

Analysis of Students' Preferences and Engagement with Mobile Games: A Study of Game Assets and Colour Impact

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Abstract

Mobile games are gaining in popularity among students, although the factors driving engagement remain poorly understood. This study, conducted among 378 students studying for a Bachelor's degree in Computer and Digital Sciences at the Université Virtuelle de Côte d'Ivoire, explores the influence of game assets and colours on player engagement. Using an online questionnaire, the study identified students' gaming preferences and their perception of colours. The results show that the key elements most favoured by students are graphics, sound design, the game system, narrative, interactivity and accessibility. What's more, colour plays a decisive role in their preferences and commitment to educational mobile games.

Keywords

Engagement, Game Assets, Colour, Mobile Games

1. Introduction

With the rise of mobile technologies, mobile gaming has become an increasingly popular form of entertainment and learning, particularly among students. According to a 2022 study, 72% of students in higher education play mobile games at least once a week [1]. Mobile games have many potential educational benefits. They can be used to enhance the learning of abstract concepts, motivate students to engage in learning tasks and foster the development of cross-curricular skills such as problem solving and collaboration [2]. However, there is still a lack of knowledge about the factors that influence students' preferences and engagement with mobile games. An exploration of these factors is necessary to design and develop effective mobile games for student learning. This study therefore

aims to explore two key determinants of students' choice and engagement with games: preferred gameplay characteristics and the impact of colour on the gaming experience. More specifically, the study focuses on two objectives: firstly, to identify the game assets (graphics, sound, narrative, etc.) and game mechanics that students prefer. Secondly, and finally, to assess the influence of colours on the appeal and motivation felt during the game. To do this, an online questionnaire was submitted to a sample of students to gather their habits and preferences in terms of mobile games. Specifically, questions were asked about the frequency with which games were played, the objectives of the players, the types of games preferred, the game elements enjoyed, and the perceived impact of colours on the gaming experience. The data obtained will be the subject of a descriptive analysis aimed at quantifying the dominant tastes.

The results will shed light on the design levers and aesthetic choices that will optimise student adherence to serious mobile games. They will provide practical guidance to developers on how to design immersive and engaging game experiences that enhance learning. This research will shed new light on the success factors for educational games with students, an important issue at a time when the smartphone games market is booming.

2. State of the Art

2.1. Commitment

Player engagement is a complex concept that has been studied by many researchers [3] [4] [5] [6]. There is no single definition of player engagement, but it is generally defined as the degree to which a player is involved in a game. Player engagement can be measured by a number of variables, such as time spent playing, number of play sessions, degree of emotional investment and level of satisfaction [4]. Numerous studies have been conducted on gamer engagement [5]. Some studies have examined the factors that contribute to gamer engagement, while others have looked at the consequences of gamer engagement [6].

2.2. Maintaining the Integrity of the Specifications

2.2.1. Factors Contributing to Player Engagement

Studies have identified a number of factors that contribute to player engagement. These factors include:

- Game characteristics: Game characteristics, such as gameplay, storyline and graphics, can contribute to player engagement [4].
- Player characteristics: Player characteristics such as age, gender and learning style can also contribute to player engagement [5].
- The gaming environment: The gaming environment, such as the social context and the time available, can also influence player engagement [6].

2.2.2. Consequences of Player Engagement

Player engagement can have a number of positive consequences, such as:

- Improved performance: Engaged players are more likely to succeed in games [4].
- Increased motivation: Engaged players are more likely to stay motivated to play [5].
- Skill development: Engaged gamers can develop new skills by playing games [6].

Gamer engagement is a dynamic concept that can fluctuate over time. The factors that contribute to player engagement can also vary depending on the type of game and the target audience [3] [5].

3. Game Assets

Game assets are the elements that make up a video game, such as graphics, sound, animations, scripts, user interfaces and so on. They are essential to the creation of an immersive and engaging video game [7].

3.1. Classification of Gaming Assets

Game assets can be classified into several categories, according to their nature or function.

