EVALUATION OF USABILITY AND USER ENGAGEMENT FACTORS PREFERABLE FOR MOBILE GAMES

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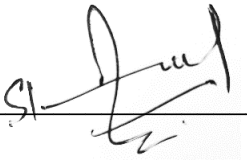
Scholar / Author's Sign: 

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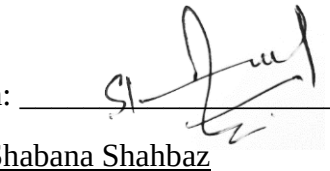
Scholar / Author's Sign: 

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Dedication

My dissertation is dedicated to my family and many friends. Heartfelt thanks to my supportive parents, whose words of encouragement and drive for persistence still sing in my ears. My sisters and brother have never left my side and are extremely important to me. This dissertation is also dedicated to my numerous friends who have helped me during the process. I will always be grateful for what they have done.

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ABSTRACT

The crucial elements in games are fun, incentive, involvement, and user engagement. Designers should, therefore, always seek out the most effective methods and strategies to maintain players' motivation and passion for the games. Mobile games offer users fascinating and immersive experiences while appearing and feeling more genuine. To create highly engaging games, it is crucial to grasp what makes them so appealing, interesting, and engaging. To better understand user engagement, flow, and usability in mobile games, we provide a hybrid model because designers always try to discover great approaches and procedures using them; they keep the players playing the game with excitement. In this research, our focus was on mobile battle royale games. This study aims to present a hybrid model based on previous models, which can enhance or improve user engagement toward games. This study used a quantitative method in which we surveyed with the help of an online survey and 140 participants answered a user engagement and usability survey. The outcome of this study provides guidelines for game designers and developers to make their games more engaging, especially for mobile devices.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

List of Abbreviations

Abbreviation	Definitions
ANOVA	Analysis of variance
CMC	Computer mediated motives
DF	Degree of freedom
FIG	Figure
FOMO	Fear of missing out
GC	Game characteristics
GUI	Graphical user interface
HCI	Human computer interaction
IE	For example
IGR	In gaming rewards
IP	Interpersonal
MM	Mediated motives
SPSS	Statistical Package for Social Sciences
STD	Standard deviation
TAM	Technology acceptance model
UE	User engagement

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

Video games are presently a popular form of entertainment for both children and adults [1]. Video games are available for all platforms including all consoles. Revenue in video games segments is projected to reach US $365.60 billion in 2023 so, with ongoing technical advancements, the gaming industry is currently one of the most promising sectors.

According to Schoenau-Fog [2], when a player becomes "hooked" and entertained by the game, they want to continue playing it. User engagement in one game may differ from another game. Although user motivation matters as "*reasons why people begin to play*," the idea of engagement is associated with aspects of playing situations such as immersion, flow, fun, and pleasure to offer deep-engagement in playing as necessary for increased whole game playability [3], [4]. The gaming industry is constantly evolving and rapidly expanding on a global scale. In developing and researching games, the primary goal is to accomplish a high level of engagement [5].

Mihaly [3] defined flow as "*a state in which people are so involved in an activity that nothing else seems to matter; the experience is so enjoyable that people will continue to do it even at great cost, for the sheer sake of doing it."*

The primary goal of games is to keep players interested; however, to make exciting games, game designers must incorporate user information or feedback [6]. If a game's engagement is not as expected, players may stop playing it because of insufficient engagement characteristics and may not return to it. Engagement is an essential factor in the gaming industry because it is one of the critical components of any game; with it, players may gain interest in continuing to play [7].

1.1 Motivation

Games impact human behavior, particularly in players who play often. Playing mobile games helps users enhance and develop their balance skills through practice and earning higher badges. The more times they try and fail, the more they desire to try again until they reach the desired goal [8].

Mobile games are popular, but engaging users in games, functionality, and simplicity are increasingly crucial [8]. A well-designed user experience, features, and functionality of a game boost user engagement. We developed a model for games that encourage or enhance user engagement and friendliness. In the future game designers and developers will benefit from this research as they work to create more captivating or engaging games that give players a lasting gaming experience.

1.2 Problem Statement

Existing studies on game evaluation have focused on the different models and factors in isolation. Many of these factors and gameplay elements overlap and influence each other during gameplay, and considering these factors' isolation limits the generalizability of such models. To mediate this problem, we present a hybrid model that encompasses heuristics elements from different existing models that cover missing factors affecting usability and user engagement.

1.3 Research Questions

1. How do models exist that evaluate user engagement in games?
2. What engagement factors motivate a game player to continue playing without

boredom?

3. Does a hybrid model help to improve user engagement, usability, or the overall gaming process?

1.4 Research Objectives

The goal of this thesis is to present a model which can improve user engagement in mobile gaming. In this research, our study aims to identify user engagement factors and determine the usability, how easily users interact with the games, and what aspects of a game can help enhance user engagement. In game design, flow is a game's central backbone, which could lead to success and enduring experience. The flow of a game determines user engagement and how the player adapts while responding to the game. It is necessary to consider a few factors to make it engage so the player can endure gameplay without boredom and anxiety.

Our research aims to provide an evaluation framework that can help the designer and developers to improve or enhance the games. To offer more engaging games with the help of the presented framework, which will highlight the relative of different gaming elements in relation to user engagement.

1.5 Significance of the Study

The significance of our research is based on user engagement. Thus, we developed a hybrid model to enhance or improve user engagement in games. In the future game designers and developers will be helped by a hybrid model to create more fascinating, enduring, and engaging games.

CHAPTER 2

LITERATURE REVIEW

Video games are considered powerful learning tools. Games can be educational or other games that produce learning [9], [10]. Games are not just for playing purposes, but also a user can learn from the games, but it all depends on the type of game a user selects. Games can be motivational tools to make learning more interesting and pleasurable by arousing curiosity and satisfying fundamental needs. Like competence or self-sufficiency, keeping the player's attention absorbed with just right challenges, and rewarding in-game activity, these are theorized by [11], self-determination theory [12], or flow theory [3]. Rewards can stoke emotional and expressive reactions that directly support encoding related information in the memory, *"Everything is deeply intertwingled"* [12]. Games have long remained identified as *"a medium that demands our attention"* [12]. The challenge was what type of models could observe users' attention, so the authors defined different models of involvement, game engagement, or immersion [12].

2.1 Mobile application types

The term mobile application refers to software application that runs on a mobile device and accomplishes functions for the user. The mobile application's extensive functionality allows it to be used for a wide range of purposes, including texting, calling, chatting, social network communication, browsing, audio, video, and gaming. There are various categories of mobile applications based on the application area [13].

We can differentiate the genre of games such as fighting games, strategy games, board

games, racing games, puzzles games, and online royale battle games. Making such games engaging is difficult, but various approaches can be used to evaluate the users'engagement, such as feedback on a game, interviews, questionnaire, survey, and userengagement scales.

2.1.1 Game Theories

These theories include mood management theory, flow theory, and other accounts that show that attentive absorption is one of the significant satisfactions people seek in gaming [12]. These accounts show how it holds our full attention, which means why we enjoy it. Still, authors could have explained or discussed what design features a user also pays attention to and concentration affects education and experience. Authors also described those games are motivational tools that encourage the users to play, and as rewards, the user may be attracted toward the game, complete the task, and make the learning enjoyable. Such activities may increase user interest through challenges, such as Malone and [11], self-determination theory [12], or flow theory of motivation, which describes a mental state of operation where a person is completely immersed in an activity.

A person may become anxious and overwhelmed if the challenge is too difficult, whereas an easy challenge may bore them. A flow experience in a game can lead to a sense of competence and self-efficacy, which leads to a desire to continue participating in the activity. [3]. Following Whitton's [12] helpful framework, with the help of a good learning environment, learners can learn meaningful things and from challenges, with rich social scaffolding and reflection, as theorized in experiential and problem-based learning, particularly sociocultural learning theories.

2.1.2 Usability technique of mobile games

Many principles like usability and interface design HCI (Human Computer Interaction) concepts (such as recognition over recall or visual hierarchies) were founded on key findings about people's visual attention and working memory [12].

In previous research, authors measured user attention using eye-tracking and investigated the interface and designs [14], [15]. Additionally, different models of attentional

processes can be built to measure users-attention or focus on the games. However, other models of attentional processes can create to estimate users-attention or concentrate on the games. The usability evaluation in gaming is still an active research area. The challenge of a varying viewpoint of usability from the perspective of developers' design goals and users' expectations is an open issue [16], [17], and [18].

Different methodological approaches have been applied to measure user engagement and usability. These can be questionnaires, interviews, and surveys. Some techniques are related to eye-tracking activity or gaze analysis [19], [20]. They learn how users interact with games, whether they pay attention to others, and which tasks make users more receptive to gaming.

