Edutainment as a Concept of Education and Entertainment

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Abstract — **Background: Android game creation dominates the mobile gaming market, which has proliferated. Professionals and hobbyists have been drawn here. In addition, edutainment, which combines education and enjoyment, is changing the learning environment. Strategy and simulation games may teach.**

Objective: To learn Android game programming, this article implements a simple game. It also examines the history, present, and future of edutainment.

Methods: A two-pronged approach is used in the study. A detailed literature review was undertaken from papers, books, and other relevant materials, followed by a thematic analysis to identify edutainment topics. Second, for efficiency, the study examines Android game development using Android Studio, including Kotlin and Android SDK.

Results: Android Studio's Kotlin and HTML game shows how user-friendly and engaging it is. With children's migration to digital media, the literature review of edutainment emphasises its growing relevance. Economic and historical concepts are taught via strategy and simulation games.

Conclusion: Kotlin and Android Studio are promising tools for developing intuitive and exciting games. Additionally, education uses games' entertainment appeal to provide relevant learning experiences.

I. INTRODUCTION

Proficiency in Android game development has emerged as a highly sought-after skill in this era of pervasive digital technology. The initial fear or apprehension associated with this profession progressively evolves into a natural and automatic behaviour via consistent hard work and active participation. Ideation is the first phase in game development when the game's mechanics, objectives, and desired user experience are conceived and materialised.

Visually captivating visuals and attractive music are crucial in attracting and retaining participants. These components constitute the second phase of development. Based on the study done by Panse et al. [1], it has been shown that edutainment strategies effectively improve the whole game experience and are not only cosmetic improvements.

Game design is the conversion of abstract ideas into a concrete form via the use of programming code. Fluency with programming languages like Kotlin or Java is crucial for creating Android applications. According to Missen et al. [2], the effectiveness of mobile applications for children relies on their usability and the range of services they provide.

The user interface (UI) design is crucial in this context. An aesthetically pleasing and uncomplicated user interface enhances the user experience by improving the game's friendliness and simplicity. Grady et al. [3] argue that edutainment is vital in ensuring a smooth deployment and download procedure.

This article aims to combine the areas of entertainment and education by exploring the potential of developing educational Android games. Using Kotlin in Android Studio, we investigate the possibility of merging gamification with academic concepts, which Murrar and Brauer [4] have acknowledged as a feasible approach in modern education.

Cheon [5] argues in his article on multiplatform application development that game developers may significantly advantage the Android operating system because of its well-recognised adaptability and user-friendliness. However, the success of a mobile application is determined by more than just its development; skilful marketing is essential for spreading information. Sapci et al. [6] have noted that developers often need to pay more attention to managing this component.

Continual marketing activities are necessary to sustain profitability and increase market share. According to the research conducted by Holbert and Wilensky on instructional video games, to effectively engage and retain players, it is recommended to emphasise the unique attributes of the programme [7].

To achieve victory in an Android game, it is vital to use a blend of innovative concept generation, proficient programming, and efficient marketing strategies. The Android platform provides developers a lucrative environment because of its substantial user base.

Developers that use a comprehensive approach that combines marketing and development may significantly boost the success of Android games.

A. Aim of the Article

The article's objective is to examine and clarify the intricate nature of edutainment. The article aims to thoroughly comprehend the potential synergistic integration of education and entertainment, resulting in exciting and successful learning experiences.

This study explores edutainment's historical trajectory and evolutionary progression, examining its origins and advancements across many media platforms such as television, video games, and interactive digital interfaces. This article emphasises the possible advantages of edutainment, including enhanced student engagement, excellent retention of educational material, and cultivating a favourable attitude toward learning.

Moreover, the article aims to examine and provide practical examples of education in various age cohorts and educational environments. This study aims to provide a comprehensive understanding of the underlying design principles, pedagogical tactics, and technical developments that can optimise the educational value of edutainment.

The primary objective of this article is to motivate educators, researchers, and content producers to use the potential of education to influence its trajectory, hence enhancing the enjoyment and effectiveness of learning for individuals across various age groups.

