INSTITUTO SUPERIOR DE ENGENHARIA DO PORTO
MESTRADO EM ENGENHARIA INFORMÁTICA




ZeroZero Fantasy League: Aumentar o Envolvimento com Produtos de uma Marca com um Jogo de Telemóvel

PEDRO MIGUEL CORREIA GARCIA
Junho de 2025

POLITÉCNICO
DO PORTO

ISEP INSTITUTO SUPERIOR DE ENGENHARIA DO PORTO

ZeroZero Fantasy League: Increasing Brand Product Engagement with a Mobile Game

Pedro Miguel Correia Garcia

A dissertation submitted in partial fulfillment of the requirements for the degree of Master of Science, Specialisation Area of Games, Graphics and Interactive Systems

Advisor: Dr. Carlos Vaz de Carvalho
Supervisor: Dr. Vasco Ribeiro

Porto, June 27, 2025

Statement of Integrity

I hereby declare that I have conducted this academic work with integrity.

I have not plagiarised or applied any form of undue use of information or falsification of results along the process leading to its elaboration.

Therefore, the work presented in this document is original and authored by me, having not previously been used for any other end. The exceptions are explicitly recognized in the section "Ethical considerations" of the first chapter. This section also states how AI tools were used and for what purpose.

I further declare that I have fully acknowledged the Code of Ethical Conduct of P.PORTO.

ISEP, Porto, June 27, 2025

Abstract

In the context of an increasingly competitive digital media landscape, brands must continuously innovate to capture and retain user attention. This thesis investigates the development of a mobile game, ZeroZero Fantasy League, as a strategic tool to enhance user engagement and foster interaction with the sports data platform zerozero, operated by ZOS, Lda. With the platform's success depending significantly on user-generated content and community participation, especially in lesser-known leagues, the project addresses the challenge of sustaining and expanding an active user base.

Guided by the hypothesis that an engaging and interactive mobile gaming experience can increase user interaction with a company's digital ecosystem, the research employs a multiphase methodology. It begins with a Systematic Literature Review (SLR) based on the PRISMA framework to identify effective gamification strategies and game mechanics associated with user retention, engagement, and co-creation. The findings inform the design and implementation of a football management mobile game prototype that integrates real-time data from zerozero and incorporates features such as achievement systems, daily challenges, and interactive UI/UX design, aiming to deliver a rewarding and immersive experience.

Subsequent testing and evaluation involved both qualitative and quantitative methods, including questionnaires, user feedback, and analytics exploration. These assessments revealed that mechanics such as early reward placement, social features, and short-session gameplay significantly contributed to increased engagement and repeat interactions. Users also expressed positive sentiment toward the game's complementary value in enhancing their overall relationship with the zerozero brand.

The study contributes to the discourse on digital engagement by demonstrating the viability of leveraging mobile gaming not only as an entertainment product but also as a meaningful extension of a brand's interactive strategy. Ethical considerations were integral throughout the development process, ensuring that user well-being and transparency were upheld by avoiding exploitative design patterns. The results support the hypothesis and underscore the potential of mobile games as co-creative, loyalty-enhancing instruments within broader digital ecosystems.

Keywords: Gamification, User Engagement, User Retention, Brand Loyalty, Game Design, Mobile Games

Resumo

No atual panorama digital altamente competitivo, a capacidade de captar e manter o envolvimento dos utilizadores tornou-se uma prioridade estratégica para empresas que operam em ambientes digitais. O presente trabalho de dissertação propõe-se a estudar, conceber e avaliar uma solução inovadora com vista a potenciar o envolvimento e retenção de utilizadores na plataforma zerozero, o principal produto da empresa ZOS, Lda., reconhecida internacionalmente pela sua vasta base de dados desportivos. A natureza colaborativa do zerozero, especialmente relevante em ligas desportivas menos conhecidas, depende fortemente do contributo ativo dos utilizadores na manutenção e atualização da informação. Assim, torna-se imperativo explorar novas abordagens que incentivem a participação ativa, a lealdade, e o retorno regular dos utilizadores.

A solução proposta consiste no desenvolvimento de um jogo móvel – ZeroZero Fantasy League – concebido como um produto complementar ao ecossistema do zerozero. Este jogo assume a forma de uma simulação casual de gestão futebolística, onde os utilizadores assumem o papel de treinadores, podendo recrutar jogadores, gerir plantéis e participar em desafios simulados, com base em dados reais recolhidos através da API do zerozero. A principal hipótese de investigação sustenta que uma experiência de jogo interativa e envolvente pode aumentar a interação dos utilizadores com os produtos de uma marca, ao mesmo tempo que promove sentimentos de envolvimento, compromisso e co-criação.

A investigação seguiu uma metodologia composta por várias fases. Numa fase inicial, foi conduzida uma Revisão Sistemática da Literatura (RSL), apoiada no método PRISMA, com o objetivo de identificar técnicas eficazes de gamificação, estratégias de retenção, elementos de design de jogos móveis e abordagens que promovam a co-criação de valor por parte dos utilizadores. A revisão permitiu identificar tendências atuais, práticas recomendadas e desafios éticos associados ao desenvolvimento de jogos que visam fins estratégicos não exclusivamente lúdicos.

Com base na RSL e na análise do estado da arte, foi desenhado e implementado um protótipo funcional de jogo móvel. Este integrou um conjunto de mecânicas de jogo recomendadas pela literatura, como sistemas de progressão e recompensas, personalização de equipas, desafios diários, e interações com a plataforma zerozero. O design da interface e da experiência de utilizador (UI/UX) seguiu princípios de acessibilidade, clareza e incentivo à exploração, com o objetivo de captar tanto utilizadores habituais do zerozero como novos públicos, menos familiarizados com a plataforma principal.

A fase seguinte envolveu a realização de testes piloto e sessões de avaliação com utilizadores, com uma combinação de instrumentos quantitativos e qualitativos. Foram aplicados questionários com escalas de usabilidade e envolvimento (incluindo a System Usability Scale), recolha de feedback aberto, e análise de métricas de interação através de ferramentas analíticas integradas e exploração da base de dados. Os testes envolveram a recolha de um feedback inicial e de um feedback após alguns dias de interação, o que permite comparar impressões iniciais com experiências prolongadas. Os resultados indicaram uma inclinação

muito positiva em termos de envolvimento, usabilidade e perceção de valor acrescentado. Elementos como recompensas imediatas, progressão visual, e ligação temática com o zerozero demonstraram ser particularmente eficazes no reforço da intenção de retorno ao jogo e à plataforma zerozero.

Destaca-se que a dimensão ética esteve presente em todas as fases do projeto. Foram tomadas precauções para evitar o uso de *dark patterns* e mecânicas manipuladoras, privilegiando sempre o bem-estar do utilizador, a transparência, e o respeito pela autonomia. As mecânicas baseadas em sorte, monetização agressiva, ou exploração de vulnerabilidades foram deliberadamente evitadas. Os dados dos participantes foram recolhidos de forma anónima, mediante consentimento informado, cumprindo os princípios do Código de Conduta Ética do Instituto Politécnico do Porto.

A análise final dos dados corrobora a hipótese inicialmente formulada: a criação de um jogo centrada no utilizador, integrada com os conteúdos e valores de uma plataforma digital, pode aumentar o envolvimento, a retenção, e a interação com a mesma. O jogo não serviu apenas como uma ferramenta de entretenimento, mas revelou-se também um meio eficaz para reforçar a ligação emocional dos utilizadores à marca zerozero. Em termos estratégicos, esta abordagem pode representar uma via sustentável de crescimento da comunidade e valorização do ecossistema digital da ZOS, Lda.

Esta dissertação contribui para o debate académico e prático sobre o papel dos jogos digitais como extensões interativas de produtos e serviços digitais, demonstrando o seu potencial, não apenas enquanto soluções lúdicas, mas também como ferramentas orientadas para objetivos de negócio, fidelização, e dinamização comunitária.

Acknowledgement

I would like to express my deepest gratitude to everyone who supported me throughout my academic journey. Your encouragement during the most challenging moments kept me moving forward, and for that, I am truly thankful.

A special thanks to my advisor, Dr. Carlos Vaz de Carvalho, for his valuable guidance and support. His feedback and advice were crucial to the development and completion of this work, alongside ZOS, for providing the necessary resources.

To everyone who witnessed the beginning of this journey and to those celebrating its conclusion – thank you. But as we all know, the hardest part is the path itself, often unseen by others. For walking that path alongside me, I owe a special thanks to my girlfriend, Patricia Oliveira, who provided unwavering support, guidance, love, and a small bit of patience, even while facing the same challenges herself. We made it through this together.

I also want to thank my parents, Anabela Correia and Celestino Garcia, whose dedication, sacrifices, and continuous support made this achievement possible. I never doubted myself, but they made sure of it, and worked tirelessly to ensure I had every opportunity to pursue my aspirations. Their encouragement, and constant presence have been the foundation upon which I built not only this academic journey but also my personal growth.

The support of all these people was indispensable to my success. Motivation comes and goes, but consistency is key – and thanks to all of you, I stayed committed to my goals until the end.

Pedro Garcia

Contents

List of Figures

List of Tables

List of Abbreviations

IPP	**I**nstituto **P**olitécnico do **P**orto
SLR	**S**ystematic **L**iterature **R**eview
PRISMA	**P**referred **R**eporting **I**tems for **S**ystematic Reviews and **M**eta-**A**nalyses
ACM	**A**ssociation for **C**omputing **M**achinery
IEEE	**I**nstitute of **E**lectrical and **E**lectronics **E**ngineers
SS	**S**earch **S**tring
SQ	**S**earch **Q**uery
RQ	**R**esearch **Q**uestion
AR	**A**ugmented **R**eality
VR	**V**irtual **R**eality
AI	**A**rtificial **I**ntelligence
E-Sports	**E**lectrocnic Sports
DOI	**D**igital **O**bject **I**dentifier
KPI	**K**ey **P**erformance **I**ndicators
IAP	**I**n-**A**pp **P**urchases
API	**A**pplication **P**rogramming **I**nterface
REST	**RE**presentational **S**tate **T**ransfer
DTO	**D**ata **T**ransfer **O**bject
SQL	**S**tructured **Q**uery **L**anguage
HTTPS	**H**yper**T**ext **T**ransfer **P**rotocol **S**ecure
SSL	**S**ecure **S**ockets **L**ayer
TTL	**T**ime **T**o **L**ive
LTS	**L**ong-**T**erm **S**upport
VPS	**V**irtual **P**rivate **S**erver
ORM	**O**bject-**R**elational **M**apping
JSON	**J**ava**S**cript **O**bject **N**otation
UI	**U**ser **I**nterface
UX	**U**ser e**X**perience
SUS	**S**ystem **U**sability **S**cale

Chapter 1

Introduction

This chapter introduces the context, motivation (Section 1.1), and problem driving this research (Section 1.2). It presents the hypothesis (Section 1.4) and research questions (Section 1.5) that guide the investigation, outlines the methodology employed in this thesis (Section 1.6), highlights ethical considerations (Section 1.7) taken into account, and provides an overview of the document structure (Section 1.8).

1.1 Context and Motivation

ZOS, Lda. (ZOS) is a prominent player in the digital sports news landscape, renowned for possessing the world's largest football database [1], which can be interacted through their main product: the website zerozero. This website offers a vast array of historical data, statistics, news, and other information on various leagues, in various sports.

Considering the competitive nature of the sports news scene, a video game associated with the ZOS' platform could be a great opportunity for evolving the user base, being an effective way to take advantage of a highly detailed dataset, creating an edge over competitors, while expanding into a new market.

A game is a dynamic and attractive way to create a bridge with other company products, increase retention and engagement, and promote the sense of community.

1.2 Problem

One of the main highlights of zerozero is its vast amount of data, across various sports and leagues within. The most competitive leagues have very accurate and detailed data, carefully curated by specialists; however, more casual, lower leagues require the input of their users.

Since the user base plays a crucial role in the creation and updating of the website's contents, in an open collaborative effort, there is a high reliance on growing and maintaining a healthy user community, which is increasingly difficult in a naturally competitive and ever evolving market.

Currently, the website already has a "fun" section with small games and intractable puzzles where users can test their sports knowledge and create an attachment to the platform. This strategy hasn't proved enough, since it doesn't directly encourage co-creation, and was built for existing users.

The need to evolve to retain and engage users with the products of a company is ever present, but for zerozero, the value obtained from co-creation cannot be undermined. This

comes with challenges associated with designing a product to amass new users, and hook them into the community, while worrying about ethical concerns, carefully treading the path between dark patterns and engaging experiences [2].

1.3 Goals

The primary objective of this project is to conceive and design an innovative solution through digital mobile gaming that leverages the extensive data available on zerozero, delivering an engaging and interactive experience that fosters user interest and retention.

This initiative aims to create an engaging experience, that also rewards interaction with other company products, enticing exploration.

1.4 Hypothesis

In light of the problem previously identified, this dissertation proposes the following hypothesis.

« An engaging and interactive mobile gaming experience is effective on motivating players to increase interaction with a company's products. »

This hypothesis builds on the premise that interactive gaming and gamification techniques are effective strategies for increasing user engagement and retention. Through the use of ZOS' existing data assets, these approaches can be used to create personalized experiences, turning passive users into active players, addressing the identified problem, while creating new business opportunities.

1.5 Research Questions

Based on the hypothesis defined in Section 1.4, the following research questions arose. The objective was to understand the most recent developments, technologies, trends, techniques, and challenges in the specific fields of game development and user engagement:

Q1: How can user retention in online environments be increased through gamification or gaming methodologies?

Q2: What methodologies are commonly used to entice users to interact with specific functionalities on websites?

Q3: Can user retention and interaction in online environments be increased by introducing a complementary product or service?

Q4: What game mechanics are most effective in enhancing player engagement and retention in mobile games?

1.6 Methodology

The following paragraphs outline the methodology used to validate the hypothesis presented in Section 1.4.

A **Systematic Literature Review** (SLR) was conducted, following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework [3], with three main objectives. First, identify effective gamification techniques or game mechanics for user engagement and retention. Second, analyze the impact on retention metrics and co-creation enticement of associated products in a brand's catalog. Finally, determine the most effective game mechanics for designing engaging mobile game experiences.

A **State-of-the-Art** was written. The goal of this step was to create a coherent narrative out of the information gathered through the Systematic Literature Review. It reflects on the current knowledge around the relevant themes, resulting in a report on the effect of gamification techniques and game mechanics, and how a new product affects a company's library. It also clarifies the best approaches to building and adapting functionalities, resulting in a satisfying mobile game experience for a targeted and identified user-base. The lucidity obtained from structuring the collected information provided meaningful insights, allowing a well-informed planning and designing phase.

A **Design and Development Phase** was then carried out, supported by the findings from the SLR and state-of-the-art review. This stage involved iterative ideation and implementation of a prototype mobile game, designed to both engage users and promote interaction with the zerozero ecosystem. Emphasis was placed on integrating mechanics identified as effective, such as achievement-based systems, progression incentives, and personalized customization, while ensuring the interface remained intuitive and lightweight for casual use. Real sports data from the zerozero API was incorporated to establish authenticity and relevance.

A **Pilot Testing and Evaluation Phase** followed the development. The main goal of this phase was to validate the prototype's potential to fulfill the defined hypothesis and research questions. A set of usability tests and interaction assessments were conducted with recruited participants, including both initial user impressions and delayed feedback from returning users. Data was gathered through structured questionnaires, including engagement and usability scales, as well as via in-app analytics captured with Unity. These were used to evaluate usage patterns, feature effectiveness, and indicators of retention.

A **Result Analysis** was performed based on both the qualitative and quantitative metrics. User feedback, behavior tracking, and gameplay data were analyzed in relation to the research goals. By interpreting user responses, analytics, and usage trends, the study evaluated how specific game mechanics influenced user behavior, retention, and cross-platform engagement. This interpretation of the results served as the foundation for validating the central hypothesis, namely, that a well-designed, gamified mobile experience can effectively enhance user interaction with a company's broader digital ecosystem, such as the zerozero website.

1.7 Ethical Consideration

Ethical considerations play a crucial role in the development and implementation of this project, ensuring that its objectives are achieved responsibly and sustainably. By prioritizing ethical practices, the project aims to build trust with users, foster a positive user experience, and avoid unintended harm. Adopting a thoughtful approach to ethics is essential for creating a product that aligns with societal values and maintains the integrity of the platform. Furthermore, the considerations described in this section are backed by the IPP Code of Good Practices and Conduct [4].

The declaration of commitment (Article 8 of the IPP Code of Good Practices and Conduct [4]) can be found at the start of the document. This emphasizes the importance of the commitment to ethical standards, affirming that this work is original, free of plagiarism, and that all sources are properly cited.

AI tools were used for multiple purposes during the development of this project. Grammarly [5] was used to ensure correctness and clarity in parts where transparency was imperative, namely in the informed consent forms described in Section 4.2.1. It was also used across the writing of this present document, with the same goal. ChatGPT's [6] image generation functionalities were used to help in selecting the visual style of the interface, such as colors, assets, and icons, by generating design suggestions based on the designed wireframes.

One significant concern is the potential misuse of dark patterns, which is design strategies that manipulate users into behaviors they might not otherwise choose. Such practices can undermine user trust and lead to negative perceptions of the product. In line with the principles of transparency and respect for autonomy outlined in Article 2 of the IPP Code of Good Practices and Conduct [4], this project carefully avoids such patterns, ensuring that all interactions are designed with user well-being in mind.

Another key area of focus is user data. Ensuring the responsible handling of personal information is paramount, as data privacy is a growing concern in the digital age. Also in alignment with the principles of confidentiality and respect for privacy outlined in Articles 2 and 10 of the IPP Code of Good Practices and Conduct [4], the project will request clear and informed consent from users before collecting or utilizing their data. Transparency in data usage and providing users with control over their information will further bolster trust and compliance.

Additionally, the design of luck-based mechanics and monetization strategies requires careful consideration. Excessive reliance on luck can lead to frustration or perceptions of unfairness, while aggressive monetization techniques can alienate users or exploit vulnerable individuals. In accordance with the principles of justice, equity, and respect for dignity outlined in Article 2 of the IPP Code of Good Practices and Conduct [4], the project seeks to create balanced mechanics that prioritize fun and fairness, avoiding practices that could be perceived as predatory or unethical.

In summary, this project takes a proactive approach to ethical considerations, addressing potential challenges in design, data usage, and monetization. Guided by the principles outlined in Article 2 of the IPP Code of Good Practices and Conduct [4], such as transparency, respect for dignity, and fairness, the project adheres to best practices and fosters a user-centered ethos. By embedding these values into its foundation, the project aims to deliver an engaging and trustworthy experience, contributing positively to the broader ecosystem of interactive entertainment.

1.8 Document Structure

This dissertation is structured in 5 chapters, aside from the introduction. This section briefly outlines the goals of the remaining chapters.

Chapter 2 – State of the Art – explores key concepts related to user motivation, engagement, and retention in mobile games, and synthesizes recent advancements and best practices in

the field. It presents a commercial view on strategies employed by competitors in the digital sports news market, and finishes with the systematic literature review that served as a basis for this analysis.

Chapter 3 – Solution – further describes the problem (requirements, limitations, and scope), and details the proposed approach to address it. It includes the system architecture, design choices, development tools, and implementation details of the prototype mobile game application.

Chapter 4 – Experimental Protocol – describes the methodology used to evaluate the developed prototype, including participant recruitment, test procedures, assessment methods, and pilot tests phase. It outlines how data was collected through analytics and questionnaires to measure user engagement and interaction.

Chapter 5 – Results – presents and analyzes the data collected during the experimental phase. It discusses user behavior patterns, feedback, and performance metrics in relation to the project's objectives and hypotheses.

Chapter 6 – Conclusion – summarizes the main findings of the dissertation and reflects on the outcomes. Also delves into future improvements based on both user suggestions and established design principles.

Chapter 2

State of the Art

This chapter presents a comprehensive overview of the current advancements and best practices in gamification, mobile game design, and user engagement. This is followed by a Systematic Literature Review, conducted using the PRISMA framework [3], ensuring a transparent and methodical analysis of existing research. This literature review formed the knowledge foundation upon which the preceding theoretical sections of the chapter are built.

By synthesizing insights from selected studies and broader industry practices, this chapter identifies the most effective techniques for fostering user retention, interaction, and co-creation. These findings inform the design of the proposed solution and align the project with evidence-based strategies. Combining this with a study on strategies used to increase relevance employed by competitors on a similar position as zerozero, allows for a broader understanding of the landscape from a theoretical and practical perspective.

The chapter is organized into four sections: Gamification and Game Design (Section 2.1); Strategies for User Interaction (Section 2.2); Competitor Strategies Analysis (Section 2.3); and Systematic Literature Review (Section 2.4).

2.1 Gamification and Game Design

This section explores key functionalities and mechanics that have proven effective in engaging games or gamified applications. It begins by examining the principles behind these mechanics and their role in driving engagement and retention. This is followed by a discussion of design elements rooted in gamification and general game design principles.

Given the nature of this project, the section places a strong emphasis on mobile gaming. The unique constraints and opportunities of the mobile platform are considered throughout, ensuring that the insights presented align with the project's goals and target audience.

2.1.1 Designing for Engagement

The correct use and implementation of game mechanics and functionalities are critical in shaping the effectiveness and appeal of gaming experiences or gamification strategies. Gamification can help achieve distinct strategic objectives by identifying pathways to success and aligning the mechanics and functionalities with these goals [7].

Understanding player motivations is another essential consideration when designing mechanics and functionalities. Developers should prioritize clarifying the intrinsic motivations of players before focusing solely on technological innovation or environmental richness [8].

Addressing these motivations can strengthen attachment behavior and encourage continued use, ultimately enhancing the long-term success of the game.

Different mechanics and functionalities serve varying psychological needs, further influencing player engagement. For instance, badges, leaderboards, and performance graphs positively impact competence need fulfillment and perceived task meaningfulness. On the other hand, avatars, meaningful stories, and team activities enhance social relatedness experiences [9]. This diversity in impact underscores the importance of selecting mechanics that align with both the objectives of the game and the psychological needs of its players.

2.1.2 Mobile Game Design

Mobile games have become increasingly accessible, broadening their appeal and attracting a diverse audience. Mobile gaming is an entry point that introduces people to gaming who might not otherwise engage with it [2]. This accessibility highlights the importance of thoughtful design that maximizes inclusivity and enjoyment for a wide range of players.

One notable trend within mobile gaming is the rise of hyper-casual games, which offer unique features aimed at simplicity and immediate gratification. These games focus on one or two gameplay mechanics, making them easy to understand and satisfying to play [2]. Creators describe hyper-casual games as the product of a "super data-driven" approach, designed to keep players in a continuous loop of engagement while ensuring accessibility and minimal barriers to entry.

Effective game design involves creating a seamless and engaging experience for players throughout the entire game lifecycle. Costa, J. et al. outlines nine core design principles to guide this process, focusing on asynchronous mobile games with idle elements, emphasizing the importance of addressing stages of use and idleness in games [10]. Designers are encouraged to consider pregame engagement, gameplay, and post-game interaction (Design Principles 1 and 2) to ensure a cohesive and enjoyable experience. Notifications, a key aspect of asynchronous gameplay, must be thoughtfully implemented to enhance player engagement without causing unnecessary disruption (Design Principle 3). Furthermore, interruptions and idle moments should not be overlooked but instead leveraged as opportunities to maintain player interest (Design Principles 4 and 9). The framework also highlights the role of creativity and player autonomy in game design. Stimulating creativity through elements such as interactive questions and answers (both direct and indirect) can deepen player engagement and encourage reflection beyond direct interactions (Design Principles 5 and 6). Granting players control over their decisions within each interaction round further fosters a sense of autonomy and immersion (Design Principle 8).

In addition to design principles, specific game attributes significantly influence the success of mobile games. As noted by Kerim, A. et al., attributes such as the number of available in-app purchases (IAPs), supporting multiple languages, and belonging to specific genres positively affect a game's success. The research also highlights the importance of visual design, showing that game icons with high entropy values and less empty space are strongly correlated with high ratings [11]. These findings emphasize the need to consider not just gameplay mechanics but also broader attributes that impact a game's performance.

