T.C.

BAHCESEHIR UNIVERSITY

GRADUATE SCHOOL OF SOCIAL SCIENCES

THE DEPARTMENT OF GAME DESIGN

THE CORRELATION BETWEEN MULTIPLAYER GAMING AND IN-APP PURCHASING THROUGH A MOBILE TRIVIA GAME: FLAGS 2

MASTER'S THESIS

YAVUZ SÜLEYMAN KİREZ

İSTANBUL 2024

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THESIS ADVISOR
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ABSTRACT

THE CORRELATION BETWEEN MULTIPLAYER GAMING AND IN-APP PURCHASING THROUGH A MOBILE TRIVIA GAME: FLAGS 2

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Game Design Master's Program

Thesis Advisor: Dr. Çakır Aker

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This study aims to find the correlation between in-app purchasing behavior and multiplayer gaming through a mobile trivia game which includes both single-player and multiplayer modes. The study uses a mixed methodology with its game analytics data and user experience survey data through the lens of self-determination theory. In this study, we found that the players who are in the purchaser segment are more engaged with multiplayer gaming. We explained our findings with self-determination theory and observed that relatedness term of self-determination theory is more related to the players who are playing multiplayer mode of the game and making in-app purchases.

Keywords: Multiplayer, In-app Purchasing, Player Engagement, Mobile Games, Self-Determination Theory

ÖZ

ÇOK OYUNCULU OYNAMA VE SATIN ALMA ARASINDAKİ İLİŞKİNİN MOBİL BİLGİ YARIŞMASI OYUN BAYRAKLAR 2 ÜZERİNDEN İNCELENMESİ

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Bu çalışma, hem tek oyunculu hem de çok oyunculu modları içeren bir mobil trivia oyunu aracılığıyla uygulama içi satın alma davranışı ile çok oyunculu oyun oynama arasındaki ilişkiyi bulmayı amaçlamaktadır. Çalışma, oyun analitiği verisi ve öz belirleme kuramı merceğinden yapılan bir kullanıcı deneyimi anketi verisi ile karma bir metodoloji kullanmaktadır. Bu çalışmada, satın alma segmentindeki oyuncuların çok oyunculu oyunlara daha fazla ilgi duyduğunu tespit ettik. Bulgularımızı öz belirleme kuramı ile açıkladık, kuramın ilişkili olma kavramının çok oyunculu modu oynayan ve aynı zamanda satın alma yapan oyuncularla daha fazla ilişkili olduğunu gözlemledik.

Anahtar Kelimeler: Multiplayer, Uygulama İçi Satın Alma, Kullanıcı Etkileşimi, Mobil Oyunlar, Öz Belirleme Kuramı

To My Neşe and Bilge

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First of all, I would like to thank my wife Neşe and my daughter Bilge for their devoted support. I would also like to thank Asst. Prof. Çakır Aker for guiding and encouraging me in my work.

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Chapter 1
Introduction

In the study, we aimed to explain the correlation between players making in-app purchases and their multiplayer engagement through a mobile trivia game that includes both single-player and multiplayer modes. While investigating this correlation we aimed to focus on why this correlation is more common in the multiplayer mode compared to the single-player mode, through the lens of self-determination theory. To achieve this, a series of studies were conducted. Firstly, a year-long data collection process was completed to obtain player engagement in numbers from real players of the game. Secondly, the Player Experience of Needs Satisfaction (PENS) model was implemented with participants. Then the results were compared and discussed in the light of past studies about the digital gaming approach in terms of self-determination theory.

1.1 Scope

The rapid progress in technology has played a crucial role in the increased accessibility of computers and telecommunications devices. Despite the increase in processing power and storage capacities of mobile devices such as smartphones, tablets, and laptops, the reduction in their physical sizes diminishes the dominance of desktop computers (Coetzee & Eksteen, 2011).The rise of mobile devices can also be viewed through industrial reports. As of 2013, the number of smartphone users was approximately 2.6 billion, and by 2023, this number has reached 4.6 billion while it is projected to further increase to 5.1 billion by the year 2028 (Statista, 2023).

When we observe the increase in the number of games available on two largest app stores, Google Play and the App Store, we can witness significant growth in the game supply over the years. The number of games on the App Store was approximately 49,000 in 2009, and by 2023, it had reached 472,000. On Google Play, the number of games was 20,000 in 2010, and by 2023, it had grown to 415,000 (Business of Apps, 2023).

This quantitative growth in the mobile gaming market, combined with qualitative improvements in mobile games and developments in revenue models, led to a significant increase in consumer spending on mobile games. While mobile

gaming, PC/Mac gaming and console gaming had similar market shares in terms of consumer spending in 2014, the market share of mobile gaming is projected to reach 56% with a total of 108 billion dollars by the end of 2023 (Data Ai, 2023).

The number of developers and publishers has also increased in the mobile game ecosystem, which is growing in terms of both player population and financial value. As there are many game options for players, the importance of keeping the player engaged with the game has increased in order for a developed game to gain financial value. For these reasons, developers and publishers started to give more importance to measurement in order to survive or make more profit. Accordingly, a terminology with metrics specific to mobile games was derived (Udonis, 2023) in this growth process from the basic game analytics terminology (Fields, 2013). These metrics are about player acquisition numbers as well as retaining existing players and generating indirect (ads) or direct (in-app purchases) revenue through them.

In a free to play mobile game the player engagement is directly related to the financial success of the game. Because, if a player has a longer play time than the average, his/her possibility of making an in-app purchase is higher and players who make purchases tend to spend much more time in the game and purchase more (Jiao, Tang, & Wang, 2022). For this reason, free to play mobile game developers and publishers need to consider these two concepts (player engagement and in-app purchase) together.

One of the main components of our study is the “multiplayer” concept. A study conducted with Australian participants also shows that users who play multiplayer are more likely to be in the purchaser segment (Zubaydi & Gide, 2019). The most important difference between the study and ours is that the surveyed users were analyzed with their actions in different games, not in the same game. The biggest similarity of the study with our study is that the study examines the engagement and spending behaviors of people who play single-player and multiplayer, specifically in mobile games.

No study could be found in the literature that directly addresses the correlation of multiplayer and in-app purchasing in mobile games from the perspective of self-determination theory. However, there are studies that can be used to explain the relationships that are the subject of this study. One of the main reference studies (Ryan,

Rigby, & Przybylski, 2006) is a general approach to understand the players' gaming motivation through the lens of self-determination theory. The study conducts four different studies on participants and examines their satisfaction of their autonomy, relatedness and competence needs separately in terms of both single-player and multiplayer. Another reference (Uysal & Yildirim, 2016) is used while explaining the self-determination theory approach to the games and constructing the terminology of our study. The study focuses on explaining how user experience in games is improved by the satisfaction of basic psychological needs. In a laboratory experiment of Reer and Krämer (2020), first-person shooter (FPS) players' enjoyment is observed and conducted through self-determination theory. They found that being related to other players has a positive impact on players' well-being and enjoyment by satisfying players' psychological needs.

1.2 Problem Statement

Self-determination theory explained player behavior in digital games with different studies, as well as explaining different topics in other disciplines. In the literature research, we see that player behavior in multiplayer/social games or the motivation to buy virtual products in games is also explained by this theory. However, no study was found that investigated the purchasers' multiplayer gaming in a mobile game that offered both single-player and multiplayer modes, and explained these results with self-determination theory. The problem addressed by this study is to explain the correlation between the player engagement in multiplayer and the in-app purchasing behavior through self-determination theory.

1.3 Objectives

We aim to find results that there is a connection between in-app purchasing and multiplayer gaming with a mixed methodology. Before applying our methods, extensive literature research is required. Because, in addition to studies on self-determination theory within the gaming context, there are also studies on multiplayer and in-app purchasing that are dependent or independent on psychological theories.

After making a detailed literature review, we will collect data and measure the engagement rates for single-player and multiplayer modes in a game with the segment breakdown of purchasers and non-buyers.

We will investigate the in-app purchasing and multiplayer game mode correlation from the results by comparing the results with other derivations like single-player and non-buyer behaviors.

A questionnaire with 27 participants will be examined in order to investigate the game from the perspective of self-determination theory.

Using the terms of self-determination theory through a survey with 27 participants and the data collected in one year from 1,193,683 players in total, between October 1, 2022 to September 30, 2023, we will reveal our findings on the positive correlation between multiplayer concept and purchasers.