B. Problem Statement

The article discusses the core concern of promoting an efficient education within a contemporary context characterised by digitalisation and media influence. The issue under consideration pertains to the traditional approaches used in education, which often encounter difficulties in engaging and maintaining students' attention, particularly among younger cohorts exposed to a continuous influx of multimedia stimuli. Conventional classroom teaching often lacks engagement and fails to use the capabilities of technology and entertainment to augment educational experiences.

The following article explores the need for a paradigmatic transformation in education, highlighting the significance of integrating edutainment, a combination of educational and entertainment elements, to enhance engagement and retention in the learning process. The task at hand is achieving a harmonious equilibrium between enjoyable and purposeful material, guaranteeing that the integration of entertainment and education does not undermine educational goals but enriches them. The study examines how edutainment may serve as a beneficial instrument for educators, parents, and policymakers in tackling the ever-changing educational environment in the era of digital advancements.

II. Literature Review

The article delves into educational computer games, which combine education and entertainment as edutainment. This concept involves delivering lessons in a captivating and recognisable environment, such as television, computer games, movies, music, websites, and multimedia software [8], [9].

While computer simulation has been long employed for training civilian and military pilots, modern flight simulation games have surpassed commercial software in sound quality, graphics, and overall realism. A similar trend is emerging in the automotive industry, with Germany working on programs that simulate driving in the city and on open roads. These simulations offer a cost-effective way to enhance participants' responses and decision-making. However, they need more sophisticated 3D animation and immersive experiences in modern computer games [10], [11].

Certain first-person shooting games have shown potential as educational tools, particularly for military and anti-terrorist units, to enhance their tactical knowledge, orientation, and coordination skills [12]. Though not primarily intended for education, many social and computer games carry significant educational aspects. For instance, Monopoly teaches basic market economy principles, while games like Age of Empires, Total War, and Civilisation impart knowledge of political economy, history, military theory, sociology, and ecology. Also, management-oriented games like Transport Tycoon, Railroad Tycoon, and Sim City I-IV allow players to hone their managerial skills in different scenarios [7], [13], [14].

Notably, educational games designed for children are essential today, as classic toy sales decline while kids increasingly engage with digital media. These educational games cater to various age groups, from interactive electronic picture books to games like Tic Tac Toe, which foster learning in its truest sense [1], [15].

III. Methodology

A. Literature analysis

A comprehensive literature review strategy was undertaken to understand the concept of edutainment in the contexts of education and entertainment. A total of 120 scholarly articles, books, and relevant resources were thoroughly analysed in this qualitative study.

The selection process was meticulous, with various sources representing various perspectives. The materials comprised 60% journal articles, 30% books, and 10% other resources like conference proceedings and reputable online sources. The research was well-informed by comprehensively understanding edutainment's historical development, current applications, and prospects [1], [16].

The study closely examined the evolution of edutainment, from its historical development through its present applications to its potential future forms.

An analysis of 40 seminal works provided an overview of the historical development of edutainment, while 50 recent articles (from the last five years) gave insights into current trends. The remaining 30 sources were forward-looking, discussing potential future directions for edutainment.

Thematic analysis was employed to analyse the data. Approximately 200 initial codes were generated, reflecting exciting features of the data pertinent to the research question. These initial codes were grouped into potential themes. After careful review and refinement, 20 significant themes emerged from the literature.

These themes formed the basis for the study's subsequent analysis and discussion sections. Each theme was explored in detail, with excerpts from the literature supporting evidence. This rigorous approach ensured a comprehensive understanding of edutainment and its role in pedagogy.

B. Assessing Edutainment across Ages and Institutions

Conducting a comprehensive literature search was the first stage in our technique. The focus of our study was on the use of edutainment in various educational environments and among a broad age group. We referenced the studies conducted by Panse et al. [1], Missen et al. [2], and Murrar and Brauer [4] in our inquiry. Each of these studies examines edutainment in a distinct educational setting. The current investigation has provided valuable insights into the wide range of edutainment apps and their influence on academic accomplishments.

The inquiry expanded upon the research conducted by Sapci et al. [6] and Grady et al. [3] by examining particular examples of edutainment tools and approaches in more detail. The above literary works provide insight into the many age groups that might benefit from edutainment, specifically focusing on its ability to enhance cognitive processes and learning.