2.2 Strategies for User Interaction

This section will focus on strategies for enhancing user engagement, retention, and co-creation. It will explore how gamification techniques and user interaction strategies can be leveraged to maintain user interest, encourage long-term participation, and foster collaborative experiences between users and developers.

2.2.1 Engagement

User engagement refers to the depth of a user's interaction with a product, often characterized by their level of attention, emotional connection, and willingness to participate. In the context of gamification and mobile games, it reflects how effectively the design captures and sustains user interest over time.

Intrinsic and extrinsic motivations play a key role in driving user engagement. Intrinsically motivated behaviors occur when users find tasks interesting and engage with them purely for enjoyment [12]. However, many activities fail to naturally capture interest, requiring external regulation to motivate participation. Gamification techniques often bridge this gap by introducing extrinsic motivators, such as rewards or challenges, to sustain engagement and encourage deeper interaction with the product.

Techniques

Effective engagement strategies leverage specific game elements to meet users' psychological needs and sustain their interest. Achievement-related elements such as badges, results, progress bars, rankings, and difficulty levels are particularly effective in satisfying the three core psychological needs: competence, autonomy, and relatedness [12].

Moreover, achievement related systems are thought to be especially efficient, since they provide users with an immediately understandable value associated to their actions, acting as a social metric for comparison and boundary identification [13].

Social-related game elements, such as competition, social networks, and cooperation, have been shown to primarily satisfy the need for relatedness, without significantly impacting competence or autonomy. This highlights the importance of tailoring gamification techniques to specific psychological outcomes, as certain elements may only fulfill limited aspects of user engagement. Additionally, immersion-related elements like avatars and customization contribute significantly to the satisfaction of competence and autonomy. When users create their profiles and customize their experiences, they set individual objectives that align with their personal goals, which may not necessarily coincide with community objectives [12]. This individualization fosters a sense of control and personal achievement, encouraging deeper engagement and sustained interaction with the system.

Additionally, engagement strategies often lead to the development of attachment behaviors, where users experience extreme concentration and deep involvement in activities that place them in highly rewarding mental states [8]. This state of attachment not only enhances the immediate user experience but also lays the foundation for long-term retention, as users become more connected to the product and are motivated to return consistently.

2.2.2 Retention

User retention is the ability of a product to keep users returning over time, often measured by the frequency and duration of their interactions. In gamification and mobile gaming, retention strategies aim to maintain user interest and loyalty through engaging content and meaningful experiences. A well-designed gameful experience has been shown to enhance users' willingness to engage with the system on a regular basis [14], fostering long-term interaction and sustained loyalty.

However, users often require more than just an enjoyable interaction with a gamified system to develop loyalty towards a brand. Consumers may expect additional game elements integrated into their journey to establish a deeper sense of loyalty [14]. This suggests that retention strategies should not only focus on creating engaging experiences but also incorporate features that add meaningful value and align with users' broader goals and expectations.

Techniques

Rewards play a critical role in encouraging user retention by reinforcing positive behaviors and driving repeated interactions. One effective strategy is focusing rewards on the first step of user interaction, such as opening the application. This approach can significantly increase the frequency of app selection, ensuring users consistently return to the platform [13].

Moreover, rewarding the decision to interact with the app immediately after opening it further enhances engagement and retention. By providing instant gratification, users are more likely to feel incentivized to continue engaging with the app, creating a positive feedback loop [13]. This emphasizes the importance of strategically timing rewards to maximize their impact on user behavior and long-term loyalty.

However, research has shown that the length of time individuals use an app can negatively impact their autonomous motivation, as they may perceive it as less fun and interesting compared to newer users [12]. This highlights the importance of continuously refreshing content and introducing new challenges or features to maintain the novelty and appeal of the system, along with loyalty rewards for long-time players.

2.2.3 Co-creation Motivation

Co-creation involves the collaborative process where users actively contribute to the development or enhancement of a product. In the context of zerozero, it refers to the user-generated content that makes up their sports data, especially on minor leagues.

Gamification has been shown to positively influence user co-creation activities on online platforms. Applying gamification strategies can enhance co-creation activities by engaging users and motivating them to contribute [15]. This demonstrates the potential of gamification, not only to increase participation, but also to improve the quality and breadth of user-generated content, which is essential for platforms like zerozero that heavily rely on community input.

Techniques

Effective techniques for fostering co-creation leverage users' intrinsic motivations, focusing on creating enjoyable and engaging experiences. Research highlights a positive correlation between users' enjoyment of gamified experiences and their intention to contribute to brand

value creation. This relationship is mediated by the pleasing feeling of various game dynamics, including "intangible rewards," "social interactions," "competition," and less prominent elements like "motivational stimulus," "challenge," "customization," "aestheticism," and "co-operation" [15].

Notably, "social interactions" play a dual role by providing both hedonic and utilitarian value, allowing users to enjoy the social interface while simultaneously using it to gain knowledge, promote ideas, and build private social networks. In contrast, tangible rewards, while effective, primarily offer utilitarian value and are less essential in driving users' engagement in co-creation [15]. These insights underscore the importance of incorporating diverse and meaningful game dynamics to maximize user participation and value co-creation.

Finally, value co-creation resulting from user engagement with branded applications significantly enhances brand loyalty, as it deepens the relationship between the user and the platform [14]. For zerozero, leveraging co-creation strategies can strengthen community ties while fostering a sense of loyalty and long-term commitment among its user base.

2.2.4 Observations

User responses to gamification are highly varied, as different users interact with gamified elements for distinct reasons. Some may use these elements to signal status or commitment, while others utilize them to set and adhere to personal goals [16].

This section explores key observations related to gamification and game mechanics, focusing on their impact on user behavior and experience. Two critical aspects are examined: the role of reward manipulation in shaping user interactions, motivation, and performance, and the potential for certain mechanics, such as artificial deficits, pay-to-win systems, and gacha mechanics (systems where players spend currency for randomized rewards, often resembling loot boxes), to frustrate users and negatively affect their engagement.

Reward Manipulation

A key factor in influencing user behavior is temporal discounting, which refers to the tendency of individuals to devalue rewards as the delay to their reception increases. Research demonstrates that even a short delay of a few seconds can significantly alter user decisions [13]. This underscores the importance of minimizing delays in reward delivery to maintain user interest and motivation.

Research shows that users are more likely to select applications that reward them early in the interaction, such as immediately after opening the app, compared to those that delay rewards. Furthermore, users often complete tasks after receiving a reward, reinforcing their commitment to the interaction [13].

These findings also highlight that reward placement does not negatively affect task performance, suggesting that early rewards can be implemented without compromising the quality of user engagement. The sunk cost effect further amplifies the effectiveness of early rewards. Initiating an action sequence increases the likelihood of task completion as users feel compelled to follow through [13].

User Frustration

User frustration is often caused by ill intentioned or badly integrated design choices. A particularly harmful aspect of malicious design is the use of dark patterns – manipulative design strategies that exploit user psychology to drive engagement or spending in ways that may not align with users' best interests. These design choices are undergoing widespread implementation, due to their effectiveness [2].

Subtle design choices, such as minor adjustments to pricing or timing within a game's economy, can determine whether mechanics are perceived as fair or exploitative [2]. This reinforces the delicate balance required in game design to ensure that mechanics remain fair, transparent, and user-centered, rather than being perceived as exploitative or intentionally confusing.

Certain mechanics have been identified as particularly frustrating for users, including pay-to-win systems, playing by appointment, daily rewards, artificial deficit, invested value (sunk cost fallacy), gacha mechanics, and loot boxes. While these mechanics can enhance engagement for some, they often lead to dissatisfaction when perceived as unfair or overly exploitative. Interestingly, players frequently engage with mechanics like loot boxes in their favorite games, enjoying the experience while simultaneously cautioning others about their potentially harmful effects [2]. This paradox underscores the complex relationship users have with such mechanics, balancing enjoyment with frustration and ethical concerns.

2.3 Competitor Strategies Analysis

The digital sports media market is characterized by intense competition, where platforms continuously adopt innovative strategies to capture and retain user attention. To better understand these competitive dynamics, a focused analysis of relevant platforms was conducted. This process included the observation of well-established international brands, as well as specialized sports news websites, to identify concrete strategies that contribute to user engagement, retention, and overall platform relevance. Particular attention was given to interactive mechanisms, gamified elements, and mobile-first solutions, as these align with the engagement and co-creation principles explored throughout the previous sections.

The selection of competitors presented in Table 2.1 was based on their market visibility and alignment with ZOS' goals, documented adoption of gamified features, and relevance to the project's thematic scope. This approach allowed for the identification of practical, real-world strategies used by key players, providing a relevant foundation for comparing their approaches with the proposed solution.

Platform	**Main Strategies**
ESPN [17]	Mobile app; fantasy games and pick'em contests; prediction games; live polls and interactive experiences; arcade-style mini-games; integrated in-app odds/betting; coverage across a wide variety of sports.
CBS Sports [18]	Mobile app; daily fantasy leagues; pick'em prediction games; live fan polls embedded in game pages; quick quizzes; betting coverage; real-time statistics with personalization and interactive notifications.

Sporting News [19]	Mobile app; prediction games and real-time polls tied to live matches; interactive trivia or "fun facts" sections; betting coverage; integration with highlight video content.
Goal.com [20]	Mobile app; global fan voting for player awards; fan-driven "vanity news"; e-sports/video-game coverage; betting coverage; social media integration to share and promote user engagement.
A Bola [21]	Mobile app; match-day prediction games; user-led prediction leagues; weekly leaderboards; visual rewards like badges and trophies for performance.
Transfermarkt [22]	Mobile app; general football quizzes; match-outcome prediction games; player-value estimation challenges; popularity guessing games; leaderboards.

Table 2.1: Main strategies used by competitor sports platforms.

A common approach among leading competitors involves integrating **gamified elements** that go beyond traditional news consumption, providing interactive experiences that foster user engagement and platform loyalty. Examples include fantasy sports, prediction games, interactive polls, and arcade-style mini-games, which are particularly prominent in global platforms, and increasingly present in specialized sports websites.

Another prevailing trend is the emphasis on **mobile-first experiences** and **standalone applications** designed to increase accessibility and session duration. Competitors have adopted mobile applications featuring prediction games, quizzes, and community-driven challenges, often supported by visual rewards such as badges and trophies. These features incentivize daily interaction, create social competition through leaderboards, and promote the sense of achievement, aligning with best practices identified in the research.

Finally, broader engagement strategies employed by these platforms frequently extend beyond direct gamified features. Partnerships with sports broadcasters, the inclusion of betting referral systems, increased video content production (such as match highlights), and community-focused features like forums contribute to reinforcing user attachment. Platforms further explore entertainment crossovers, integrating player awards, esports news, and fan-driven content. Collectively, these practices underline the importance of combining interactive, social, and multimedia elements to enhance relevance, retention, and user satisfaction within the sports media ecosystem.

2.4 Systematic Literature Review

This section presents the Systematic Literature Review using the PRISMA framework [3] used to identify and analyze relevant work in gamification, user engagement, and mobile game design. The findings served as a foundation for the State of the Art analysis, presented at the start of this chapter (Sections 2.1 and 2.2).

2.4.1 Research Domain

Gamification techniques and games have evolved significantly over the years, leveraging psychology and design principles to more effectively captivate, motivate, engage, and retain

users. This evolution has made these methods indispensable in various fields, from education to marketing, but implementing the right combination of techniques remains a complex challenge. Designing experiences that balance user satisfaction and strategic goals requires a nuanced understanding of engagement and retention dynamics.

The aim of this research is to identify the most effective techniques for engaging and retaining users in online environments, focusing on strategies that motivate users to interact with specific functionalities and contribute to co-creation. It also examines the impact of introducing new products into a company's catalog, alongside exploring best practices for designing mobile games. By addressing these objectives, this study seeks the answers for the research questions listed in Section 1.5.

The followed steps followed according to the PRISMA framework are depicted in Figure 2.1

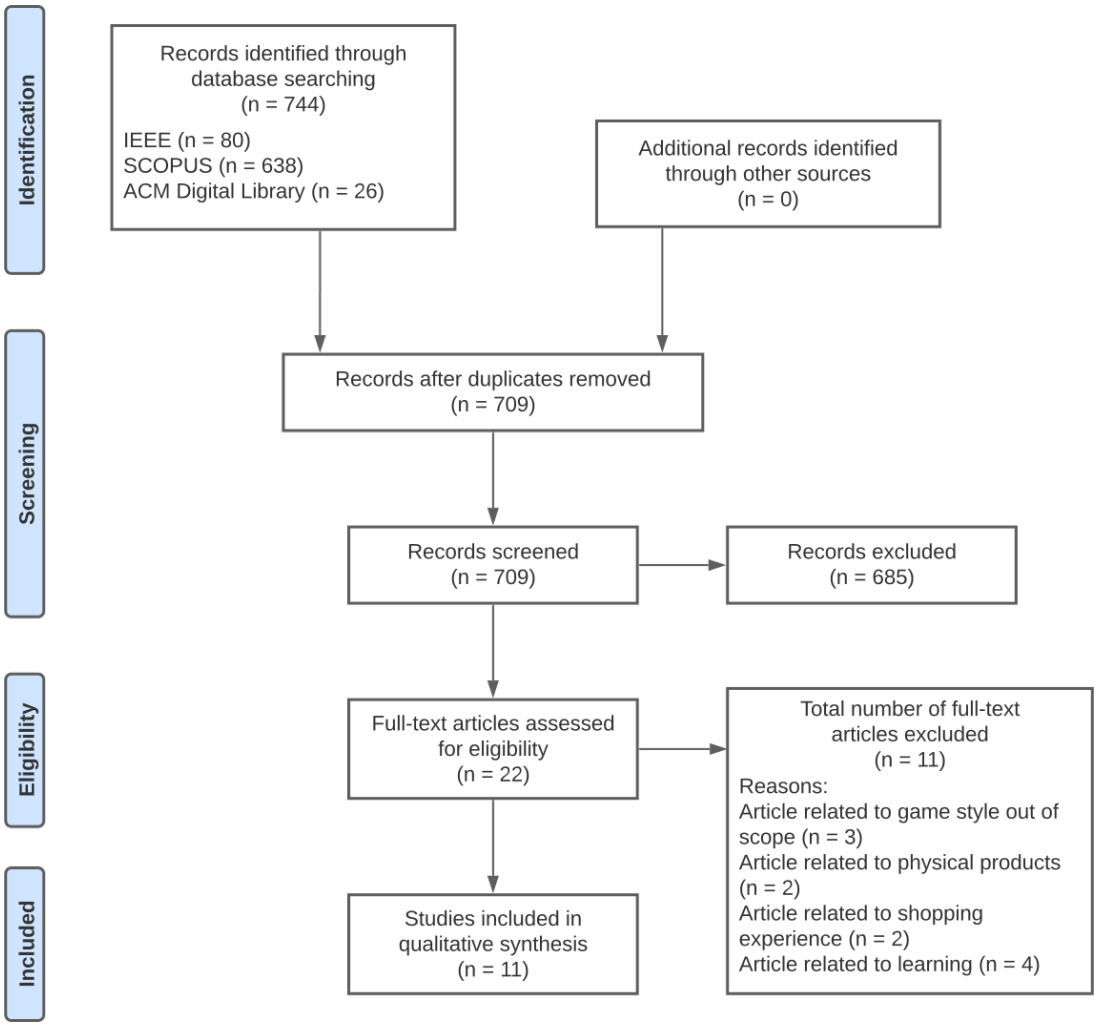


Figure 2.1: PRISMA Flowchart.

2.4.2 Identification Phase

An extensive search was conducted across leading digital libraries to gather comprehensive knowledge on the identified research domain. The search included a wide range of sources, such as journal articles, conference papers, and relevant books, or equivalent of each, depending on library, ensuring a thorough exploration of the literature.

Three prominent digital libraries were selected for this process: IEEE Xplore, Scopus, and ACM Digital Library. Specific keywords were carefully defined and iteratively refined to balance specificity and breadth, ensuring the retrieval of the most relevant and high-quality studies while avoiding an overwhelming number of irrelevant results. The initial search strings are described in Table 2.2.

Search String	**Query**
SS1	("user" OR "player") AND ("retention" OR "engagement" OR "impact") AND ("gamification" OR "game mechanics" OR "game-based") AND ("online" OR "website" OR "digital")
SS2	("user") AND ("interact" OR "interaction" OR "engagement") AND ("techniques" OR "methodologies" OR "mechanics") AND ("website" OR "platform") AND ("boost" OR "increase" OR "impact")
SS3	("user" OR "player") AND ("interact" OR "interaction" OR "engagement" OR "usage") AND (("complementary" OR "secondary" OR "other") AND ("product" OR "game" OR "website" OR "platform")) AND ("boost" OR "increase" OR "impact" OR "metric")
SS4	("design") AND ("mobile game")

Table 2.2: Pre-refinement search strings.

The initial search strings were designed to capture a broad range of themes, which were later refined to focus on the desired topic. Synonyms and broad terms were included to ensure all relevant articles were considered.

Search Criteria

Gamification and game mechanics are increasingly used in various contexts, such as engagement and retention strategies, with diverse objectives. To ensure relevance, the search was limited to the last five years. Only open-access articles, conference papers, and books/book chapters were included, tailored to each search engine:

- IEEE Xplore [23]: 2020+ English open access Conferences, Journals, Books, Open Access Only.
- Scopus [24]: 2020+ English open access conference papers, articles, book chapters (search within Article title, Abstract, Keywords).
- ACM Digital Library [25]: 2020+ publications (search within Title, Abstract).

Refinement

All search strings were refined, following the same process: inspecting the results on Scopuss [24], already filtering by date (last 5 years), search in title, abstract, and keywords, written in english, and open access. Only articles, conference papers, and book chapters were taken into account in Scopus.

Each search string went through 2-3 iterations, with adjustments made after evaluating the results. The search was broadened if too few results were found and narrowed if the results covered too wide a range of topics. The resulting search strings are shown in Table 2.3.

Search String	**Query**
SS1	("user" OR "player") AND ("retention" OR "engagement" OR "impact") AND ("gamification" OR "game mechanics" OR "game-based") AND ("online" OR "website" OR "digital") AND NOT ("virtual reality" OR "augmented reality" OR "healthcare" OR "artificial intelligence")
SS2	("user") AND ("interact" OR "interaction" OR "engagement") AND ("techniques" OR "methodologies" OR "mechanics") AND ("website" OR "platform") AND ("boost" OR "increase" OR "impact") AND NOT ("artificial intelligence" OR "virtual reality" OR "augmented reality")
SS3	("user" OR "player") AND (("complementary" OR "secondary" OR "other") W/3 ("product" OR "game" or "website" or "platform")) AND ("boost" OR "increase" OR "impact" OR "metric") AND ("interact" OR "interaction" OR "engagement" OR "usage") AND NOT ("ai" OR "artificial intelligence" OR "augmented reality" OR "virtual reality" OR "recommendation")
SS4	("create" OR "design") AND ("mobile") AND ("game") AND NOT ("learn" OR "health")

Table 2.3: Post-refinement search strings.

Refinement Results

A total of 744 papers were retrieved using the final search strings across all selected digital libraries. The results were imported into the reference management system EndNote [26]. Table 2.4 provides the details of the retrieved results.

	Scopus	IEEE	ACM
SQ1	233	9	5
SQ2	265	5	2
SQ3	107	3	2
SQ4	33	63	17
Total	638	80	26

Table 2.4: Search strings results.

2.4.3 Screening Phase

The screening phase involved defining inclusion and exclusion criteria, and reviewing the retrieved papers to ensure they met them. This step aimed to filter out irrelevant, duplicate, or low-quality studies, ensuring only the most relevant and reliable sources were included in the final analysis.

Inclusion/Exclusion Criteria

The identification phase yielded 744 papers. Inclusion and exclusion criteria were applied to ensure the selection of the most relevant papers for this research. The papers were screened based on the following criteria:

Include:

- Search engine results.
- Full text access.
- Published in English.
- Related to Digital Games, Digital Design, or Digital Platforms.
- Related to User Motivation, Engagement, and Social Methodologies.

Exclude:

- Published before 2020.
- Duplicates and Retracted Publications.
- Related to AR/VR, Alternative Interfaces.
- Related to AI, E-Sports, Social Media Content Creation.
- Related to Health, Learning, Politics, Climate, Investing, Historical Accuracy.

The criteria ensure that the selected literature aligns with the research goal: identifying gaming and gamification techniques most effective for engaging, retaining, and motivating users, fostering co-creation, and integrating these techniques into well-designed games. These criteria were designed to select research closely aligned with the project's specific characteristics and environment.

Duplicate Removal

After defining the criteria, the next step was to remove duplicates using EndNote [26]. The software was configured to identify duplicates by matching authors, title, year, publication type, or exact DOI. This accounts for minor differences between references exported from different search engines. This process removed 35 duplicates, leaving 709 unique papers.

Screened Records

The 709 unique papers were screened by analyzing their titles and abstracts, excluding those that did not meet the criteria defined in Section 2.4.3. This process resulted in the exclusion of 685 papers, leaving 22 papers.

2.4.4 Eligibility Phase

The eligibility phase of PRISMA [3] involves a detailed assessment of the full-text of the remaining 22 papers to determine whether they meet the inclusion criteria for the review. This phase is crucial for ensuring that only studies with relevant, high-quality evidence are included in the final analysis.

The full texts of 17 out of the 22 papers were obtained using EndNote's "full-text search" feature, while the remaining 5 were found manually.

Selected Records

This phase involves a thorough analysis of the full-text for each record, summarizing key contributions and assessing their relevance to the study.

Of the 744 papers identified initially, only 11 were deemed relevant after applying the inclusion and exclusion criteria. Table 2.5 summarizes the key contributions of each selected paper to this project.

Reference	Relevance for this research
[2]	Highlights the appeal of mobile games due to accessibility and hyper-casual designs. Discusses game mechanics such as "pay-to-win," loot boxes, and the impact of "dark patterns" on engagement and retention.
[8]	Emphasizes the role of intrinsic motivations in mobile social network games and suggests focusing on player motivations to enhance attachment and continued use.
[12]	Identifies effective gamified elements: achievement-related features enhance competence and autonomy, while social elements mostly improve relatedness. Recommends short play sessions to sustain motivation.
[10]	Proposes design principles, including lifecycle vision, importance of notifications, creativity in gameplay, and idle moments for engagement.
[13]	Recommends early reward placement to boost app engagement and task completion, emphasizing the sunk cost effect and the importance of immediate feedback.
[14]	Highlights the connection between gamification, brand loyalty, and engagement. Suggests that value co-creation and additional game elements enhance loyalty and long-term interaction with a company's catalog.
[7]	Suggests aligning gamification design elements with strategic objectives and measuring success through relevant KPIs.
[9]	Describes effective online engagement strategies, including leaderboards, achievement-related features, and immersion elements. Highlights the impact of avatars and stories on social relatedness.
[11]	Analyzes game success factors such as genre, number of in-app purchases, and design elements like icon complexity and language support. Highlights seasonal release timing effects.
[15]	Demonstrates how gamification positively influences user co-creation activities and emphasizes hedonic over utilitarian values in motivating.
[16]	Explores varied user responses to gamification, including status signaling, goal setting, and self-evaluation through social comparison.

Table 2.5: Relevant contributions for selected records.

2.4.5 Main Takeaways

This section synthesizes the findings of the systematic literature review to explicitly address the research questions defined in Section 1.5. Each question is discussed in relation to the key insights gathered from the reviewed studies.

It is important to note that the research questions 3 and 4 cannot be fully answered at this stage, and will only be fully addressed upon the completion of the study.

Q1: How can user retention in online environments be increased through gamification or gaming methodologies?

Studies highlight the effectiveness of early reward placement, immediate feedback, and strategic gamification elements like leaderboards and achievement systems [9, 13]. Integrating hedonic values over utilitarian ones and aligning gamification with strategic objectives are also critical for sustained engagement [7, 15].

