moderate. The consistency of

Table 3. **Summary of the hypothesis**

Hypothesis	Supported?	Effect size	Key Insights
H1: Engagement	Yes	d = 3.35 (day); h = 1.13 (user)	The experimental group had significantly higher goal-completion frequency; engagement was broad-based.
H2: Retention	Yes	Descriptive / trend	The experimental group sustained engagement over time; the control declined steadily.
H3: Time Investment	Yes	d = 1.72 (Goal 1)	The experimental group spent significantly more time per event.
H4: Conversion Rate	Yes	OR = 7.41; φ = 0.17 (user)	The experimental group converted at 6.9× the control rate.

significant results across multiple metrics provides strong evidence for gamification's positive impact on user behaviour in subscription-based services.

Gamification can significantly improve key subscription-related metrics such as activity, retention, and conversion. To encourage satisfaction and loyalty, businesses should incorporate well-designed game elements (progress tracking, streak mechanics, challenges, and reward systems) into the user experience.

Discussion

Key findings

This study provides quasi-experimental field evidence on the association between gamification and user behaviour in subscription-based business models, aligning with the broader findings of Hamari et al. (2014) and Suh et al. (2015, 2016) regarding gamification's positive impact on user behaviour.

A relatively simple streak-based mechanic was associated with substantial behavioural differences: 3.7 times higher daily engagement frequency, 4.5 times greater time investment, and a 6.9-fold higher conversion rate compared to the control condition. As discussed in Sections *Internal Validity and Group Composition* and *Measures and Data Analysis*, the day-level magnitudes are large in part by construction and may be inflated by the new-versus-existing-user composition; the user-level analyses, however, confirm that the effects are broad-based and that the conversion association, while smaller at the person level (φ = 0.17), remains robust and significant. The pattern is consistent with mechanics aligned with core service value, generating stronger outcomes than the superficial gamification criticised by Nyström (2021). These effect sizes substantially exceed those typically reported in gamification meta-analyses, suggesting that mechanics aligned with core service value – similar to the effective implementations described by Zhao (2024) – generate superior outcomes compared to superficial gamification often criticised by Nyström (2021).

The difference in engagement depth supports Paschmann et al.'s (2024) finding that proximity to rewards increases user involvement, while extending their work by suggesting that streak

mechanics are associated with sustained rather than momentary engagement. The control group's short median interaction time (30.4 seconds) is consistent with concerns raised by El Hafidy et al. (2021) regarding superficial digital engagement, whereas the experimental group's markedly longer median (114.1 seconds) suggests that well-designed gamification can counteract the shallow interaction patterns identified by Nyström (2021).

The divergence in retention trajectories – specifically the experimental group's resistance to the typical novelty-decay curve – supports Koivisto and Hamari's (2019) assertion that gamification sustains interest beyond initial novelty effects. This finding extends Edney et al.'s (2019) work on attrition reduction by demonstrating that streak mechanics specifically interrupt the honeymoon-decline pattern characteristic of subscription services, converting initial interest into habitual behaviour as theorised by Litvin et al. (2020).

Theoretical implications

Our findings make several contributions to the theoretical understanding of gamified systems. First, the results are consistent with Self-Determination Theory (SDT) in subscription contexts, supporting Ryan and Deci's (2020) framework regarding the internalisation of extrinsic motivation. The streak mechanism satisfied competence needs through progress feedback while supporting autonomy through voluntary participation, suggesting – as Tyack and Mekler (2024) argue – that gamification can foster genuine intrinsic motivation when designed to support psychological needs rather than merely control behaviour.

The study validates Hunicke et al.'s (2004) MDA framework application to non-gaming services, demonstrating how simple mechanics (streak counters) generate specific dynamics (sustained usage patterns) that produce meaningful aesthetic experiences (satisfaction and accomplishment). This aligns with Hewapathirana and Caldera's (2023) conceptualisation of emotional engagement in marketing contexts, while extending their work with experimental evidence. Our results confirm Zhao's (2024) assertion that progress tracking mechanics create effective feedback loops, yet suggest that even minimal implementations can yield substantial effects when aligned with user goals.