1.4 Research Questions

We aim to answer the questions below after completing our study:

- If multiplayer playing frequency per purchaser is more than either single-player playing frequency per purchaser or multiplayer playing frequency per non-buyer, can we explain the result with the items of self-determination theory?
- Is purchase status more relevant to multiplayer engagement than to single-player engagement?

1.5 Research Hypotheses

Multiplayer players are more engaged than the single-player mode players. Because, while they have the similar quiz game experience with the single-player mode, their need for relatedness is also satisfied by connecting with other players.

If a mobile game player makes an in-app purchase including visual items to display others, the player is more likely to engage with the multiplayer mode of the game which serves both single-player and multiplayer modes.

The behaviors of this mobile game's players from the purchaser segment can be explained with the relatedness item of self-determination theory.

Chapter 2
Terminology, Definitions and Literature Review

2.1 Multiplayer Games

A multiplayer game is a game that is played by two or more people in the same session. Korhonen and Koivisto (2007) says that many people find multiplayer games more engaging and challenging compared to single-player ones. This is because interacting with other players adds an element of unpredictability and enjoyment that is usually not present when playing against artificial intelligence.

When multiplayer is mentioned, state-of-the-art digital games that entertain us by interacting with people from all over the world with all their visuals and audio may be thought of. *Tennis for Two* (1958) and *Spacewar!* (1962), which are also considered to be the first video games, are two of the first games developed in the player-versus-player model. *PONG* (1972) may be the first game to spread to a wide audience using this two-player game model (Joseph & Knuttila, 2013). However, these games did not use the Internet or even a local area network.

Multi-User Dungeons (MUDs) are text-based multiplayer online games. They are the earliest forms of virtual worlds and online communities. In the late 1970s and early 1980s, they were developed by computer enthusiasts and gamers (King & Borland, 2014). MUDs shaped the landscape of online gaming and are considered to be the predecessors of modern massively multiplayer online role-playing games (MMORPGs) (Lin & Sun, 2015).

With the widespread use of PCs and the global expansion of the internet, the concept of multiplayer gaming has evolved from being a hobby for a few enthusiasts to becoming a global phenomenon including various game genres such as MMORPG, FPS, RTS, and more. The invention of smartphones, along with continuous improvements in processor speed, increased storage capacity, rising internet connection speeds, and expanded coverage areas, has led to the mobile spread of the multiplayer concept across the world.

2.2 Mobile Games

Mäyrä (2015) discusses mobile games, starting from long before the first handheld electronic games emerged in the late 1970s. The study, referring (Joannou,

2007), reminds that there is evidence, citing that even in ancient times, Roman Emperor Claudius (10 BCE – 54 CE) carried dice and board games while traveling. This highlights the idea that playing games on the go is very ancient. The study (Mäyrä, 2015) explains that when looking at mobile games concept, it's essential to consider not only those on mobile phones but also on laptops and video consoles, addressing them separately. However, ultimately, the same study which is also titled as "Mobile Games" states that it discusses games created specifically for mobile phones. The term “mobile game” used in our study also refers to games made for mobile smartphones and tablets, which are downloaded and played from stores like the *App Store* and *Google Play*, aligning with common use of the term.

2.3 Mobile Trivia Games

Mobile trivia games are games where players have to answer every given question correctly as a condition for winning or advancing, just like in classic trivia games. Single-player mobile trivia games generally rely on taking a certain amount of time to answer and having a limited chance of being wrong. In multiplayer mobile trivia games, there may be a requirement to answer within a certain period of time, but there are also systems where the first correct answer gains an advantage or victory. Multiplayer trivia games can be simultaneous or turn based like the game *Trivia Crack*. When we look at the games in the mobile trivia genre of the stores, in addition to the multiple-choice quiz formatted games, there are also games based on core mechanics where the player writes the correct answer as text or matches objects.

2.4 Player Engagement

Player engagement term is used to describe how much a player is involved and interested while playing a game. Engaged players find the game interesting, and have the motivation to continue playing (Brown & Cairns, 2004). Engagement is not just about making the player start the game, the engagement must be sustainable to make the player continue (Schoenau-Fog, 2011). Exciting gameplay, challenges, and social interactions in the game can make players more engaged.

Mobile games are usually designed for shorter, on-the-go play sessions. They are often simpler and may focus on quick entertainment. PC/console games are often more complex, with longer gameplay sessions, providing a more immersive

experience. Player engagement in mobile games is often quick and casual, while in PC/console games, it tends to be more involved and sustained.

2.5 Mobile Game Revenue Models

Free to Play (F2P) mobile games can be installed freely from app stores (Hahl, 2014). F2P mobile games generally include two monetization models. These are direct and indirect monetization models. Direct monetization means that there are purchasable virtual items or features in the game. In this monetization model the player directly pays the money to the mobile app store and after the store's cut of commission the remaining amount is paid to the developer/publisher (Alomari, Soomro, & Shaalan, 2016). Indirect monetization means that the players see advertisements in the game and the developer/publisher is paid for showing ads by ad networks.

A Pay to Play (P2P) or Premium mobile game can be installed from a mobile app store for a certain price. This is an initial cost for the player. However, in-app paid products and ads may still be placed in the game.

Freemium revenue model is defined as a combination of F2P and P2P models (Alomari et al., 2016). However, this concept is generally used to mean F2P games (Kati, Elina, Janne, Juho, & Jani, 2014). In other words, F2P is a more generalized form of use for free models. *Jan Wedekind* explains the difference between Freemium and F2P based on whether the game's free version includes the important features for playing the game (Henderson, 2013). According to his statement, this game is not Freemium since it is not necessary to pay to play the levels of *Candy Crush*, but it is a F2P game.

It is necessary to explain mobile game advertisements in order to understand the indirect revenue model in more detail. Advertisements shown in mobile games are ads that help the developer or publisher to get indirect revenue. The developer makes an agreement with an ad network ("Google AdSense - Terms and Conditions," n.d.). The ad network's ads are integrated into the developer's app to be displayed in a specific placement at a specific stage of the game. These advertisements are created by advertisers to market and sell various products and services. They are shown to end users by the advertising network and the advertiser makes a payment to the advertising network for each impression. The developer gets revenue as these ads are displayed in

the developer's app through the advertising network. Earning per impression for the developer varies depending on the value of the player who views the ad in the advertising network's algorithm. This value is determined by the advertising network according to the country the player is located in, the language he/she uses, and his/her behaviors in other apps and games. The developer who owns the app usually does not know the value of the user. In fact, due to privacy policies ("ironSource Mobile Ltd. Privacy Policy - IronSource Knowledge Center," n.d.) that have become more prominent in recent years, even networks have started to estimate the value of users in general with certain algorithms and artificial intelligence tools, instead of tracking users one-on-one.

Advertisements shown in applications and games are of three types, with various sub-variations. These are banner ads, interstitials and rewarded ads.

Banner ad placement stays constantly on a certain part of a certain screen of the mobile application, without covering the entire screen. In this area, suitable advertisements for the player are displayed according to the advertising network's criteria.

Interstitial ads are shown to the player in full screen, such as before or after a certain action of the player. The certain action may sometimes be such as finishing a level, or sometimes just changing the screen. According to the ad network's policy, these ads can be dismissed by the player immediately or after a certain period of time.

Rewarded ads are ads that can be viewed optionally by the player. The mobile game promises the player a specific reward for watching a rewarded ad in a specific condition. If the player watches the ad, he/she wins the promised reward. This is sometimes a reward such as increasing the points or collectable amount earned from a certain level by 2 or 3 times, and sometimes opening a level or section that is locked by default in the game to the player. The way the reward is given, unless the player is misled, is relatively dependent on how the developer uses his or her creativity or best-case scenarios in game design and monetization (Google AdMob, n.d.).

Ad impressions are becoming more anonymous day by day due to the reactions of states, regional governments such as the EU with GDPR (Ducato, 2020), consumer associations, activists and end users. The reason for these reactions is related to the

very detailed analysis of user behavior by advertising networks. Therefore, ad networks are trying to analyze user behavior and habits anonymously, without following the users personally, according to the new rules determined as a result of the pressures.

2.6 In-App Purchasing

If there is an option of purchasing some extra features, abilities, additional levels or any virtual items in the game, it means that the action of in-app purchasing is included in this game (Roma & Ragaglia, 2016). In-app purchasing can be placed in both F2P or P2P mobile games. In many games, removing ads is a paid feature. It is sold as an in-app product subject to in-app purchasing. The main revenue method for many commercially successful mobile games is in-app purchasing. Generally, players tend to make purchases not when they first install the game, but when they spend some time with the game and anticipate that they will want to play the game in the future (Jiao et al., 2022). This is related to the fact that the in-app purchasing action should be directly related to player engagement, as explained in our study.