2.1.3 User Engagement

Engagement is a crucial factor in the mobile game industry to create games having longer and sustained interest of the users. According to Van Doorn, customer engagement behavior in a customer-to-firm relationship focuses on behavioral aspects of the relationship [21]. Furthermore, players seek relaxation, enjoyment, and social needs that are not met in the real world [5]. A game should be designed so that the difficulty matches the players' abilities; it should not be too difficult or too easy. In other words, this conditionrelates to the sense of control, enhancing or engaging the game-playing experience [5]. With the recent improvement, video gaming has become one of the most popular recreational activities in information technology around the world [22].

Thus, to gain a competitive advantage, online game developers and publishers are looking for new ways to provide the best game experience to players while also attempting to build long-term relationships with users [22]. Some researchers have focused on the flow experience of games in the existing literature, believing that it enhances consumer loyalty, fulfillment, and desire to continue gaming [22].

2.2 Evaluation methods used

Table 2.1 below shows some previous evaluation techniques for various game genres. These techniques included interviews, questionnaires, surveys, and direct observation. The table also lists the number of participants.

Table 2.1 : Evaluation methods

Paper title	Author & Publication year	Evaluation Methods	Nature of games	Participants
Game Factors and Game-Based Learning Design Model [23].	(Shi, & et al. 2015).	They designed a questionnaire to survey players.	Educational game, cards games.	25
Academic methods forusability [24].	(Yanez-Gomez, et al. 2016).	Research Questions.	Serious game.	10-20
Towards a methodology for User Experience Assessment of Serious Games with children with Cochlear Implants [25].	(Cano, S., et al. 2018).	Direct observation, survey.	Educational game	23
A Usability Study of a Serious Game in Cognitive Rehabilitation: A Compensatory Navigation Training inAcquired Brain Injury Patients [26].	(Kuil, et al. 2018).	Computer-based questionnaire.	Serious game Serious	30
An approach to evaluating theuser experienceof seriousgames [27].	(Mozier, et al . 2019)	Survey-based.	Serious game.	116

Relationship Between Children`s Enjoyment, User Experience Satisfaction, and Learning ina Serious Video Game for Nutrition Education: Empirical Pilot Study [28].	(Espinosa-Curiel, et al, 2020).	E Game Flow questionnaire and the Game User Experience Satisfaction Scale (GUESS) questionnaire.	Health game.	60
Does Playing Video games Increase Emotional Creativity? [29].	(Čábelková, et al, 2020).	Online Survey	Selected any specific game.	453
Serious Motion-Based Exercise Games for Older Adults: Evaluation of Usability, Performance, and Pain Mitigation [33].	(Brauner, et al, 2020).	Survey	Serious game.	Randomly selected
User Requirements for S oftwareGame Pr ocess:An Empirical Investigation [30].	(Aleem, et al, 2021)	A structured survey questionnaire was also developed	Puzzles, action or adventure,racing, sports,music-based, strategy/role-playing	469

2.3 Previous Studies

Ten studies found that Authors used different methods or instruments to evaluate the games. Questionnaires were used the most [31].

Table 2.2 : Evaluation of questionnaires & interviews

Studies	**Percentage**
Questionnaire	70% & 7/10
Interviews	30% & 3/10

2.4 Gaming Platform

A Worldwide survey was conducted online containing different questions and various age groups as part of this survey, led by J. Clement on 9th March 2022 [32].

Table 2.3 : Gaming platforms

Devices	**Percentage**
Any Device	83.6%
Mobile Devices	68.1%
Desktop & Laptop	36.8%
Games Console	25.8%

Tablet devices	17.2%
Handled game device	13.6%
Media streaming device	9.7%
VR (Virtual Reality) devices	8.7%

2.5 Use of Mobile Games

Modern mobile phones are getting smarter and faster, and gamers demand faster internet connections for these advanced mobile phones to play games smoothly. People can play games at any time because it is extremely convenient and is used for much more than this.

A mobile phone allows anyone to do almost anything. One can also connect while playing games, as some games can be played as a team. People who live in different locations stay connected while playing games, which helps them improve their communication skills. People spend their leisure time playing video games, which allows them to keep their mental health in check. Mobile games are a type of game that contains social features, enabling players to interact with each other through gameplay via messaging and combined social media.

Gaming is another way to enjoy it at any time and from any location. Gaming can never be boring because there are so many options. With the widespread use of mobile devices, mobile gaming raised games to an entirely new level. In addition, gamers require a game that runs more smoothlyand without lag. Various kinds of games are accessible, and developers are working on releasing more addictive games to keep players interested.

2.6 Hypothesis Development

The prior sections covered the theory and existing empirical data on the connections

between user engagement factors and gameplay elements. It serves as the foundation for my thesis theories.

In earlier studies, authors concentrated on enhancing the gaming experience and created models to do so by identifying factors or components that improve gameplay. This leads us to the primary study problem addressed by these papers. These studies finding indicate the direction of the causal connection between gaming elements and experience enhancement as a result. Therefore, we anticipate that other gaming components will impact user engagement and usability. In this scenario, we investigate the existing studies on game evaluation have focused on the different models and factors in isolation and many of these gameplay elements and factors influence each other during gameplay (as shown in fig 3.1, 3.2 and 3.3). To mediate this problem, we present a hybrid model that encompasses heuristics elements from different existing models that cover missing factors affecting usability and user engagement and this results in the following hypothesis, and we used them to test the effect of them:

H1: There is a positive effect of mediated motives on user engagement.

H2: There is a positive effect of game characteristics on user engagement.

H3: There is a positive effect of in gaming rewards on user engagement.

H4: There is a positive effect of Interpersonal elements on user engagement.

CHAPTER 3

RESEARCH METHODOLOGY

This chapter will discuss the proposed hybrid model, our research methodology and collection of our data, sample size, population, sampling technique and measuring instrument. We will go into detail about the analysis of data gathering, the examination of several models that already exist, the development of a hybrid model, and the experimental setup.

3.1 Theoretical foundations of Proposed User Engagement Model

Our research approach is built on the following models as shown in fig 3.1, fig 3.2 and fig 3.3, with the help of these models we proposed a hybrid model to enhance the user engagement in mobile games. We consider the models listed below to provide a hybrid model and explain and define each model. In future this study can help game developers and designers to produce more engaging games.

3.2 Computer-mediated communication

As shown in fig 3.1, The communication between two or more people using different computers via a network connection is known as computer-mediated communication (CMC). [33]. This communication entails the use of social software, such as online games [34]. To

better understand online game addiction behaviour, we assume that CMC motives are strongly connected to player flow, revealing a link among flow and addiction [33].

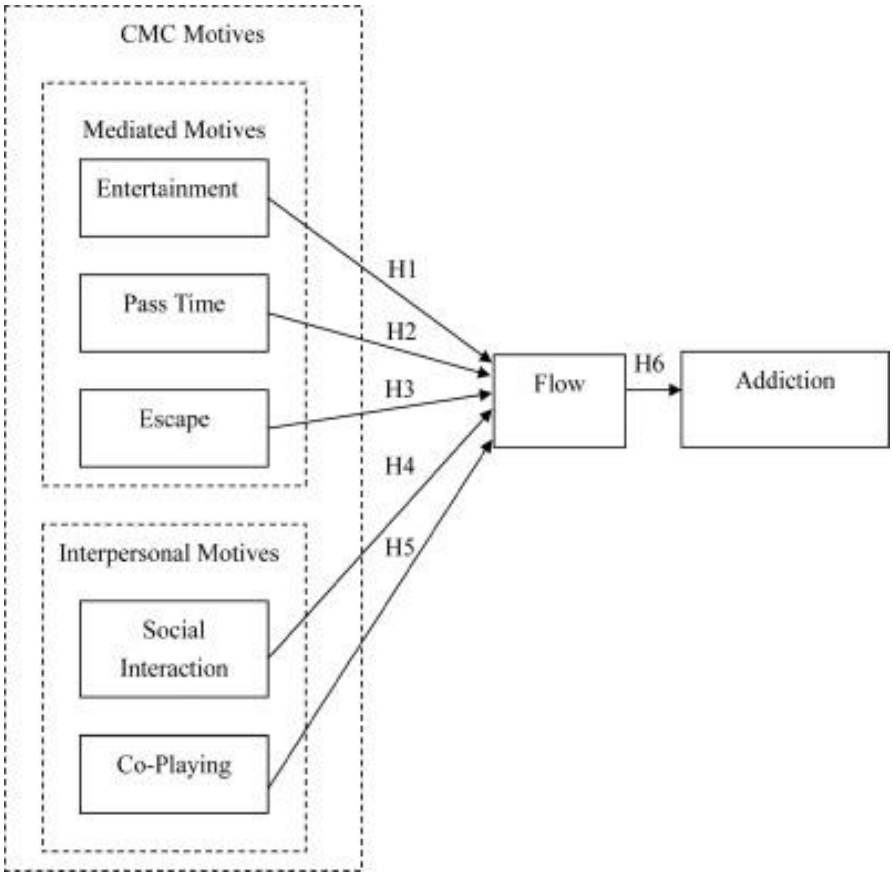

Figure 3.1 : Engagement factors of online games [35]**.**

3.2.1 Mediated Motives

The idea of flow resulted in the mediated goals of entertainment, passing time, and escape [33].