Furthermore, we extend the Technology Acceptance Model (TAM) as applied by Mohd Amir et al. (2020), demonstrating that gamification enhances perceived usefulness through increased engagement depth rather than merely improving ease of use. The significantly higher conversion rates support Jacobides et al.'s (2024) identification of retention as a central pathway for gamification value creation, while providing the experimental evidence they identify as necessary for establishing causal relationships between virtualisation, engagement, and monetisation.

Our findings also contribute to behavioural economics by demonstrating how streak mechanics may leverage loss aversion and endowment effects identified in classical behavioural theory, converting extrinsic rewards into intrinsic behavioural habits – a mechanism implied by Bunchball (2010) but rarely

demonstrated experimentally in live commercial environments.

Contribution to gamification and digital marketing literature

This study contributes to the growing literature on gamification in several important ways. First, it provides rare quasi-experimental field evidence within a live subscription environment, addressing calls for more ecologically valid research designs (Koivisto & Hamari, 2019). Second, the findings demonstrate that a single, relatively simple mechanic can generate substantial behavioural and commercial effects, challenging assumptions that complex multi-element gamification systems are necessary for success. This aligns with emerging research suggesting that the effectiveness of gamification depends more on psychological alignment than on technological sophistication (Bitrian et al., 2021).

Third, the study extends research linking engagement to monetisation outcomes by providing behavioural evidence connecting increased interaction patterns with conversion performance. While prior studies have identified engagement as a mediator between gamification and loyalty or purchase behaviour (Ramdhani et al., 2024; Persada, 2023; Israfilzade, 2025b), experimental evidence demonstrating downstream financial outcomes remains limited. The present findings therefore strengthen the argument that gamification can function as a strategic revenue optimisation tool rather than merely a user experience enhancement.

Practical implications

For subscription-based businesses, this study offers several actionable insights. First, gamification features like streak mechanics can significantly improve key performance indicators, including engagement, retention, and conversion. The magnitude of effects observed suggests substantial potential return on investment for gamification implementation.

Second, gamification should be integrated with core service value rather than treated as a superficial decoration. Users converted because gamification enhanced their service experience, not despite it. The streak mechanism was meaningful because it tracked progress toward goals that users valued, not merely arbitrary actions.

Third, the relatively simple implementation (a visual streak counter) achieved substantial effects, suggesting that businesses need not invest in complex gamification systems to realise benefits. The key is alignment between game mechanics and user motivations, not technological sophistication.

Fourth, the consistency of engagement in the gamified group highlights the importance of daily interaction patterns for subscription success. Businesses should design gamification to encourage habitual usage rather than sporadic engagement, as habits are the foundation of long-term retention.

Limitations

Several limitations should be acknowledged. The most consequential concerns

the quasi-experimental design: group assignment followed onboarding status rather than randomisation, so the experimental (new-user) and control (existing-user) groups likely differed in baseline motivation and engagement, and newly onboarded users may have exhibited onboarding or novelty effects. As discussed in Section *Internal Validity and Group Composition,* this confound is expected to inflate the absolute magnitude of the observed differences, which should therefore be read as an upper bound on the gamification-associated effect rather than a clean causal estimate. While the direction and consistency of effects across all behavioural dimensions and the full six-week window – together with the broad-based user-level results – make it unlikely that the entire effect is artefactual, the design cannot fully isolate the treatment from group composition; randomised assignment of comparable users is needed to confirm causality. The sample was also limited to English-speaking iOS users of a single application, potentially limiting generalisability to other platforms, languages, or service categories. Finally, the data export provided behavioural counts aggregated by day rather than full user-level event histories, which constrained the primary analyses to the day level; we mitigated this with user-level reach and conversion analyses, but richer user-level modelling remains desirable.

The six-week duration, while sufficient for initial patterns, cannot capture very long-term effects or determine whether observed benefits persist, diminish, or compound over extended periods. Additionally, the study examined only one gamification mechanic (streaks); other mechanics, such as leaderboards, badges, or points, may produce different effects.

The reliance on behavioural data without accompanying attitudinal measures means we can infer motivation from behaviour but cannot directly assess psychological mechanisms. Finally, the study was conducted in a specific commercial context, and results may not generalise to non-commercial or non-subscription environments.

Future research directions

Future research should examine gamification effects across diverse platforms, demographics, and industry contexts to establish boundary conditions for our findings. Comparative studies testing different gamification mechanics (e.g., leaderboards versus streaks versus badges) would inform design decisions and help identify optimal configurations for specific contexts.