Before the rise of hyper casual mobile games, in-app purchasing revenue model was usually consisting of consumables (like in-game currency) and in-game cosmetics (like avatars, themes) in mobile games. Hyper casual mobile games generally include frequent interstitial ads. Therefore, removing ads action was begun to be sold by developers as a feature. This in-app product type is not an invention of hyper casual developers but it is adopted to be the second traditional way of generating income after showing ads for hyper casual game developers. “Remove Ads” product of which a word phrase is a call-to-action at the same time, became a time saver for the players who do not hesitate to spend money instead of seeing tens or even hundreds of advertisements.

One of the common other revenue models is the subscription model which is used by both apps and games. This model incentivizes players to make payments weekly, monthly or yearly which in return provides certain privileges and advantages to players. Thus, the players do not have to pay more for an on-time purchase, compared to a weekly, monthly or yearly subscription fee which has a lower price. There are various free trials and introductory offers in the subscription model. This model is common among companies because the players keep paying despite not

playing the game continuously. Also, even though the players can cancel a subscription, they can easily start paying again after returning to the game. This subscription model which is used by online video streaming platforms, audiobook platforms, and music streaming platforms removes or reduces annoying distractions such as advertisements and time-consuming upgrades. Multiplayer games use this model and players feel privileged to have the advantages.

In-game cosmetics are a big part of in-app purchasing. Although cosmetics may not seem as important as consumables, they are a significant revenue model for different gaming categories. For example, MOBA, FPS and Battle Royale games on PC use this revenue model commonly via loot boxes and chests (Nguyen, 2022). Players can customize his/her character with these cosmetic items which vary with their color and design model. Mobile games also use this revenue model (Fennimore, 2020).

There are also mobile games which design a system where a player has to watch rewarded ads or pay to unlock a game mode or a section. In addition to that, there are so-called “pass systems” in which players make payments, one time or subscription based, to get rewards. The variety of payment systems created additional options to the publishers and stores and this condition caused new competition areas. Therefore, there have been disagreements between mobile application markets and mobile game companies/publishers about payment systems and revenue sharing (Ambrasaitė & Smagurauskaitė, 2021).

2.7 Self-determination Theory

Deci (1971) found the result that when people were rewarded with money their intrinsic motivation decreased and when people were responded with positive words their intrinsic motivation increased. Intrinsic motivation and human behavior relation is examined from a broad perspective and self-determination theory is conceptualized (Deci & Ryan, 1985). Self-determination theory examines human motivation, personality and behavior using traditional empirical methods, in relation to the development and regulation of personality and behaviors through human’s internal resources (Ryan, Kuhl, & Deci, 1997).

According to the self-determination theory, for well-being a person's autonomy, competence, and connection needs should be satisfied (Ryan & Deci, 2000).

Self-determination theory is a macro approach to human motivation and behavior, but it is a theory applied to other fields as well as in the field of video games. In this study, we examine the psychological needs of players in terms of player engagement and in-app purchasing. Bartle (2005) also defines people's desire to have fun as a reason for spending time in virtual worlds, and asks almost all the questions about "fun" in his study. Therefore, it can be said that the player's desire is not only to win an external motivational reward but also to have a self-satisfaction.

2.7.1 Autonomy. In self-determination theory, autonomy relates to a sense of will or willingness when performing a task (Deci & Ryan, 1980). People with intrinsic rather than extrinsic motivation have a higher sense of autonomy, so they can continue their work on their own without the need for any external incentives (Ryan et al., 1997).

If games can provide an understandable experience and detailed feedback to the user about what they have done, the user can complete the game without the need of external incentives. On the other hand, games that are difficult to understand and difficult to complete can weaken the players' autonomy and lower their continuity in the game. So, if the game design of the game is shaped to keep the player's sense of autonomy strong, the player's engagement with the game will be higher (Ryan et al., 2006).

2.7.2 Competence. Competence was defined as the interaction ability of an individual with its environment and associated with the motivation concept (White, 1959). Competence is about feeling sufficient to be successful in a process. A person with a high sense of competence tries harder on the path to success. This increases his chance of success. Compared to autonomy, competence is also an important factor for achieving self-determination theory. People with a high sense of competence have high internal motivation and internal satisfaction.

If a game is more understandable, the experience it offers to the player will be higher. In this way, the player becomes more involved in the game. To achieve this, the game design of the game must be done correctly. The player's intrinsic motivation

can always be kept active by correctly designing the on-boarding part of the game, the difficulties of the missions, and the achievements given after successes (Ryan et al., 2006).

If we consider hyper casual games, although they do not meet the game definition of (Caillois, 2001), the fact that they are intuitive in terms of the experience they offer and have a difficulty curve can be considered as the reason why engagement times are higher than expected.

2.7.3 Relatedness. Relatedness is the third important factor mentioned in self-determination theory. The basis of this concept is based on the social relations of people with other people and the communication they establish with each other (La Guardia, Ryan, Couchman, & Deci, 2000).

Motivation increases when a person establishes relationships with other people. Although this motivation can be encountered in the gaming world today with artificial intelligence and computer-made products, the multiplayer mode is the most important game mode on which we can focus on relatedness (Ryan et al., 2006).

A game that has a social environment, where you can interact with other people, can offer more than the intrinsic satisfaction that a single-player game can offer (Rigby & Ryan, 2011). We can also talk about this in relation to both the single-player and multiplayer modes of the same game. While the intrinsic motivation of players in the single-player mode of a game may be lower, the intrinsic motivation of multiplayer players may be higher.

2.8 Player Experience Needs of Satisfaction (PENS)

PENS was first used in a study to measure players' psychological needs based on SDT (Ryan et al., 2006). The aim of their study was to approach the players' relationship with the game not in terms of goals and behaviors, but in terms of motivation and psychology.

Before Ryan et al. (2006) made their study, cognitive evaluation theory (CET), one of the theories of SDT, had previously been used to examine the elements that support intrinsic motivation in different studies. This theory is based on the fact that situations related to human autonomy and competence needs are in correlation with the individual's intrinsic motivation. Before PENS was introduced in the gaming

context in the relevant study, CET had been used in more than a hundred studies (E. Deci, Koestner, & Ryan, 1999) for different fields like school and sport. Ryan et al. (2006) suggested in their study that autonomy and competence would also be valid in the context of games, PENS's autonomy and competence subscales were developed based on the CET.

Ryan & Rigby (2007) say that in the gaming field, observing and cataloging the players' behavior during engagement is not enough to understand the motivation of the players, what is really important is to understand the energy that creates the player's motivation to play. According to SDT, this energy is expressed most briefly with autonomy, competence and relatedness, and they state that they see PENS as a method that is easy to apply and gives instant results. They recommend developers use PENS for both experimental and commercial purposes. They explain that the experiments they conducted with thousands of players in their own game laboratories showed that the player experience and therefore the success of the game can be increased.

2.9 Related Works

In free to play games, the main tools of monetization are advertisements and in-app purchases. Because, by the nature of these games, the player does not pay to own the game, developers or publishers generate revenue as much as the player's interaction with the game. In a study conducted by Jiao et al. (2022) based on this perspective, the factors of play duration and in-app purchases were explored. The research revealed that a player's play duration decreases when the player shows either very successful or very unsuccessful performance. As a solution to this, the study suggests tracking player performances and rewarding players. As another result, it is reported that player's acquisition of virtual items causes an increase in player's interaction with the game and their purchases, and the importance of personalized pricing is emphasized. The study also highlights the significance of social factors in the game by stating that giving players the opportunity of being a clan member and playing with friends results with longer play durations and more in-app purchases.

In a study (Zubaydi & Gide, 2019) conducted through a survey with 202 participants from Australia, the behavior of players using Android smartphones in mobile games is observed. Their study aims to reveal which of the single-player and multiplayer user groups tends to purchase more. Saying that every consumer has a

natural resistance to purchase, the study assumes that the less pain of paying brings more possibility of purchase. The study found that multiplayer players spend more time in games than single-player players. In the study, it was observed that multiplayer players suffered less when purchasing compared to single player players, and therefore it was noticed that multiplayer players gained the habit of purchasing more quickly. Therefore, this study recommends that it is more efficient in terms of investment for game studios to choose multiplayer instead of single player when making mobile games.