3.2.2 Entertainment

The degree to which involvement in an online game is considered as entertaining, pleasurable and fun is referred to as entertainment [36], [37]. Users who perceive more fantastic online game entertainment value engage in more online games and engage in more exploratory activities. Since entertainment indications increase the online gaming experience, creating high levels of perceived control and attention, entertaining online games significantly affect flow creation [33]. Users often play online mobile games for fun [38]. People play games to amuse themselves or to fulfil their craving for entertainment [33].

3.2.3 Passing time

The degree to which online game, users believe that games allow them to pass the time when bored is referred to as passing time [33].

3.2.4 Escape

Escape is described as the extent to which players perceive online game playing to be a relief from boredom and anxiety [39]. Online games allow gamers to escape from their daily worries by immersing themselves in an imaginative environment [40]. Escape is a kind of activity used to relieve tension and anxiety in the actual world [41]. Many individuals play online games to get away from reality [42], and this kind of escapism may be a significant reason for playing online games [43]. Usually, escaping everyday realism is a significant element in inducing flow experiences [33].

3.2.5 Interpersonal Motives

One of the most important aspects of great computer gaming experiences is an interpersonal connection [44]. When players compete in teams against other teams in online games, groups sharing information becomes more important for victory. Many players prefer online games because they increase social contact and allow them to communicate with other players through computer-mediated patterns [45]. Social engagement via information sharing allows online-game users to experience and learn about games, resulting in immersion [46]. As a result of social connection and co-playing, the flow of online-game players has increased. People can communicate with each other as well as create groupsto discuss the planning of game strategies.

Interpersonal is one of the most popular and required factors in gaming perspectives and plays a significant role. The features include an activity feed, which allows users to see the actions of their other participants in a feed. Users may track the progress of others and post questions and ideas on their game experience, life demands, and anything else that comes to mind.

Most interactive desktop games offer in-game conversations, so why not incorporate this in-app communication option into your mobile games? Offering your players, a platform to chat alongside the game will provide them with a more realistic gaming experience and eliminate the need for them to switch applications to contact their buddies. Why do we need social user engagement in mobile gaming? It generates a feeling of competitiveness by inviting their friends to the app and putting them against one other, which keeps their attention at high levels. It boosts retention. A smooth user experience inside a game, such as immediately connecting with friends and phoning them, keeps the player on saves for a longer period.

3.2.6 Social interaction

The Internet has brought about a new era of interaction, with many users being able to access online games at the same time and engage in synchronous engagement. In social

network games, social contact between two or more players may increase immersion [47]. This typeof interaction can generate flow experiences [47], [48] and [46]. One of the most important aspects of great computer gaming experiences is interpersonal contact [44]. When players participate in online games as groups against other groups, information exchange among groups becomes more vital for winning.

3.2.7 Co-playing

Online games include co-playing for entertaining purposes. Co-playing online games is related with more excellent communication between parents and teens [49] andhigher levels of social connection. *"People who enjoy flow experience during activity may repeat the activity... Repetition of a particular activity may eventually develop into a tendencytoward addiction... Flow experience is the precondition that activates addiction"* [50]. The basic aspects of co-playing online games imply that individuals like playing and discussing their favourite games with families and colleagues. In this case, social engagement predicts game play and game information exchange. Those who are socially engaged, especially those who play games for social interaction and co-playing, play online games to share their online activities with families and buddies with whom they have social relationships [33].

3.2.8 Flow

In the 1970s, psychologist Mihaly Csikszentmihalyi by experimentation evaluated flow theory [3]. Inferred that a person's skill and the trouble of a task to interact outcome in different cognitive and emotional states. Flow is an ideal experience that leads to deep involvement, receptiveness to information, heightened motivation, and diminished perception of time [51]. Researchers have also looked at a sense of flow, or deep involvement, with a virtual environment and immersion [52]. To keep players interested in the game, the difficulties must be adjusted to their ability level [53]. Flow occurs when individuals are confronted with a clear set of objectives that need proper answers and get rapid feedback on their progress in attaining these goals [3].

3.2.9 Addiction

Addiction is defined as the urge to engage in an activity regardless of the consequences [54], is a human condition in which individuals have an illogical desire to engage in harmful and obsessive behaviours involving small or repeated tasks [50]. Withdrawal (i.e., unpleasant feelings that develop while unable to play online games), conflict (e.g., playing online games interferes with other vital activities), relapse, and reinstatement are all possible outcomes. (i.e., the inability to reduce the time spent playing online games voluntarily). Additionally, behavioural salience are all symptoms of online-game addiction (i.e., online gaming dominates everyday life and takes priority over other tasks) [60]. Addicts have intense cravings for online games and experience withdrawal signs when they stop playing [55]. *"Previous studies have mainly focused on the negative effects of addiction, whereas this paper proposes that online-game addiction is crucial for flow".*

3.2.10 Methods

Our study model's questionnaire was based on past research. 3 online-game researchers conducted a pretest of the survey in order to improve the instrument's face validity. Before delivering the instrument to the target demographic, forty-six undergraduate students participated in a pilot study [33].

3.3 Game Characteristics

As shown in fig 3.2, Game characteristics include the game story, game graphics, perceived ease of use,and hab known as a habit.

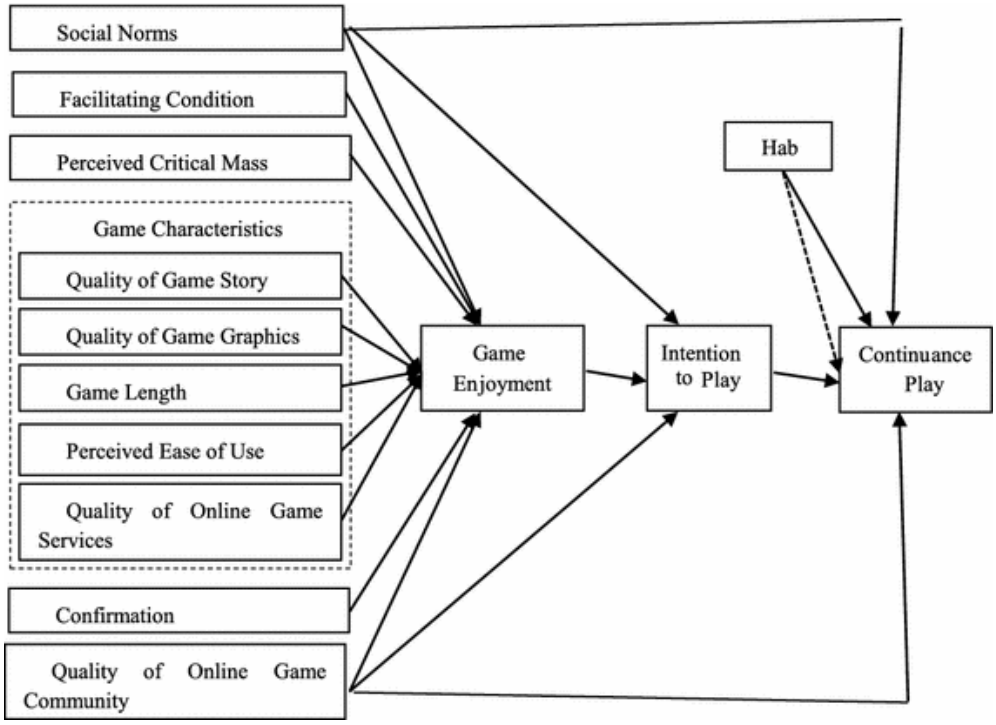

Figure 3.2 : A Model for online-game continuance-playing [56]**.**

3.3.1 Game Story

Virtual environments are created in online games. Game storylines are often utilised to immerse players in the virtual environment. A strong plot draws players' interest and boosts their desire to explore the virtual environment. A good storyline provides a lovely growth place for the game's actors. Game players "watch" and "feel" the evolution of their actors as the tale progresses from the beginning [56]. The storylines they produce in the game will be appreciated by the players, providing them with hours of entertainment and allowing them to forget about the bad events in their actual life [41].