Quasi-experimental field studies extending beyond six weeks could assess whether effects persist, diminish, or compound over time. Of particular interest is whether gamification benefits show diminishing returns as novelty wears off, or whether habit formation sustains engagement indefinitely. Studies examining the removal of gamification features could also illuminate whether effects represent genuine motivation changes or merely temporary responses to novelty.

Research incorporating attitudinal measures alongside behavioural data would provide deeper insight into psychological mechanisms. Understanding users' subjective experiences of

gamification – including enjoyment, perceived value, and satisfaction – would complement behavioural findings and inform design improvements.

Finally, research examining individual differences in gamification response could enable personalised gamification approaches. Not all users responded equally to the streak mechanism; understanding factors that predict responsiveness would enable more targeted and effective implementation.

Conclusions

This study provides quasi-experimental field evidence that a streak-based gamification mechanic is associated with enhanced behavioural engagement, more stable participation, deeper interaction, and improved monetisation within a subscription-based digital service. The findings suggest that even relatively simple gamification elements can be associated with substantial behavioural differences when aligned with meaningful user activities and platform objectives. These associations should be interpreted in light of the quasi-experimental design: because the experimental and control groups differed in onboarding status, the absolute magnitudes likely overstate the pure treatment effect, even as the direction and breadth of the effects remain robust across units of analysis.

The results highlight that gamification functions not merely as an entertainment feature but as a behavioural structuring mechanism capable of reinforcing consistent interaction patterns and encouraging deeper experiential involvement. Increased engagement frequency and sustained participation trajectories suggest that gamification can facilitate habit formation and psychological commitment, thereby reducing disengagement risks commonly observed in digital subscription environments. Moreover, the significant increase in trial-to-paid conversion rates demonstrates the direct commercial relevance of behavioural engagement improvements, reinforcing the strategic importance of experiential design within digital marketing.

From a theoretical perspective, the study contributes behavioural field evidence – rather than simulated or self-reported data – to motivational and technology adoption theories. The findings contribute to motivational and technology adoption theories by illustrating how gamification influences perceived value indirectly through behavioural engagement pathways. Furthermore, the results support emerging perspectives suggesting that minimalistic gamification design – when psychologically aligned with user goals – can be highly effective without requiring complex multi-element systems.

Nevertheless, the study is subject to limitations, including potential baseline differences between experimental and control groups, reliance on behavioural analytics without complementary psychological measures, and a relatively short observation period that may not fully capture long-term sustainability or novelty effects. Future research should therefore investigate long-term behavioural patterns, incorporate qualitative and attitudinal measures, and compare multiple gamification mechanics across diverse digital service contexts.

Overall, the findings provide valuable insights for both scholars and practitioners by demonstrating that strategically implemented gamification can serve as a powerful driver of behavioural engagement and revenue growth in subscription-based digital platforms. As digital markets continue to evolve, integrating psychologically grounded and data-driven gamification strategies may become increasingly central to sustaining competitive advantage and enhancing customer experience.

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Annex 1. **Weekly goal completion events: control vs. experimental groups**

Gamification tasks	Week No	Control Group	Exp. Group	Total
view_daily_goal_completed_1	Week 1	89	237	326
	Week 2	92	264	356
	Week 3	83	266	349
	Week 4	71	238	309
	Week 5	88	288	376
	Week 6	59	231	290
	Total	482	1524	2006
view_daily_goal_completed_2	Week 1	33	114	147
	Week 2	36	134	170
	Week 3	36	117	153
	Week 4	26	120	146
	Week 5	33	139	172
	Week 6	24	95	119
	Total	188	719	907
view_daily_goal_completed_3	Week 1	17	63	80
	Week 2	16	85	101
	Week 3	16	70	86
	Week 4	11	67	78
	Week 5	16	79	95
	Week 6	14	51	65
	Total	90	415	505
view_daily_goal_completed_4	Week 1	12	44	56
	Week 2	8	50	58
	Week 3	10	46	56
	Week 4	5	39	44
	Week 5	10	55	65
	Week 6	8	33	41
	Total	53	267	320
view_daily_goal_completed_5			27	31
			30	35
			30	35
			23	25
			31	34
			22	28
			163	188