Q2: What methodologies are commonly used to entice users to interact with specific functionalities on websites?

Gamified elements such as avatars, narratives, and social comparison foster interaction by enhancing social relatedness and immersion [9, 16]. Effective design principles, such as lifecycle vision and creative use of idle moments, further contribute to user involvement [10].

Q3: Can user retention and interaction in online environments be increased by introducing a complementary product or service?

Value co-creation through gamification can drive long-term user loyalty and interaction, particularly when combined with in-game rewards or additional game elements that enhance the user experience [14, 15].

Q4: What game mechanics are most effective in enhancing player engagement and retention in mobile games?

Accessibility, hyper-casual design, and mechanics like "pay-to-win" and loot boxes attract players but risk over-reliance on "dark patterns" [2]. Elements that promote competence, autonomy, and relatedness, such as achievements and social features, are critical for sustaining engagement [11, 12]. Seasonal release timing and appropriate notification strategies further enhance user retention [10, 11].

2.4.6 Limitations

One notable limitation of this section is the scarcity of articles directly addressing mobile game design. A significant number of relevant studies were behind paywalls or had closed access, restricting their availability for review. As a result, the analysis is based primarily on publicly accessible sources, which may not fully represent the breadth of research in this area. This limitation could mean that certain insights and emerging trends in mobile game design were not captured, potentially affecting the comprehensiveness of the findings.

2.5 Summary

This chapter provided a comprehensive overview of the current advancements, trends, and best practices in gamification, mobile game design, and user interaction strategies. It incorporated findings from a systematic literature review conducted using the PRISMA framework [3], which distilled 11 relevant studies from an initial pool of 744 papers. These studies explored key themes such as psychological motivation, reward structures, social features, and game mechanics, establishing a robust foundation for the research.

By synthesizing these insights, the chapter examined how specific design choices, such as achievement-based systems, immersive customization, and asynchronous competition, can effectively foster user engagement, retention, and co-creation. It also highlighted the importance of aligning gamification techniques with user needs and organizational goals, particularly in mobile contexts where short session design, idle mechanics, and notifications are central to sustained interaction, as well as considering competitive market strategies observed in leading sports platforms.

In addition, the analysis addressed the ethical dimensions of game design, noting the risks of dark patterns and manipulative reward strategies. A balance must be maintained between incentivizing participation and ensuring a positive, user-centered experience. Overall, the findings serve as the conceptual groundwork for the proposed solution, offering clear direction for creating an engaging and ethically sound mobile gaming experience aligned with the zerozero platform's goals.

Chapter 3

Solution

This chapter presents the prototype developed to explore and validate the hypothesis outlined in Section 1.4. Section 3.1 specifies the presented problem, and Section 3.2 details the proposed solution, outlining the concept and main features of the mobile game designed to enhance user engagement and promote interaction with the zerozero platform, fostering brand loyalty. Section 3.3 focuses on the design and implementation aspects of the prototype, describing how the proposed features were brought to life through technical and design choices.

3.1 Problem

Mobile gaming has rapidly become one of the most influential forms of digital media, offering users accessible and engaging experiences that fit into their daily lives. This rise has reshaped expectations across digital platforms, where interaction and entertainment increasingly overlap. As users grow accustomed to high-quality, interactive content, even non-gaming platforms must explore new ways to capture attention and build lasting engagement.

ZOS, the company behind the sports statistics website zerozero [1], stands out in the digital sports media space for its vast, collaborative database covering football and other sports. However, in a highly competitive environment, delivering accurate information is no longer enough to retain users. With countless alternatives available, ZOS must find innovative methods to stay relevant and maintain user participation. Building a stronger relationship with users is crucial, not only to encourage loyalty but, also to support the site's collaborative content model, which depends on consistent user contributions.

A promising opportunity lies in transforming zerozero's rich dataset into a mobile game experience. Such a game could engage users in new ways, extend their interaction with the brand, and promote recurring visits to the platform. By integrating real sports data into interactive gameplay, along with connections to the platform itself, the game could bridge entertainment and information, reinforcing user retention and emotional connection to the zerozero ecosystem.

3.1.1 Scope

The scope of this project focuses on the development of a mobile game prototype designed to promote user engagement with the zerozero platform through gamification. The game centers on football team management, allowing users to simulate decisions such as player

[1] https://www.zerozero.pt

selection, match participation, and progression. Its primary objective is to explore strategies that encourage users to return to the application regularly and deepen their connection with the zerozero brand.

The prototype integrates real-time sports data through the zerozero API and includes features such as team customization, missions, reward mechanics, and website-linked interactions. While the gameplay experience remains intentionally lightweight, the design prioritizes accessibility, short play sessions, and intuitive interaction, aligned with typical mobile usage patterns.

Certain aspects were intentionally left outside the scope of the project. The game does not include monetization features, in-depth player statistics tracking, or complex multiplayer and community interaction due to the time constraints inherent to this thesis. Although the architecture is designed with future expansion in mind, the current version focuses solely on football. The insights and findings obtained from this implementation aim to inform future iterations of gaming or gamified experiences tied to the zerozero ecosystem

3.1.2 Requirements

To effectively address the problem of user engagement and retention identified in this project, the prototype was developed according to a set of functional and non-functional requirements. These requirements were defined based on the project's objectives, the capabilities of the zerozero platform, and established best practices in mobile game and interaction design highlighted in the state of the art (Chapter 2).

Functionally, the prototype had to allow users to manage a football team and use real-world sports data. This involved integrating with the zerozero API to retrieve and display accurate, up-to-date information about players, teams, and matches. The game also needed to support features such as match simulation, player recruitment, and league progression.

Because the central goal was to explore strategies for increasing user engagement with the brand, the prototype needed to incorporate mechanics aimed at promoting repeated interaction. These included daily missions, daily games, a reward system, visible progression markers, and social features such as friend leagues. All interactions needed to be designed to be lightweight, engaging, and capable of reinforcing user connection to the zerozero brand.

Finally, from a **non-functional** perspective, the game was required to operate smoothly on both Android and iOS platforms and offer an intuitive user interface accessible to a broad audience, including non-gamers, due to the heterogeneity of the zerozero users. It had to ensure consistent performance across devices and require no external instructions beyond what was provided in-game.

3.1.3 Limitations

The main limitations for this project revolve around platform and device constraints, as the prototype can only be tested on a limited range of Android and iOS devices (during the development process). Consequently, it may present performance or compatibility issues on low-end or less common models that were not part of the testing pool.

In terms of evaluation, the testing period has to be relatively short, approximately two weeks, which restricts the ability to observe long-term user engagement and retention patterns.

3.2 Proposed Solution

The research conducted in Chapter 2 highlighted several effective strategies for driving user engagement and retention through gamified systems. Studies revealed that the most impactful approaches in mobile game environments include:

- **Achievement-based systems** to fulfill users' needs for competence and progression, highlighted in Section 2.2.1.
- **Competitive features** that foster a sense of relatedness and community, discussed in Section 2.2.1.
- **Early rewards and idle mechanics** that promote daily interaction and reduce drop-off, discussed in Section 2.2.4.
- **Customization and progression** mechanics to support autonomy and long-term attachment, highlighted in Section 2.2.1.

These insights, combined with an understanding of the user behaviors within the zerozero platform, highlight the opportunity to introduce a mobile game experience that directly utilizes zerozero's rich sports database.

Contextual Application to the ZOS Ecosystem

The zerozero platform is already a rich resource for football enthusiasts, offering detailed information about teams, players, matches, and historical data. However, user interaction with this data is mostly passive and information-driven. The proposed mobile game addresses this by offering a parallel product that maintains thematic consistency with zerozero while providing an active and engaging gameplay experience.

The game takes the form of a football management simulator, where users take on the role of a team coach. This allows them to recruit players, manage lineups, and lead their team through matches. The game does not aim to replicate the complexity of traditional football simulators. Instead, it offers a streamlined and accessible experience, optimized for short, daily play sessions. In this way, it aligns well with mobile gaming habits while reinforcing the player's connection to the zerozero brand.

The game encourages daily interaction by integrating mechanics such as match scheduling, mission-based challenges, incremental team development, and league competition between players. Players are drawn into a loop of collecting, upgrading, and competing, a structure that mirrors familiar mobile game loops but is uniquely informed by real-world football data.

The *Daily Challenges* use actual match schedules, involving real teams, obtained through zerozero's database, encouraging players to explore the website to stay informed about future matches that can be played in-game.

Gameplay Concept and Mechanics

At the heart of the game is a collectible and competitive loop: players build their own fantasy team by recruiting real-life footballers, unlocked through card packs, obtained through challenges or earned currency. Each player card reflects real-world performance metrics, grounding the game in the zerozero dataset. This fusion of live data and gameplay ensures

that the in-game dynamics are not just abstract mechanics, but extensions of real sporting events.

Users engage in multiple types of matches: training games for experimentation, league matches for progression and competition, and daily games that correspond to actual matches scheduled on that specific day, for match-relevant rewards. This last category directly encourages players to check the zerozero website for up-to-date information, team lineups, and match details, since the rewards obtained are bound to the real-world team they are playing as, building a habit of cross-platform engagement.

Social features play a supporting role in the experience. Players can join leagues, compete asynchronously with friends, and compare statistics and team lineups, obtaining rewards based on the results obtained at the end of the league. These elements reinforce a sense of community and light competition, without imposing pressure or aggressive leaderboard dynamics.

Progress is marked through visible milestones such as leagues won, goals scored, and total size of the roster. The team's lineup can be continually refined through strategic player swaps, offering both short-term incentives and long-term goals. While the game includes a resource system (in-game currency used to unlock new players), it is designed with ethical principles in mind, having no manipulative scarcity tactics or exploitative monetization models implemented.

Integration with the zerozero Platform

A key differentiator of this solution lies in its integration with the zerozero ecosystem. Rather than functioning in isolation, the game subtly directs users to the platform through contextual incentives. Users can check daily challenges' schedule, view real team details, and check player's pages on zerozero, through the game.

This strategy transforms passive exploration into a meaningful part of the gameplay loop. Players who take the time to visit the website can make more informed decisions, increasing their chances of obtaining the football players they desire the most. This not only drives traffic to the platform but also enhances user familiarity with its structure, content, and breadth of data.

Through this integration, the game becomes a gateway, particularly for new users, into the broader zerozero ecosystem. It introduces the database's value in a light and approachable format, fostering long-term engagement and brand affinity. The design ensures that the game and the platform are perceived not as separate products, but as complementary components of a cohesive user experience.

3.3 Implementation

This section details the implementation phase, describing the system architecture, the developed services, and the resulting mobile application.

3.3.1 System Architecture

This subsection presents a high-level overview of the system architecture, detailing the major modules and their interactions. Figure 3.1 illustrates the core components (Mobile

App, Backend API, Database, and zerozero API), along with the communication paths that connect them. All client requests are routed exclusively through the Backend API, which encapsulates business logic, manages authentication via zerozero, and coordinates data persistence within its own database.

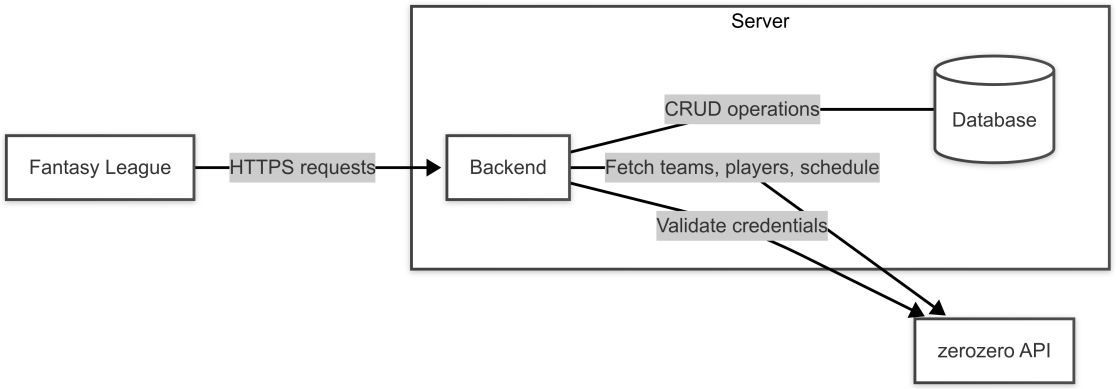


Figure 3.1: High-level component diagram of the system architecture.

The components shown in Figure 3.1 are described as follows:

- **Fantasy League:** The mobile game and user interface, responsible for issuing HTTP requests and rendering responses (the mobile app that users interact with).
- **Backend:** The single integration point for client interactions, excluding direct website integrations; point of communication with the database and the zerozero API; responsible for request validation, and authentication handoff to zerozero.
- **Database:** A SQLite store of various game related data, and cached zerozero data.
- **zerozero API:** An external football data provider, used for authentication, and queried daily for teams, players, and match schedules.

The architecture is organized around the dedicated backend API that intermediates all client interactions with the zerozero platform. By preventing the mobile application from calling the external API directly, tight coupling (software components being highly interdependent) is avoided and the impact of changes or outages in zerozero's services is confined to a single integration layer. Error handling and authentication handoff remain centralized, reducing the likelihood of client-side failures due to upstream modifications.

Game logic, session management, and progress tracking are maintained in the independent database, ensuring a single source of truth for all gameplay and user data. This separation permits evolution of features without dependency on zerozero's release schedule or data model. Versioning, schema migrations, and data integrity can be managed in isolation, preserving backward compatibility and minimizing migration risk.

Finally, the clear boundary between external real-data retrieval and internal business app logic supports future extensibility. New features can be introduced without altering the zerozero integration layer. As the game expands to include tournaments or additional partnerships, this modular and decoupled design facilitates faster, safer, and more maintainable development.

Technology Stack

To support cross-platform delivery, maintainability, and rapid iteration, aligning with mobile game design trends, and with ZOS' technology stack, the following technologies were selected:

Component	Technology	Justification
Mobile App	Unity 2022.3.44f1	Mature, LTS game engine with built-in mobile support, C# scripting, and a large ecosystem of tools and plugins [27].
Backend API	.NET 9 with ASP.NET Core	High-performance, cross-platform web framework offering built-in dependency injection, middleware pipeline, in C# for consistent development across client and server [28].
Data Access	Entity Framework Core	Code-first ORM that streamlines database schema management, migrations, and LINQ-based queries [29].
Database	SQLite	Lightweight, file-based relational database well suited for embedding in a standalone backend, with zero operational overhead and fast local caching of external data [30].
UI Design	Figma	Design tool enabling rapid mockup creation, interactive prototypes, and handoff-ready assets for Unity [31].
Hosting & SSL	Contabo VPS with Nginx	Cost-effective virtual server providing full root access [32]; Nginx handles HTTPS termination and certificate management [33].

3.3.2 Services: Server-Side

This section briefly documents each server-side component, its responsibilities, design decisions, and operational considerations, providing a comprehensive insight into each architectural choice and logical rationale.

The backend is organized into three layers: controllers, services, and data access, as represented in Figure 3.2.

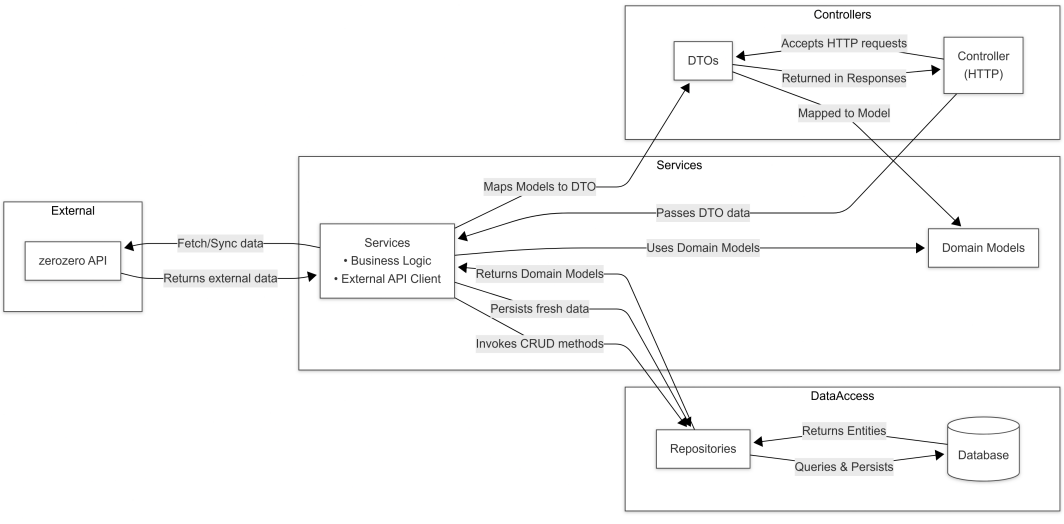


Figure 3.2: Component diagram of the services' components.

The data access layer directly interacts with the database via Entity Framework Core [29], and the services layer with the external zerozero API with http requests. No contributions were made to the zerozero API, all developments were made using the already existing endpoints. Each component is designed for high performance, easy extensibility, and streamlined deployment.

The overall system follows an onion architecture: each layer has clear boundaries and responsibilities, enabling updates or extensions without unintended side effects. The Backend API is structured as a web-service interface, supporting future dashboard integrations for in-game content and event management, without requiring changes to the mobile client.

Server Configuration

The backend server is hosted on a Contabo VPS [32] and acts as a protective layer between the mobile application and the zerozero platform. A firewall is configured to restrict incoming traffic, allowing only HTTPS requests on the designated port and blocking any direct access attempts to the zerozero API endpoints. This setup ensures that all client-to-zerozero interactions are funneled through the backend, preventing unauthorized or malformed requests from reaching the external service. Nginx [33] is employed as a reverse proxy and SSL terminator. It manages *Let's Encrypt* certificates for HTTPS, listens on port 443, and forwards application traffic to the ASP.NET Core [34] process running on the internal port (e.g., 5000). By centralizing TLS termination and port mapping in Nginx, the server maintains both secure communication and clear separation between public ingress points and internal application services.

Server Initialization and Database Seeding

Upon the first launch of the backend, a multi-step initialization routine populates the database and establishes baseline game data. First, core game definitions, such as formation layouts, mission templates, and player-pack configurations, are inserted into the database to provide the fundamental gameplay structures. Next, the service layer invokes the zerozero API to retrieve the latest team and player information. Each returned JSON object is transformed into corresponding internal entities and persisted, ensuring fast read access and reducing runtime dependency on external endpoints. Subsequently, a set of AI-controlled "bot" teams is generated, with unique names and assigned formations, to guarantee that users always have opponents available. Once seeding is complete, the ASP.NET Core application begins listening on the configured port, indicating that the service is ready to handle incoming client requests and external API synchronizations.

Authentication Service Process

The authentication component is exposed via an Auth Controller, which handles HTTP endpoints for login, logout, registration, and token refreshing. Upon receiving a login request (username and password), the controller forwards credentials to the Authentication Service. This service first invokes the external zerozero API to validate credentials; a successful response includes a *zerozeroUserID*. The service then queries the User Repository: if a matching game account exists, it is loaded; otherwise, a new account record is created and persisted.

Once the game account has been determined, the Token Service issues a pair of tokens: an access token (valid for 1 hour) and a refresh token (valid for 1 week). Refresh tokens are

stored in the Token Repository and can be invalidated on logout or upon issuance of a new refresh token (to enforce single-session rules). Access tokens simply expire after their TTL.

All requests apart from authentication require the user to identify themselves, and this is done through the access token. If the access token is expired, the refresh token is used to generate another. The refresh token is also periodically refreshed, increasing security and minimizing interruptions. If the refresh token is invalid, the user is asked to authenticate again.

Registration is similar: the Auth Controller accepts user details and directs to the Authentication Service to create a new account in both the zerozero platform and the local database. On first successful authentication, whether via login or registration, the *ProfileDTO* returned to the client contains flags and settings (tutorial steps, feature toggles, etc.) necessary for the game's initial onboarding flow.

To visualize the **data-flow** from the user perspective, Figure 3.3 shows the happy-path of a login attempt.

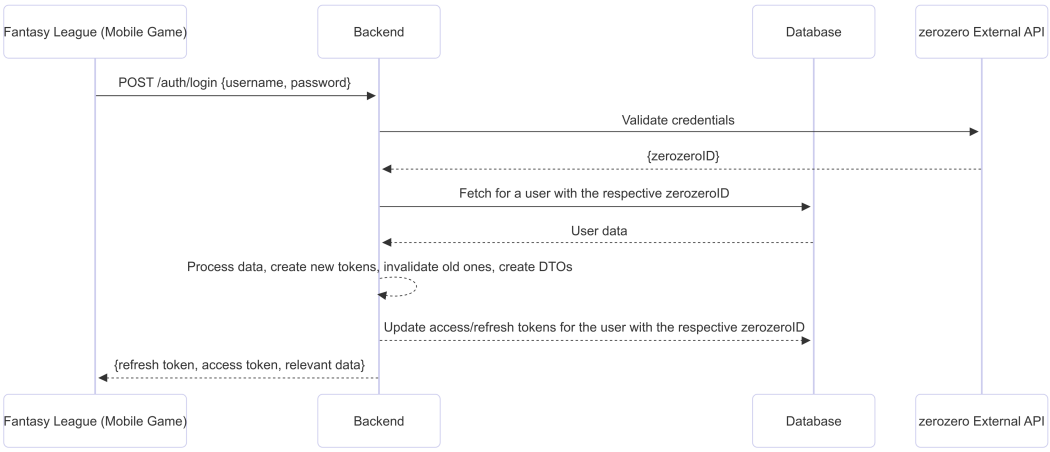


Figure 3.3: Sequence diagram for successful user authentication.

Figure 3.3 shows the end-to-end authentication handshake between the mobile client and the zerozero ecosystem. First, the Fantasy League app submits the user's credentials via a *POST /auth/login* call to the Backend API. The backend proxies these credentials to the zerozero API for validation. Upon success, zerozero returns the user's account identification. The backend then looks up (or creates) the corresponding coach profile in its database and returns session tokens, along with relevant metadata to the client. In case of invalid credentials, the zerozero API returns a 401, which the backend propagates to the client. Network or server errors at any point produce an appropriate 5xx response. By centralizing authentication in this way, client code remains simple and all session logic lives in one place.

External API Integration

Several game features depend on up-to-date football data provided by the zerozero external API, beyond the previously described initial seeded data for players and real teams, and authentication calls.

A daily synchronization job runs during off-peak (around midnight) hours to fetch the list of real-world matches scheduled for that day. At the configured time, the backend sends a

request with the relevant data. The zerozero API responds with a list of upcoming matches, which the service layer translates into new *Daily Challenges*. These new entries replace any existing challenges for that date, guaranteeing that daily in-game events are driven by accurate, real-time data. If the external call fails, or the response is empty, the backend logs the error and randomly generates content for the day, preventing disruption to users' daily gameplay.

Figure 3.4 represents the happy-path of updating the daily challenges.

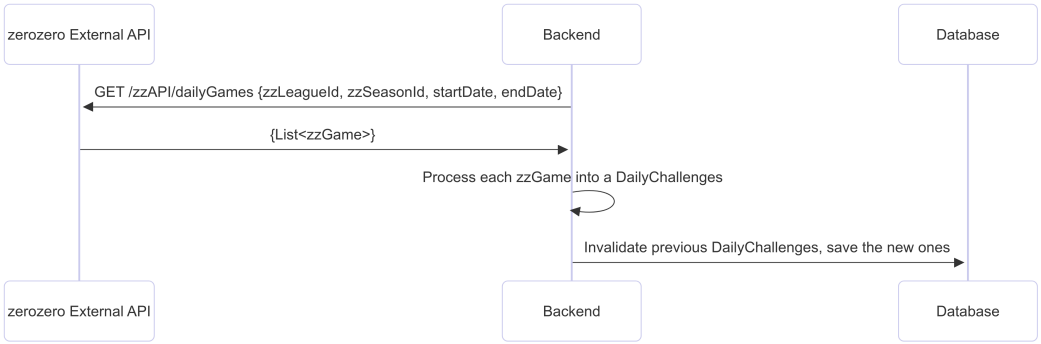


Figure 3.4: Sequence diagram for daily challenge updating.