3.3.2 Game Graphics

3D graphics have lately gotten a lot of attention owing to its usage in a variety of applications including filmmaking, 3D gaming, virtual environment modelling, and 3-D

Graphical User Interface (GUI) creation [56]. Aesthetic appeal is critical in establishing a pleasurable user experience in online games [41]. Online game visual designs include static, moving, and stunning graphics. Static visuals are things in the gaming world that do not move. A better static image approach lets gamers feel more accurate in the virtual environment. The game's movement design, such as running and fighting, is represented via movement visuals [56].

3.3.3 Habit

The moderator variable hab or habit influences the link between continuance-intention and use [56].

3.3.4 Perceived ease of use

One variable in this research included is perceived ease of use, adapted from TAM [56]. In the case of video games, perceived ease of use focuses on the product's ease of use, such as easy-to-understand and smooth control that enables players to move swiftly [1]. The easiness with which the game may be played will make the participants feel happier and more at ease. Perceived usefulness may be described as a person's degree of faith in a system [57] to help him do his job.

3.3.5 Methods

This study surveys the current literature and summarizes why gamers choose to play a certain online game for a longer period of time. This report provides a research model for predicting continued participation in online games [56].

3.4 Opening Experience

As shown in fig 3.3, Several participants were immediately motivated by the pleasurable element of opening the treasure box, and this topic incorporated both characteristics of the box opening and the sentiments that this elicited [58].

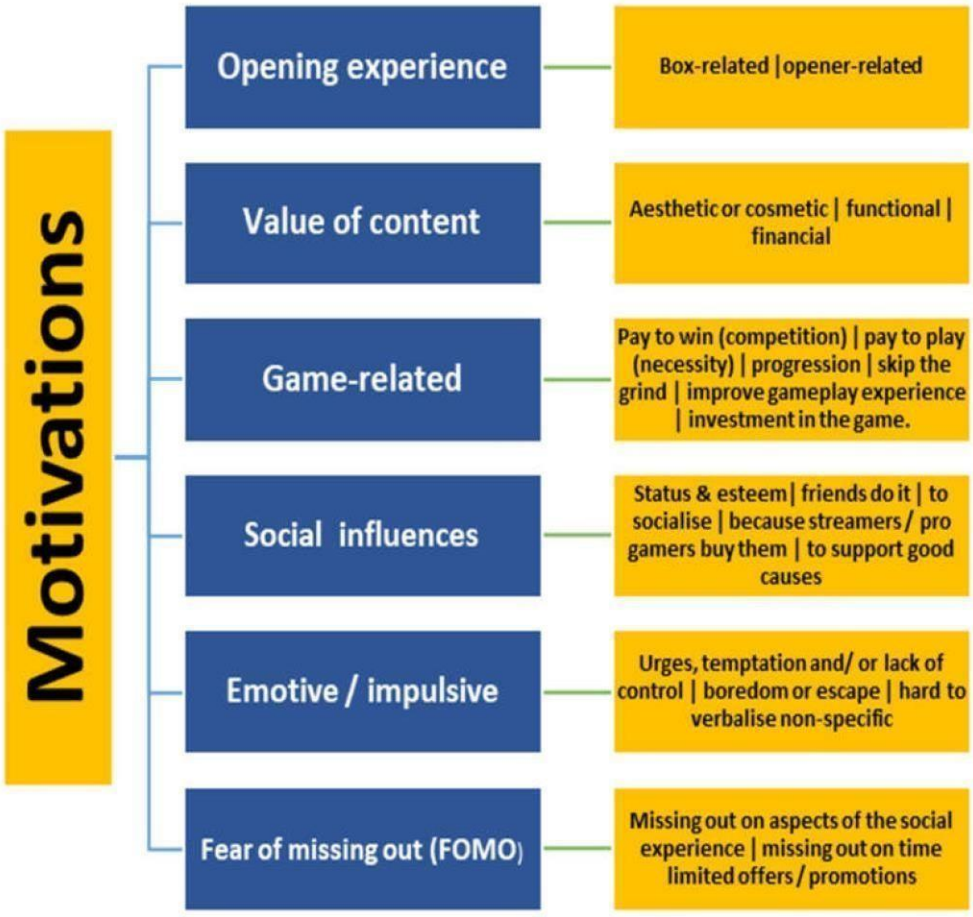

Figure 3.3 : Motivations associated with qualitative interview topics and subthemes [58]**.**

3.4.1 Fear of missing out (FOMO)

Fear of missing out was commonly cited as a motivator, especially fear of missing out on shared social events. As previously stated, there were social aspects to involvement for many, such as "real world" activities such as parties or sleepovers, and others felt that if they did not purchase loot boxes, they would be excluded from these. One gamer recalls purchasing treasure boxes to avoid missing out on a shared in-game experience, which included a unique skin that all of their friends wore. Individuals who reported social anxiety tended to reflect larger social reasons and were demographically varied [58].

3.4.2 Methods

Considering that motivation for gaming and gambling has been useful in understanding dangerous participation in both activities, this qualitative research evaluated motives for purchasing loot boxes via in-depth interviews with 28 players from throughout the UK [58].

Participants were given an After registering their interest using Qualtrics XM survey software, they will get an information page, consent-form, and demographic questionnaire (age; gender; ethnicity; geography; marital, living, occupational, individual pay, and educational status) (Manufactured by Qualtrics Seattle, WA, USA) [58].

3.5 Proposed Hybrid User Engagement Model

Engagement in a mobile game is like customer engagement behavior for other products. User engagement in one game may differ from another game. In terms of player motivation "*reasons why people begin to play*," The term engagement is linked to several things of playing situations such as flow [3], [4], pleasure, immersion, and fun, and deals with "*what makes people want to continue playing*" [6].

Video games are designed to deliver as much deep engagement in gameplay as is required for improved overall game enjoyment [4]. Every game's primary objective is to amuse, yet different individuals enjoy themselves in various ways. As a result, games attempt to adapt their scenarios to the player's preferences from the start. Most commonly, game adaptation is performed based on the player's abilities and as a result, the difficulty level is changed. Therefore, this study investigated user engagement and usability in the context of mobile games for the battle royale genre with the help of the proposed hybrid user engagement model as shown in fig 3.4.

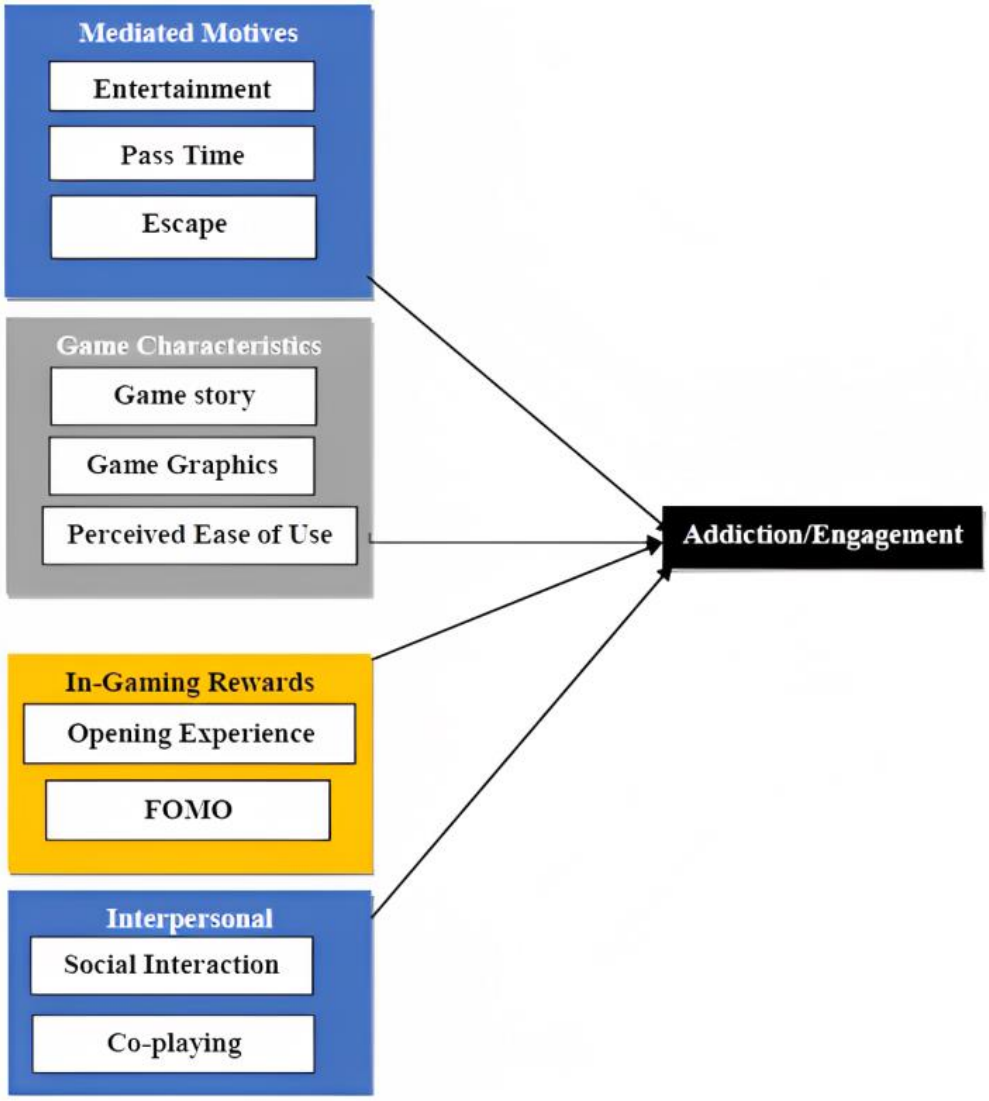

Figure 3.4 : Hybrid User Engagement Model

3.6 Selection of genre

It is still being determined if a particular game made battle royale very popular or if this category is so understood that many players want to try these games. However, you already know that battle royale games are top-rated on PCs and consoles and have become a phenomenon on mobile devices. The truth is that everybody, from teenagers to adults, has become obsessed with third-person shooters. The main advantage is that these games are portable. Better said, battle royale games are everywhere.