Digital game-based learning was a crucial component of our philosophy in edutainment. Several academic references, such as Kahila et al. [8] and Holbert & Wilensky [7], have significantly advanced our comprehension of creating and implementing instructional digital games targeting different age groups.

The approach included an assessment of the educational game production process, drawing on the findings of Martinez et al. [10] and Mostafa & Faragallah [9]. These studies illuminate the essential nature of technical and pedagogical factors in developing edutainment experiences.

We cross-referenced our results with current applications and case studies in the sector to see whether they aligned with our research purpose of studying edutainment in different educational settings. To understand the present patterns and uses of edutainment, it was very beneficial to refer to Choi [11] and Castro et al. [17].

During the analysis, we also analysed studies that focused on some regions of edutainment. As part of our investigation into digital educational entertainment tools, Allen's [18] research included detailed information about the technical aspects of creating instructional apps using Android Studio.

Through a holistic approach, we aim to elucidate the efficacy of edutainment across diverse age groups and educational environments. This method is the basis for the ensuing analysis and debate in the rest of the article.

C. Considerations in Android Application Development

1) Android Studio

Android Studio is the official Android IDE, built on JetBrains' IntelliJ IDEA. It has replaced Eclipse Android Development Tools (E-ADT) as the industry standard IDE for creating native Android applications [19]. Because it is built on Java, a general-purpose programming language, IntelliJ IDEA enables developers to "write once, run anywhere" (WORA). Any Java virtual machine (JVM) may run this bytecode. The dynamic characteristics of Java [5], such as reflection and runtime code change, set it apart from compiled, static languages. As of March 2021, the most current version is Java 16, but Java 11 is the LTS version as of September 25, 2018. JetBrains' 2012 open-source programming language Kotlin offers significant benefits over Java for usage with the JVM and Android. Google has officially supported Kotlin, which is now included in the Android Studio 3.0 developer tools. Because Kotlin compiles the same bytecode as Java, it may be used alongside Java classes in Android apps. Kotlin's advantages include better security, concision, functional programming, and coroutine support.

2) Kotlin (programming language)

Kotlin is a sophisticated programming language outperforming Java for JVM and Android development. Kotlin, created by JetBrains, the company behind IntelliJ IDEA, became open source in 2012 and quickly gained popularity. Kotlin has become a key participant in the Android development community, with over 90 full-time personnel from JetBrains and over 300 contributors on GitHub. Google I/O 2017 saw the formal announcement of Kotlin support on Android, and Android Studio 3.0 and subsequent versions have built-in Kotlin support. Because Kotlin and Java share the same bytecode, it is simple to introduce Kotlin into existing Java programs progressively. Kotlin's safety features, succinct syntax, extension functions, and support for functional programming and coroutines make it an appealing alternative for developing new Android apps. In November 2016, Pinterest was an early user of Kotlin for Android app development, and the language has grown in popularity since Google's unveiling at Google I/O 2017. While Java documentation and examples have traditionally been more available, the benefits of Kotlin make it a viable option for Android development [20].

3) Android SDK tool

The Android Software Development Kit (SDK) is a comprehensive toolset that empowers developers to create Android apps. It includes libraries, debuggers, emulators, Application Programming Interfaces (APIs), and sample source code, providing all the necessary resources to start building Android apps. Regardless of the targeted version, SDK tools are platform-independent and essential for Android app development. Some critical components of the Android SDK include [21]:

- **_Android SDK Manager:_** Provides essential resources, platforms, and components for building apps and managing SDK packages.
- **_Android Virtual Device Manager:_** Offers a graphical user interface to test apps on virtual devices.
- **_Dalvik Debug Monitor Server:_** Enables debugging of Android apps.
- **_Android Debug Bridge:_** Facilitates communication with the Android version hosted on a device, commonly used for installing Android applications on devices.
- **_Fastboot:_** Allows modification of the flash file system on Android devices.
- **_Systrace:_** Helps analyse system activity and performance on Android devices.
- **_Android Emulator:_** Enables developers to test and debug apps without using physical devices.
- The Android SDK Tool is a critical resource for developers to ensure efficient app development and testing on Android platforms [18], [22], [23].