Game Logic and Data Validation

All game logic resides on the server side and is exposed via REST-style service endpoints. Upon each client request, whether loading initial game data, fetching a user's roster, or submitting a play action, the corresponding service layer component retrieves raw entities from the database, applies business rules, and returns a data transfer object (DTO) for the client to render.

Every in-game operation, such as making a play or purchasing a player pack, invokes a server-side validation routine. The service component first ensures that the client's request payload matches the expected schema (correct lineup size, sufficient currency balance, valid player identifiers, etc.). Once validated, the logic executes deterministically on the server, producing the results, be it match results, experience gains, or new player assignments. Any state changes are then persisted to the database in a single transaction, guaranteeing atomicity (a single, indivisible operation). If validation fails (e.g., the client's reported game state version is stale, or the user lacks the required currency), the service returns an error response with the correct state, allowing the client to reconcile and retry.

By centralizing all rules and simulations in the service layer, as one would with a traditional web-app REST API, data integrity is preserved and the risk of client-side tampering is reduced. This design also simplifies future updates: adjusting scoring formulas, reward thresholds, or game-balance parameters requires modifying only the server logic, without deploying new client binaries. Consequently, the backend serves as the authoritative source for all gameplay decisions, ensuring consistency, security, and maintainability.

Figure 3.5 represents the data-flow of a happy-path game logic interaction, namely making a play while in a match.

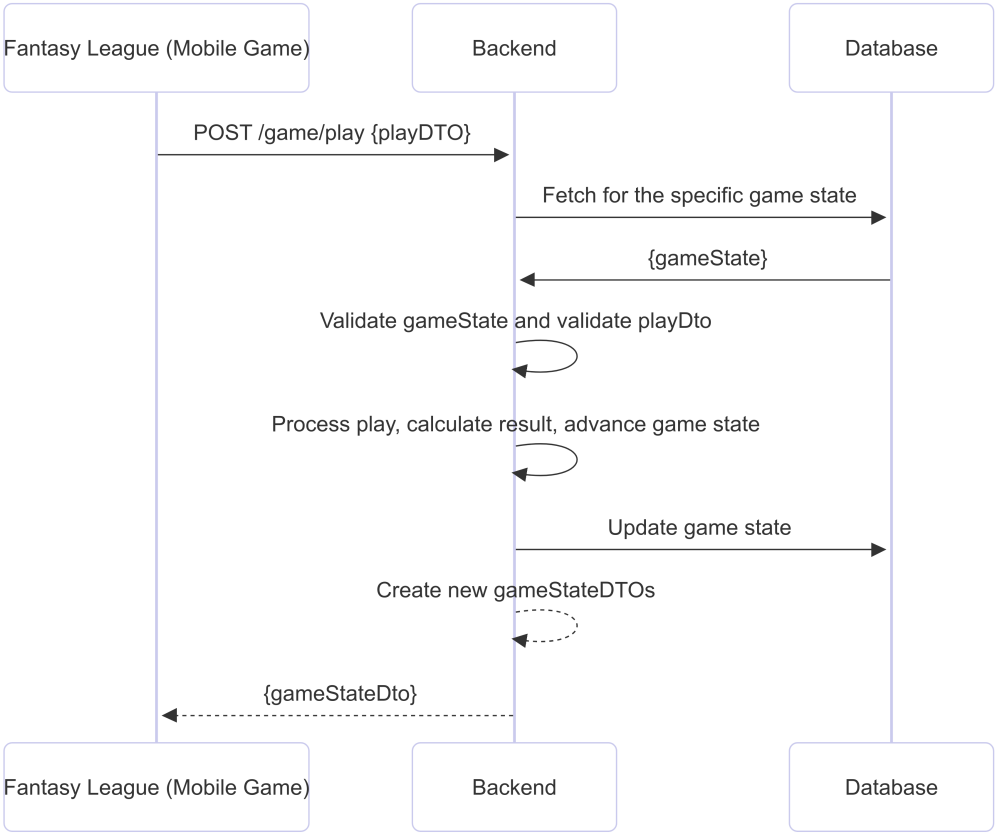


Figure 3.5: Sequence diagram for making a play during a game.

3.3.3 Application: Client-Side

This section documents the user experience and interface design decisions behind the prototype, as well as the gameplay hooks employed to foster recurring engagement. All visual elements were conceived to align with the thematic identity of the zerozero platform while supporting usability and retention strategies uncovered in Sections 2.1 and 2.2.

UX Design

This subsection presents the core user experience flows, including the onboarding process, menu structure, daily gameplay loop, and interaction design principles.

Onboarding and Tutorial The tutorial sequence is designed to gradually introduce players to core functionalities. Upon first launch, players are greeted with a narrative onboarding screen contextualizing their role as coach, starting with a finals game scenario on a close game, serving as both an initial gameplay hook, and an excuse for a tutorial. After the tutorial game ends, the players are then prompted to create a new team, which they will manage and compete with.

The tutorial then continues presenting various functionalities, such as player acquisition, team formation editing, and league mechanics. The last step of the tutorial presents the missions, encouraging players to complete them, allowing users to explore the rest of the

functionalities at their own pace, while also rewarding the players with in-game currencies, aligning with what was discussed in 2.2.4.

This onboarding sequence is represented by the wireframes shown in Figure 3.6:

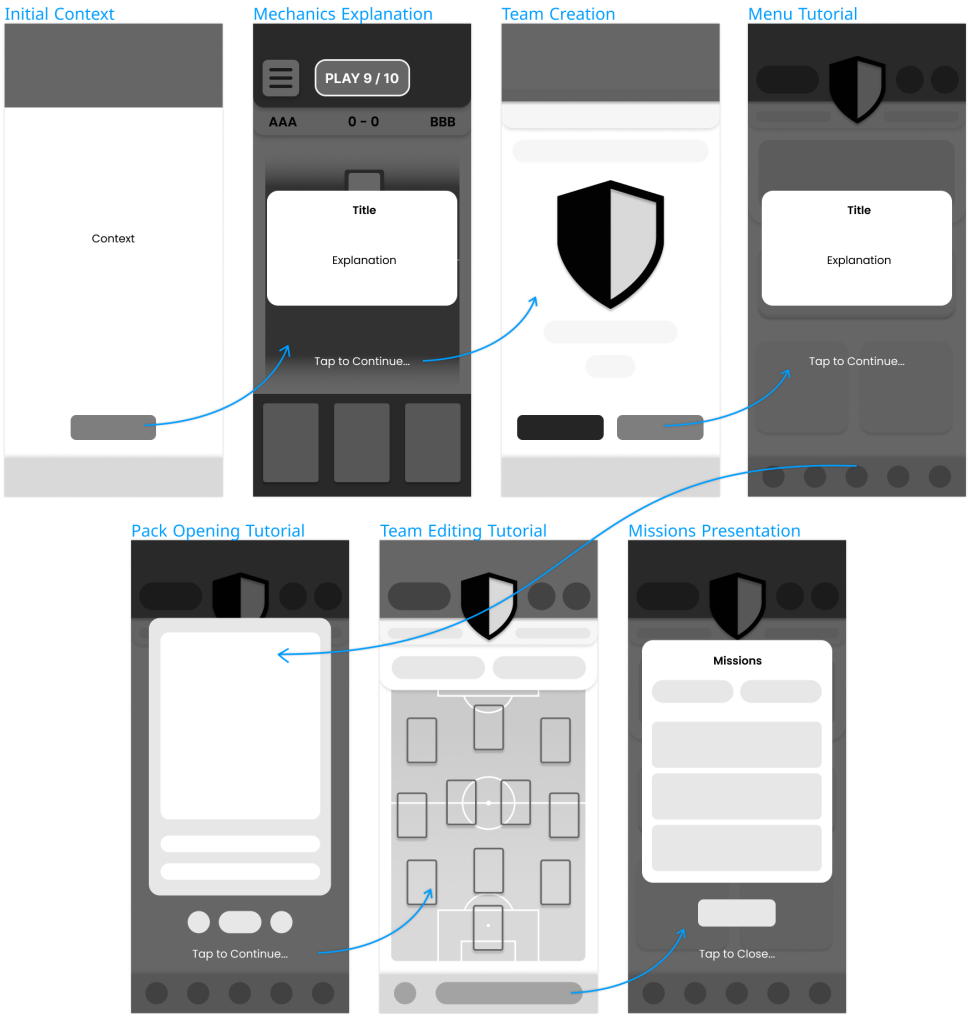


Figure 3.6: Wireframe representation of the tutorial flow.

Layouts While not engaged in active gameplay, the application uses a bottom navigation bar to organize its structure into five main pages: *Home*, *League*, *Team*, *Recruit Players*, and *Daily Challenges*.

Each page serves a focused function: *Home* provides daily entry points and progression highlights, *League* handles asynchronous player competition, *Team* allows squad customization and viewing of the roster, *Recruit Players* for users to obtain new players, and *Daily Challenges* presents real-world event-based matchups.

Daily Usage Flow The daily play session is structured around a light, repeatable loop that reflects mobile gaming retention techniques discussed in Chapter 2. Each session typically begins with the user engaging in a league match, where performance-based rewards are earned. This is followed by playing daily challenges, which are dynamically linked to real-world matches, providing game-relevant rewards. Players are then incentivized to complete

or continue progress on available missions. The currency earned through these activities can be used to open card packs, obtaining new players that can be used to enhance the user's team, giving a sense of progression. This loop is intentionally compact and rewarding, designed to support daily engagement without overwhelming cognitive or time investment.

Gameplay Matches are structured around a sequence of ten plays, each occurring in one of three zones: defense, midfield, or attack. In every play, both the opponent and the user draw players based on their team formations and current position in the field. The user selects a subset of their current "hand" to contest the play, while the oponent's field is pre-selected, since the game is asynchronous, played in two games (one by the player, one by the opponent). Victory is determined by comparing the total power of each side, calculated from the sum of players' rankings and remaining stamina. Winning a play allows the user to advance to the next field zone – progressing from defense to midfield, then to attack, and ultimately to a goal opportunity – while considering the user's selected order of play, bringing the last chosen player into the next step of the match. Losing results in the opponent gaining ball control.

Stamina management adds a strategic layer to the gameplay loop. Each player loses stamina when used, encouraging thoughtful selection and rotation, while also opening the possibility of exhausting the opponent's roster over time. Winning a play also gives the user a small advantage in the following one, as the ball remains with their team. After ten plays, the match concludes with a win, draw, or loss outcome, depending on the final score.

Animations play a key role in reinforcing gameplay outcomes. When a play is won or lost, the field and players animate accordingly, with movement and ball-passing sequences that visually communicate progress. These subtle interactions provide immediate, intuitive feedback, helping users understand results without relying solely on text or numeric cues.

Cross-Product Exploration The *Daily Challenges* tab also acts as a bridge to the zerozero platform, and directs users to check real-world match schedules from zerozero. Furthermore, when selecting a team for a challenge, users can view that team's official page directly on the website, encouraging exploration and informed choices. Similarly, within the *Team* tab, each collected player has a *View More* button, which opens the corresponding profile on zerozero. This integration promotes cross-platform engagement and reinforces the player's connection to real-world football data and the ZOS' main product, the zerozero website.

UI Design

This subsection outlines the visual identity of the application, covering the selected color palette, typography choices, and iconography, all designed to support clarity, accessibility, and brand alignment.

Color Palette The color palette (Figure 3.7) draws inspiration from the zerozero brand, combining dark tones for depth with bright accents for clarity and focus. Deep grays and blues form the background, enhancing contrast and readability. Teal and light gray support structure and balance, while the vibrant blue and orange, taken directly from zerozero's logo, highlight interactive elements and key actions throughout the interface.

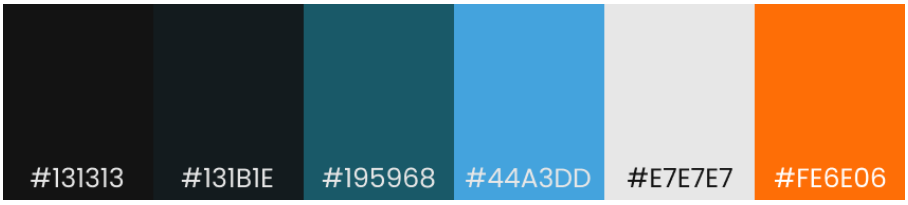


Figure 3.7: Color palette used in the application interface.

Typography The application uses the Poppins typeface in regular and semi-bold weights [35]. Clean, modern appearance ensures strong readability across different screen sizes, while its geometric design supports the interface's contemporary and approachable aesthetic.

Iconography The interface uses a consistent set of flat, minimalistic icons to ensure clarity and quick recognition across navigation and in-game features. All icons follow a line-based style with rounded edges, promoting a cohesive and friendly visual tone. They were sourced from the Icons8 plugin in Figma, chosen for their high legibility and compatibility with both dark and light interface elements [36].

Gameplay Hooks

Gameplay hooks are short-cycle mechanisms designed to drive recurring engagement and session continuity, reinforcing progression through ethical, well-timed incentives.

Notifications Following the engagement strategies explored in 2.1.2, time-based notifications are employed with restraint to remind players of daily league matches and mission expirations. All notifications are opt-in and designed to reinforce existing game rhythms, not artificially drive sessions.

Progression and Rewards Players receive immediate feedback for completed games through animated reward pop-ups, typically containing in-game currency or player packs. These reinforcements help maintain engagement while supporting ethical design practices. The mission system provides both short-term and long-term objectives, driving continued interaction across sessions and reinforcing the daily loop described in Section 3.2, consistent with engagement strategies centered on competence and progression, as explored in Sections 2.1.1 and 2.2.1.

Progress is also reflected in the *Team* tab, where users can view cumulative achievements such as games played, goals scored, roster size, and leagues won. Formation customization allows for visible and strategic team improvement, giving players a tangible sense of growth over time as they acquire better players and refine their tactics.

Social Features The game introduces light asynchronous competition through a seven-day league system, where each user competes against a pool of other players across 14 scheduled matches. This structure creates mid-term goals and promotes sustained engagement by offering week-long competitions, as supported by what is discussed in Section 2.2.1.

Users can track their position in the standings through the *League* tab, which also provides detailed statistics for each opponent – such as wins, losses, draws, points, goal difference, and current formation. This transparency not only supports tactical planning but also creates

a layer of friendly rivalry that reinforces social motivation. Although matches are played independently, the visibility of others' progress contributes to a sense of shared competition, encouraging regular play to maintain or improve one's rank in the league.

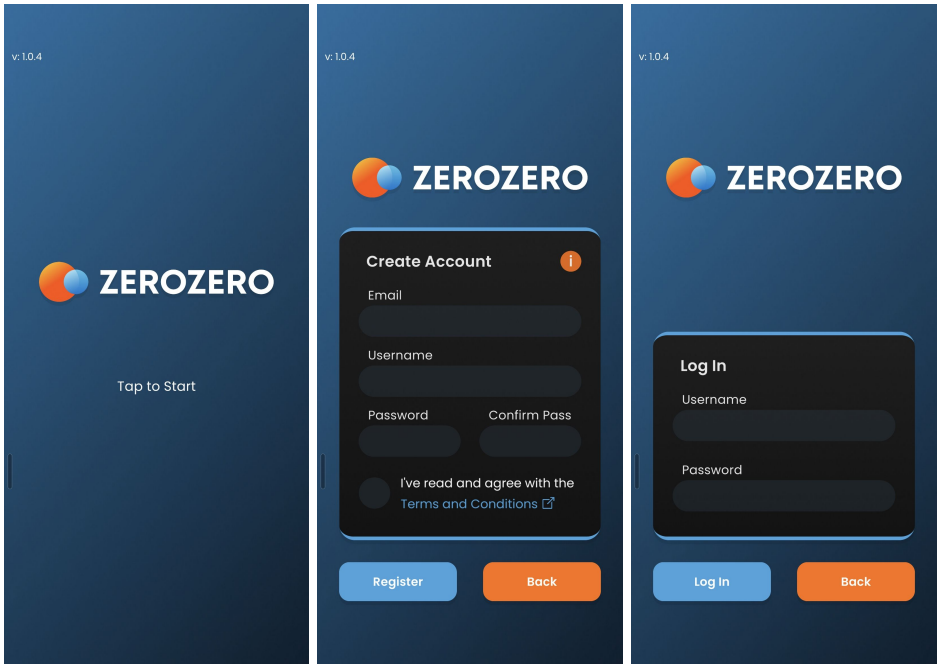
3.3.4 Final Prototype

The resulting application brings together all previously discussed design principles, system architecture, and engagement strategies into a cohesive mobile game experience. It encapsulates real-time football data from the zerozero platform, intuitive tap-based mechanics, meaningful progression systems, and a visually consistent UI aligned with the brand identity.

From onboarding and daily loops to league-based competition, the game supports repeated short sessions while offering depth for long-term engagement. Core features like formation editing, mission tracking, and match simulations are seamlessly integrated, reinforcing both usability and retention. The UI leverages a dark visual style with vibrant brand-colored highlights, while animations and feedback systems provide satisfying moment-to-moment interaction. The backend and synchronization systems ensure reliable gameplay tied to real-world data, with minimal latency and smooth performance.

Authentication Pages

Figure 3.8 presents the finalized authentication flow, including the title screen (a), registration screen (b), and login screen (c), shown from left to right. Transitions between screens are handled with smooth sliding animations, reinforcing a fluid and cohesive user experience.



(a) (b) (c)

Figure 3.8: Authentication pages: title screen, registration, login.

Tabs Navigation

Figure 3.9 displays the *Home* (a), *Team* (b), and *Recruit Players* (c) tabs, respectively.

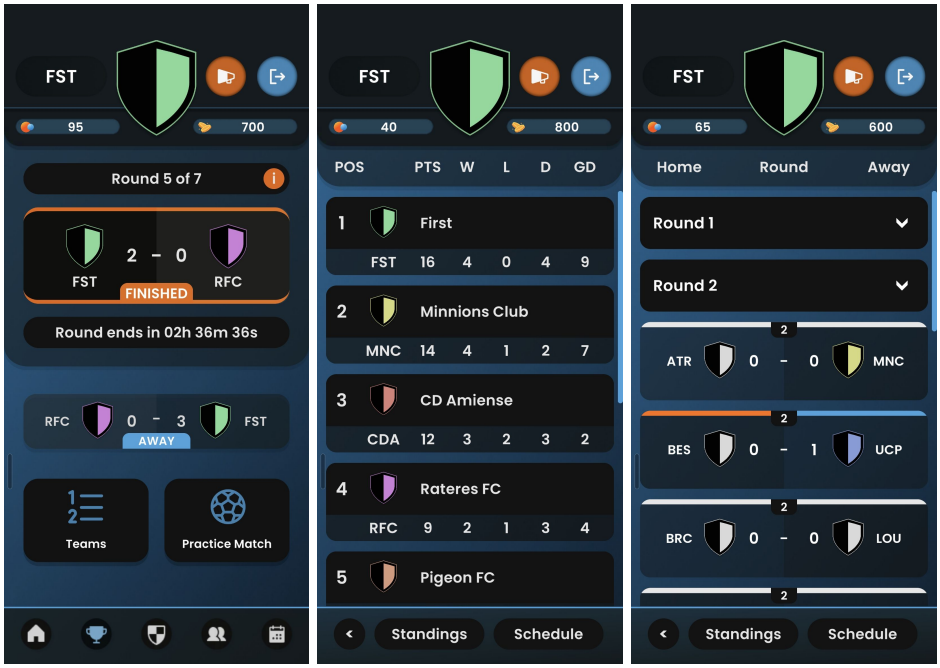
(a) (b) (c)

Figure 3.9: Navigation pages: Home, Team, and Recruit Players tabs.

The *Home* tab (a) serves as the central hub for daily interaction, featuring quick-access buttons for league matches, pack openings, mission tracking, and navigation to daily challenges. The *Team* tab (b) presents various statistics related to the user's team and provides access to the player collection and formation editor. Lastly, the *Recruit Players* tab (c) lists the available player packs, allowing users to spend in-game currency to acquire new players and strengthen their roster.

League Pages

Figure 3.10 showcases the league-related pages, the *League* (a), *Standings* (b), and *Schedule* (c) pages.



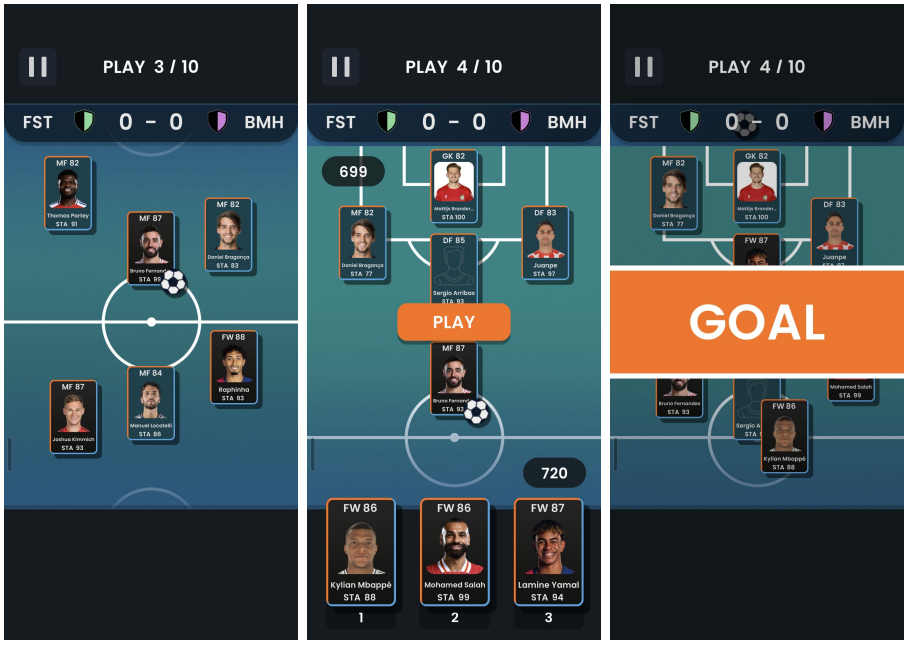
(a) (b) (c)

Figure 3.10: League-related page: League, Standings, and Schedule pages.

The *League* tab (a) displays key information about the ongoing competition, including the current round, the day's opponent, and the time remaining until the round ends. It also allows users to play practice matches, which are non-competitive games, designed to help refine tactics and get used to the game's mechanics. By tapping the *Teams* button, users can access the *Standings* and *Schedule* tabs: the *Standings* page (b) presents the live league table, updated in real time as players complete their matches, while the *Schedule* page (c) outlines all upcoming rounds and opponents throughout the week.

In-Game Pages

Figure 3.11 presents a sequence of in-game scenarios illustrating different phases of a match. The first image (a) shows the field state after a midfield contest has concluded. The second (b) depicts the user selecting player cards for the upcoming play. The final image (c) captures the moment a goal is scored, following a successful attacking play.



(a) (b) (c)

Figure 3.11: In-game images: play, play selection, goal.

Website Connections

Figure 3.12 showcases several points of integration with the zerozero platform, including the *Daily Challenges* screen (a), team details view (b), and player profile view (c).