We all know that madness started on PCs. Soon after, people play them on consoles now available on mobile devices. There are different game genres, fighting games,Board games, and Strategy games. The selected game genre is battle royale games. An evaluation was done using a survey-based questionnaire adapted from prior studies focusingon a game's usability, intractability, ease of use, error-free play, user engagement, and gameflow.

Battle royale games have dozens to hundreds of participants who start with little equipment and must destroy their opponents while staying outside a shrinking "safe area," with the victor being the last individual or team remaining. The huge demand for battle royale gaming experience may be attributed to two factors. First, battle royale games have infinite replay value since each match experience differs from the last [59]. According to Shen, Second, the game mechanics are fair to the participants. In battle royale games, players are spawned along a path that varies with each match, and weapons are placed over the virtual battlefield, giving players a fair opportunity of snatching a gun and killing opponents [59].

The selected genre in our research was battle royale games. We used it in our study and determined a hybrid model contained several factors or elements that affect user engagement and game usability.

3.7 User Engagement in Games

Designers and developers must thus develop techniques for creating engaging interactive experiences. In mobile games, designers and developers should pay more attention and develop an interest to improving user engagement to keep players attached and engaged in games. Players want games to satisfy their expectations. Some gamers play online games to relax, while others play to pass the time.

Mobile games should be built in such a way that their difficulty corresponds to the players' abilities. By playing challenging or easy games, players cannot feel a feeling of accomplishment or satisfaction. Therefore, when developers design a game, they should focus on players' joy and develop a game with proper difficulty to fulfill users' desires, thus appealing to more users [33]. Battle passes (also known as season passes) have increasingly become popular in mobile games. This is true for battle royale games like Free Fire and PUBG, as well as games in other genres including simulation, casual, and strategy. A battle pass (or season pass depending on the game type) is a progression-based, time-bound mechanicthat prizes users for playing your game. Battle or royale passes give players more to do whilerewarding skill as well as determination.

Gamers may purchase the track and then spend extra money on a mobile game. Competing with newcomers is one thing; competing with friends is quite another. A game might be something that people play together, so if one user becomes hooked to your game and appreciates what you've created, it's a good sign.

3.8 Data Collection

In this study, we used a survey-based questionnaire collected from different numbers of participants. This survey-based questionnaire is based on our proposed hybrid model, which was applied to the battle royale genre. Additionally, we perform an online survey-based questionnaire. We used the Likert Scale for measurement. Previous studies included factors such as focusing on a game's usability and user engagement. A hybrid model is based

on several elements, these are mediated motives containing three elements: entertainment, passing time, and escape. Game characteristics include a game story, graphics, and ease of use. In gaming rewards have an opening experience and fear of mission out. The other is Interpersonal, which includes social interaction and co-playing, and all these elements are crucial for user engagement and usability.

3.9 Hypothesis

H1: There is a positive effect of mediated motives on user engagement.
H2: There is a positive effect of game characteristics on user engagement.
H3: There is a positive effect of in gaming rewards on user engagement.
H4: There is a positive effect of Interpersonal elements on user engagement.

3.10 Respondents

In this research, 230 participants were invited through convenience sampling using the online survey. Finally, 204 participants filled out the survey form, of which 123 were males and 81 were females. Additionally, we filter the data based on the frequency of game play time and game genre, with 140 respondents playing games for one hour or longer and battle royale being the genre of choice.

Table 3.1 : Gender respondents without filtered data

Gender of respondents (Without Filtered Data)					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	81	39.7	39.7	39.7
	Male	123	60.3	60.3	100.0
	Total	204	100.0	100.0	

Table 3.2 : Age of respondents without filtered data

Age of respondents (Without Filtered Data)					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	15+	44	21.6	21.6	21.6
	20+	154	75.5	75.5	97.1
	30+ or more	6	2.9	2.9	100.0
	Total	204	100.0	100.0	

Table 3.3 : Genre selected by the respondents without filtered data

Genre selected by the respondents (Without Filtered Data)					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Battle Royale Games	194	95.1	95.1	95.1
	Others	10	4.9	4.9	100.0
	Total	204	100.0	100.0	

Table 3.4 : Duration of playing games without filtered data

Duration of playing games (Without Filtered Data)					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	15+ min	59	28.9	28.9	28.9
	1 Hour or Above	145	71.1	71.1	100.0
	Total	204	100.0	100.0	

So, we considered the 140 responses out of 204 others, and we discarded the irrelevant data based on game playing duration in which we only considered the hours-based respondents. We only chose games from the battle royale genre. The survey included responses from the individuals collected through an online survey, which comprised 140 respondents. Out of the total 140 participants, 96 were males and 44 were females, and their ages varied from 15 to 56 years.

Table 3.5 : Univariate Statistics

Univariate Statistics			
	N	Missing	
		Count	Percent
Mediated Motives	140	0	0.0
Game Characteristics	140	0	0.0
In Gaming Rewards	139	1	0.7
Interpersonal	140	0	0.0
User Engagement	140	0	0.0

Table 3.5: We analyzed missing values and found that in gaming rewards count one missing value.

Table 3.6 : Gender respondents filtered data

Gender of respondents (Filtered Data)					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	44	31.4	31.4	31.4
	Male	96	68.6	68.6	100.0
	Total	140	100.0	100.0	

3.11 Detail of Survey Participants

The frequency table shows how many participants are in this category, and their percentage shows what percentage of participants is at the level of this category. The cumulative percentage shows the combined total frequency of each category level or below that level. In which we discard or filter irrelevant data based on game genre and gameplay duration; prior to filtering and finding one missing value in in gaming rewards, the sample size was 204, but after implementing these conditions, it decreased to n=140. The below table shows the frequency of gender, and in this analysis, 44 females and 96 males are involved.

Table 3.7 : Age of respondents' filtered data

Age of respondent (Filtered Data)					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	15+	26	18.6	18.6	18.6
	20+	108	77.1	77.1	95.7
	30+ or more	6	4.3	4.3	100.0
	Total	140	100.0	100.0	

Table 3.7 shows the frequency of respondents' age; most respondents are between 15-20 years of age, and some are 30 years or above.

Table 3.8 : Genre selected by respondents' filtered data

Genre selected by the respondent (Filtered Data)					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Battle Royale Games	140	100.0	100.0	100.0

Table 3.9 : Duration of playing games filtered data

Duration of playing games (Filtered Data)					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 Hour or Above	140	100.0	100.0	100.0

Table 3.9 shows the frequency of duration of playing games where 140 respondents are playing games for 1 hour or above. Here we only consider the frequency based on the hourlyperiod; others were discarded, as mentioned above.

3.12 Sample Size

The sample size consists of n=204 participants, but after discarding the irrelevantdata, it became n=140, which we finally considered for our research analysis.

3.13 Data Analysis

We collected data through a survey which was imported into SPSS for results. The test was applied to check the behavior of data, applied regression test between independent and dependent variables, and descriptive statistics in which we measured the frequency of demographics section, and measured the reliability of data individual and overall series of items.

3.14 Sample Technique

The convenience sampling technique was used for data collection. We created a survey-based questionnaire on usability, user engagement, and other preferable factorsfor mobile games. There were four independent variables and one dependent variable in the questionnaire. Independent variables were mediated motives, game characteristics, and gamingrewards, and the interpersonal and dependent variable is user engagement.

3.15 Measuring Instrument

Our survey used a questionnaire for data collection, including items reflecting our research aims. In this study, a Likert scale was used as the measuring instrument. Data was gathered using an online google form. A questionnaire was filled out by different numbers ofparticipants, to determine whether they agreed or disagreed with the statements.