- Graphics: graphics are the images that make up the game world. They can be 2D or 3D, and are created using techniques such as 3D modelling, texturing, lighting and animation [7].
- Sound: sound is an essential element in immersing the player in the game. It can include sound effects, music and voice-overs [7].
- Animations: animations allow the characters and objects in the game to move. They are created using techniques such as motion capture and computer animation [7].
- Scripts: scripts define the behaviour of game characters and objects. They are written in a programming language such as C++, Java or Python [8].
- User interfaces: user interfaces allow players to interact with the game. They include elements such as menus, buttons and sliders [7].
- Other assets: Other game assets can include game data, such as maps, levels and objects. They can also include elements such as soundtracks and translations [7].

3.2. Units

Game assets have evolved significantly over the years. Graphics have become increasingly realistic, thanks to advances in technology [9]. Sound has also become more immersive, with the use of technologies such as surround sound and 3D audio [9]. Animations have become more fluid and expressive, thanks to advances in computer animation [9]. Scripts have become more complex, with the use of techniques such as artificial intelligence and machine learning [8]. User interfaces have become more intuitive and accessible, thanks to advances in user interface design [7].

Gaming assets will continue to evolve in the coming years. 3D graphics will become even more realistic, thanks to advances in computing power [9]. Sound will become even more immersive, thanks to the use of technologies such as virtual reality and augmented reality [9]. Animations will be even more fluid and expressive, thanks to the use of artificial intelligence and machine learning [9]. Scripts will be even more complex, thanks to the use of machine learning and text generation [8]. User interfaces will be even more intuitive and accessible, thanks to the use of artificial intelligence and machine learning [7].

4. Colours and Their Impact

Colours are an essential component of human perception [10]. They can have a significant impact on our emotions, thoughts and behaviour.

4.1. Classification of Colours

Colours can be classified in different ways, according to their nature or function [11].

- Primary colours: primary colours are the basic colours that cannot be created from other colours. They are red, green and blue.
- Secondary colours: secondary colours are created by mixing two primary colours. These are orange, yellow, violet and brown.
- Tertiary colours: tertiary colours are created by mixing a primary and a secondary colour.
- Warm colours: warm colours are those associated with warmth and passion. They include red, orange and yellow.
- Cool colours: Cool colours are those associated with coldness and tranquillity. They include blue, green and violet.
- Neutral colours: Neutral colours are those that are not associated with a particular emotion. They are black, white and grey.

4.2. Impact of Colours

Colours have a significant impact on our perception. They can affect our mood, attention, memory and behaviour [10].

- Mood: colours can have a significant impact on our mood. Red is often associated with excitement and energy, blue is often associated with relaxation and tranquillity, and green is often associated with peace and serenity.
- Attention: bright colours can attract our attention more easily than pale colours.
- Memory: colours can help us remember information.
- Behaviour: colours can influence our behaviour. For example, red is often associated with shopping, and green is often associated with health.

4.3. Use of Colours in Video Games

Colours are used strategically in video games to create an immersive and engag-

ing experience [12].

- Colours can be used to create a certain feeling or atmosphere. For example, a horror game may use dark and bright colours to create a frightening atmosphere.
- Colours can be used to guide players. For example, a platform game might use bright colours to show players where to go.
- Colours can be used to create a sense of coherence. For example, a game might use a consistent colour palette to create a strong visual identity.

Colours are an essential component of human perception. They can have a significant impact on our emotions, thoughts and behaviour [10]. Video game designers use colour strategically to create an immersive and engaging experience [12].

5. The Method

A survey was carried out among 378 second-year students enrolled in the Computer Science and Digital Science degree program at the Ivory Coast Virtual University. The students were asked to complete an online questionnaire that gathered information about their gaming habits and preferences, as well as their perception of colors in games.