The self-determination theory is often referred to when trying to understand why people buy things because it is about motivating individuals by satisfying their psychological needs. Therefore, people's purchasing motivations have been studied through this theory with different approaches. Gajanova and Radišić (2021) examined in their research whether gamification could increase customers' buying motivations both internally and externally. Their study, conducted in March 2020 with 399 participants in Slovakia, suggests that gamification increases the possibility of a completed purchase through internal motivation, and relying solely on external motivation, such as price discounts, might be insufficient to sales.

When we explore the impact of motivation on purchasing virtual items in the literature, we see similar results. Jang, Lee, and Yoo (2018) conducted an online survey of 4,556 participants in South Korea, based on a freemium mobile game, investigates users' reasons for making purchases. Built on the pillars of the self-determination theory and self-perception theory, the research concludes that needs of autonomy and relatedness positively correlate with the motivation to make in-app purchases, while the competence need is negatively related to in-app purchase motivation. Due to these findings, the study suggests that companies should focus more on determining the defining characteristics of the purchaser segment.

Neys, Jansz and Tan (2014) focus on finding out why players insist on staying in the game despite weak rewards. Their study approaches this issue from the perspective of both self-determination theory and Social Identity Theory. The study conducts a comparative survey of 7252 people. There are three groups in their study: Hardcore, Heavy and Casual gamers. While Hardcore gamers have the highest Gamer Identity Strength (GIS), Heavy and Casual gamers have lower GIS. They found

positive correlation between the GIS and the three needs for competence, autonomy and relatedness of self-determination theory. They also found that persistence was in a positive correlation with GIS. And they summarize their conclusion that Heavy and Casual gamers' persistence motivation was related to both enjoyment and relatedness while Hardcore gamers' persistence was mostly about enjoyment through intrinsic motivation.

Fernandez de Henestrosa, Billieux and Melzer (2023) examined a study with Battle Royale players, found that the psychological needs of Battle Royal players as competence and autonomy, while these needs were considered as autonomy and relatedness in this genre.

Chapter 3
The Game: Flags 2

3.1 General Information

The game Flags 2 was released in March 2020 and is still being updated. The game is translated to 29 languages and localized to more than 40 countries in two major app stores: App Store and Google Play. The name of the game varies almost for every country, language, and store not only for localization purposes but also for a better app store optimization. For example, the game has two different default English names for the United States in the App Store and Google Play respectively: “Flags 2: Map - Geography Quiz” and “Flags 2: Multiplayer”. To avoid any confusion, we just call the game “Flags 2” or “the game” in this study.

“Flags 2” is a trivia game with multiple choice quiz mechanics with various modes under the main modes single-player and multiplayer. The first two purposes of the game are to give players a playground to compete and have fun by using their knowledge of country flags with others. “Flags 2” was developed because some features could not be added in the first game, from which players expected more such as map quizzes/matches both in single-player and multiplayer modes. The game uses both advertisements and in-app purchasing as revenue models.

3.2 Core Game

The game is basically a multiple-choice quiz game. These multiple-choice quizzes are based on answering every question within 20 seconds by choosing one of four or six options. In single-player mode the player has the right to give a certain number of wrong answers depending on the mode he/she plays. This number changes from one to three. When these rights expire, the user loses the game. In the multiplayer mode, the player has no right to give an incorrect answer. If one player answers the question incorrectly while the other player’s answer is correct, the latter wins the match session. If two players answer the question incorrectly, the game ends in a draw. The user can also use lifelines to get help. There are two lifeline types: double chance and fifty-fifty.

3.3 Game Modes

3.3.1 Single-player. Single-player section includes five main sections and 14 different quiz types in total. In all single-player quiz types the main idea is to choose the correct flag before the given period of 20 seconds is finished or the player loses the last one of his/her three lives. In every type of 14, there is a progressive path of 15 levels that ask a specific type of knowledge about 240 countries. Since Flags 2 is a quiz game related to geography, its educational features stand out in some respects, and even cause some players to define the game as a gamified application. Since the single-player section progressively covers different content in each section (flag-country name, map-flag, etc.) —except for the extended levels in the last phase of the sub-types— it is a much more suitable experience for the players to increase their knowledge about the countries compared to the multiplayer mode. Because only a maximum of 20 questions can be answered in a multiplayer match, the probability of witnessing all available knowledge about all countries is very low—even if the player plays lots of consecutive matches. This makes the single player mode more fitting for educational purposes. Moreover, in the extended levels at the end of all sub modes, the player is challenged to correctly remember the whole knowledge he/she acquired up to that point.

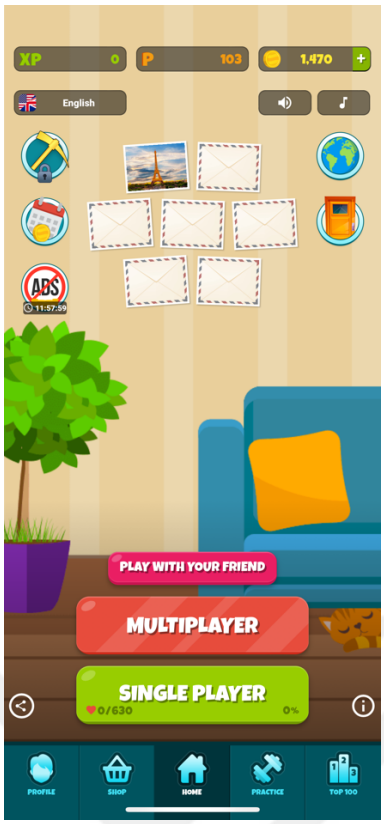

Figure 1. Home screen

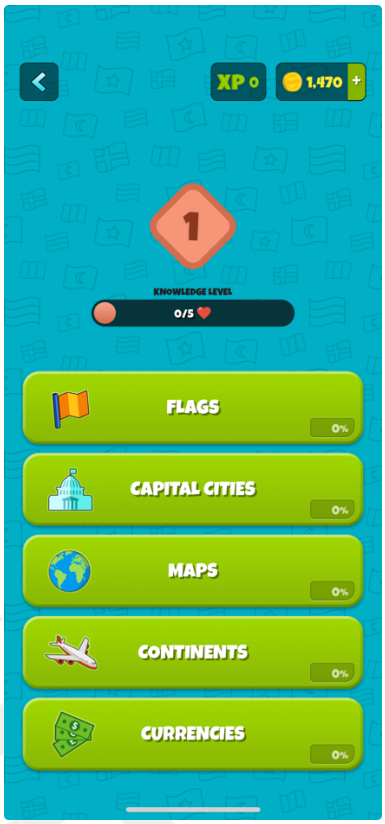

Figure 2. Single-player main menu

3.3.1.1 Quiz type flags. In this quiz type, the player is given either a flag or a country name as the question. Then he/she must choose the correct answer out of multiple options. The options might be flags or names depending on the question type. For example, if the question is a flag, then the options are country names and vice versa. This quiz type has four sub modes:

3.3.1.1.1 Flags mode 4 flags. The player is given a country name as the question, and four options with flag images to choose from (Figure 3).

3.3.1.1.2 Flags mode 4 countries. The player is given a flag image as the question and the names of four different countries to choose from, as seen in (Figure 4).

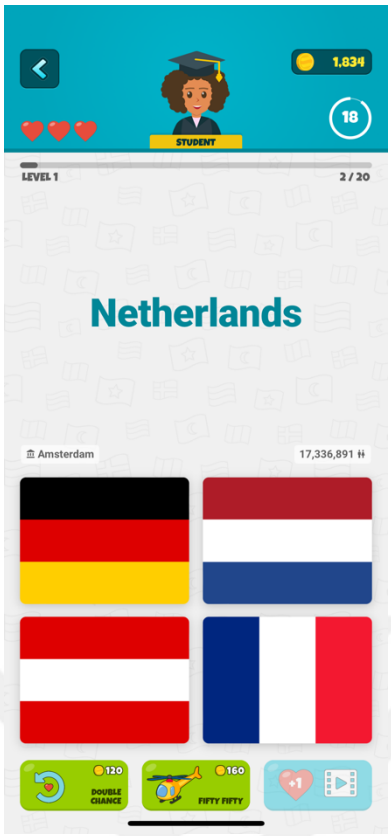

Figure 3. Flags mode 4 flags

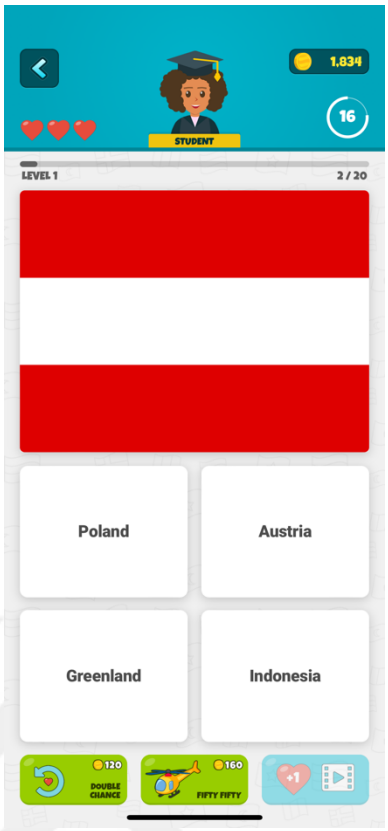

Figure 4. Flags mode 4 countries

3.3.1.1.3 Flags mode 6 flags. The player is given a country name as the question and six flag images to choose from. This sub mode can be thought of as a harder mode for players who like challenges as seen in (Figure 5).