Questions referring to positive and negative responses have the following values, in this way: Strongly Disagree = 1, Disagree = 2, Uncertain = 3, Agree = 4, Strongly Agree = 5.

3.16 Likert Scale

In this research, we used the 5-point Likert Scale because it gives us much more apparent answers than simple yes or no. Likert-type questions give us more granular feedback, according to Buttle, F and Babakus and Mangold 5-Point Likert Scale increasing the response rate and reducing the frustration level [60]. There is more variance on a larger scale, so adding more options will give us worse, not better results.

CHAPTER 4

RESULTS AND DISCUSSION

In this chapter, we will discuss the methods used to analyze our survey. In this section, we describe each technique, including Cronbach's alpha, reliability analysis, regression analysis, descriptive statistics, and hypothesis testing to see if it has a positive impact on user engagement or not.

4.1 Cronbach’s Alpha

The Cronbach's alpha test is typically applied to test the consistency and stability of the questionnaires, which measure latent variables. A latent variable is a variable that cannot be observed. User engagement cannot be directly measured.

Table 4.1 : Shows Cronbach's alpha & internal consistency

Cronbach's Alpha	Internal Consistency
$\alpha \geq 0.9$	Excellent
$0.9 > \alpha \geq 0.8$	Good
$0.8 > \alpha \geq 0.7$	Acceptable
$0.7 > \alpha \geq 0.6$	Questionable
$0.6 > \alpha \geq 0.5$	Poor
$0.5 > \alpha$	Unacceptable

4.2 Reliability Analysis

The internal consistency of the constructs in the study is measured by reliability. If the Alpha value of a construct exceeds 0.70 [61]. Cronbach's Alpha was used to assess construct consistency. The result has shown that the Mediated Motives scale with five items (Alpha = 0.718) was reliable, Game Characteristics scale with seven items (Alpha = 0.785). Similarly, the In Gaming Rewards scale with six items (Alpha = 0.818), and Interpersonal elements scale with six items (Alpha = 0.807) as well in user engagement, scale with five items (Alpha = 0.721), and the overall scale with 29 items ((model reliability were found reliable (Alpha = 0.940)).

Table 4.2: Shows reliability analysis

Variables	Cronbach Alpha	Number of Items
Mediated Motives	0.718	5
Game Characteristics	0.785	7
In Gaming Rewards	0.818	6
Interpersonal elements	0.807	6
User engagement	0.721	5
Overall	0.940	29

Table 4.2 shows the reliability analysis. The overall reliability of a hybrid model was 0.940.

4.3 Descriptive Statistics

Descriptive statistics help to manage the data, as shown in the below-listed tables, and we can compare one variable item to another. In descriptive statistics, the mathematical average includes the arithmetic mean used to determine the variables' central tendency. Also showsthe minimum and maximum of the variable we want to calculate.

Table 4.3 : Descriptive statistics of mediated motives factors

Descriptive Statistics of Mediated Motives Factors					
	N	Minimum	Maximum	Mean	Std. Deviation
MM1	140	1.00	5.00	4.1214	1.08268
MM2	140	1.00	5.00	3.7857	1.06471
MM3	140	1.00	5.00	3.8857	1.13851
MM4	140	1.00	5.00	3.8571	1.05647
MM5	140	1.00	5.00	4.0000	0.93686
Valid N (listwise)	140				

Table 4.3 Shows the number of items of mediated motive factors and shows the minimum responses of participants' falls at 1.00. In other words, a minimum number of

participants strongly disagree with the statements, and the maximum number of answers falls to 5.00, orthey strongly agree with the statements of mediated motives. The last two columns show each test's mean score and standard deviation. The test's mean score on the mediated motives questionnaire ranged between 4.1 to 3.7, indicating that participants were less likely to agree and more likely to be neutral. So, this means that mediated motive positively impacts user engagement.

Table 4.4 : Descriptive statistics of game characteristics factors

Descriptive Statistics of Game Characteristics Factors					
	N	Minimum	Maximum	Mean	Std. Deviation
GM1	140	1.00	5.00	3.8286	0.93642
GM2	140	1.00	5.00	3.9643	1.12787
GM3	140	1.00	5.00	3.9214	0.99689
GM4	140	1.00	5.00	3.8857	1.10646
GM5	140	1.00	5.00	3.8786	0.95562
GM6	140	1.00	5.00	3.9429	1.09131
GM7	140	2.00	5.00	3.9857	0.85651
Valid N (listwise)	140				

Table 4.4 Shows the number of items of game characteristics factors and shows minimum responses of participants fall at 1.00 and 2.00. In other words, a minimum number of participants strongly disagree and disagree with the statements. The maximum number of answers falls at 5.00, or they strongly agree with the statements of game characteristics. The last two columns show each test's mean score and standard deviation. The test's mean score of 3.9 indicates that participants are making neutral statements, according to the game characteristics questionnaire. So, this means game characteristics positively impact user engagement.

Table 4.5 : Descriptive statistics of In-gaming rewards factors

Descriptive Statistics of In Gaming Rewards Factors					
	N	Minimum	Maximum	Mean	Std. Deviation
IGR1	140	1.00	5.00	4.2143	1.02337
IGR2	140	1.00	5.00	3.8714	1.05832
IGR3	139	1.00	5.00	3.9209	1.14249
IGR4	140	1.00	5.00	3.8857	1.16351
IGR5	140	1.00	5.00	4.0214	1.07602
IGR6	140	1.00	5.00	3.8929	1.07085
Valid N (listwise)	139				

Table 4.5 Shows the number of items in gaming rewards factors and shows the minimum response of participants falls at 1.00. In other words, a minimum number of participants strongly disagree with the statements, and the maximum number of answers falls to 5.00. The last two columns show each test's mean score and standard deviation. The test's mean score ranged between 4.2 to 3.8, indicating that participants were less likely to agree and more likely to be neutral. So, this means in gaming rewards positively impact user engagement.

Table 4.6: Descriptive statistics of Interpersonal elements

Descriptive Statistics of Interpersonal elements					
	N	Minimum	Maximum	Mean	Std. Deviation
IP1	140	1.00	5.00	4.2143	1.03037
IP2	140	1.00	5.00	3.8643	.97605
IP3	140	1.00	5.00	3.9286	1.11008
IP4	140	1.00	5.00	3.9571	1.06529
IP5	140	1.00	5.00	3.9357	1.10076
IP6	140	2.00	5.00	4.0500	.89221
Valid N (listwise)	140				

Table 4.6 Shows the number of items of Interpersonal elements and shows minimum responses of participants fall at 1.00 and 2.00. In other words, a minimum number of participants strongly disagree and disagree with the statements. The maximum number of answers falls at 5.00, or they strongly agree with the statements of interpersonal

characteristics. The last two columns show each test's mean score and standard deviation. The test's mean score of the interpersonal questionnaire ranged between 4.2 to 3.8, indicating that participants were less likely to agree and more likely to be neutral. So, this interpersonal positively impacts user engagement.

Table 4.7 : Descriptive statistics of user engagement

Descriptive Statistics of user engagement					
	N	Minimum	Maximum	Mean	Std. Deviation
UE1	140	1.00	5.00	3.8571	1.05647
UE2	140	1.00	5.00	4.1143	1.03941
UE3	140	1.00	5.00	3.9143	1.08280
UE4	140	1.00	5.00	3.9643	1.07563
UE5	140	1.00	5.00	4.0286	1.03842
Valid N (listwise)	140				

Table 4.7 Shows the number of items of user engagement factors and shows minimum responses of participants' falls at 1.00. In other words, a minimum number of participants strongly disagree with the statements, and the maximum number of answers falls at 5.00, or they strongly agree with the statements of user engagement. The lasttwo columns show each test's mean score and standard deviation. The test's mean score of user engagement questionnaire ranged between 4.1 to 3.8, indicating that participants were less likely to agree and more likely to be neutral.

4.4 Regression Analysis

To further validate our hypothesis, regression was conducted, and it was used to figure out whether it had a positive impact or not.

4.5 Results & Discussion

The study investigates the effect of Mediated Motives, Game Characteristics, In Gaming Rewards, and Interpersonal elements. The following hypotheses were proposed.

H1: There is a significant impact of mediated motives on user engagement.

H2: There is a significant impact of game characteristics on user engagement.

H3: There is a significant impact of in-gaming rewards on user engagement.

H4: There is a significant impact of Interpersonal elements on user engagement.

4.5.1 Hypothesis H1:

H1: There is a significant impact of mediated motives on user engagement.