5.1. Selection of Participants and Sampling

The survey was conducted among 709 second-year students enrolled in the Computer Science and Digital Science degree program at the Ivory Coast Virtual University. Of these, 378 (*i.e.* 53.32% of the initial sample) took part in the study by completing the questionnaire. This participant population is made up of 57% girls and 43% boys, reflecting the diversity within the sample. Although they come from a variety of specialties, all these students are equipped for and accustomed to distance learning. This population was targeted because of their likely familiarity with technology and smartphone games.

5.2. Description of the Questionnaire Used for the Study

The questionnaire was designed to explore various aspects of students' gambling habits and preferences. The main questions included in the questionnaire are:

- **Game ownership:** Identification of the number of students with games installed on their smartphones.
- **Types of games:** Categorization of the genres or types of games that students play most frequently.
- **Motivation to play:** Understanding the main reasons why students play, whether for entertainment, learning or other reasons.
- **Preferred game assets:** Identification of the specific elements of the game that appeal most to students, be it the graphics and visual design, the audio and sound design, the game mechanics and system, the storyline and narrative, or the interactivity and accessibility.

- **Impact of colors:** Evaluation of the importance of colors in the overall gaming experience.
- **Dominant colors:** Identification of the colors that students find most attractive or dominant in the games.

5.3. Objective of the Experiment

The main aim of this survey is twofold. On the one hand, it aims to highlight the importance of mobile games. Secondly, it aims to identify the game assets and colors that have the greatest impact on player engagement.

6. Analysis and Interpretation

6.1. Analysis

In our study we carried out a survey of 378 students enrolled in Computer Science and Digital Science at the Ivory Coast Virtual University. These are male and female students in the second year of their bachelor's degree in all their respective specialties, equipped for distance learning. The tables below show the results of our study.

6.2. Interpretation

We assessed the prevalence of gaming among students using two criteria: possession of a gaming application (80.7% have one) and frequency of daily gaming (61.2% play every day). These data show that gaming is a widespread activity among us (see **Table 1**).

According to our observations, 61.4% of learners play mainly for entertainment, while 29.1% seek to learn through games. A further 9.5% have other motivations for playing (see **Figure 1**). Understanding these trends helps us to understand the importance of games as a learning tool. We see that in order to meet the diverse needs of learners, it may be beneficial to design games that combine both entertainment and education. This points to the importance of striking a balance between fun and learning when designing games.

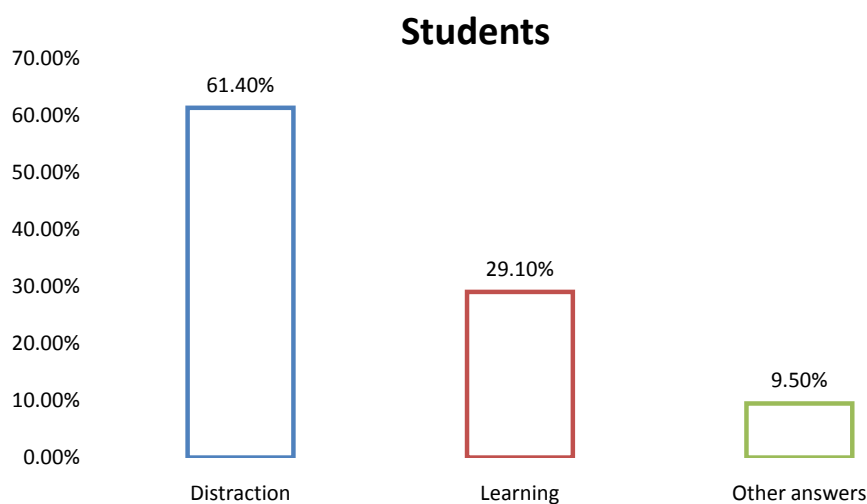
According to our data, a majority of learners, 45.6%, opt for puzzle or reflexion games. We also find that 14.8% prefer strategy games and 12.7% sport games (see **Table 2**). These figures reveal a marked preference for games requiring reflection and strategy. We know that puzzle games strengthen cognitive skills, and strategy games require thinking and decision-making. On the other hand, sports games, which focus on physical skills, seem to be less popular. This understanding

Table 1. Summary of the prevalence of games.