3.3.1.1.4 Flags mode 6 countries. The player is given a flag image as the question and the names of six different countries to choose from. This sub mode is also harder than the first two sub modes in this section (Figure 6).

Figure 5. Flags mode 6 flags

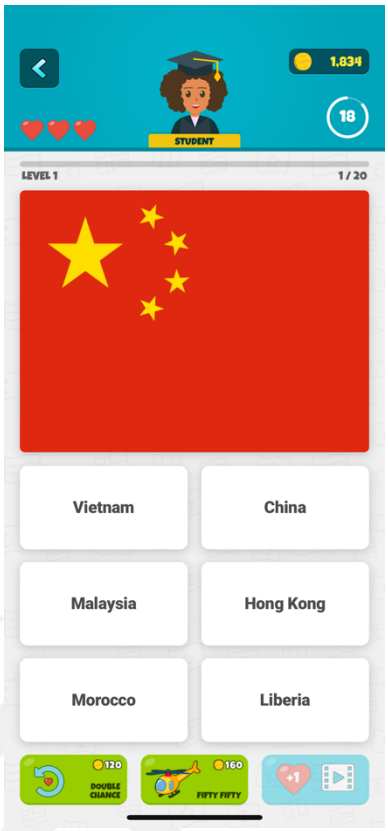

Figure 6. Flags mode 6 countries

3.3.1.2 Quiz type capital cities. Players who have more enthusiasm about geography trivia might not be satisfied with just the flags of the countries. They might also want to test their knowledge about the capital cities. Therefore, the capital cities quiz type was designed. This type includes four sub modes.

3.3.1.2.1 Capital mode 4 countries. The player is given a name of a capital city as the question and the names of the four countries to choose from.

3.3.1.2.2 Capital mode 4 capital cities (country). The player is given a country name as the question and four capital city names to choose from.

3.3.1.2.3 Capital mode 4 flags. The player is given a capital city name as the question and four flag images to choose from (Figure 9).

3.3.1.2.4 Capital mode 4 capital cities (flag). The player is given a flag image as the question and four capital city names to choose from.

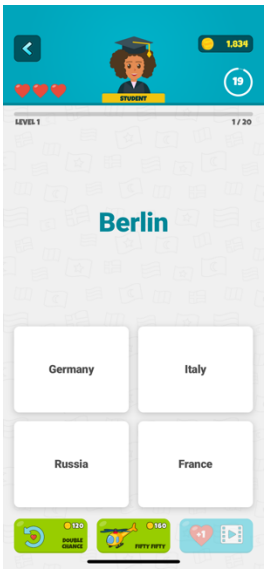

Figure 7. Capital mode 4 countries

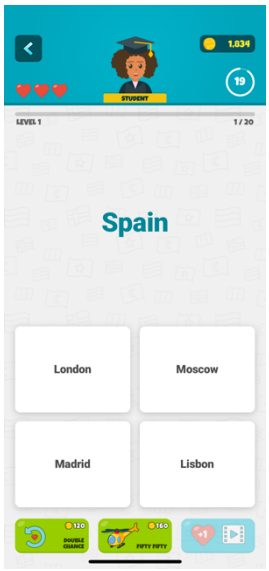

Figure 8. Capital mode 4 capitals

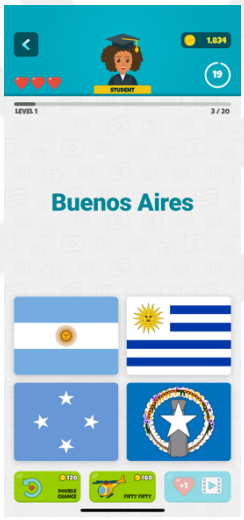

Figure 9. Capital mode 4 flags

Figure 10. Capital mode with flag

3.3.1.3 Quiz type maps. This section allows players to test their knowledge of the map shapes of countries and their locations around the world. This section is also designed to increase the diversity of the game visually with the world map covering the screen. This type includes two sub modes.

3.3.1.3.1 Map mode countries. It is based on choosing the correct name for the country that is shown on the map, out of 4 country names (Figure 11).

3.3.1.3.2 Map mode flags. It is based on choosing the correct flag for the country that is shown on the map, out of 4 country flags (Figure 12).

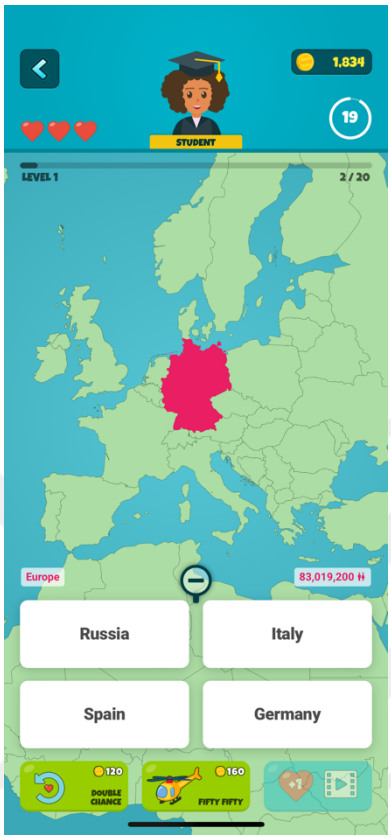

Figure 11. Map mode 4 countries

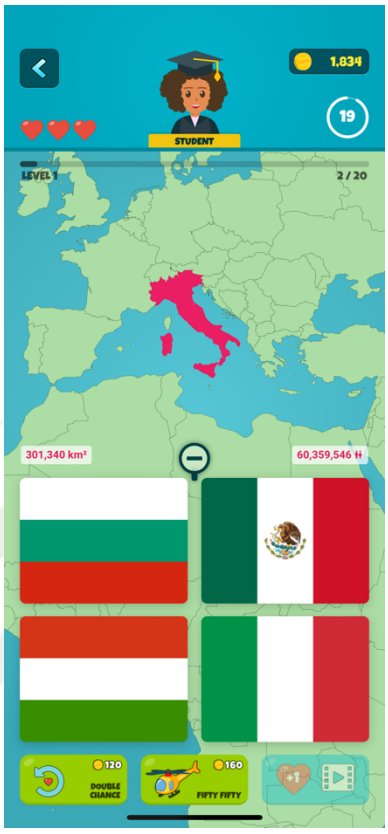

Figure 12. Map mode 4 flags

3.3.1.4 Quiz type continents. This quiz type relies on finding the correct continent for the asked country.

3.3.1.4.1 Continent mode countries. It is based on choosing the right continent out of 4 continent options, for the given country name.

3.3.1.4.2 Continent mode flags. It is based on choosing the right continent out of 4 continent options, for the given country flag.

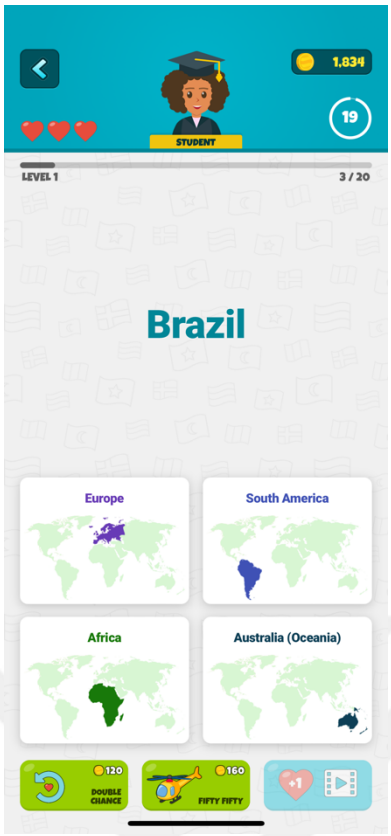

Figure 13. Continent mode 4 countries

Figure 14. Continent mode with flag

3.3.1.5 Quiz type currencies. This quiz type tests the players knowledge on the money currencies of countries.

3.3.1.5.1 Currency mode countries. It is based on choosing the right currency out of 4 options, for the given country name.