Table 4.8 : Model summary of mediated motives

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.760[a]	0.578	0.574	2.37397

Table 4.9 : Anova table of mediated motives

ANOVA[a]						
Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	1063.203	1	1063.203	188.653	0.000[b]
	Residual	777.733	138	5.636		
	Total	1840.936	139			

Table 4.10 : Coefficient table of mediated motives

Coefficients[a]						
		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	4.892	1.109		4.410	0.000
	Mediated Motives	0.763	0.056	0.760	13.735	0.000

Table 4.8 shows the impact of mediated motives on user engagement. The R square value shown in table 4.8 is 0.578 revealing that the interpreter variable justified 57.8% variation in the outcome variable along with, F (1,138) = 188.653, and these values are shown in Tables 4.8 and 4.9. As we can also see in table 4.9 where the p-value is 0.000, less than 0.05. The findings revealed that there is a significant relationship between mediated motives and user engagement, and (Beta = 0.760, p<0.000) these values are shown in table 4.10 which means that change in an independent variable which is mediated motives by one unit will bring change in the dependent variable which is user engagement.

Table 4.11 : Mediated motives questionnaire

Statements	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Mediated Motives	**1**	**2**	**3**	**4**	**5**
MM1) Playing the game gets me away from reality.	**3**	**11**	**23**	**32**	**71**
MM2) Playing the game gets me away from the problems and pressures.	**7**	**14**	**13**	**74**	**32**
MM3) I play games whenever I am frustrated or angry.	**5**	**14**	**27**	**40**	**54**
MM4) Playing the game makes me feel like I am in a different world of reality.	**4**	**11**	**32**	**47**	**46**
MM5) I play games to escape fromproblems.	**1**	**9**	**28**	**53**	**49**

Maximum participants strongly disagree with question MM2, and minimum participants strongly disagree with question MM5. Maximum contributors disagree with questions MM2 and MM3 and minimum participants disagree with question MM5. Maximum contributors are neutral with question MM4, and minimum contributors are neutral with question MM2. Maximum contributors agree with question MM2, and minimum contributors agree with question MM1. Maximum contributors strongly agree with question MM1, and minimum contributors strongly agree with question MM2. So, we can correlate them because 74 contributors agree with the question MM2 as compared to the other mediated motive questions so, this question is highly correlated with user engagement and

mediated motive have a positive impact on user engagement.

4.5.2 Hypothesis H2:

H2: There is a significant impact of game characteristics on user engagement.

Table 4.12 : Model summary of game characteristics

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.768[a]	0.589	0.586	2.34071

Table 4.13 : Anova table of game characteristics

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1084.844	1	1084.844	198.003	0.000[b]
	Residual	756.092	138	5.479		
	Total	1840.936	139			

Table 4.14 : Coefficient table of game characteristics

Coefficients[a]						
		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	3.559	1.177		3.025	0.003
	Game Characteristics	0.595	0.042	0.768	14.071	0.000

Table 4.12 shows the impact of game characteristics on user engagement. The R square value shown in table 4.12 is 0.589 revealing that the interpreter variable clarified 58.9% variation in the outcome variable with, F (1,138) = 198.003, and these values are shown in table 4.13. As we can also see in table 4.13 where the p-value is 0.000 which is less than 0.05. The findings revealed that there is a significant connection between game characteristics and user engagement, and (Beta = 0.768, $p<0.000$) these values are shown in table 4.14 which means that change in an independent variable which is game characteristics by one unit will bring change in the dependent variable which is user engagement.

Table 4.15 : Game characteristics questionnaire

Statements	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Game Characteristics	**1**	**2**	**3**	**4**	**5**
GM1) I felt that I could continuously reuse techniques that I learned on previous tasks on my later tasks.	**3**	**10**	**27**	**68**	**32**
GM2) The environment was able to support multiple human users at the same time.	**7**	**9**	**22**	**46**	**56**
GM3) I found the visual display hardware to be of high quality.	**2**	**13**	**24**	**56**	**45**
GM4) I found the visual content of the environment to be of high quality.	**5**	**13**	**25**	**47**	**50**
GM5) I found the user interface to help inform me of my current task.	**2**	**8**	**37**	**51**	**42**
GM6) I know the various gun items, protection gear, healing items, etc.	**3**	**16**	**21**	**46**	**54**
GM7) It is easy for me to play mobile games.	**7**	**31**	**59**	**43**	**0**

Maximum participants strongly disagree with question GM2 and minimum participants strongly disagree with question GM5. Maximum participants strongly disagree with question GM7, and minimum participants disagree with question GM5. Maximum participants are neutral with question GM7, and minimum participants are neutral with question GM2. Most participants agree with question GM1, while the minority agree with question GM7. Most participants strongly agree with question GM2, while the minority strongly agree with question GM7. So, we can correlate them because 68 participants agree with question GM1 as compared to the other game characteristics questions so, this question is highly correlated with user engagement and game characteristics have a positive impact on user engagement.

4.5.3 Hypothesis H3:

H3: There is a significant impact of in gaming rewards on user engagement.

Table 4.16 : Model summary of in gaming rewards

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.690[a]	0.475	0.472	2.64399

Table 4.17 : Anova of in gaming rewards

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	868.060	1	868.060	124.174	0.000[b]
	Residual	957.724	137	6.991		
	Total	1825.784	138			

Table 4.18 : Coefficient of in gaming rewards

Coefficients[a]						
		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	7.209	1.161		6.208	0.000
	In Gaming Rewards	0.533	0.048	0.690	11.143	0.000

Table 4.16 shows the impact of in gaming rewards on user engagement. The R square value shown in table 4.16 is 0.475 revealing that the predictor variable described 47.5% variation in the outcome variable with, F (1,138) = 124.174 and these values are shown in table 4.17. As we can also see in table 4.17 where the p-value is 0.000 which is less than 0.05. The findings revealed that there is a significant connection between in gaming rewards and user engagement (Beta = 0.690, $p<0.000$ these values are shown in table 4.18 which means that change in an independent variable which is in gaming rewards by one unit will bring change in the dependent variable which is user engagement.

Table 4.19 : In gaming rewards questionnaire

Statements	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
In gaming rewards	**1**	**2**	**3**	**4**	**5**
IGR1) I feel excited while opening the air drops to collect the different rewards.	**3**	**9**	**16**	**39**	**73**
IGR2) A flare gun creates excitement which contains a more significant amount of special equipment than regular airdrop.	**6**	**11**	**19**	**63**	**41**
IGR3) I go to the Supply Shop and purchase them using Shop Tokens.	**9**	**7**	**21**	**51**	**51**
IGR4) I can check the location of nearby crates on the map and collect them.	**9**	**8**	**25**	**46**	**52**
IGR5) The randomness of supply air drops significantly changes the chances of winning.	**6**	**6**	**25**	**45**	**58**
IGR6) The randomness of the discard of a weapon significantly changes thechances of winning.	**6**	**7**	**31**	**48**	**48**

The maximum number of participants strongly disagree with the question IGR3 and IGR4 and the minimum number of participants strongly disagree with question IGR1. Maximum participants strongly disagree with question IGR2, and minimum participants disagree with questions IGR3 and IGR6. Maximum participants are neutral to question IGR6, and minimum participants are neutral the question IGR1. Maximum participants agree with question IGR2, and minimum participants agree with question IGR1. Most participants strongly agree with question IGR1, whereas the minority strongly agree with question IGR2. So, we can correlate them because 73 participants strongly agree with the question IGR1 as compared to the other in gaming rewards questions so, this question is highly correlated with user engagement, and in gaming rewards have a positive impact on user engagement.

4.5.4 Hypothesis H4:

H4: There is a significant impact of Interpersonal elements on user engagement.

Table 4.20 : Model summary of interpersonal elements

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.675[a]	0.455	0.452	2.69521

Table 4.21 : Anova table of interpersonal elements

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	838.485	1	838.485	115.428	0.000[b]
	Residual	1002.451	138	7.264		
	Total	1840.936	139			

Table 4.22 : Coefficient table of interpersonal elements

Coefficients[a]						
		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	6.563	1.260		5.208	0.000
	Interpersonal	0.556	0.052	0.675	10.744	0.000

Table 4.20 shows the impact of interpersonal elements on user engagement. The R square value shown in table 4.20 is 0.455 revealing that the predictor variable clarified a 45.5% variation in the outcome variable with F (1,138) = 115.428. $p<0.05$ and these values are shown in table 4.21. As we can also see in table 4.21 where the p-value is 0.000, which is less than 0.05. The findings revealed that there is a significant relationship between interpersonal and user engagement and these (Beta = 0.675, $p<0.05$) values are shown in table 4.22 which means that change in an independent variable which is interpersonal by one unit will bring change in the dependent variable which is user engagement.