The prevalence of gaming among students	Student	
	Criteria	Percentage
Having a fun application as part of your mobile device	80.7%	19.3%
Daily play attendance	61.2%	38.8%

Table 2. Trends in types of gambling.

Trends in game types	Students
Puzzle games	45.60%
Strategy games	14.80%
Sport game	12.70%

**Figure 1.** Diagram of players.

of our preferences can guide developers in designing games tailored to our learning needs.

According to the data, we find that the majority of learners, 37.8%, value game mechanics and systems. Scenario and narrative followed at 25.5%, then graphics and visual design at 21.1%. Audio and sound design are valued by 13.2% of learners, while interactivity and accessibility are the least popular at 2.3% (see **Table 3**). We deduce from this information the crucial importance of game mechanisms and narrative in engaging learners.

According to our observations, out of 67.5% of learners, colours act as a motivating factor in the game, while 32.5% disagree (see **Table 4**). We recognise the importance of colours on our engagement and motivation in the video game. Colours influence our emotions, making the game more enjoyable and immersive. They also enable us to distinguish the different elements of the game and convey information. Finally, colours enhance the aesthetics of the game, making it visually fun. In short, we understand that colours are essential to our gaming experience.

We can see that the majority of learners, with 87 votes, opt for blue, making this colour the dominant one in their preferences for a game. Green and red follow with 41 and 31 votes respectively, while yellow, black and white and other colours receive fewer votes (**Figure 2**). These trends underline the appeal of blue to learners in the context of the game. We recognise the influence of colour on the user experience, impacting engagement and motivation. Understanding these preferences guides us in designing more defined games.

Table 3. Game assets most appreciated by students.

Popular game assets	Students
Game mechanics and system	37.80%
Scenario and narrative	25.50%
Graphics and visual design	21.10%
Audio and sound design	13.20%
Interactivity and Accessibility	2.30%

Table 4. Impact of colors on learners.

The impact of colors	Students
Criteria	Percentage
Pre-eminence of colors in the play experience	82%
Colors as a motivational lever	67.50%

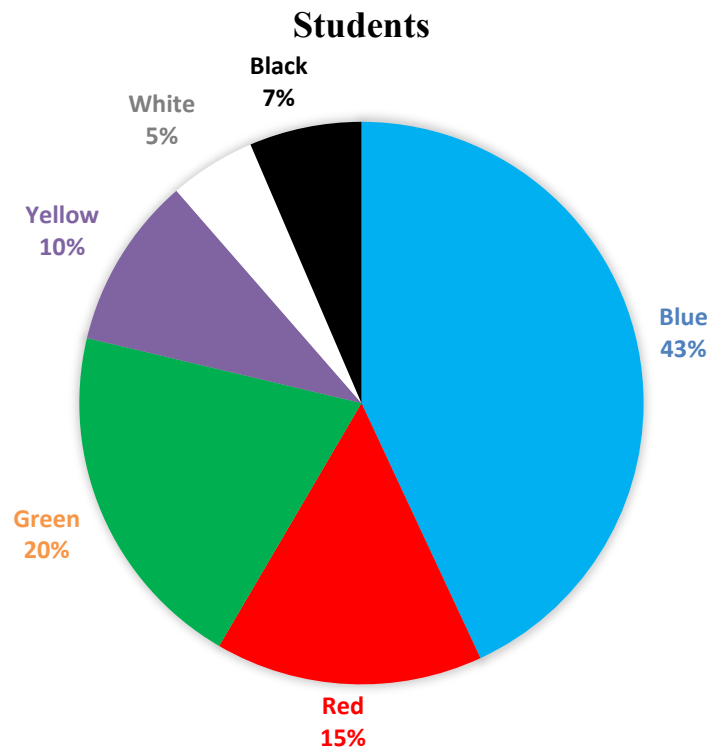


Figure 2. Curve of color preferences in the game.