3.3.1.5.2 Currency mode flags. It is based on choosing the right currency out of 4 options, for the given country flag.

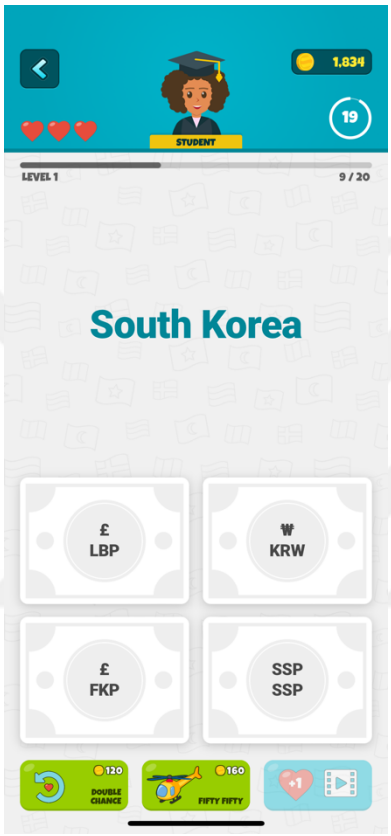

Figure 15. Cuurency mode 4 countries

Figure 16. Currency mode with flag

3.3.2 Multiplayer. In the multiplayer mode, to win the match, the player must correctly answer one of the 4 options presented to him/her within 10 seconds. The players are asked up to 20 questions. If one side fails to provide the correct answer, the game immediately ends. If both sides fail to answer correctly, a draw occurs. In other words, the player not only needs to give the correct answer but wait for the other player's mistake, in order to secure a win. If both sides answer 20 questions correctly, this results in a win-draw situation where both parties are rewarded. The player earns

points for each question he/she knows, and gets extra points if he/she answers any question before his opponent.

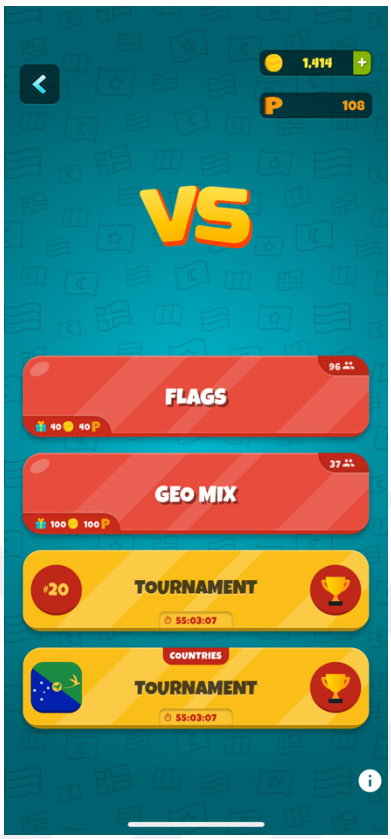

Figure 17. Multiplayer menu

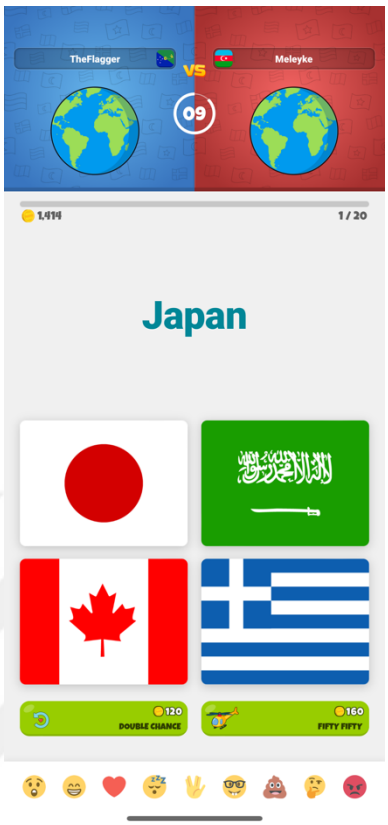

Figure 18. Multiplayer match screen

3.3.2.1 Quiz type flags. In this type of multiplayer mode, questions are asked in an increasingly difficult curve. It is based on choosing the right flag for the country whose name is given as a question.

3.3.2.2 Quiz type geo mix. From the various quiz types of single-player mode, a multiplayer quiz is randomly prepared by the algorithm of the game in a balanced difficulty. This quiz type requires an extensive knowledge of the geography and the world.

3.2.2.3 Tournaments. Tournaments take place three times a week. These tournaments are held on Monday-Tuesday, Wednesday-Thursday and Friday-Saturday-Sunday. The tournament basically consists of lists of 50 people. In the lists, players are ranked according to the points they have collected in the given period. The

player is rewarded according to his/her rank. The player participates in the tournament when he earns points in one of the 2 multiplayer modes.

There is also a Countries Tournament. In this tournament, players collect points for the flags they choose. Flags are ranked according to the points collected in the given time and awards are distributed accordingly.

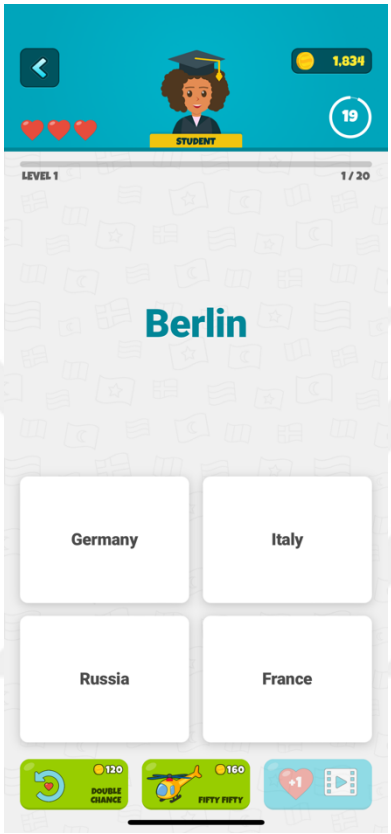

Figure 19. Player tournament

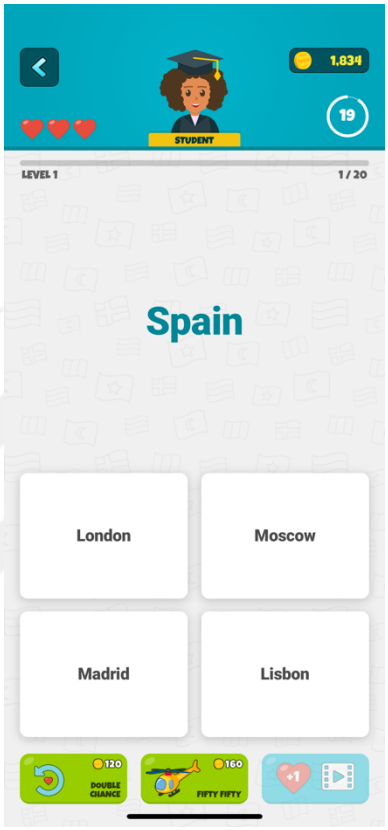

Figure 20. Country tournament

3.4 Purchasable In-Game Products

Gold is the in-game currency used to purchase lifelines, chances to continue single player matches, avatars, and themes.

There are various packages available for sale in the game's market. These packages include Remove Ads, various amounts of gold, themes, and avatars.

Table 1

Purchasable Products of The Game

Pack Name	Pack Description
Special Offer	The Special Offer package removes ads and adds 7500 extra gold to the player's in-game wallet. It can be purchased for a limited time and has a duration of 48 hours. There will be a break after the 48-hour period ends. After this interval has passed, the pack becomes visible again.
Premium Monthly Subscription	The subscription model is a monthly subscription model that gives the players an opportunity to remove ads, use 6 avatars and 3 themes. This product has an introductory offer of a 3-day free trial. After the free trial period, the players have to pay monthly to continue to use the products.
Starter Pack	Players get 2500 gold, 4 avatars, and 1 theme.
Super Pack	When a player purchases the pack, the player gets 7500 gold, 6 avatars, 2 themes. This pack provides an opportunity to use an average of 54 lifelines to a player.
Mega Pack	This is the biggest pack in the game. With this pack a player can use an average of 108 lifelines. This pack also includes 8 avatars and 3 themes.
Gold Packs	This type of consumable packs provides a certain amount of gold respectively 1000, 2000, 5000, 10000, 25000, 50000.