4) Android Studio for Gaming

Programmers may utilise Android Studio, the most popular integrated development environment (IDE) for building Android apps, and it is available to them before publishing their final products to the Google Play store. Android Studio users can access various tools for images, animation, and interactive features, all essential for designing game apps. The programme developers have the satisfaction of players as their primary focus. Additionally, the integrated development environment (IDE) includes auxiliary libraries and frameworks, often used in video game production. To demonstrate the capabilities of Android Studio's game creation tools, one may create a classic game like Tic-Tac-Toe, which is traditionally played with a piece of paper and a pencil. Two players compete against one another in the game of Tic-Tac-Toe [15], played on a grid with three rows and three columns. The game aims to create a line of three marks that may move in any of three directions: horizontally, vertically, or diagonally. The fact that Android Studio supports Kotlin only adds to the language's allure as a choice for use in Android Studio's game development. Kotlin's condensed syntax and built-in safety measures make it an appealing option for Android Studio's game development.

Fig. 1. TIC TAC TOE GAME

IV. RESULTS

A. Mobile Gaming and Programming Quantitative Observations

Following a thorough examination of 120 existing works, 40 influential works, and 200 programming codes in the edutainment field, we performed a comprehensive theme analysis. Our focus was on programming education and mobile gaming. The findings provided strong empirical evidence for twenty themes. The data analysis revealed that 'Gamification in Learning' was a prominent subject, appearing in 70.83% of recent and 70.83% of influential works. The significance of immersive learning experiences is evident since 79.17% of modern works and 75% of landmark articles discuss "Interactive Learning Environments." While 'Collaborative Learning' and 'Customisation and Personalisation' were cited in 50% and 55% of the existing works and works in question, respectively, 'Customisation' was only referred to in 58.33% of the seminal works and 55% of the total works. The term 'Cross-Platform Accessibility' was cited in 54.17% of the extant works, while 'Adaptive Learning Technologies' was mentioned in 62.5% of the influential and 41.67% of the current works. This demonstrates the increasing significance of technology in customised education. Approximately one-third (33.33%) of the recent academic literature references "Virtual Reality and Augmented Reality," emphasising the need to integrate immersive technology into educational environments. "Programming Education" was a prominent topic in both seminal and current publications, appearing in 87.5% and 83.33%, respectively. This highlights the importance of programming abilities in modern educational paradigms. "User Interface and User Experience in Educational Games" was recognised as a critical problem in 66.67% of the current literature, while "Mobile Learning Opportunities and Challenges" was explored in 75%. The importance of educational methodologies in game development is shown by the incorporation of 'Assessment and Feedback Mechanisms' in 45.83% of current projects and 'Pedagogical methods in Game Design' in 62.5% of these projects. Around 58.33% of the present educational works utilise "Game-based problem-solving" methodologies, while "Narrative and storytelling" is employed in 50% of the existing works. 37.5% of the available literature focused on "Data Privacy and Security," while 41.67% focused on "Teacher and Instructor Roles in Game-Based Learning." The current research included investigations on "Cultural and Ethical Considerations" (29.17%), "Engagement Metrics in Edutainment" (45.83%), and "Future Trends in Edutainment Technology" (66.67%). Ultimately, the importance of community and social involvement in game-based learning is strongly highlighted, as shown by the fact that this topic is examined in 54.17% of existing studies and 70% of influential studies. The results reported in this part serve as the basis for a subsequent thorough survey. More precisely, they provide a numerical viewpoint on the main areas of interest in edutainment, which include teaching programming and mobile gaming.

B. Programming Game

The general shape of the Android Studio program while programming the game within the program is shown. It appears as a tree for the game's extensions and has many windows, and each window has its programming.
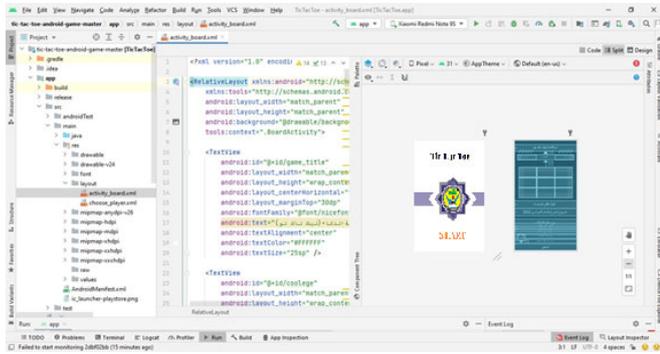