Table 4.23 : Interpersonal elements questionnaire

Statements	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Interpersonal	**1**	**2**	**3**	**4**	**5**
IP1) My teammates and I have a WhatsApp group to discussmatters/issues of the game.	**2**	**12**	**14**	**38**	**74**
IP2) I have met people personally whomI have befriended through mobile games.	**5**	**10**	**17**	**75**	**33**
IP3) I get angry/frustrated when myfriends do not cooperate while playing.	**6**	**11**	**22**	**49**	**52**
IP4) My teammates and I have dedicated time to play gamestogether.	**5**	**10**	**22**	**52**	**51**
IP5) The in-game chatting/discussion for the game is crucial for me to have control over the competition.	**4**	**14**	**23**	**45**	**54**
IP6) I recommend it to people so that we can play together.	**0**	**8**	**28**	**53**	**51**

Maximum participants strongly disagree with question IP3 and minimum participants strongly disagree with question IP6. Maximum participants strongly disagree with question IP5, and minimum participants disagree with question IP6. Maximum participants are neutral with question IP6, and minimum participants are neutral with question IP1. Most participants agree with question IP2, while the minority agree with question IP1. Most participants strongly agree with question IP1, whereas the minority strongly agree with question IP2. So, we can correlate them because 75 participants agree with the question IP2 as compared to the other interpersonal questions so, this question is highly correlated with user engagement and interpersonal has a positive impact on user engagement.

4.6 Research findings

The purpose of this study was to measure user engagement for mobile games. This chapter reports the findings regarding the following research questions listed below:

1. How do models exist that evaluate user engagement in games?
2. What engagement factors motivate a game player to continue playing without boredom?
3. Does a hybrid model help to improve user engagement, usability, or the overall gaming process?

4.6.1 Finding regarding research question 1:

The finding for research question 1 was to identify the models that exist to evaluate user engagement in games, these models are shown in fig 3.1, 3.2, and 3.3, we studied these models and created a hybrid model (as shown in fig 3.4) to evaluate user engagement effectively.

4.6.2 Finding regarding research question 2:

The finding for research question 2 was to identify the elements or factors that can enhance or improve user engagement. We researched the various models and aspects that could boost user engagement (as shown in fig 3.1, 3.2, and 3.3) to formulate this inquiry we have found different factors. These factors are Mediated motives which contain different sub-elements such as entertainment, pass time and escape. Game characteristics contain the game story, game graphics, and perceived ease of use. In gaming rewards contain an opening experience and fear of missing out. Interpersonal contains social interaction and co-playing. All these factors (as shown in fig 3.4) can motivate a game player to continue playing games without boredom and keep them engaged.

4.6.3 Finding regarding research question 3:

The answer to research question 3, after performing a survey, this research indicates that a hybrid model can help to improve user engagement, gaming usability, or overall gaming process. This model can help game developers and designers to produce more engaging games that users can play without boredom. We also tested our hypothesis which includes four independent variables and one dependent variable. The result of our hypothesis positively impacted user engagement.

CHAPTER 5

CONCLUSION

In this chapter, we will examine our research-based conclusion and show how user engagement and involvement play a key part in gaming and how it helps designers and developers.

5.1 Conclusion

Engagement and flow are essential components in the gaming industry. These are utilized as fundamental parameters in gaming to assess the user engagement and usability aspects that are best for mobile games and to assess it for the chosen genre, battle royale games. The success of any battle royale game is determined by how well it is created with the many prior models' factors or elements, which we combined to provide a hybrid model. These aspects include those linked to interpersonal relationships, game characteristics, in game rewards, and mediated motives.

Battle royale games require significant user engagement, flow, usability, and interaction. Conducting the usability evaluation and user engagement factors preferable for mobile games are essential in our research. Serval exciting alternatives have been developed in the last several years to comprehend usability and user engagement. Still, much research is required in the area to learn all gaps.

The perspective of usability and user engagement requires much attention. The survey criteria were based on the literature review to make it reliable and valid. Our comprehensive research involves the prior models we generate a hybrid model that held the quality to bring a broad range of usability and user engagement. In this research, a hybrid model measuring

the battle royale games has been proposed. Hybrid model evaluation compromises questionnaires, and a survey is conducted to validate the analysis of results.

Our questions conclude that researchers have different perspectives on user engagement and usability, and we have covered all these factors. User engagement isthe crucial perspective, and it is investigated to make further advancements in research. We found gaps in user engagement for battle royale games in the survey, which we must cover.

Participants' responses are positive during the evaluation of usability and user-engagement factors preferable for mobile games to find whether these games are more engaging or not. As this research has demonstrated, this kind of battle royale game is an essential part of the future and will improve the battle royale games' effects on the usability and user engagement.

Based on previous research, we present a hybrid model that encourages players to stay motivated and continue playing the games. To make games engageable, it is necessary to keep a few factors concerning that the player could have endured gameplay without boredom and anxiety.

There is an impact on usability, and user engagement in battle royale games in overall user engagement, and usability process as these games highly motivate the players. However, evaluation of battle royale games cleared and evident that players are interested in playing battle royale games which follows the user engagement. These usability aspects strengthen the need for user engagement to cover the analysis. Mediated motives, game characteristics, in gaming rewards, and interpersonal factors have positively affected users’ engagement.

5.2 Recommendation and Future work

This study revealed the effectiveness of user engagement and usability in mobile games. Since user engagement and usability have proven efficacy, developers and designers should incorporate user engagement and usability into mobile games to maintain quality.

Furthermore, it could help to maintain player interest in the games, inspire them, and assist them in preserving player interest over time. Moreover, the ultimate way to get involved in mobile games' usability and user engagement is to include the developers and designers to consider their usability and user engagement activities in the games. In the future, it will benefit developers and designers to produce more engaging games and make them endure gameplay without boredom and anxiety.

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APPENDIX A

"Evaluation of Usability and User Engagement factors preferable for Mobile games"

The questions asked below are about the flow and user engagement factors. Please mark the appropriate answer in responding to those questions.

For each of the following questions, circle the response that best describes how you feel about the statement, where: 1= Strongly agree, 2= Disagree, 3= Neutral, 4= Agree, 5= Strongly agree.

Gender: 1) Female, 2) Male.

Age: 1) 15+, 2) 20+, 3) 30+ and above.

Genre: 1) Battle Royale, 2) Others.

Duration: 1) 15 minutes, 2) 1 Hour or Above.

Demographic Section	**Write your answers here:**
Age:	
Gender:	
Battle royale game you play:	
Time for playing games:	

Questionnaire-based on these papers [62], [63], [52], and [64].

APPENDIX B

Statements	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Mediated Motives					
Playing the game gets me away from reality.	1	2	3	4	5
Playing the game gets me away from the problems and pressures.	1	2	3	4	5
I play games whenever I am frustrated or angry.	1	2	3	4	5
Playing the game makes me feel like I am in a different world ofreality.	1	2	3	4	5
I play games to escape from problems.	1	2	3	4	5
Game Characteristics					
I felt that I could continuously reuse techniques that I learned on previous tasks on my later tasks.	1	2	3	4	5
The environment was able to support multiple human users at the same time.	1	2	3	4	5
I found the visual display hardware to be of high quality.	1	2	3	4	5
I found the visual content of the environment to be of high quality.	1	2	3	4	5

I found the user interface to help inform me of my current task.	1	2	3	4	5
I know the various gun items, protection gear, healing items, etc.	1	2	3	4	5
It is easy for me to play mobile games.	1	2	3	4	5
In gaming Rewards					
I feel excited while opening the air drops to collect the different rewards.	1	2	3	4	5
A flare gun creates excitement which contains a more significant amount of special equipment than regular airdrop.	1	2	3	4	5
I go to the Supply Shop and purchase them using Shop Tokens.	1	2	3	4	5
I can check the location of nearby crates on the map and collect them.	1	2	3	4	5
The randomness of supply air drops significantly changes the chances of winning.	1	2	3	4	5
The randomness of the discard of a weapon significantly changes the chances of winning.	1	2	3	4	5
Interpersonal					
My teammates and I have a WhatsApp group to discuss matters/issues of the game.	1	2	3	4	5
I have met people personally whom I have befriended through mobile games.	1	2	3	4	5

I get angry/frustrated when myfriends do not cooperate while playing.	1	2	3	4	5
My teammates and I have dedicated time to playing games together.	1	2	3	4	5
The in-game chatting/discussion for the game is crucial for me to have control over the competition.	1	2	3	4	5
I recommend it to people so that we can play together.	1	2	3	4	5
User Engagement					
Playing the game makes me feel like I am in a different world ofreality.	1	2	3	4	5
I could construct a story about my actions in the environment.	1	2	3	4	5
I believed that I was the character I was controlling.	1	2	3	4	5
The environment used multiple techniques to convey emotion.	1	2	3	4	5
I feel more connected to my friends while playing a game team match with them rather than playing alone.	1	2	3	4	5

Usability-2ndVersion

by Shabana T

Submission date: 24-Mar-2023 11:22AM (UTC+0500)
Submission ID: 2045202407
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Usability-2ndVersion

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