3.5 Ads

3.5.1 Ad types. There are two ad types in the game. These are interstitial ads and rewarded ads. No banner ad placements exist in the game.

3.5.1.1 Interstitial ad. It is shown automatically between two different screens after a specific action. For example, after finishing a single-player quiz or a multiplayer match, an interstitial ad is shown to the player.

3.5.1.2 Rewarded ad. The user views this type of ad in order to get a reward. In this game, a player can view a rewarded ad to get an extra life after being out of lives in a single-player quiz session or to collect more points and a postcard after winning a multiplayer match.

3.5.2 Ad placements. Interstitial ads appear at regular intervals at the end of the match. Interstitial ads have a 60 seconds interval. The player can watch willingly rewarded ads to earn more lives, points, gold or postcards.

3.6 Audience

3.6.1 Platform. The game has more than 3 million downloads on Android and more than 300 thousand downloads on iOS. 91% of the players play on mobile phones, while 9% play on tablets. While the average engagement time of players on Android is 25 minutes, it is 41 minutes on iOS. Average engagement session per user is 2.8 on Android and 6.1 on iOS.

3.6.2 Country. The game has players from 200 countries around the world, and the 10 countries ranked according to the number of first users are as follows: Türkiye, Russia, France, Egypt, Israel, Iran, Iraq, Poland, Italy, Serbia. Among these countries, the most active country in the game is Israel with 7.43 engaged sessions per user and 51 minutes average engagement time. While the most used language in the game is English, the other languages in the top 5 are: Arabic, Russian, Spanish, Turkish. The top purchasing countries are as follows: Türkiye, France, Israel, Germany, Poland, United States, Brazil, Spain, United Kingdom, Ukraine.

Chapter 4
Methodology

4.1 Engagement and Purchasing Measurements

In this section of our research, we create a setting to measure the player engagement and the in-app purchases. This data collection process had a year-long process from October 1, 2022 to September 30, 2023 through the actual players of the game.

Player engagement is measured with Google Analytics. Special parameters were set in order to collect suitable data for this study. In our case, the core game is playing and completing a single-player quiz or a multiplayer match. Therefore, players' completed quiz and match sessions were counted. The analytics platform served us the average counts of the quiz sessions per player.

Since the study is also focusing on purchase events; completed quiz and match counts should have had breakdowns by purchasers and none-buyer players. In order to achieve this condition, the players were segmented by their statuses of in-app purchasing. If a player made an in-app purchase he/she was counted in the purchaser segment, if not, he/she was counted in the non-buyer segment.

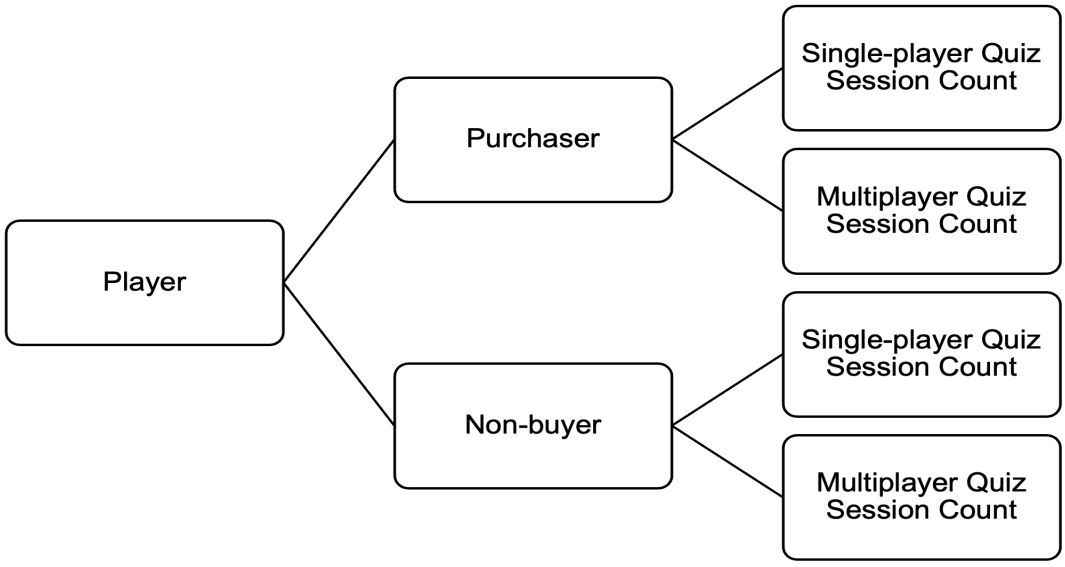

Figure 21. Segmentation of Players

In-App purchasing was measured with different analytic tools. Google Analytics measured the purchasing events and their values. Then we collected the counts related

to in-app purchases from the dashboards of App Store Connect and Play Console which have specific use for developers and publishers. Thus, we could verify that Google Analytics also counted the purchases correctly.

The segmenting process to group players as purchasers and non-buyers was implemented by Google Analytics tool. This segmentation let us see the engagement metrics by purchasers and non-purchasers.

4.2 User Experience Measurements

4.2.1 Participants. Twenty-seven individuals, including 8 females and 19 males, were sourced from the researcher's social network. Despite the initial count being 29, the final 27 participants engaged in required questionnaires, experiencing both the standard version and the version with an in-app purchase product named Mega Pack. Each participant received a unique promotional code generated from Google Play and the App Store, as it could be inappropriate to request participants to purchase an in-app product directly.

The ages of the participants range from 20 to 33 years old. Detailed mean statistics can be found in Table 2. Participants were surveyed regarding their gaming behaviors to verify that they are valid samples to represent mobile game players. Using a scale range from 1 (Never) to 7 (Almost always), the average frequency of gaming for the sample was 2.94 (Standard Deviation = 1.58).

Table 2

Statistics of the Participants

Gender	Male (n=19)		Female (n=8)		Total (n=27)	
	Mean	SD	Mean	SD	Mean	SD
Age	27.37	3.70	28.25	3,65	27,63	3,64
Mobile Gaming	2,48	1,41	3,64	1,74	2,82	1,57
Gaming	3,39	1,60	1,86	0,89	2,94	1,58

Lifetime Television Exposure Scale (LTE) was used (Riddle, 2010) to measure the exposure rates of the individuals by asking them their watching frequency for different times of the day, and the weekends. In our study, LTE items were adapted to measure the computer and mobile gaming frequencies of the participants.

4.2.2 Procedure. The participants who had experienced both iterations of the game were singled out. Individuals who did not meet this criterion for inclusion were removed from the dataset.

T-tests are categorized into two main types. One is the independent t-test, applied when comparing two groups that are independent of each other. The other is the paired t-test, applied when comparing two groups that are interdependent. Paired t-tests can also be used when subjects aren't divided into separate groups (Kim, 2015).

We conducted a paired t-test on the same group in two phases and we measured the change between tests.

In the first version, the participants played the game as a player who did not buy any in-app purchase product. They had no option for choosing an avatar, they had limited coins, and they had to spend time by seeing interstitial and rewarded advertisements. After playing the game in these conditions, the players were asked to answer the questionnaires for PENS items which are Competence, Autonomy, Relatedness, Presence/Immersion, Intuitive Controls. The PENS model was chosen for having items of SDT terms directly.

For the second session, every participant was given a promo code and instructions to use the promo code according to the store from which they installed the game. Promo codes were generated from the store dashboards for the in-app product Mega Pack which provides exactly the same advantages regardless of which store the player uses. After applying the promo code, the players played the game again. With this version of the game, the players had 15,000 coins which is initially 2,000 for the non-buying players. Also, they got 8 avatars to use in multiplayer sessions, 3 patterns/themes for a different view and display in the game. Finally, having Mega Pack provided an ad-free experience to the players. After playing the session in those conditions, the participants took the PENS questionnaires again.

During both survey sessions, the questions were asked in a random order. The survey mean scores of PENS are evaluated based on the scores of the items. Paired samples t-tests were implemented on the dataset obtained from the participants.