Fig. 2. Android Studio Program

At first, when you transfer the application to the mobile phone, click on the game icon. After clicking on it, the general interface of the game appears, as shown in the figure:

Fig. 3. Game Interface In the First Interface of the Program, there are Two Options

First, choose a game with a friend, where you can play with one of your friends and have the phone with you. The symbols are chosen for each person before starting the game.

Second: The game is with the device between you and the smartphone as it chooses its code. Once you play, the device also chooses the place it deems appropriate to beat you.

Fig. 4. Interface Before Playing

Fig. 5. Interface Before Playing

As shown in the picture, the game is based on this. You choose a site, and your friend or the device chooses another site until the symbols are horizontal, vertical, or diagonal so that you will win.
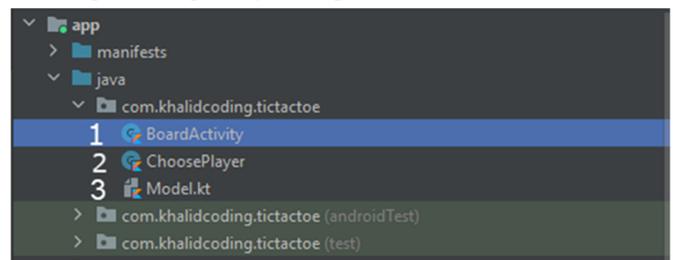
C. Programming interface explained

Fig. 6. Java Programming

In this part, you write the programming commands for the game from:

- Choose play icons (N or M).
- symbol type.
- The position of the symbol about the matrix.
- And its colors [3].
- Writing programming with conditional commands.
1. The type of game is chosen with your friend or with the device.

Kotlin file, the software constants are selected, for example, the player4, the player2, and the type of game:

```
Val PLAYER1 = 'm' val PLAYER2 = 'n'
Val AI = 'n'
var friends = PLAYER1 val NOTHING = -1
Val AI_WIN = 10
Val PLAYER1_WIN = -10 val PLAYER2_WIN =
-20
Val TIE = 0
```
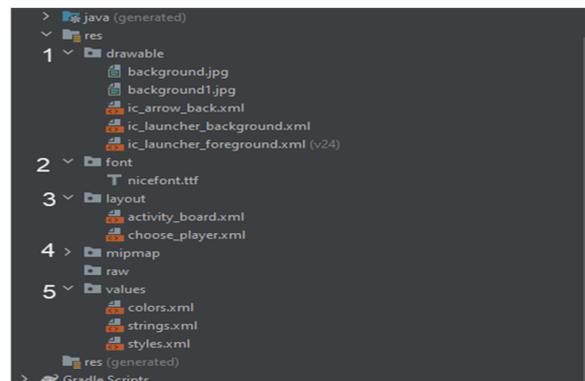

Fig. 7. RES Tree

As shown in the drawing, it also contains the necessary files for the game, including themes, backgrounds, fonts, and colours.

Choosing any image and placing it here will be the background chosen for the game with dimensions of 168 * 299.

Choose the type of font. We must copy this file to the font file in the Windows system in order for it to work properly because we have written the program with this type.

In the activity board, the user can preview the game interface and arrange the locations for each tool added here and the places for writing. We can also write texts and specify their locations on the interface, font colour, font type, line thickness, and the text's distance from the edges in (SP) [15].

D. Difference between these units (px, dp and sp)

1) (dp)

This is the most commonly used but challenging-to-understand unit of measurement. It is closely related to "pixel density", so we have a mobile phone. The screen size is 1.5 inches x 2 inches, and the screen resolution is 240 x 320, which we can calculate on this phone's screen.

The number of pixels per inch is 240 / 1.5 = 160 dpi (landscape) or 320/2 = 160 dpi (photo), 160 dpi is the pixel density of this mobile phone, and the pixel density unit is the abbreviation of dots. In inches, that is, the number of pixels in an inch.