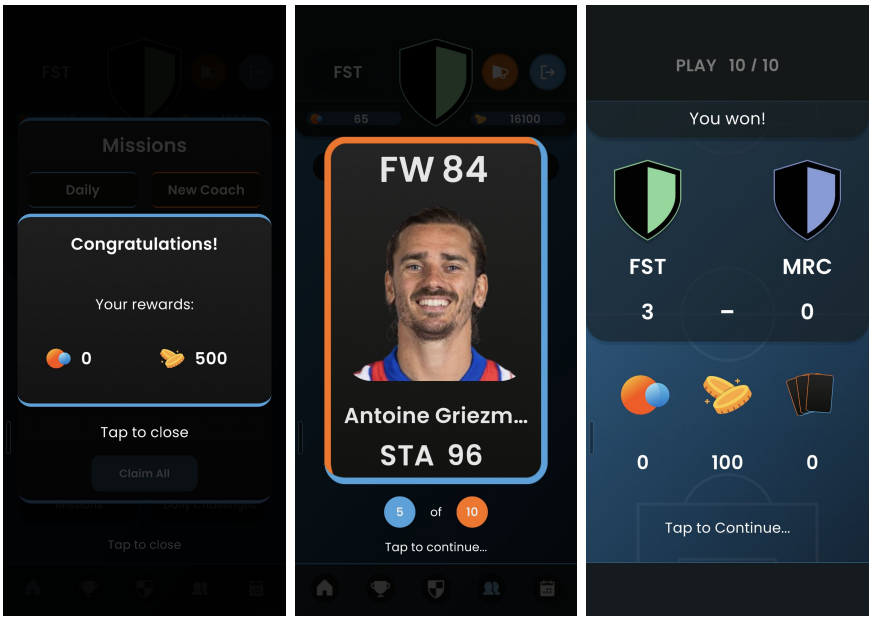
(a) (b) (c)

Figure 3.12: Website connections within the mobile game.

Daily Challenges (a) are based on real-world matches, allowing users to select a team for each game and play a one-off match for rewards tied to the chosen team. To prepare for upcoming challenges, users can tap the *Check Schedule* button (a), which opens the list of upcoming real matches on the zerozero website. Additionally, users can navigate to a team's page on the platform by tapping the team's name (b), or access a specific player's profile by selecting *View More* within the player details screen (c).

PopUps and Rewards

Figure 3.13 illustrates how rewards are presented to the user throughout the gameplay experience. The images depict different contexts in which rewards appear: standard rewards collected through the main interface (a), newly acquired players from opened packs (b), and the match end screen (c), which may display both types of rewards together.



(a) (b) (c)

Figure 3.13: Rewards and pop-ups.

3.4 Summary

This chapter presented the complete development process of the proposed mobile game, from conceptual foundations to technical implementation and final interface design. Drawing from user engagement strategies identified in previous chapters, the solution uses familiar game mechanics, such as progression systems, competitive features, and daily incentives, while grounding them in real-world football data from the zerozero platform. The integration between the game and the zerozero ecosystem is central to the approach, reinforcing brand familiarity through cross-platform interactions. On the technical side, the architecture prioritizes modularity and maintainability, supported by a backend capable of managing authentication, synchronization, and gameplay validation. The final prototype demonstrates how thoughtful design, grounded in theory and implemented with care, can effectively transform a static data platform into an engaging, interactive experience.

Chapter 4

Experimental Protocol

This chapter outlines the procedures used to evaluate the mobile game developed to validate the hypothesis outlined in Section 1.4 . The evaluation aimed to assess the effectiveness of the implemented gamification strategies in engaging users and promoting sustained interaction.

This chapter presents the methodology used to conduct the tests (Section 4.1), the participant gathering process (Section 4.1.2), the specific procedures involved in testing (Section 4.1.3), the assessment methods and instruments (Section 4.2), details of the pilot testing process (Section 4.3), and a summary of the key aspects of the experimental design.

4.1 Test Methodology

The tests aimed to analyze player engagement, feature usability, and retention behavior in the context of gamification strategies applied to a football-themed mobile game. The methodology combined quantitative analytics gathered via Unity Analytics, with qualitative data collected through two in-game questionnaires. The later were designed to trigger at specific points in the user experience to capture insights from initial and long term impressions.

4.1.1 Description

The testing procedures aimed to evaluate the game's ability to encourage players to interact with the specified product (zerozero website), along with its capacity to foster player engagement and sustained usage, addressing Research Questions 3 and 4, from Section 1.5, that were left unanswered from after research in Chapter 2:

- **Q3:** Can user retention and interaction in online environments be increased by introducing a complementary product or service?
- **Q4:** What game mechanics are most effective in enhancing player engagement and retention in mobile games?

The evaluation was conducted remotely using the final prototype of the game, distributed via the platforms' stores (PlayStore [37] for Android users, TestFlight [38] for Apple users). The testing environment was uncontrolled, reflecting real-world usage conditions. Players interacted with the game at their convenience, using their own mobile devices. With all this in mind, the test can be specified as follows:

Where/When: Remotely, over a span of two weeks, starting on May 12, 2025. Participants were free to play and interact with the game during their normal daily routines.

Platform and Tools: A mobile device with either Android or iOS operating systems, along with internet connection and access to the platform's respective store, to download and play the prototype.

Coordinator, Facilitator and Observers: Apart from the distribution and technical help related to the instalation of the prototype, all tests were individual, without any supervision. This facilitates a more natural form of response gathering and data collection, resembling habitual usage, leading to more valuable insights.

Participants: A total of 80 participants were involved in the main testing phase. Recruitment details are explained in Section 4.1.2.

Assessment Methods: Players were assessed using a combination of behavioral metrics (e.g., retention rate, mission completion, games played, website interaction) and qualitative feedback obtained through two questionnaires (see Section 4.2).

Help Resources: Players were provided with a brief in-game tutorial, and had access to contextual help pop-ups in relevant features. Additional support was offered via email for technical issues only.

The prototype remained unchanged throughout the duration of the tests to ensure consistency and comparability across participant experiences.

4.1.2 Participant Gathering

Participants were gathered through a snowball sampling method [39], starting from a core group of acquaintances. An email containing installation instructions, game context, and participation guidelines was distributed. This approach allowed for rapid acquisition of testers and diverse feedback, as it incompasses both gamers and non-gamers, as well as from users and non-users of the zerozero platform.

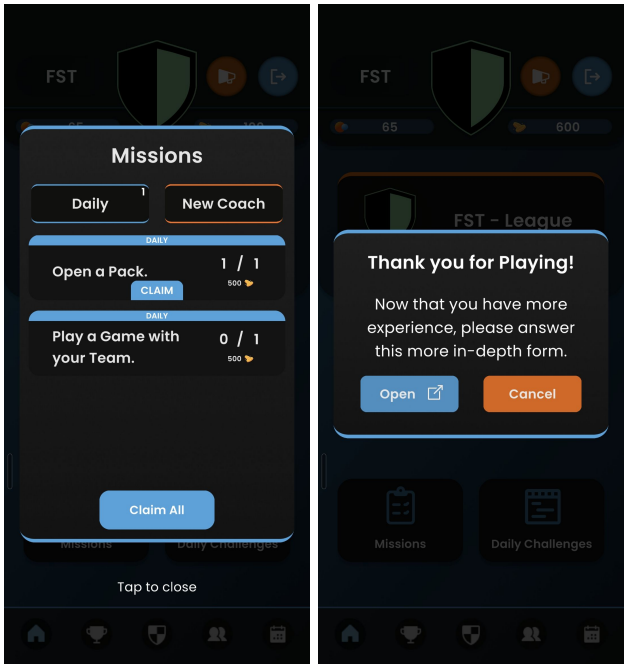
4.1.3 Procedure

Participants engaged with the game in a natural, unguided manner. They progressed freely through the game at their own pace, without external guidance beyond the in-game instructions and tutorial. This approach aimed to simulate organic user behavior and real-world engagement patterns.

Testing revolved around metric collection through Unity Analytics [40], along with two key feedback moments:

- **First Form:** A pop-up was triggered upon completion of the *New Coach* missions, typically after 20 minutes of gameplay. This questionnaire captured early impressions and usability insights. While the response rate was high, responses were limited in depth due to players' lack of experience – Annex A.
- **Second Form:** Triggered after completing three consecutive days of daily missions. This form targeted experienced users and provided more valuable insights regarding long-term engagement, feature utility, and retention – Annex B.

These mission-triggered forms were presented as optional pop-ups within the game, as illustrated in Figure 4.1, which shows both the missions page (a) and the second feedback form (b) displayed after sustained engagement.



(a) (b)

Figure 4.1: Missions and feedback pop-ups.

Players were informed in advance, through the initial email, about the first form to maximize the response rate. However, the second form was not announced beforehand to avoid influencing gameplay behavior and to capture more authentic feedback.

Due to the nature of the remote testing environment, several external factors introduced variability in user experience. Differences in device performance, screen size, operating system load, and background activity may have influenced gameplay responsiveness.

Test Completion Criteria

The test was considered initiated upon game installation and account creation. Completion of the "New Coach" missions was the condition for triggering the first questionnaire, and for the effects of this experiment, this was considered as the completion criteria.

For the second form, players needed to complete all daily missions for three days. Data collection through Unity Analytics was continuous, and thus, the testing process was never truly "complete" for any user, as their behavioral data continued to be logged.

Test Success Criteria

Given that the evaluation aimed to gather insights rather than validate predefined answers, success was measured qualitatively. No binary correctness or performance scores were associated with the questionnaire results.

Two conditions depicted a successful test:

- The user's responses to the familiarity questions in the first form indicated that they had interacted with at least 2 of the available functionalities.

- Having completed the second form – as an extra, optional, success criteria.

4.2 Assessment Methods

The effectiveness of the implemented prototype was evaluated with two complementary approaches: formative questionnaires, and analytics, both involving direct interaction with the game. These methods were selected to provide a well-rounded perspective, capturing both subjective player perceptions and objective behavioral data.

This multiple approach methodology enhanced the reliability of the findings about how users interacted with the system, which features were better suited for the project's goals, and where improvements could be made.

The following subsections provide detailed explanations of ethical considerations surrounding data collection, how each assessment method was implemented, including the structure and focus of the questionnaires, and the types of metrics collected through analytics.

4.2.1 Informed Consent

Informed consent was necessary to ensure ethical data collection and to guarantee that participants understood the purpose and scope of their involvement in the study. Users were informed both for the questionnaires and analytics about the goals of the data being collected.

For the questionnaires, consent was explicitly requested on the front page of each form. Before proceeding, users were informed that participation was voluntary, that all responses would remain anonymous, and that the data would be used solely for academic and research purposes.

Regarding the collection of gameplay analytics, consent was requested at the moment of account creation. Players were presented with a privacy screen detailing the nature of the data to be collected via Unity Analytics. Only users who agreed to these terms were allowed to proceed into the game. This mechanism ensured that all analytics data was obtained with clear and documented user authorization.

4.2.2 Questionnaires

The questionnaires were designed using Google Forms [41] and were triggered contextually within the game to collect qualitative insights from players. Their main goal was to gather feedback on the overall user experience, covering areas such as usability, engagement, perceived fairness, and the effectiveness of the game's integration with the zerozero website.

To accommodate players at different stages of familiarity with the game, two distinct forms were developed, as described in Section 4.1.3.

In-Game Missions

Two distinct mission types were implemented in the game to structure progression and trigger data collection events: the *New Coach Missions* and the *Daily Missions*. These missions were designed not only to guide player learning and encourage engagement, but also to serve as contextual triggers for the in-game questionnaires.

The **New Coach Missions**, introduced players to the core mechanics of the game. These missions included tasks such as playing the first match, accessing the team management interface, and navigating to the *Recruit Players* tab. Several of these missions were completed automatically during the mandatory tutorial, while others required players to explore additional features independently. Upon completion of all *New Coach Missions*, a pop-up was triggered prompting the player to complete the first questionnaire (see Form 1 4.2.2).

The **Daily Missions** were recurring tasks designed to promote regular gameplay and long-term engagement. These were comprised of two missions, which could be completed through playing a match with the user's team (either within the league or in a training match) for the first mission, or by opening a card pack – achievable by spending in-game currency in the *Recruit Players* tab or as a reward for winning a *Daily Game* for the second one. Upon completing all *Daily Missions* for three days, the game triggered a second pop-up, inviting players to complete the second questionnaire (see Form 2 4.2.2).

These mission-based triggers ensured that questionnaire responses were collected at meaningful points in the user journey – after sufficient exposure to core features and after establishing a baseline of engagement, respectively.

Form 1: Initial Impressions

The first form (Annex A) was intentionally kept concise and focused, designed to collect broad, early-stage insights without overwhelming less experienced users. Structurally, it was divided into four sections:

- **General Information:** assessed player familiarity with the zerozero website (whether they were previously aware of the platform, and if so, if they were regular users) – Annex A.1.
- **Feature Usage:** to helped contextualize each user's experience by asking which of the game's functionalities they had interacted with so far – Annex A.2.
- **Experience and Interest:** used Likert-scale [42] items to measure how various game aspects influenced the user's interest and engagement. Questions evaluated the effectiveness of website integration, motivational aspects of the reward system, satisfaction with team progression, and the impact of competition and daily challenges on continued play – Annex A.3 and Annex A.4.
- **Usability:** statements from the standard System Usability Scale (SUS) [43] framework, allowing users to rate their agreement on a scale from "Strongly Disagree" to "Strongly Agree" – Annex A.5.

Finally, an Open Comment field invited players to provide additional thoughts or suggestions, giving them the opportunity to express issues not covered in the structured questions. This qualitative feedback was particularly valuable for identifying usability pain points and gauging emotional responses to the gameplay experience, along with collecting ideas for future improvements.

Form 2: Long-Term Impressions

In contrast to the first questionnaire, the second form (Annex B) targeted users who had shown sustained engagement by completing all daily missions over three days. This ensured

that responses came from players with substantial experience, leading to more insightful and informed feedback.

The form was divided into three sections:

- **Feature Evaluation:** Users rated their satisfaction with key functionalities. Ratings were given on a scale (e.g., 1 to 5 or "Very Negative" to "Very Positive") to allow for quantitative comparison – Annex B.2.
- **Motivation and Retention:** This section asked which features motivated users to return to the game. Users could select multiple entries from a predetermined list of relevant features, helping identify the most engaging aspects of gameplay – Annex B.3.
- **Website Interaction:** Users were asked which game elements encouraged them to visit or engage with the zerozero website, supporting evaluation of cross-platform interaction – Annex B.4.

By targeting users with substantial exposure to the game, the second questionnaire provided deeper insights into which features drove player satisfaction, long-term retention, and engagement with the broader zerozero ecosystem. This approach helped overcome the limitations of early feedback, offering a clearer picture of the game's impact beyond initial use.

4.2.3 Unity Analytics

In parallel with the qualitative data gathered through questionnaires, Unity Analytics was employed to collect quantitative data on user behavior within the game. This tool enabled the continuous logging of gameplay interactions and usage patterns, providing an empirical foundation for evaluating the effectiveness of different mechanics and user engagement strategies.

Unity Analytics provided two types of data: default system metrics and custom event logs. The **default metrics** included user acquisition, daily active users, average session time, and sessions per daily active user. In addition to these baseline statistics, a series of **custom events** were implemented to capture specific interactions relevant to the project's objectives. These included:

- **Authentication events:** register, login, refresh login, and logout, used to track entry and return behavior.
- **Core gameplay events:** claim mission and start game, to monitor progress through missions and match participation.
- **Integration events:** check a player's page on the website, check a team's page on the website, and view the schedule games that would be played in real life, designed to track when players interacted with external content, through the zerozero platform.

Together, these metrics enabled a detailed analysis of how players navigated the game, which features captured their attention, how frequently they returned, and whether the integration with the zerozero website influenced their behavior. By correlating this data with responses from the questionnaires, it is possible to identify patterns of engagement and areas requiring refinement or further development.

4.3 Pilot Tests

Before launching the full-scale test, two rounds of pilot tests were conducted to ensure the adequacy of the test structure, timing, content clarity, and technical performance.

Pilot tests took place in late April 2025, with participants using their own devices in a moderated setting. Each session was initiated by a reading of the email that would later be sent to actual testers. Participants were then instructed to play the game freely, proceeding through the tutorial and *New Coach Missions* until the first questionnaire appeared.

The participants' gameplay was informally observed, aiming to identify usability bottlenecks or moments of confusion. In the end, participants joined an open feedback session to discuss their experience and offer suggestions.

Two rounds of pilot tests, following the described procedure, were performed, aiming to perfect the testing methodology.

The first round, composed of 6 users, revealed that the absence of social mechanics reduced long-term interest. In response, the ability to create and browse leagues to play with friends was implemented, as clearly suggested by all 6 users.

The second round, composed of 4 users, highlighted the need for better team identification. Consequently, a simple badge color customization feature was added during account creation.

General feedback from both rounds also suggested splitting the questionnaire into two parts: one early form for immediate impressions, mitigating player drop off, and a later form for deeper analysis, balancing the need for early data with experienced insight, which corresponds to the final approach followed and explained in the previous sections.

4.4 Summary

This chapter presented the experimental protocol used to evaluate the mobile game prototype, designed to test the impact of gamification on user engagement and interaction with the zerozero website. The evaluation combined remote, unsupervised testing with two complementary data sources: Unity Analytics for behavioral metrics and in-game triggered questionnaires for user feedback.

Participants were recruited via snowball sampling and played the game naturally on their personal devices. Two forms were triggered at meaningful points – after the completion of onboarding missions and after sustained play over three days – capturing both early impressions and more informed insights. Unity Analytics tracked both standard metrics (e.g., sessions, retention) and custom events (e.g., feature usage, website interactions), offering detailed usage patterns for comparison with survey responses.

Pilot testing played a key role in refining the evaluation design, leading to critical improvements in features and feedback collection. Overall, this multi-method approach provided a solid foundation for analyzing user behavior and evaluating the effectiveness of the prototype.

Chapter 5

Results

This chapter reports the findings from the experiment performed in Chapter 4. Section 5.1 analyzes questionnaire responses, including user grouping and filtering out outliers or invalid submissions. Section 5.2 presents data collected through Unity Analytics. The results are interpreted and discussed in Section 5.3, with key takeaways summarized in Section 5.4.

5.1 Forms

Two questionnaires were used to gather user feedback at different stages of the gameplay experience. The first form was administered early on and aimed to assess users' initial impressions, expectations, and onboarding experience, while the second form targeted more experienced players, focusing on sustained engagement, perceived value, and gameplay satisfaction. The following subsections showcase the results of each of the forms, highlighting key trends, usability insights, and notable differences in perception between user groups.

5.1.1 Initial User Impressions

This subsection analyzes the responses collected through the first questionnaire (described in Section 4.2.2), which appeared after users finished the *New Coach Missions*. A total of 34 users submitted valid responses to Form 1. No submissions were excluded, as none showed signs of erratic answering on the SUS (System Usability Scale).

The goal of this form was to gather early impressions regarding onboarding, usability, and feature clarity. The SUS responses were aggregated and analyzed to assess overall usability perceptions.

Retention and Engagement

One of the sections in Form 1 specifically addressed users' perception of the game's ability to promote continued engagement and interest (Annex A.4). In this section of the form, participants were presented with a set of statements to evaluate on a 5-point Likert scale [42], where 1 corresponds to "strongly disagree" and 5 to "strongly agree":

Q1: The reward systems (e.g., opening player packs, completing missions) kept me motivated to continue playing.

Q2: The ability to compete with other players (e.g., through leagues) increased my interest.

Q3: Team progression (e.g., formation editing, acquiring new players) is engaging and encourages continued play.

Q4: The daily activities (e.g., daily missions and challenges) maintained my interest.

As illustrated in Figure 5.1, the average ratings for these statements were consistently high, suggesting that the implemented features effectively promoted player motivation and retention. A more detailed graph of the responses, including the distribution of each rating per question, is provided in Annex C.1.

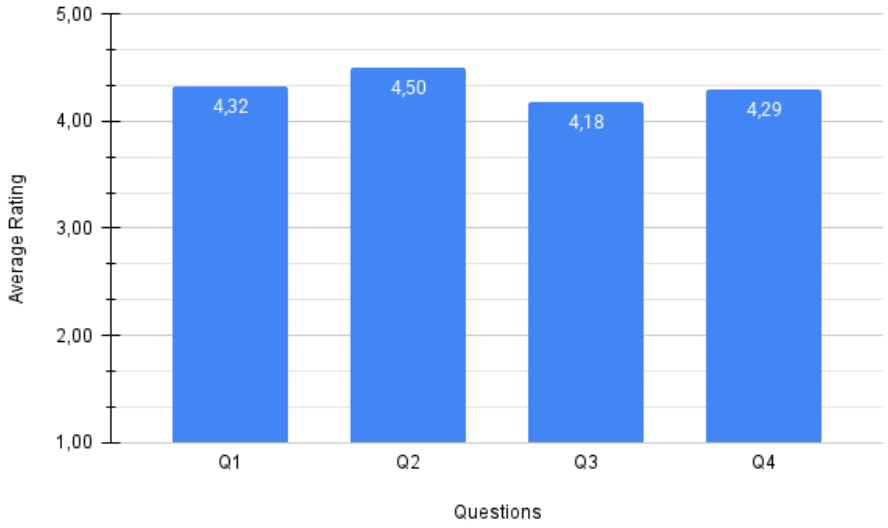


Figure 5.1: Average rating per question – Form 1, engagement and retention.

Based on Figure 5.1, many highlighted that the reward system, particularly the ability to open packs and complete missions, gave them clear goals and kept them engaged (Q1). Competing with other players through the league structure was also described as a motivating factor, even at this early stage (Q2). The sense of team progression proved satisfying for most users, reinforcing their willingness to continue playing (Q3). Additionally, the presence of daily challenges was frequently mentioned as a feature that helped maintain consistent interest in returning to the app (Q4).

Game Usability

The usability of the game was evaluated using the System Usability Scale (SUS), consisting of ten statements rated by participants on a 5-point Likert scale [42], where 1 corresponds to "Strongly Disagree" and 5 to "Strongly Agree." The questions were slightly adapted to better suit the context of the game under evaluation:

Q1: I think I would play this game frequently.

Q2: I found the game unnecessarily complex.

Q3: I thought the game was easy to play/understand.

Q4: I think I would need the support of a technical person to play this game confidently.

Q5: I thought the game's features were well integrated.

Q6: I thought there was too much inconsistency in the game.

Q7: I would imagine that most people would learn to play the game quickly.

Q8: I found the game very complicated and difficult.

Q9: I felt very confident while playing the game.

Q10: I needed to learn many things before I could play the game confidently.

The box-plot in Figure 5.2 illustrates the distribution of ratings for each SUS question (Annex A.5). The variability in responses is represented for each item, highlighting both positive and negative trends across the usability evaluation. All responses were closest to their positive extremities, however, two can be highlighted, deviating most from the trend, namely Q01 and Q09.

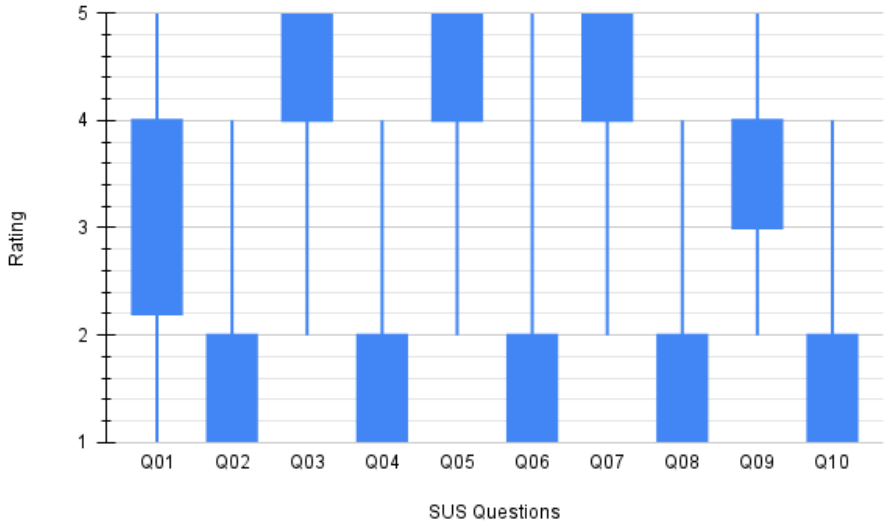


Figure 5.2: SUS scores.

The SUS evaluation resulted in an overall score of 78.75. According to standard SUS interpretation guidelines [43], scores close to 80 are typically associated with products that users find highly usable, intuitive, and satisfying.

This result suggests that users experienced minimal friction during their interaction with the prototype, and that the interface and gameplay flow were effective in supporting early-stage engagement.