Chapter 5
Results

5.1 Player Experience Results

After participants completed the questionnaires, we had the results for the items of the Player Experience of Needs Satisfaction model. Our findings reveal that there is a significant effect of having an in-app purchase product on the relatedness item of PENS and SDT. The game version with the players who have the in-app purchase product, has a significantly higher score of PENS Relatedness (M=4.83, SD=1.53) than the version with the players do not have an in-app purchase product (M=3.86, SD=1.58) $p<.05$. It is observed that PENS: Intuitive Controls also has a significant change between the non-buyer version score (M=6.28, SD=0.87) and the purchaser version score of the game (M=6.53, SD=0.65) $p<.05$.

The scores for the items Competence, Autonomy, and Presence/Immersion do not have significant changes between two versions ($p>0.05$). PENS Autonomy item has the least affected item when we compare the scores of the non-buyer version (M=4.98, SD=1.36) and the purchaser version (M=5.16, SD=1.33). All items with their scores can be seen in Table 3.

Table 3

Paired t-test Results for User Experience through PENS

	Before Purchase		After Purchase		
	Mean	SD	Mean	SD	p
PENS Competence	5.68	1.00	5.90	1.21	0.26
PENS Autonomy	4.98	1.36	5.16	1.33	0.40
PENS Relatedness	3.86	1.58	4.83	1.53	0.009*
Presence/Immersion	4.34	1.45	4.68	1.52	0.15
PENS: Intuitive Controls	6.28	0.87	6.53	0.65	0.026*

5.2 Game Analytics Engagement Results

Our findings from the one-year long analytics data of the game reveal that in single-player mode, the average completed quiz count of purchasers (M=62.85) is higher than the same count for non-buyers (M=29.94). Player counts can be seen in Table 4. In other words, purchasers' single-player quiz count is 110% higher than the players who did not buy any in-app product.

Table 4

Single-player Engagement Results

	Total Player Count	Mean Quiz Count
Non-buyers	550,140	29.94
Purchasers	1,277	62.85

In multiplayer mode, the players who made at least one purchase played more matches (M=366.02) than non-buyers (M=34.86). The result has a correlation with the result obtained from single-player users. However, the rate of difference is 1,050% which is significantly higher than the corresponding result for single-player users.

Table 5

Multiplayer Engagement Results

	Total Player Count	Mean Match Count
Non-buyers	254,776	34.86
Purchasers	1,130	366.02

The products that were bought by the players may be seen in Table 6. The purchase counts are also given with the breakdown of store.

Table 6

Purchases by Store

Product	App Store	Google Play	Total
Special Offer	166	391	557
Premium Monthly Subscription	405	539	944
Starter Pack	1	55	56
Super Pack	0	39	39
Mega Pack	17	55	72
Gold Packs	1	31	32
Total	590	1110	1700

Chapter 6
Discussion and Conclusions

6.1 Discussion

When we examine user behavior both from game analytics and through the survey, our results show that the user is more engaged and psychologically more satisfied as being a purchaser rather than being a non-buyer. And when we compare the results of single-player and multiplayer modes through the collected data from game analytics, it is observed that purchasers playing multiplayer mode have a significantly higher match count mean (M=366.02) than purchasers playing single-player mode have (M=62.85).

Across our participants there was significantly greater (p=0.009) relatedness reported by the players having an in-app purchase product compared to those who have not. The participants owned three major features in the second phase of the tests. They had game currency (15,000 Coins), they played the ad-free version of the game and they had some cosmetic/visual items like avatars and background-patterns.

The avatars and background-patterns are visible to other players when a player plays a multiplayer match with a random opponent from a random region of the world. Ryan & Rigby (2007) define relatedness as an intrinsic motivation to connect with others. One of the reasons to be more satisfied in terms of relatedness can be the privilege of using and displaying different visual items rather than using ordinary visual items which can be used by the common audience for free. In this game, every player can express her/his virtual identity for free with a nickname, a national flag and an avatar. However, using a rare avatar and background-pattern can provide a more satisfying experience when playing with others.

According to our game analytics results, the percentage of purchased items which have the function of removing ads is 92.5%. And it is observed that, player engagements are higher for both single-player and multiplayer mode players who had made in-app purchasing. However, the breakdown of multiplayer mode players who had made in-app purchasing has the highest engagement score regarding Table 4 and Table 5. This condition can be discussed in terms of relatedness. It can be said that the players have a better experience without the ads which interrupt their gameplays.

When a non-buyer player plays either a single-player quiz or a multiplayer match, after completing the match she/he views an ad. In this ad period, which is not shorter than 10 seconds, the player loses all connection with the game. This condition causes an overall poor experience in terms of PENS and SDT. However, a multiplayer mode player who is interrupted with an ad, does not also lose the connection to the game, but also lose the existing connection to the other players. Therefore, a player who is not interrupted with an ad while playing multiplayer, can have a greater potential to be engaged than a player playing a single-player session. In addition to the game analytics results, the pack obtained by the survey participants also had the "remove ads" features with the Mega Pack. And they expressed a significantly higher result ($p=0.009$) in terms of the relatedness item of the PENS model.

Another PENS item which revealed a significant change in our experiment is "intuitive controls". However, since the experiment was implemented by the same group as a paired-samples t-test and the questions of this item were about learning and remembering the controls, we do not have available data to discuss on it. If the same experiment is implemented with an independent-samples t-test, the change value of intuitive controls could be more accurate, since different players would play each version of the game.

Our findings revealed that there is not a significant effect of purchasing on the items of PENS: Autonomy, Competence and Presence/Immersion in this mobile trivia game. This can be explained with the in-app purchasing product that has no direct effect on the gameplay like other in-app purchasing items of the game in terms of these items of PENS.

6.2 Conclusion

In the literature, there are studies on player engagement in multiplayer games. The same applies to in-app purchasing concepts for mobile games. However, no study has been found that examines both multiplayer player engagement and in-app purchasing behavior through a multiplayer mobile game that also includes a single-player mode and tries to explain this with self-determination theory. This was thought

to be a gap in the literature. Thus, we aimed to find a correlation between multiplayer playing and in-app purchasing through SDT.

Afterwards, a one-year long data collection process was conducted from the actual players of the game. Then a PENS experiment was implemented with 27 participants to measure their experiences.

According to our results, it has been seen that when a player makes a purchase, her/his satisfaction level of relatedness is higher, compared to a player's satisfaction level who does not make a purchase. Purchasing event increases the engagement of multiplayer playing significantly higher than the engagement of single-player playing. Therefore, it can be said that multiplayer gaming engagement and purchasing has a positive correlation and this correlation can be explained with need of relatedness item of SDT.

Our findings revealed that there was no significant effect of purchasing on needs of autonomy and competence in this mobile trivia game. More studies can be conducted with in-app purchasing products that contain items and features which should be designed with the aim to satisfy the player's needs of autonomy and competence.

6.3 Limitations

It is obvious that the number of purchaser count (1,130) observed during the one-year period of the data collection operation is much less than the number of non-buyers playing the multiplayer mode in the game (254,776). This may not have yielded the most accurate results in terms of the data collection from game analytics. More accurate results can be found through another game that has more purchases and includes a single-player mode.

In the purchasable in-app products, if there were features which were more related with autonomy and competence needs and they were found in the results, we could have discussed the correlation with SDT in a broader perspective.

Another limitation in our study is that reporting tools and regional and global privacy policies prevent the players from being examined down to the most detailed

breakdowns. For example, players were not tracked specifically for the product they purchased and were not examined in this detail along with their engagements. A way to use this would be to ask users for their consent one by one and follow them throughout the research. However, carrying out such work on a commercial game could cause financial burden. In addition, making such special requests from players could negatively affect players' engagement in the game.

6.4 Further Studies

In a scenario where the problems related to restrictions about user privacy are largely solved, the relationship of single-player players with the self-determination theory term competence can be examined. Because from the data obtained, when we look at the behavior of single-player players, we observe that some players re-finish the game in different languages after completing all the levels of the game. Reaching results regarding competence in a knowledge-based game may also yield useful inferences for developers and publishers, and a new study that explains the term competence in games from a different perspective will be added to the literature.

In their work, Jang et al. (2018) claims that autonomy and relatedness needs are positively correlated with in-app purchasing motivation, while the need of competence is negatively related to in-app purchase motivation. With a series of t-tests, this can be researched on this game.

Another study may be about Trivia games and their categorization. While there are many studies on many types of mobile games and gamified learning applications, no study offering a comprehensive categorization of trivia games has been found. Mobile trivia game study can begin with a proper definition which is also needed by the game industry. There are many puzzle and skill games with trivia genre labels on them. This may result in two ways: The trivia meaning will change in years or the app stores may change the name of the genre with a name that also implies trivia. Therefore, this topic might be stated as a problem and researched.

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