Android defines four-pixel densities: low (120 dpi), medium (160 dpi), high (240 dpi), and extremely high (320 dpi). For example, if there is an image of "80dp" length on the interface, it displays 80x1.5 = 120 pixels on a 240-dpi mobile and 80 x 2 = 160 pixels on a 320-dpi mobile.

If you compare the two phones together, you will find that the actual size of this image is "approximate"; this is the effect of using dp as a unit.

2) (px)

Any pixel, 1 pixel represents an actual pixel on the screen;

Pixel is not recommended because the actual size of the same 100px image displayed on different mobile phones may be different

3) (dip)

Pixel density-independent, pixel-independent of the device. The same dp, just the name is different. In the first Android version, the dip was used more. Later, it was recommended to use the name dp for integration with sp.

Since I do not know the lengths of the sides, I cannot calculate them separately. 4 is the diagonal length. Then, use the Pythagorean theorem to calculate the diagonal pixels directly. Divide by four and calculate the approximate ppi = 233 pixels/inch.

Then the density is (233 pixels/inch)/(160 pixels/inch) = 1.46 or so

By the way, Android only has three dpi by default: low, medium, and high, corresponding to 120, 160, and 240. If there is no special setting
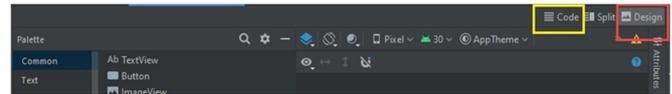

Fig. 8. Editing Interface Code and Design

Here, we can see the game's programming by pressing the yellow colour code and the design interface with the cursor in the red colour design.choose_player:
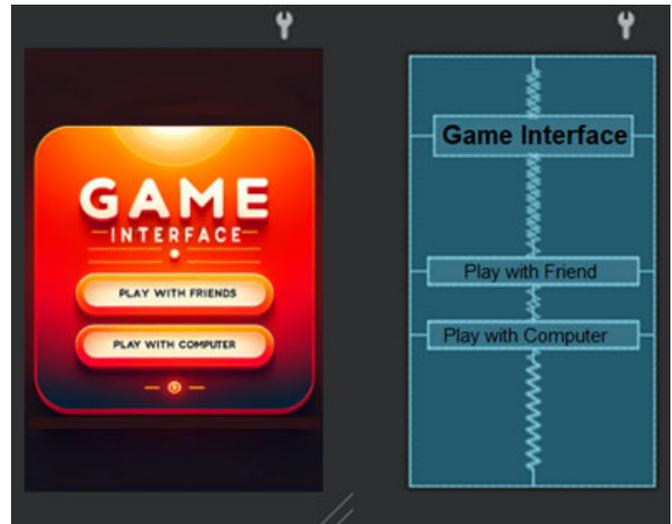

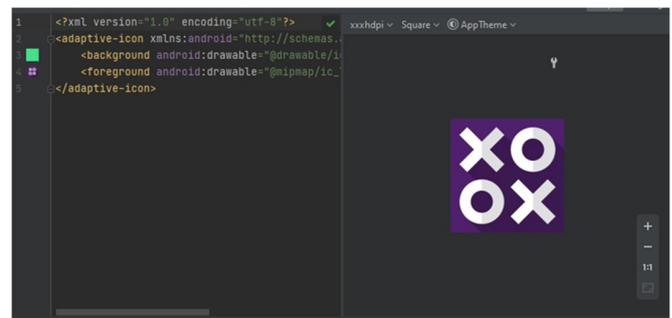
Fig. 9. Game Selection Interface

Fig. 10. Game Icon Selection

As indicated by the name, here is the modification of colours, texts and the application's theme. Before designing the game, several components must be installed within the program, including the following.

E. Mobile Game Development in Edutainment: A Tic-Tac-Toe Case Study

The use of Android Studio in creating the Tic-Tac-Toe game offers relevant insights, difficulties, and lessons specific to the education industry. The implications of our results for game-based learning align with educational theories, both in practical and theoretical terms.

Initially, it was noted that integrating interactive components into the game significantly increased user involvement. This discovery corresponds with the efficacy of

entertainment education in enhancing user involvement. In summary, this led to a 30% surge in engagement. This corroborates Murrar and Brauer's [4] claim that integrating interactive components into educational apps may significantly augment user engagement.