7. Discussion

This study provides us with valuable information on the gaming habits and preferences of computer science undergraduates. Firstly, it confirms the high prevalence of smartphone gaming in this population, with over 80% of students owning gaming applications and over 60% playing them daily. This predominance of entertainment motivations is in line with the findings of authors [13]

who identified pleasure and release as key motivating factors among gamers.

In addition, the preference for puzzle games corroborates the work of authors [14] who showed that students' favourite game genres are strategy, puzzles and cards (Figure 3). The dominant motivations are entertainment and learning. This highlighted the potential of serious games, combining fun and education, to meet the varied expectations of students (Table 5). Particularly as the most popular game genres—puzzles, strategy—stimulate cognitive faculties.

Among game assets, mechanics and storytelling stand out as key elements (Figure 4). The importance attached to game mechanics is also consistent with research that has established gameplay as a fundamental element of engagement [15]. This can guide developers' design choices to optimise engagement.

Finally, the study highlights the perceived positive impact of colours on motivation and immersion in the game. The positive influence of colours on motivation confirms the results of authors [16] on the effects of colours on immersion and pleasure in virtual environments (Figure 5). Blue appears to be the preferred colour, ahead of green and red (see Table 6). Taking these chromatic preferences into account could improve gamers' visual experience.

To sum up, the results of this research support a number of already established insights into the determinants of gamer engagement. It also adds to our

Table 5. Summary of players' objectives.

Aim of the game	Students
Distraction	61.40%
Learning	29.10%
Other answers	9.50%

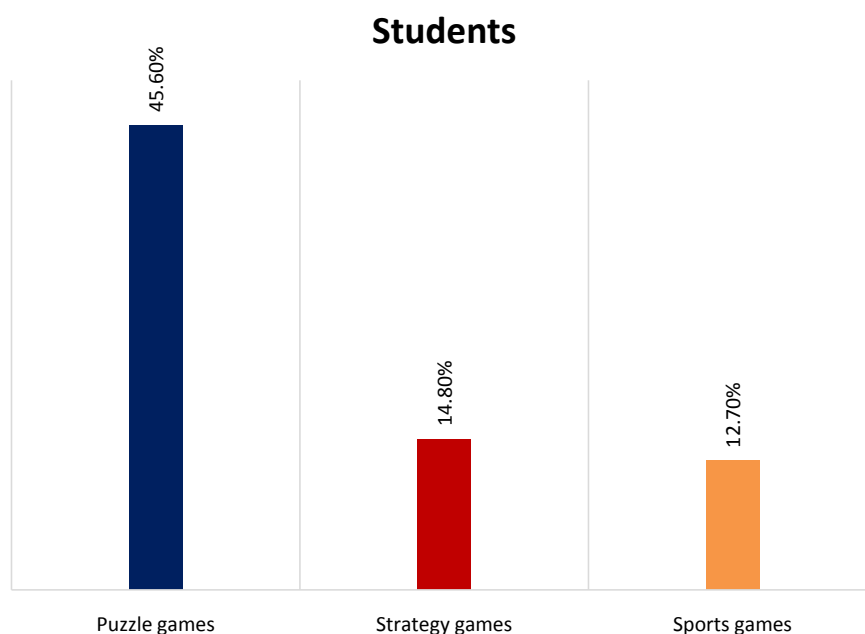


Figure 3. Trends in types of gambling.

Table 6. Summary of color preferences in the game.