Game Value

Beyond gameplay mechanics and usability feel, the questionnaire also included questions about the game's value as a complementary product within the zerozero ecosystem, as shown in Annex A.3. In this section of the form, participants were again asked to evaluate statements, using a 5-point Likert scale [42] where 1 corresponds to "strongly disagree" and 5 to "strongly agree":

Q1: The experience with this game increased my interest in interacting with other products or services related to the zerozero website.

Q2: The connectiong between the game and the zerozero website (daily challenges, real team details, real player statistics) are adequate.

As shown in Figure 5.1, the average ratings for these statements were consistently high, indicating that the game successfully enhanced interest in the zerozero website. A detailed graph of the responses, including the distribution of each rating per question, is available in Annex C.2.

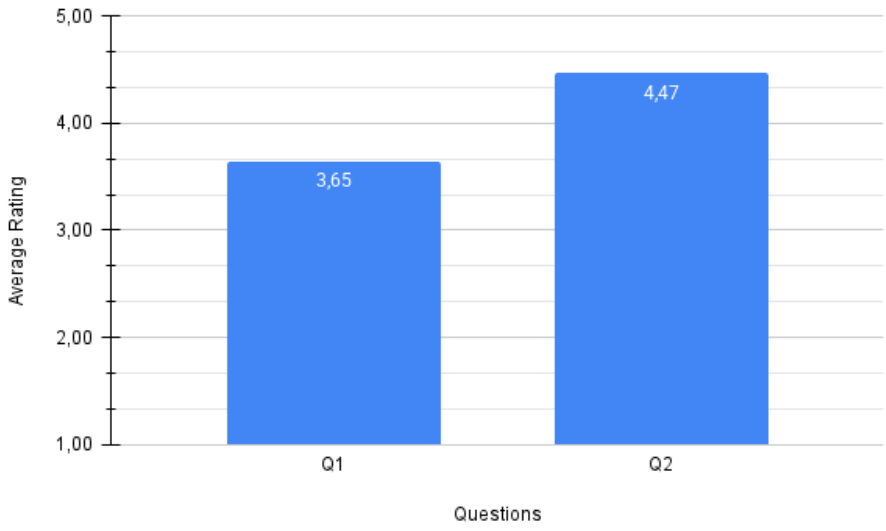


Figure 5.3: Average rating per question – Form 1, complementary product.

From Figure 5.3, the initial responses indicated that the game increased users' interest in interacting with other products or services related to the platform (Q1). Users also responded positively to the use of real-world data, noting that the integration of real teams, player statistics, and match schedules, especially through daily games, was well-executed and meaningful (Q2).

Open Feedback

The questionnaire concluded with an optional open-ended question (Annex A.6), which received 15 responses. These were grouped into four broad categories:

- **UI/UX Suggestions**: Feedback included requests for clearer button ordering and more contextual help during onboarding or early gameplay.
- **Mechanics and Functionality**: Users suggested a range of additional features such as more in-depth player stats (e.g., passing, dribbling), aditional gameplay mechanics (e.g., fouls, penalties), expanded mission types, more competitive formats, global leaderboards, player training, and enhanced user interaction (e.g., trading, chat, friend lists).
- **Balance and Progression**: Some users noted that formations should have a greater impact on match outcomes, and suggested either expanding the player pool or adjusting the balance to make high-level players harder to obtain.

- **General Feedback**: Several users praised the core idea and expressed that the prototype had strong potential, describing it as a solid and interesting foundation for a complete product.

5.1.2 Later Impressions from Returning Users

The second questionnaire (described in Section 4.2.2) aimed to assess the evolving perceptions of users who had multiple play sessions. There were 23 submitted responses to Form 2, however, after filtering out responses from users who claim to have played for fewer than three days, 19 valid answers remained.

This form focused on sustained engagement, perceived progression, and gameplay satisfaction. Compared to the first form, this feedback provided a more complete picture of how initial expectations evolved over time.

Game Mechanics

The functionalities considered in this subsection are:

F1: League system.

F2: Player collection system.

F3: Daily Challenges.

F4: Player competition (competitive play).

F5: Team improvements.

F6: Attempting to recruit specific players.

F7: Daily missions.

Participants identified several gameplay mechanics that had a strong influence on their continued engagement with the game. Among the most frequently mentioned were the league system (F1), the player collection system (F2), and the Daily Challenges (F3), which together formed the core pillars of user motivation.

Table 5.1 presents the features most frequently cited by users as contributing to their retention within the game. The questions used to collect this data are provided in Annex B.3.

Features	**F1**	**F2**	**F3**	**F4**	**F5**	**F6**	**F7**
Count	13	12	13	8	10	8	8
Percentage	68,42%	63,16%	68,42%	42,11%	52,63%	42,11%	42,11%

Table 5.1: User responses by feature – Form 2, retention.

Game Value

The functionalities considered in this subsection are:

F1: Player collection system.

F2: Team formation editing system.

F3: Daily Challenges.

F4: Exploring which players from a team can be recruited to the collection.

Participants were asked to indicate which game features most motivated them to engage with the zerozero website and its broader ecosystem. Among the functionalities listed, the Daily Challenges (F3) were the most frequently cited, reinforcing the value of real-world data integration as a mechanism to encourage platform interaction. The player collection system (F1) ranked a close second, providing a clear link between in-game progression and the exploration of player data on the website.

These trends are summarized in Table 5.2, which presents the features most frequently cited as contributing to user interaction with the zerozero website. The corresponding questionnaire items are detailed in Annex B.4.

Features	**F1**	**F2**	**F3**	**F4**
Count	9	7	10	3
Percentage	47,37%	36,84%	52,63%	15,79%

Table 5.2: User responses by feature – Form 2, website interaction.

5.1.3 Feature Usage Comparison

This subsection presents an analysis of feature usage based on participant interaction data collected during both phases of the evaluation process. The functionalities considered are outlined below, providing a structured overview of the game's interactive elements:

F1: Create a league.

F2: Join a league using the league browser.

F3: View the teams in my league.

F4: View the match schedule of my league.

F5: Play a league match.

F6: Play a training match.

F7: Unlock new players (post-tutorial).

F8: Edit team formation (post-tutorial).

F9: Play a match in the Daily Challenges tab.

F10: View the Daily Challenges schedule (website).

F11: View information about a Daily Challenges team (website).

F12: View information about a player in the collection (website).

Figure 5.4 shows the answers to the feature interactions questions from the first questionnaire (Annex A.2).

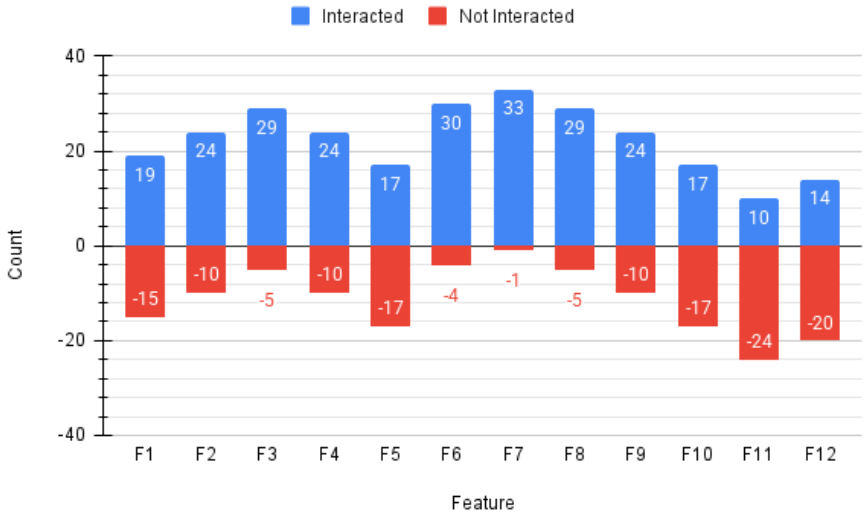


Figure 5.4: Usage per feature – Form 1, feature interaction.

Based on Figure 5.4, certain features show notably lower interaction rates, among these was the option to play a league match (F5). This stood in contrast to the high engagement observed with practice (F6) and daily challenge matches (F9), which were immediately accessible and provided short-term rewards. Similarly, the three website integration features (viewing the daily challenge schedule (F10), accessing player details (F12), and exploring team pages (F11)) also saw limited use. Of these, the daily challenge schedule (F10) had the highest interaction rate, followed by player details (F12), and lastly, team details (F11).

The second questionnaire revealed a significant increase in the usage rate of all functionalities when compared to the initial responses. In addition to usage, participants were also asked to evaluate their experience with each functionality (Annex B.2), as illustrated in Figure 5.5. Notably, only one negative response was recorded, which referred to dissatisfaction with the pack opening feature used to obtain players.

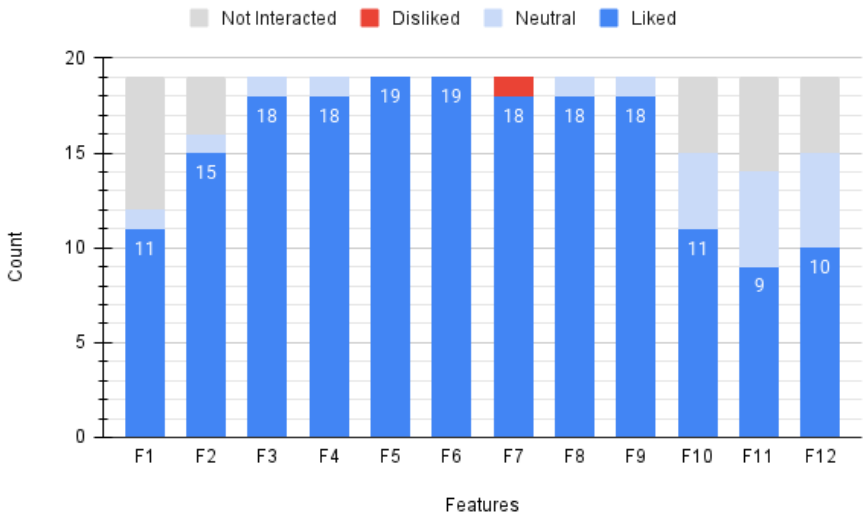


Figure 5.5: Evaluation per feature – Form 2, feature evaluation.

Based on Figure 5.5, as users spent more time with the game, league matches (F5) emerged as the most positively received feature. Other league-related functionalities, such as practice matches (F6), also performed well, followed closely by features like player unlocking (F7), and daily challenges (F9).

5.2 Analytics

This section presents the data collected through Unity Analytics and internal logging mechanisms during the experimental period. It includes an overview of account and user activity, interaction with website-integrated features, gameplay engagement, and Unity's default behavioral metrics.

5.2.1 Account and User Activity

This section describes the two methods used to gather account and user activity metrics: database analysis, and Unity's default metrics.

Database Analysis

A total of 60 accounts were used throughout the experiment, corresponding to 55 unique users. Of these, 10 accounts were associated with pre-existing zerozero users, while the remaining 50 were created directly through the game. In total, 34 unique users completed the tutorial, using 46 accounts, indicating that some participants used more than one account during testing. All users who completed the tutorial submitted the first questionnaire (Form 1), which was configured to accept only a single submission per user.

Regarding sustained engagement, 35 accounts were active for more than three non-consecutive days, and 28 accounts remained active for more than seven non-consecutive days. A total of 22 valid responses were received for the second questionnaire (Form 2), with nearly all coming from users who met the minimum engagement criteria of playing across three different days.

Default Unity Metrics

Unity's built-in metrics further contextualized user engagement by tracking key behavioral indicators such as daily active users (DAU), the average number of sessions per user per day, and average session duration. These metrics allowed for a continuous and quantitative evaluation of user retention and play frequency across the full duration of the test, enabling cross referencing trends with other collected metrics.

As shown in Figure 5.6, the number of daily active users peaked at 39 on the second day of testing. This number gradually declined over the course of the experiment, reaching 6 on the final day. The overall average across the testing period was 20 daily active users, indicating a consistent but decreasing level of engagement after the initial days.

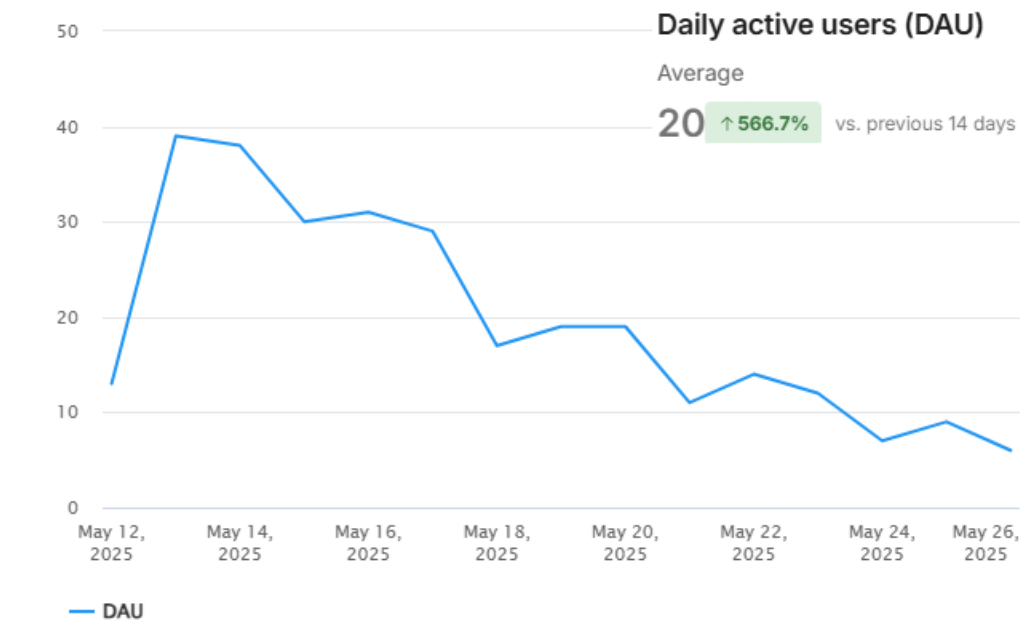


Figure 5.6: Unity Analytics – Daily active users.

A similar trend can be observed in the number of sessions per daily active user, illustrated in Figure 5.7. This metric reached a maximum of 6.3 sessions per user on the most active day, and dropped to a minimum of 1.5 sessions on the least active day. The average across the experiment was approximately 4 sessions per daily user.

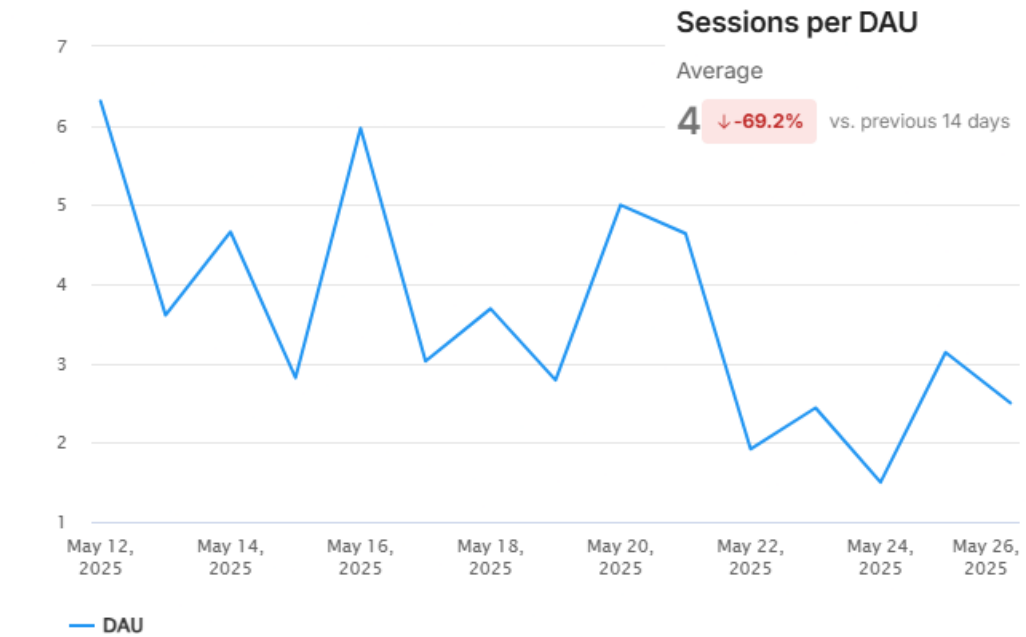


Figure 5.7: Unity Analytics – Sessions per daily active user.

Unlike the previous two metrics, the average session duration remained relatively stable throughout the test period, as shown in Figure 5.8. The data shows limited fluctuation, with session lengths consistently averaging around seven minutes. This suggests that while user frequency declined over time, the duration of each session remained largely consistent, indicating sustained depth of engagement among active users.

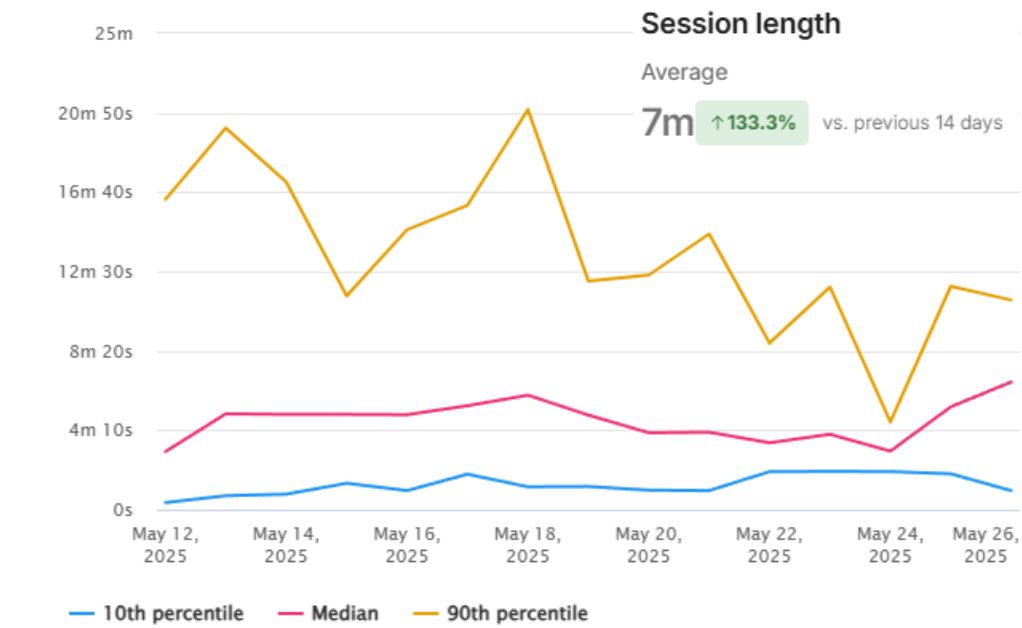


Figure 5.8: Unity Analytics – Average session length.

5.2.2 Website Interaction Metrics

Website interaction through the prototype interface is illustrated in Figure 5.9. The most frequently used feature was viewing the schedule of daily challenges, which accounted for 42 total interactions. This was closely followed by visits to individual player pages, which occurred 41 times. Team pages were accessed less frequently, with only 6 recorded visits.

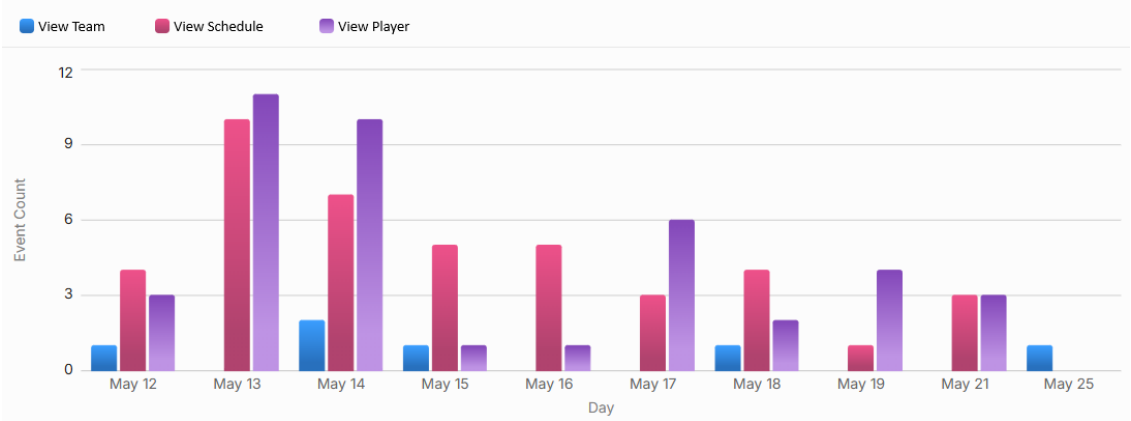


Figure 5.9: Unity Analytics – Website interaction metrics.

5.2.3 Gameplay Metrics

Gameplay metrics included the total number of matches played and missions completed. As shown in Figure 5.10, a total of 1,239 matches were played during the experiment period, and 564 missions were completed and claimed by users.

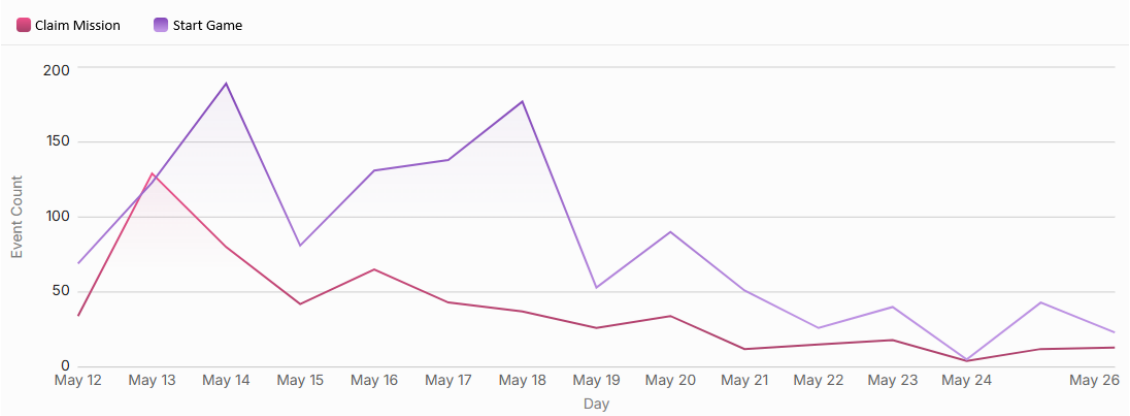


Figure 5.10: Unity Analytics – Gameplay metrics.

5.3 Discussion

This section interprets the findings presented in the previous sections, linking user feedback and analytics data with the research objectives (Section 1.3) and hypotheses (Section 1.4) established earlier. The discussion examines how the implemented gamification strategies impacted engagement and retention, reflects on observed limitations, and considers implications for future development and integration with the zerozero ecosystem.

5.3.1 Summary of Key Findings

The evaluation results presented in Sections 5.1 and 5.2 highlight a generally positive reception of the prototype. Users demonstrated high levels of engagement and satisfaction, particularly in early stages, as reflected in the SUS score of 82 (Figure 5.2), which exceeds average usability benchmarks [43].

Form 1 responses emphasized the clarity of goals, enjoyment of missions, and motivational effect of features such as pack openings and daily challenges (Figure 5.1). Form 2 responses showed that league participation, progression, and player collection were major contributors to sustained engagement (Table 5.1). Analytics data further confirmed these patterns, with consistent daily usage and a stable average session length (Figures 5.6 to 5.8).

Notably, although the website exploration functionalities were entirely optional and not required to complete any core gameplay tasks, they still saw a meaningful level of use. This suggests that users were curious and motivated to explore beyond the main loop. Many users specifically expressed appreciation for the integration of real-world zerozero data into multiple features of the prototype, such as team and player pages and the daily match schedule. This integration enhanced the perceived value of the app and reinforced its connection to the broader zerozero ecosystem.