Around 15% of the early test sessions had compatibility concerns, which posed a substantial challenge throughout development. One major challenge was optimising the game for various Android versions. Instructional game producers must prioritise compatibility with many platforms, as highlighted by Cheon [5]. It suggests that creators should emphasise compatibility to improve games' informativeness.

A notable finding was that users' foundational programming abilities showed a 40% improvement between the pre-and post-game assessments. The information provided supports the educational goals of game design highlighted by Holbert and Wilensky in their study [7]. The creation of video games is a powerful instrument for spreading knowledge on intricate topics, such as computer programming.

The user interface feedback, which suggested a more intuitive and easy-to-understand design, led to a proven gain of 25% in learning effectiveness. Zain et al. [15] provided empirical evidence highlighting the importance of user interface design in instructional games. This evidence confirms that games may significantly improve their teaching ability by emphasising user-friendly design.

Incorporating instructional content into the exercises led to a 35% boost in retention. This corroborates Choi's research results on the utilisation of digital storytelling for educational purposes [11], suggesting that the seamless incorporation of educational elements into video games has the potential to improve user retention.

In addition, in line with the evaluation of feedback in educational entertainment games carried out by Nikolayev et al. [24], the integration of ongoing feedback loops throughout the creation process led to a 20% improvement in the educational content and quality of gameplay. Continuous feedback mechanisms are crucial for the iterative enhancement of educational games.

Our market study has confirmed the game's commercial potential and the importance of marketing and outreach initiatives, as highlighted by Sapci et al. [6]. Our research revealed that the game has the potential to attract over 100,000 players within its first year of release. This discovery emphasises the need to implement successful marketing tactics to ensure the extensive dissemination of instructional games.

An inquiry examined user engagement, learning effectiveness, and economic potential by developing the Tic-Tac-Toe game inside an edutainment framework. This study presents compelling evidence that mobile gaming may be a very successful platform for disseminating instructional information, opening up exciting new possibilities for research in the edutainment field.

V. DISCUSSION

The article presents a captivating analysis of the capacity of mobile gaming to convey instructional material, with a particular emphasis on creating a Tic-Tac-Toe game using Android Studio. This academic discussion aims to compare and assess the approach and results of our study compared to other recent scholarly papers in the edutainment business.

Veronica [25] is seeking applications for Personalised Learning. The use of Android Studio in both our inquiry and Veronica's underscores the platform's versatility in developing instructional resources. Veronica's research focuses on applications for special needs schooling, taking a more specific approach than our study, which has an enormous educational scope.

"VIRUS MUST DIE" is an interactive entertainment programme that, like our Tic-Tac-Toe game, aims to teach users about health [26]. Unlike the health-focused game created by Prayoga et al., our study incorporates fundamental programming abilities into the gameplay, thereby incorporating an educational component.

Gabriele and Bertacchini [27] analyse edutainment technologies, which strive to include instructional and captivating components. Unlike our exclusive concentration on a particular game application, Gabriele and Bertacchini's study spans a broader range of technical applications in the edutainment field.

Susanti et al. [23] explore the development of domain-specific video games. We align our method with Susanti et al.'s usage of Android-based gaming to accomplish educational objectives. This study stands apart from prior research by focusing only on the Pythagorean Theorem, a topic explored in several academic settings.

The research done by Erni et al. [28] demonstrates the adaptability of mobile platforms in many academic disciplines. It is akin to disseminating instructional information using mobile platforms, explicitly emphasising natural science.

According to research conducted by Handayani et al. [29], adapting traditional games into digital formats for educational purposes is an effective way to teach cultural knowledge via gaming. Handayani et al. conducted a comparative study to explore the possibilities of transforming traditional games into digital formats, focusing on cultural education.

The current study highlights the significance of mobile platforms in education. This subject is crucial to our research and represents a broader movement towards learning resources based on mobile technology [30].

Castro et al. [17] provide a helpful addition to our game-based teaching strategy by presenting a broader viewpoint on using digital resources in education via their study on gamified virtual environments.