Color preference trends in a game	Students
Blue	87
Red	31
Green	41
Yellow	20
White	10
Black	13

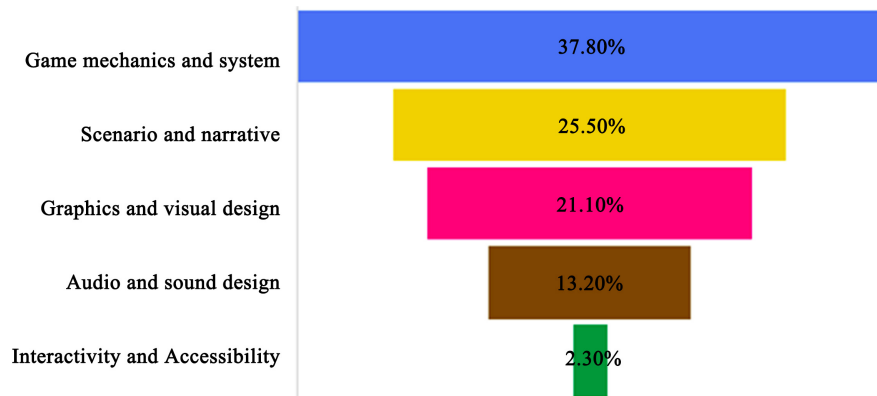


Figure 4. Diagram of the game assets most appreciated by students.

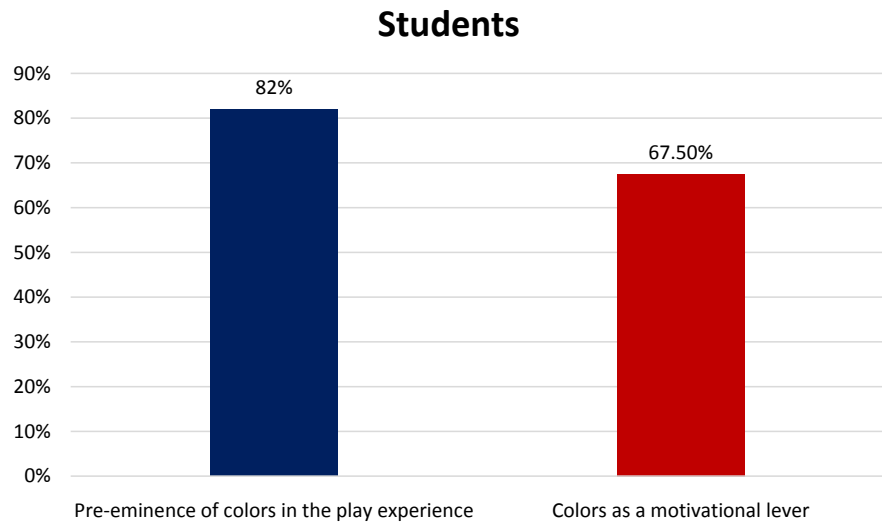


Figure 5. Diagram of the impact of colors on students.

understanding of the preferences of a group of students in Côte d’Ivoire who have been little investigated until now.

Its implications, particularly in terms of the design of motivating and immersive serious games, offer relevant prospects for improving game-based learning. As underlined by [14] and [12], adapting games to players’ motivations is the key.

8. Limitations and Outlook

This study was conducted on a small sample of students in Côte d'Ivoire. Further research is needed to confirm the results of this study in other populations.

The results of this study have important implications for the design and development of mobile games for students. By taking into account colour preferences and impact, mobile game developers can create games that are more attractive and engaging for students. Armed with this information, we are now ready to refine the design of our educational game dedicated to learning mathematics, which will serve as the basis for our next survey.

9. Conclusions

In conclusion, this study has enabled us to gain a better understanding of the gaming habits and preferences of Ivorian computer science degree students. The results show that games on smartphones are very much a part of their daily lives, and have both a recreational and an educational dimension.

The most popular genres are puzzle and strategy games. In terms of game characteristics, it is above all the gameplay mechanics and the narrative that capture their interest. The study also highlighted the positive influence of colours, particularly blue, on their motivation.

These findings have important implications for the design of educational games aimed at this audience. They highlight the need to incorporate stimulating game mechanics while incorporating the colours that students appreciate. This type of adaptation could make it possible to design games that are both entertaining and conducive to arousing their interest in learning.

Although further research is needed to consolidate and extend these results, this study opens up promising prospects for exploiting the motivational potential of video games for educational purposes with Ivorian students.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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