5.3.2 Interpretation of Results

The consistent engagement observed across both qualitative and quantitative data supports that the chosen gamification strategies/game mechanics can effectively foster user interest and retention. The most impactful mechanics, being daily challenges, team progression, and collection systems, fulfilled psychological needs of competence, autonomy, and relatedness.

Additionally, features that rewarded early and frequent interactions, such as login-based missions and fast match cycles, appear to have correctly used the sunk cost effect and temporal reward framing.

5.3.3 Comparison with Literature

The results are in agreement with multiple conclusions drawn in the literature review (Chapter 2). Achievement systems and customization features were found to be effective engagement drivers, while competition and social features supported relatedness and community formation. The early and consistent reward feedback loop also supports theories on intrinsic reinforcement mechanisms in mobile games.

Several studies emphasized the potential of gamified experiences to extend user interaction across digital ecosystems, particularly when aligned with hedonic motivations and user needs (e.g., competence, autonomy, and relatedness). This aligns with the observed behavior in the prototype, where users not only returned to the app but also engaged with platform-linked features, confirming prior findings that complementary gamified products can reinforce user engagement with a brand.

The limited presence of dark patterns, along with no manipulative monetization strategies, did not hinder engagement, reinforcing that ethical design can coexist with successful games if well-aligned with user motivation.

5.3.4 Limitations and Observations

Several limitations are worth noting. The experimental period was limited to two weeks, which constrains the conclusions that can be drawn about long-term retention or lifecycle engagement. Platform testing was also limited in scope, possibly omitting behaviors from edge cases or older devices.

Additionally, a significant element of modern mobile gaming, the use of frequent content updates, time-limited events, and evolving gameplay scenarios, was intentionally excluded from the prototype due to the short testing timeframe. These dynamics often play a crucial role in maintaining player interest over extended periods. As such, the absence of these features makes the strong retention and engagement results even more noteworthy, suggesting that with ongoing updates and event-driven content, user interaction levels could potentially be even higher.

User feedback also indicated interest in expanded features such as deeper stats, social interaction, and more complex game mechanics. Some perceived shortcomings (e.g., player pool repetitiveness or match balance) were intentional design choices for test simplicity, ensuring player familiarity and progression pacing. This focus appears to have supported initial satisfaction, even if the reasoning was not always transparent to users.

5.3.5 Takeaways

The prototype demonstrated that a complementary product, in this case, a mobile game, can successfully increase both user retention and platform interaction. Users consistently engaged with the app over multiple sessions, and a significant portion interacted with optional website-linked features. Feedback indicated that the integration of real-world zerozero data added value and encouraged exploration of other platform services. As for enhancing engagement and retention, the most effective mechanics observed were daily challenges, collectible content (e.g., players), and competition (leagues). These systems supported short-session engagement and fulfilled psychological needs such as competence, autonomy, and relatedness, all of which are well-established motivators in gamification literature.

Therefore, a well-designed, companion game can enhance interaction with a broader ecosystem. Not only did users engage with the prototype, but many reported increased interest in the zerozero website and related services. These findings support continued investment in gamified features and deeper integration with zerozero's community tools. Introducing in-game incentives for data contribution or forum participation, alongside expanding the player base, adding new game modes, and planning long-term content updates, could transform the prototype into a scalable and sustainable product aligned with zerozero's strategic goals.

5.4 Summary

This chapter presented the results from user questionnaires and Unity Analytics collected during the experimental period. The analysis showed strong early engagement and sustained interest over time, with users responding positively to the prototype's usability, gameplay features, and integration with zerozero's platform.

Initial feedback highlighted effective onboarding, clear goals, and enjoyable mechanics such as pack openings and daily missions. Later feedback confirmed that league participation, player progression, and content collection were key factors in maintaining retention, along with social functionalities, which proved to have played a crucial role in this matter. Optional website integration features were also explored by a considerable portion of users, reinforcing the prototype's potential to enhance cross-platform interaction.

Quantitative data further supported these insights, with high average session counts and consistent play duration across the testing period. Overall, the findings validate the proposed gamification approach and suggest that a companion mobile game can successfully increase user engagement and ecosystem interaction.

Chapter 6

Conclusion

6.1 Final Remarks

This thesis explores how to improve user retention and engagement with the zerozero website, a digital sports database that depends on community contributions. The core challenge lies in sustaining user interest and promoting meaningful interaction within a competitive digital landscape. To address this, a mobile game prototype was designed and evaluated to enhance engagement, retention, and platform integration. The hypothesis proposes that a compelling and interactive mobile experience can increase user involvement across a company's digital ecosystem. The research investigates how gamification and mobile game design affect user behavior through literature review, prototype development, and user feedback analysis.

The Systematic Literature Review (SLR), guided by the PRISMA framework, analyzed recent research in gamification, user retention, and mobile game design, narrowing the existing literature into 11 key studies. It identified the effectiveness of achievement-based systems, immediate feedback, early rewards, and social elements like leaderboards, while also stressing the importance of ethical considerations such as avoiding dark patterns. Building on these findings, the state of the art analysis contextualized them for digital news and data platforms, like zerozero, highlighting that sustained engagement depends on fulfilling users' psychological needs. The main challenges involve balancing engaging design with ethical responsibility, and aligning user experience with brand objectives. Overall, the literature supports a user-centered, ethical approach to game design.

After analyzing the problem, the proposed solution is a mobile game – *ZeroZero Fantasy League* – designed to increase user engagement, retention, and interaction with the zerozero ecosystem. This solution is a football-themed team management mobile game, guided by specific technical and engagement requirements. It expands on the conclusions from the state of the art by integrating validated game mechanics that address known engagement challenges.

The prototype was developed using Unity for the game client and a backend built with .NET, ASP.NET, Entity Framework, and SQLite. It incorporated real-world data from zerozero to create football simulation mechanics. Key engagement and retention features included daily challenges, league progression, virtual currency, team customization, and reward-based incentives. These mechanics were designed to meet user needs by fostering autonomy through player choices, competence through achievements, and relatedness through social components like the league.

The experimental protocol was designed to evaluate the effectiveness of the prototype in fulfilling the project's goals. Considering the target audience and the prototype, participation was voluntary and conducted without supervision. The protocol encompassed two questionnaires – one capturing initial impressions, including a System Usability Scale (SUS), and another assessing long-term retention, as well as behavioral analytics collected through Unity Analytics and database exploration. Both the protocol and the prototype were refined based on observations from the two pilot test rounds.

The results revealed that users found the prototype engaging, usable, and aligned with their interests. This is supported by quantitative metrics like high average SUS scores and repeated user logins. Users demonstrated a meaningful level of interaction with website features, linked through the app, and provided positive feedback on the design and mechanics. Despite these results, users suggested improvements on visual clarity, the onboarding flow, and general game content.

Based on the work, the answers to the Research Questions are the following:

Q1: How can user retention in online environments be increased through gamification or gaming methodologies?

The study confirms that user retention can be effectively increased through early reward placement, immediate feedback loops, and the implementation of strategic game mechanics such as leaderboards and achievements. These elements, when properly aligned with user enjoyment and the objectives of the product, foster higher engagement levels and repeat interactions.

Q2: What methodologies are commonly used to entice users to interact with specific functionalities on websites?

Narratives, customizable avatars, and social interaction features emerged as the most impactful methodologies to promote user interaction. Complementary design elements, including lifecycle vision, idle moments, and challenge systems, further strengthen immersion and motivate users to engage more deeply with specific functionalities within a platform.

Q3: Can user retention and interaction in online environments be increased by introducing a complementary product or service?

The prototype demonstrates that introducing a complementary mobile game can significantly increase user retention and interaction with an existing digital platform. The mobile game, integrated with zerozero data, created an ecosystem where users regularly engaged with both products. Features within the game generated needs or incentives that encouraged users to explore and interact with the zerozero website, validating the approach of using complementary products to enhance overall platform engagement.

Q4: What game mechanics are most effective in enhancing player engagement and retention in mobile games?

Daily challenges, collection systems, and social-competitive mechanics were found to be the most effective mechanics for enhancing engagement and retention. These features encourage short but frequent play sessions while satisfying key motivational drivers such as

competence, autonomy, and relatedness, as established in the literature review and user testing phases.

With the Research Questions addressed, the hypothesis formulated at the beginning of this study can be evaluated. The results obtained from both qualitative feedback and quantitative data confirm that a well-designed mobile application, grounded in effective gamification principles, can successfully increase user engagement with the zerozero website. Participants not only interacted with the mobile game but also demonstrated increased activity on the website, highlighting a positive correlation between game engagement and platform interaction.

The initial hypothesis – *"An engaging and interactive mobile gaming experience is effective on motivating players to increase interaction with a company's products"* – is thus validated. Furthermore, this project provides evidence that the strategic use of mobile games as complementary products can enhance user retention, and strengthen brand loyalty within a digital ecosystem.

6.2 Future Work

Although the prototype successfully demonstrated the viability of using a complementary mobile game to increase user engagement with the zerozero website, several areas for future development can be identified. These improvements build upon both user suggestions and established design principles to enhance engagement, retention, and gameplay depth.

Firstly, expanding the game's coverage to include additional real-life leagues would address existing limitations in player progression and content variety. By integrating lower-tier leagues and lesser-known teams, the player pool would naturally increase, making it more challenging to obtain high-level players, or even real-life acquaintances, and thereby enhancing long-term progression mechanics. This expansion would also enrich the daily challenges, providing more varied and dynamic content linked to real-world football data, a feature that several participants recognized as a key strength of the prototype.

In terms of competitive gameplay, introducing new formats would further strengthen user engagement and interaction. These additions include:

- The ability to **leave a league** at any time, forfeiting ongoing rewards. The player's team would be replaced by a bot-controlled replica, ensuring competitive balance is maintained.
- The creation of a **Cup-style competition**, structured as a short-term, knockout tournament that offers faster-paced, high-stakes gameplay.
- The introduction of **leaderboards and ranking systems**, fostering competition, social comparison, and long-term player motivation, consistent with user suggestions for more competitive features.

Further enhancing gameplay depth, several new mechanics are proposed:

- The implementation of a **player training system**, designed as an off-screen, idle mechanic that allows players to consume duplicate players to enhance their statistics. This system aligns with user feedback requesting greater team development options.

- The expansion of **in-game statistics** to include attributes such as passing, dribbling, pace, and other relevant metrics. Enhanced simulation depth was one of the most frequently mentioned user suggestions and would contribute to a more strategic and immersive gameplay experience.

To further encourage long-term retention and cross-platform interaction, the addition of expanded mission systems and profile customization is proposed. New mission types could include tasks completed both within the game and directly on the zerozero website, fostering deeper integration between products and promoting co-creation behaviors. Completing specific challenges could reward players with titles or badges that are displayed on their team profile, providing a sense of achievement, status, and personalization, features consistently identified in the literature as effective for enhancing user autonomy and relatedness.

These proposed features aim to reinforce the core motivational drivers of competence, autonomy, and relatedness, while maintaining the ethical design principles established throughout the project. Their implementation would also allow for further research into the long-term impact of competitive formats, progression mechanics, co-creation, and cross-platform interactions on user retention and brand loyalty.

Bibliography

[1] ZOS, Lda. *ZOS – Home of the world's largest football database*. https://www.zos.pt/. Accessed: 2025-05-01. 2025.

[2] J. Aagaard et al. "A Game of Dark Patterns: Designing Healthy, Highly-Engaging Mobile Games". In: *Conference on Human Factors in Computing Systems – Proceedings*. Export Date: 20 December 2024; Cited By: 10. 2022. doi: 10.1145/3491101.3519837. url: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85129712354&doi=10.1145%2f3491101.3519837&partnerID=40&md5=44c752422ee6d89e80f2d4a965a369a6%20https://dl.acm.org/doi/pdf/10.1145/3491101.3519837.

[3] Matthew J Page et al. "The PRISMA 2020 statement: An updated guideline for reporting systematic reviews". In: *BMJ* 372 (2021), n71. doi: 10.1136/bmj.n71.

[4] Instituto Politécnico do Porto. *Regulamento do Código de Boas Práticas e de Conduta do Instituto Politécnico do Porto*. Accessed: Dec. 28, 2024. Available at: https://files.diariodarepublica. 2020. url: https://files.diariodarepublica.pt/2s/2020/11/221000000/0019300203.pdf.

[5] Grammarly Inc. *Grammarly*. https://www.grammarly.com/. Used for grammar and style suggestions during the writing of this dissertation. 2025.

[6] OpenAI. *ChatGPT (May 2025 Version)*. https://chat.openai.com/. Used for image generation and design suggestions during UI development. 2025.

[7] M. G. Jacobides et al. "The Business Value of Gamification". In: *California Management Review* 66.2 (2024). Export Date: 19 December 2024; Cited By: 2, pp. 91–107. doi: 10.1177/00081256231218469. url: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85182220464&doi=10.1177%2f00081256231218469&partnerID=40&md5=28461dd7f85004f8f4daf11036ebae23.

[8] H. C. L. And and K. E. Hou. "Player Attachment to Mobile Social Network Games: An Information Processing View". In: *IEEE Access* 9 (2021), pp. 13031–13038. issn: 2169-3536. doi: 10.1109/ACCESS.2021.3051191. url: https://ieeexplore.ieee.org/ielx7/6287639/9312710/09320469.pdf?tp=&arnumber=9320469&isnumber=9312710&ref=.

[9] N. S. Jayawardena et al. "Effective Online Engagement Strategies Through Gamification: A Systematic Literature Review and a Future Research Agenda". In: *Journal of Global Information Management* 30.5 (2022). Export Date: 19 December 2024; Cited By: 40. doi: 10.4018/JGIM.290370. url: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85120618509&doi=10.4018%2fJGIM.290370&partnerID=40&md5=177cc54d1639202e2e2cafd8beba5b22.

[10] J. Costa et al. "Principles for engineering social interaction in asynchronous mobile games: Featuring idle-ability". In: *International Journal of Gaming and Computer-Mediated Simulations* 13.3 (2021). Export Date: 20 December 2024; Cited By: 0. doi: 10.4018/IJGCMS.290306. url: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85118310553&doi=10.4018%2fIJGCMS.290306&partnerID=40&md5=d1915b51f9c44c0d1c85b6c5d96ec374.

[11] A. Kerim and B. Genc. "Mobile Games Success and Failure: Mining the Hidden Factors". In: *2020 7th International Conference on Soft Computing and Machine Intelligence, ISCMI 2020*. Export Date: 20 December 2024; Cited By: 0. 2020, pp. 167–171. doi: 10.1109/ISCMI51676.2020.9311587. url: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85100333659&doi=10.1109%2fISCMI51676.2020.9311587&partnerID=40&md5=79d9f2cffe5e116b1562989c2a7e9f16%20https://ieeexplore.ieee.org/document/9311587/.

[12] P. Bitrián, I. Buil, and S. Catalán. "Gamification in sport apps: the determinants of users' motivation". In: *European Journal of Management and Business Economics* 29.3 (2020). Export Date: 19 December 2024; Cited By: 40, pp. 365–381. doi: 10.1108/EJMBE-09-2019-0163. url: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85089682107&doi=10.1108%2fEJMBE-09-2019-0163&partnerID=40&md5=55e87101db262f80adcac9a6e1eb64b5%20https://www.emerald.com/insight/content/doi/10.1108/ejmbe-09-2019-0163/full/pdf?title=gamification-in-sport-apps-the-determinants-of-users-motivation.

[13] D. Garaialde, A. L. Cox, and B. R. Cowan. "Designing gamified rewards to encourage repeated app selection: Effect of reward placement". In: *International Journal of Human Computer Studies* 153 (2021). Export Date: 19 December 2024; Cited By: 11. doi: 10.1016/j.ijhcs.2021.102661. url: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85111049909&doi=10.1016%2fj.ijhcs.2021.102661&partnerID=40&md5=54c13a935a7739a2be5bd051cd9750f8%20https://www.sciencedirect.com/science/article/pii/S1071581921000793?via%3Dihub.

[14] S. Habachi, J. Matute, and R. Palau-Saumell. "Gamify, engage, build loyalty: exploring the benefits of gameful experience for branded sports apps". In: *Journal of Product and Brand Management* 33.1 (2024). Export Date: 19 December 2024; Cited By: 10, pp. 57–75. doi: 10.1108/JPBM-07-2022-4070. url: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85174832533&doi=10.1108%2fJPBM-07-2022-4070&partnerID=40&md5=b1949b130c37ad658229950ac04c9954%20https://www.emerald.com/insight/content/doi/10.1108/jpbm-07-2022-4070/full/pdf?title=gamify-engage-build-loyalty-exploring-the-benefits-of-gameful-experience-for-branded-sports-apps.

[15] M. A. Merhabi, P. Petridis, and R. Khusainova. "Gamification for brand value co-creation: A systematic literature review". In: *Information (Switzerland)* 12.9 (2021). Export Date: 19 December 2024; Cited By: 26. doi: 10.3390/info12090345. url: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85114208166&doi=10.3390%2finfo12090345&partnerID=40&md5=b08dc04d430c1dd5f16cc5a14d6c1ea6%20https://mdpi-res.com/d_attachment/information/information-12-00345/article_deploy/information-12-00345.pdf?version=1629975843.

[16] L. Moldon, M. Strohmaier, and J. Wachs. "How gamification affects software developers: Cautionary evidence from a natural experiment on github". In: *Proceedings – International Conference on Software Engineering*. Export Date: 19 December 2024; Cited By: 27. 2021, pp. 549–561. doi: 10.1109/ICSE43902.2021.00058. url: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85108717464&doi=10.1109%2fICSE43902.2021.00058&partnerID=40&md5=89008db0d1c0c5acf2a2b511c090f445%20https://ieeexplore.ieee.org/document/9402097/.

[17] ESPN, Inc. *ESPN.com – Official website of ESPN*. https://www.espn.com/. Accessed: 2025-05-01. 2025.

[18] CBS Sports. *CBS Sports – News, live scores, fantasy games, and betting*. https://www.cbssports.com/. Accessed: 2025-05-01. 2025.
[19] The Sporting News. *Sporting News – Sports news, scores, commentary, and videos*. https://www.sportingnews.com/. Accessed: 2025-05-01. 2025.
[20] Goal.com. *Goal – World football news, live scores and player awards*. https://www.goal.com/. Accessed: 2025-05-01. 2025.
[21] A Bola. *A Bola – Portuguese sports news and live coverage*. https://www.abola.pt/. Accessed: 2025-05-01. 2025.
[22] Transfermarkt GmbH. *Transfermarkt – Football transfers, market values, and mobile app*. https://www.transfermarkt.pt/. Accessed: 2025-05-01. 2025.
[23] Institute of Electrical and Electronics Engineers. *IEEE Xplore Digital Library*. https://ieeexplore.ieee.org.
[24] Elsevier. *Scopus*. https://www.scopus.com.
[25] Association for Computing Machinery. *ACM Digital Library*. https://dl.acm.org.
[26] Clarivate. *EndNote*. https://endnote.com. Reference management software, version 2024. 2024.
[27] Unity Technologies. *Unity Real-Time Development Platform*. https://unity.com/.
[28] Microsoft. *What's New in .NET9*. https://learn.microsoft.com/en-us/dotnet/core/whats-new/dotnet-9/overview. 2025.
[29] Microsoft .NET Foundation. *Entity Framework Core: Cross-platform ORM framework*. https://docs.microsoft.com/ef/core. Latest version supports LINQ, change tracking, migrations;
[30] D. Richard Hipp. *SQLite: Self-Contained, Serverless SQL Database Engine*. https://www.sqlite.org.
[31] Inc. Figma. *Figma: Collaborative Interface Design Tool*. https://www.figma.com.
[32] Contabo. *Contabo VPS provider overview*. https://www.contabo.com. NVMe storage, high-performance VPS.
[33] Igor Sysoev / F5. *Nginx open-source web server*. https://nginx.org. High-performance HTTP and reverse proxy server, 2025.
[34] Microsoft. *ASP.NET Core web development framework*. https://dotnet.microsoft.com. Modern, cross-platform, open-source framework, 2025.
[35] Indian Type Foundry. *Poppins: Geometric Sans-Serif Typeface*. https://fonts.google.com/specimen/Poppins. Designed by Jonny Pinhorn and Ninad Kale; SIL Open Font License 1.1; 2014.
[36] Icons8. *Icons8 Plugin for Figma*. https://icons8.com. Accessed: 2025-02-01. 2024.
[37] Google LLC. *Google Play Store*. https://play.google.com/. Used to distribute the Android version of the prototype. 2025.
[38] Apple Inc. *TestFlight*. https://developer.apple.com/testflight/. Used to distribute the iOS version of the prototype for testing. 2025.
[39] *Snowball sampling*. https://en.wikipedia.org/wiki/Snowball_sampling. Accessed: 2025-05-01. 2025.
[40] Unity Technologies. *Unity Analytics*. https://unity.com/products/unity-analytics. Used to collect quantitative behavioral data from users during the evaluation. 2025.
[41] Google LLC. *Google Forms*. https://www.google.com/forms/about/. Used to create and manage the in-game questionnaires. 2025.
[42] Wikipedia contributors, Pritha Bhandari, and Kassiani Nikolopoulou. *Likert Scale*. https://en.wikipedia.org/wiki/Likert_scale. Accessed: 2025-05-01; definition refined by Scribbr and Britannica. 2025.

[43] Will T. “Measuring and interpreting System Usability Scale (SUS)”. In: Accessed: 2025-05-01. url: https://uiuxtrend.com/measuring-system-usability-scale-sus/.

Appendix A

Form 1 (PT)

A.1 Title

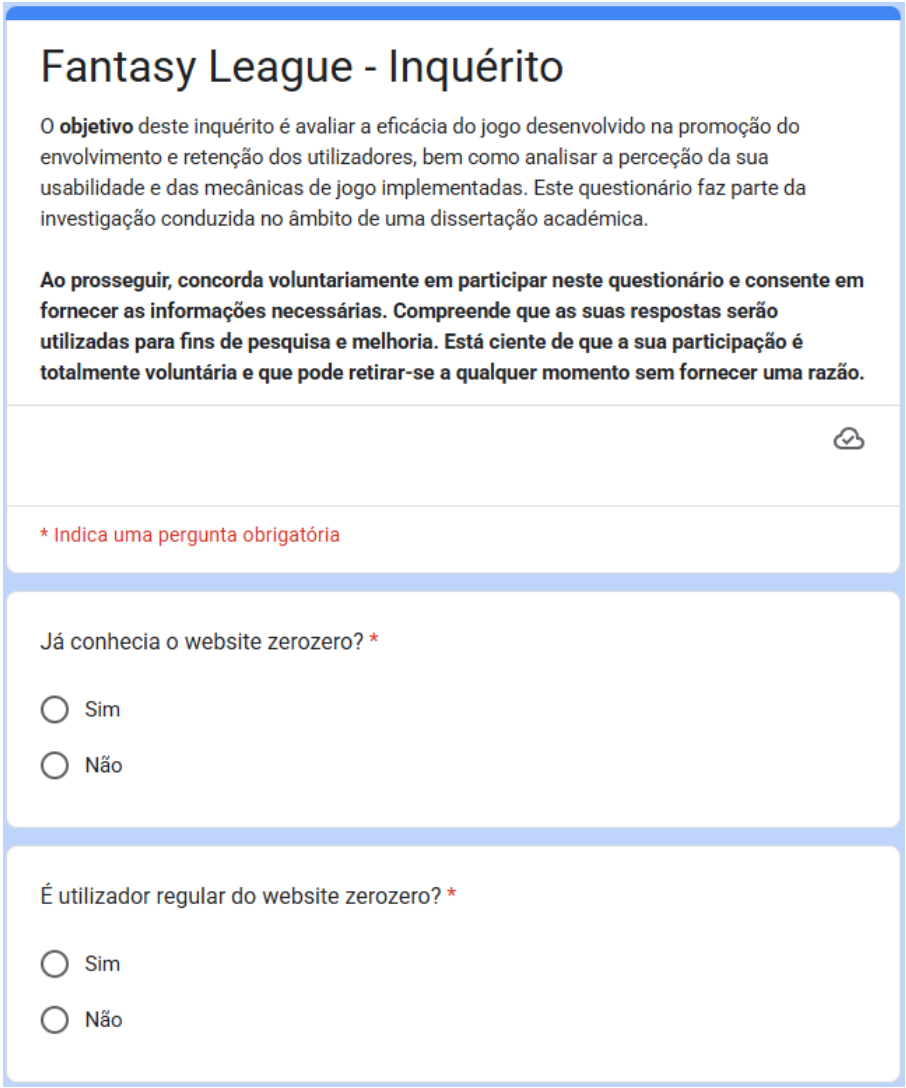


Figure A.1: Form 1 – Title.