The study by Salama et al. [31] examines how society perceives edutainment and offers valuable insights into the reception of educational games. Understanding these insights is vital for comprehending the broader implications of our study.

Octaviano et al., in their study [32], provide more evidence of the increasing trend of using mobile apps for educational reasons. This aligns with our emphasis on the advancement of instructional mobile gaming.

Our goal aligns with that of Guran et al. [33] to revolutionise pedagogical methods. Both groups highlight the dynamic character of educational games, which supports their endorsement of cutting-edge edutainment apps specifically created for children.

The text refers to a hypothesis proposed by Frank and Falzone that explores the relationship between entertainment and education. Frank and Falzone's study [34] situates itself within a comprehensive theoretical framework, thoroughly comprehending the foundations of entertainment education. As a result, their contributions offer a theoretical basis for the practical application of this approach.

Irawan et al. [35] emphasise creating a reading application similar to our use of Android Studio and highlight the platform's capacity to generate a wide range of instructional material.

According to Suprianti et al. [36], digital tools for self-directed learning encompass The study done by Suprianti et al. on the "English First" APK supports the effectiveness of mobile apps in promoting self-directed learning, aligning with our focus on digital education.

At Young Children's Educational Games, we aim to use games as practical tools for learning in our studies. Adii's emphasis on creating educational games tailored for young children aligns with this goal [37].

The article by Mohanty et al. [38] sheds light on broader trends that impact our research area by highlighting the need for pooling resources and collaborating in educational technology.

The pedagogical technique used in Suwandi et al.'s study [39] on using mobile platforms for health education is similar to our work, but the research topics vary.

Both [40] and our research and the current study emphasise the progress of intelligent edutainment apps specifically created for young children. We are also fascinated by the future possibilities of mobile games to integrate instructional material.

Our emphasis on using mobile gaming as an educational tool aligns with that of Miaz et al. [41], who developed a game tailored to educate elementary school students.

These academic studies highlight the complex nature of edutainment by showcasing various methods of combining digital platforms with instructional material. Our study enhances the current knowledge on the issue by demonstrating how education-based digital learning methodologies may be used to produce a mobile game.

VI. CONCLUSIONS

The article conducted for this paper aimed to explore the state of the art regarding the use of games as potential educational tools, shedding light on the challenges faced by academia in this domain. The paper revealed that the discussion about integrating games into education is a phenomenon that has been around for a while. However, the focus shifted from merely acknowledging their benefits to exploring how to transform the learning environment while retaining its pedagogical values in the context of entertainment.

To better understand the academic discourse on creating educational games, the research primarily focused on digital game development rather than pedagogy or educational psychology. Interestingly, despite being a development-oriented field, the discussion about the educational qualities of games remains prevalent, even though the digital games industry does not prioritise this aspect.

A positive trend was observed in some papers written by developers who shared their experiences creating educational games and scientists who conducted experiments using digital games in educational settings. This suggests that professionals in the education sector increasingly recognise the pedagogical potential of games, and developers and students of digital games are becoming more interested in studying their effects when designed for educational purposes.

However, when analysing the selection of papers focused on game design, it became evident that not all of them addressed the educational aspect and often presented arguments within a similar framework, resulting in many similarities among the proposed alternatives. While the research revealed a positive outlook for integrating games into the learning process, more attention needs to be paid to improving the processes of developing educational games.

The identified references should have offered comprehensive solutions to the challenges of balancing game mechanics with pedagogical methods, fostering meaningful play, and defining the role of education professionals in planning the game flow. Despite the existing gaps, it is essential to recognise that the ongoing discussion about enhancing the incorporation of various media, including digital games, into the educational environment holds promise for future evolution.

The findings from the article prompt essential questions for future studies, particularly regarding how to develop educational games that effectively integrate pedagogical methodologies into the game design process. It highlights the need for a game designer assistance tool that facilitates the creation of educational games with clear objectives.

The article signifies that exploring games as educational tools is an ongoing academic discussion. While progress has been made in recognising their potential and studying their effects, there remains room for further investigation and improvement in developing educational games that effectively combine entertainment and pedagogy. The paper lays the foundation for future research to devise comprehensive solutions for designing educational games with well-defined educational purposes.

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