A.2 Feature Usage

2 - Fantasy League - Familiarização com o Jogo

Nesta secção são descritas as funcionalidades do jogo.

Por favor indique com quais funcionalidades interagiu: *

	Interagi	Não interagi
F1 - Criar uma liga	◯	◯
F2 - Entrar em uma liga através do navegador de ligas	◯	◯
F3 - Verificar as equipas na minha liga	◯	◯
F4 - Ver o horário dos jogos na minha liga	◯	◯
F5 - Jogar um jogo na liga	◯	◯
F6 - Jogar um jogo de treino	◯	◯
F7 - Desbloquear novos jogadores (pós tutorial)	◯	◯
F8 - Editar formação (pós tutorial)	◯	◯
F9 - Jogar um jogo na aba Daily Challenges	◯	◯
F10 - Ver horário dos Daily Challenges (website)	◯	◯
F11 - Ver informação de uma equipa dos Dailly Challenges (website)	◯	◯
F12 - Ver informação de um jogador na coleção (website)	◯	◯

Figure A.2: Form 1 – Feature usage questions.

A.3 Complementary Product

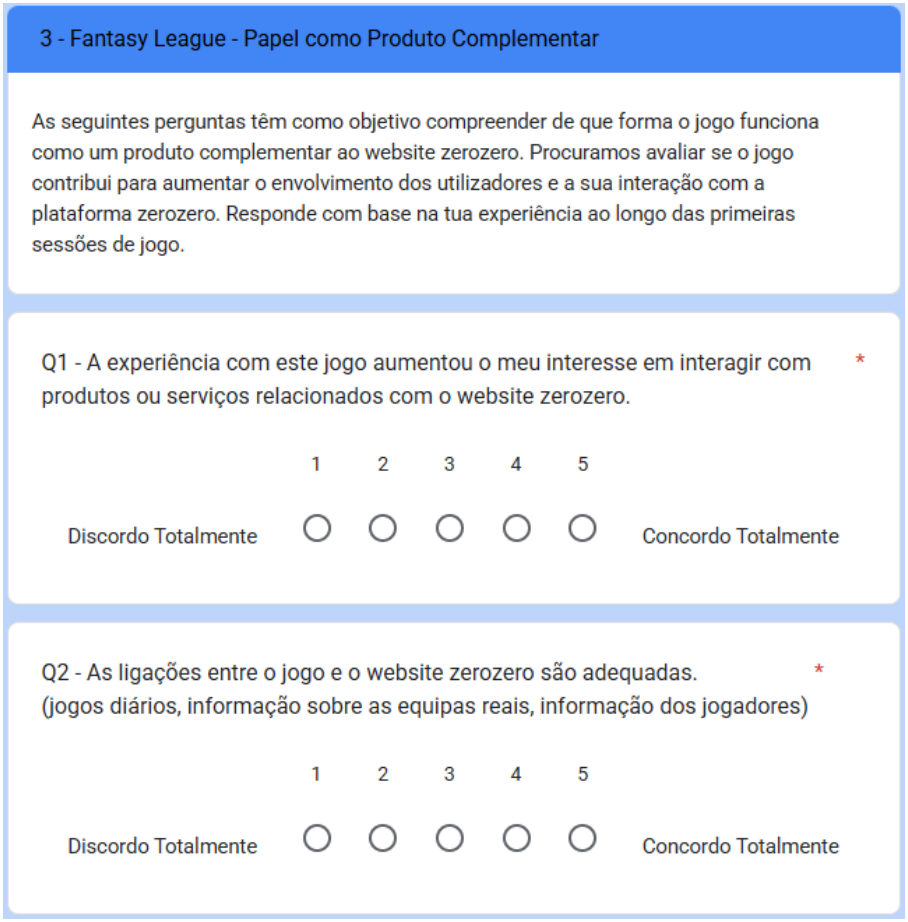


Figure A.3: Form 1 – Complementary product questions.

A.4 Engagement and Retention

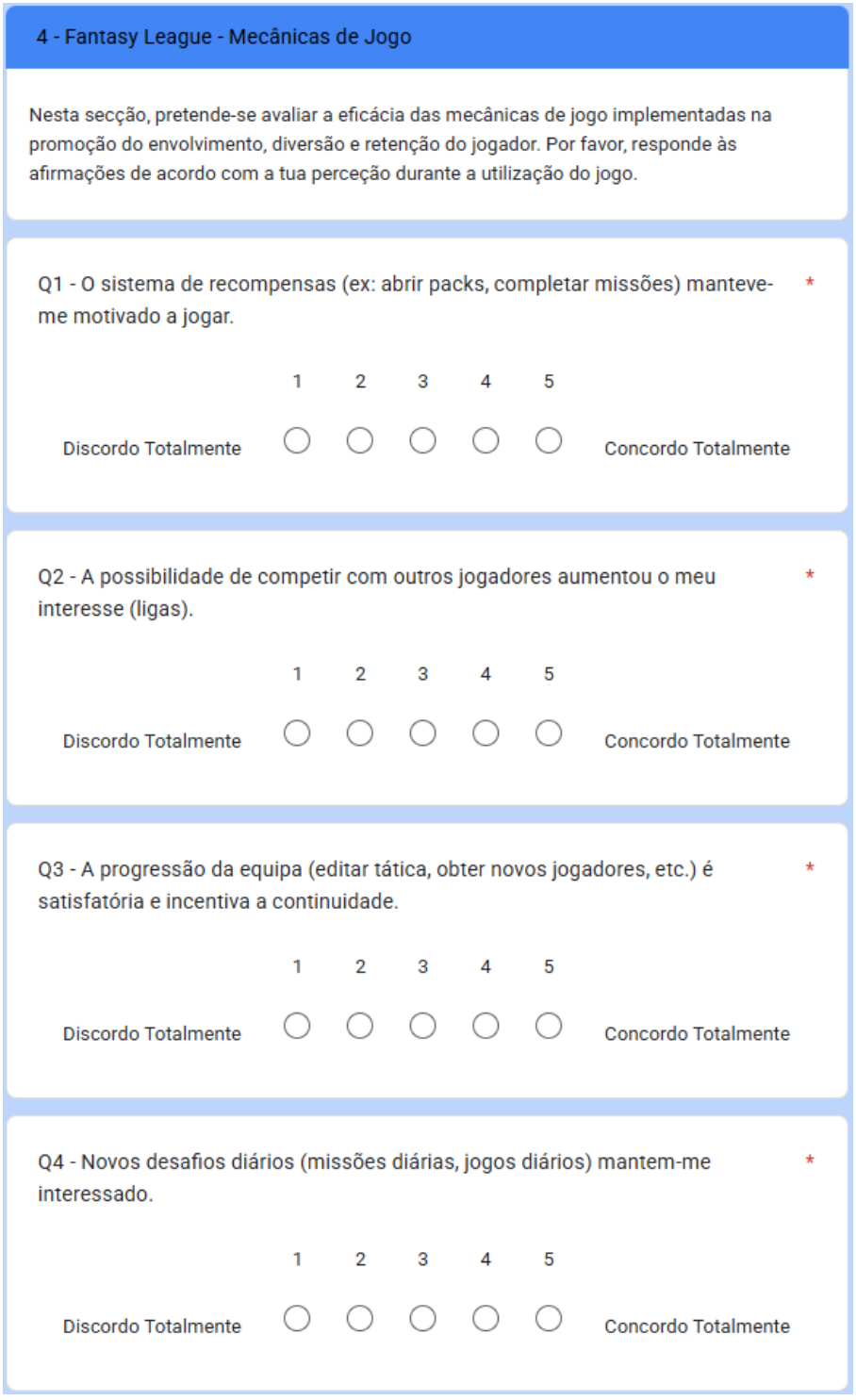
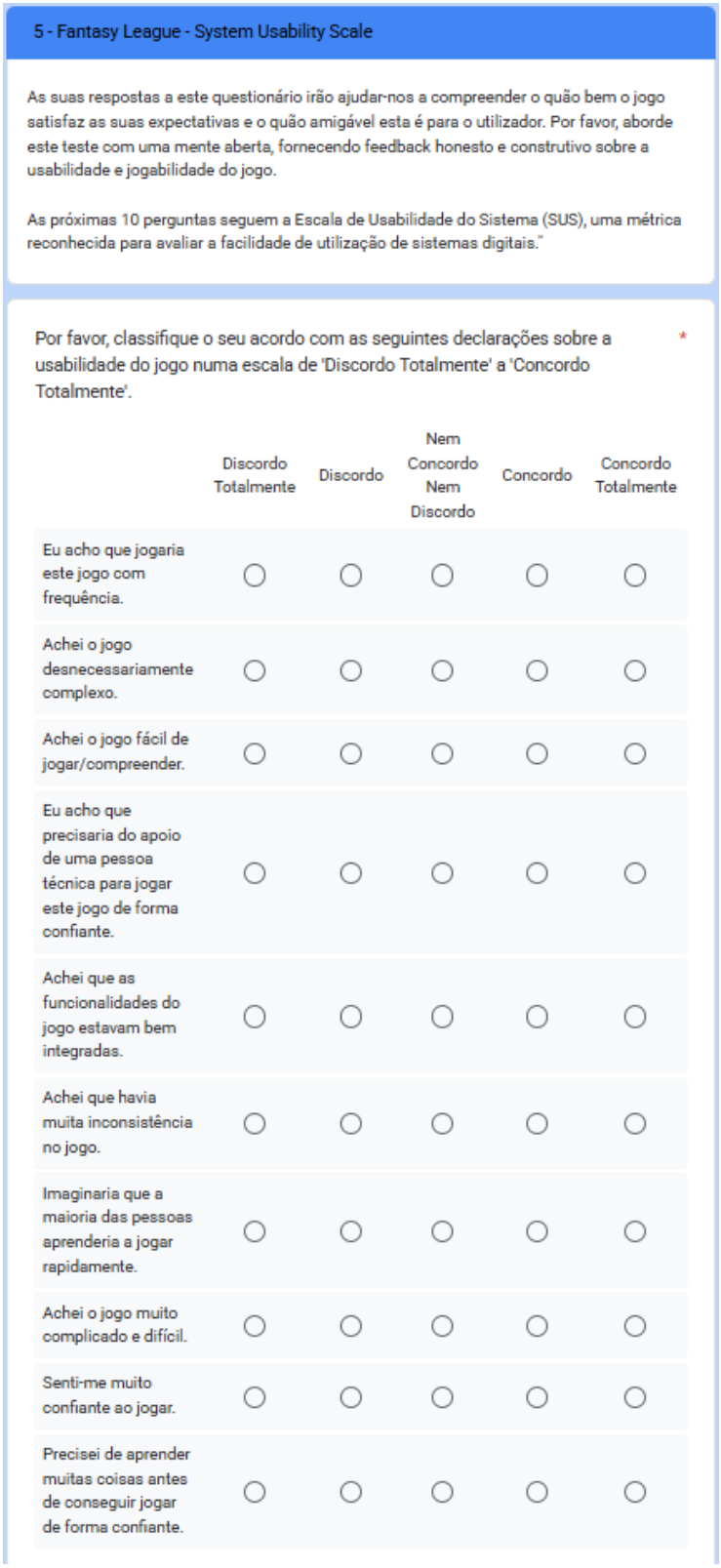


Figure A.4: Form 1 – Engagement and retention questions.

A.5 System Usability Scale



5 - Fantasy League - System Usability Scale

As suas respostas a este questionário irão ajudar-nos a compreender o quão bem o jogo satisfaz as suas expectativas e o quão amigável esta é para o utilizador. Por favor, aborde este teste com uma mente aberta, fornecendo feedback honesto e construtivo sobre a usabilidade e jogabilidade do jogo.

As próximas 10 perguntas seguem a Escala de Usabilidade do Sistema (SUS), uma métrica reconhecida para avaliar a facilidade de utilização de sistemas digitais."

Por favor, classifique o seu acordo com as seguintes declarações sobre a usabilidade do jogo numa escala de 'Discordo Totalmente' a 'Concordo Totalmente'. *

	Discordo Totalmente	Discordo	Nem Concordo Nem Discordo	Concordo	Concordo Totalmente
Eu acho que jogaria este jogo com frequência.	○	○	○	○	○
Achei o jogo desnecessariamente complexo.	○	○	○	○	○
Achei o jogo fácil de jogar/compreender.	○	○	○	○	○
Eu acho que precisaria do apoio de uma pessoa técnica para jogar este jogo de forma confiante.	○	○	○	○	○
Achei que as funcionalidades do jogo estavam bem integradas.	○	○	○	○	○
Achei que havia muita inconsistência no jogo.	○	○	○	○	○
Imaginaria que a maioria das pessoas aprenderia a jogar rapidamente.	○	○	○	○	○
Achei o jogo muito complicado e difícil.	○	○	○	○	○
Senti-me muito confiante ao jogar.	○	○	○	○	○
Precisei de aprender muitas coisas antes de conseguir jogar de forma confiante.	○	○	○	○	○

Figure A.5: Form 1 – System usability scale questions.

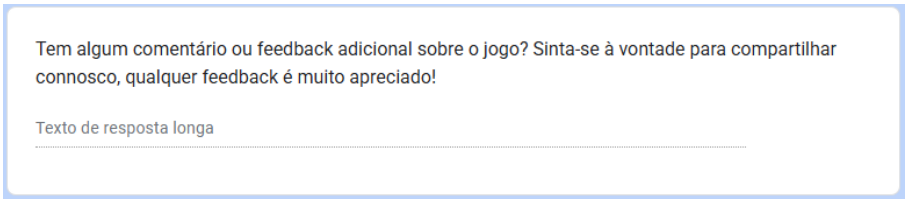


Figure A.6: Form 1 – Open-ended question.

Appendix B

Form 2 (PT)

B.1 Title

Figure B.1: Form 2 – Title.

B.2 Feature Usage and Review

2- Fantasy League - Familiarização com o Jogo

Nesta secção são descritas as funcionalidades do jogo.

Por favor indique a sua opinião relativa ás seguintes funcionalidades: *

	Gostei	Neutro	Não Gostei	Não Utilizei
F1 - Criar uma liga	○	○	○	○
F2 - Entrar em uma liga através do navegador de ligas	○	○	○	○
F3 - Verificar as equipas na minha liga	○	○	○	○
F4 - Ver o horário dos jogos na minha liga	○	○	○	○
F5 - Jogar um jogo na liga	○	○	○	○
F6 - Jogar um jogo de treino	○	○	○	○
F7 - Desbloquear novos jogadores (pós tutorial)	○	○	○	○
F8 - Editar formação (pós tutorial)	○	○	○	○
F9 - Jogar um jogo na aba Daily Challenges	○	○	○	○
F10 - Ver horário dos Daily Challenges (website)	○	○	○	○
F11 - Ver informação de uma equipa dos Dailly Challenges (website)	○	○	○	○
F12 - Ver informação de um jogador na coleção (website)	○	○	○	○

Figure B.2: Form 2 – Feature usage and review questions.

B.3 Retention Mechanics

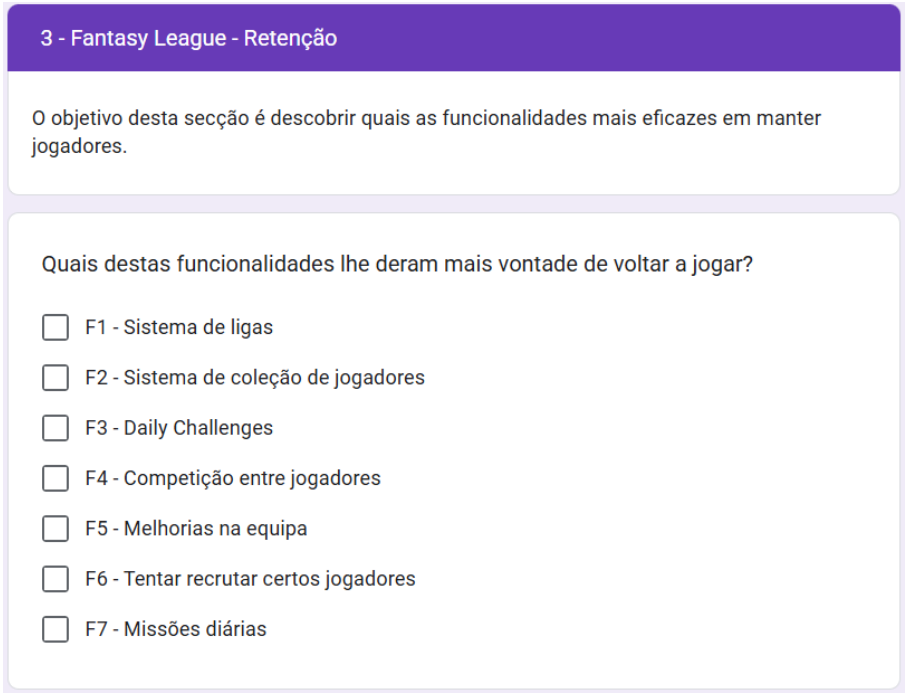


Figure B.3: Form 2 – Retention mechanics questions.

B.4 Platform Interaction

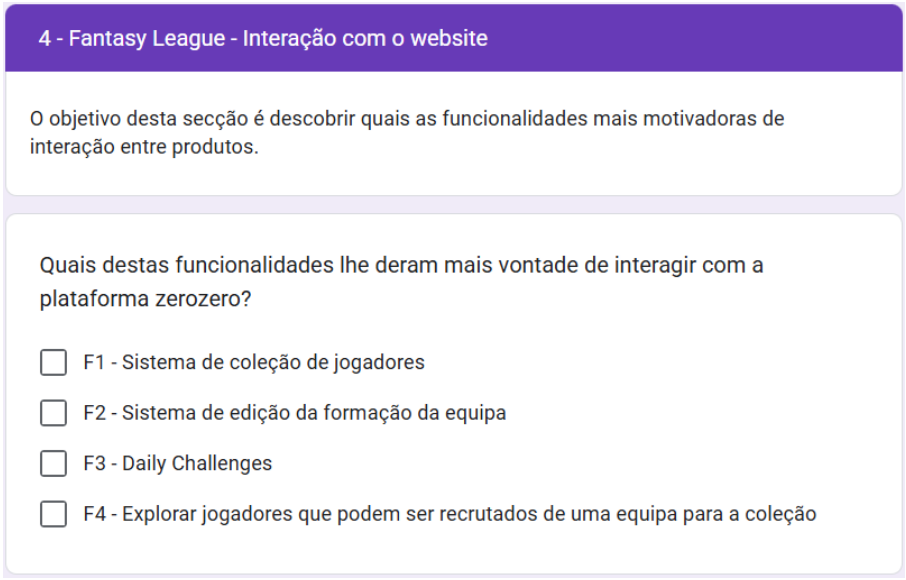


Figure B.4: Form 2 – Platform interactions questions.

Appendix C

Supplementary Graphs

C.1 Form 1 – Engagement and Retention Answers

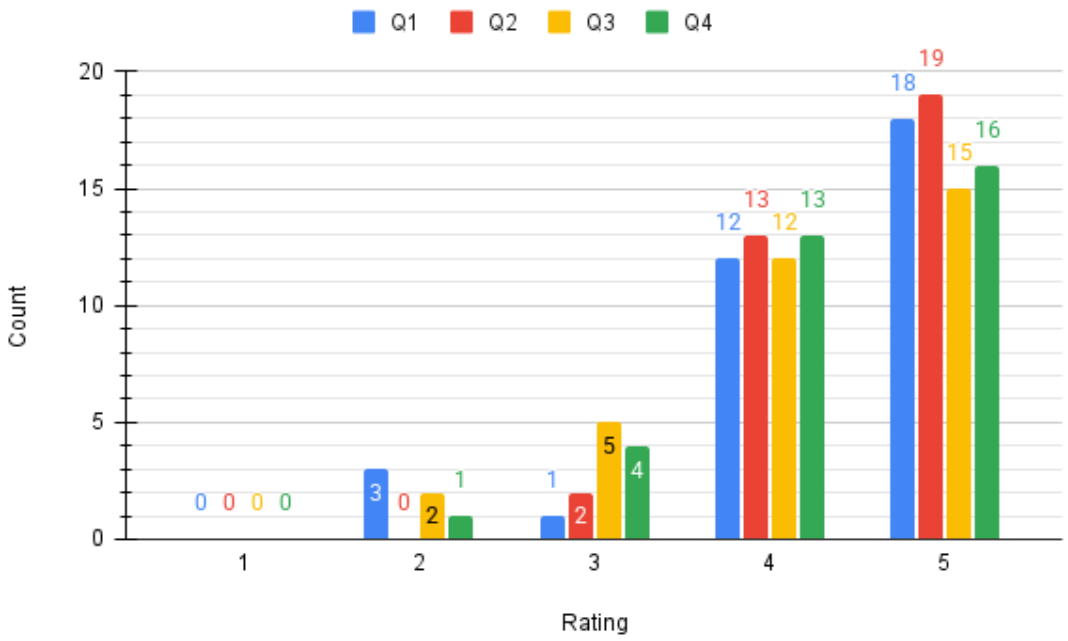


Figure C.1: User rating per question – Form 1, engagement and retention.

C.2 Form 1 – Complementary Product Answers

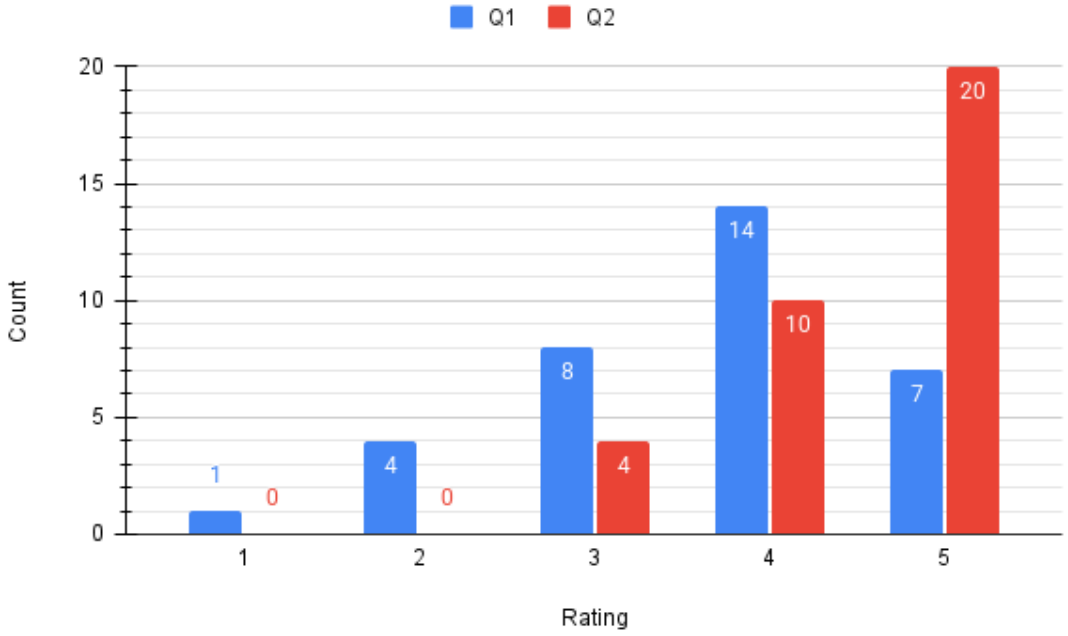


Figure C.2: User rating per question – Form 1, complementary product.