

# Design And Implementation Of An Edutainment Games Application For Kindergarten Kids Learning

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## Abstract

Edutainment is a worldwide known concept, adopted by many countries for its educational uses and studied in various forms, unfortunately less explored in the teaching learning space due to other priorities regarding education. The lack of case studies related to this concept in the educational space brings the opportunity to adapt the concept to the needs of preschoolers and teachers. Technology became a part of everyday life and its usage should be oriented to the benefit of the next generations. The situation of kindergartens having difficulties in counting numbers and pronouncing letters on their own, less excitement while learning in class via the traditional method of teaching, lack of motivation to learn on their own, and the boredom that comes with the traditional way of teaching, led to this research. This research is on design and implementation of an edutainment games application for kindergartens that enable them to effectively learn alphabets and numbers by producing the sound of each of them when clicked, acquaint themselves with various animals and the sound they make, know the names of various fruits and vegetables by a click. It also enable kids learn popular nursery school rhymes in both English and Igbo languages by just a click. The methodology adopted is Object Oriented Analysis and Design (OOADM). Multiple Regression Algorithm was utilized for the analysis. The application was developed in two versions; mobile application installed in android version 5.0 and web- based application that was deployed via XAMPP that provided cross-platform for utilizing tools such as MySQL, PHP, Java script and CSS(Cascading Style Sheet) that enhanced interactivity and dynamism in the web app.

**Keywords:** Edutainment, education Game, Mobile application, E-Learning, Game base learning, kindergarten

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## I. INTRODUCTION

The need for an upgrade in the educational approaches has been raised in the recent times. The advancement of technology has opened new horizons for the future work context. The trend of digitalization in every aspect of our life is increasing evidently each day. The requirement for digital citizens forces the need for developing digital skills in the young African Union citizens. The use of technology in the teaching process raises many debates from the perspective of replacing teachers by teacher-bots, based on the advances in Artificial Intelligence[1] [2]. Educational system has faced several reforms along the last twenty-eight years regarding curriculum, and redefining the ideal of education according to the EU requirements. It is organized in three stages: preschool stage (children aged 3 to 6), school stage, children aged 6/7 to 18-primary, secondary and high school) and university stage. [3]. Our research in developing edutainment applications for preschoolers has the main goal of introducing digital competences elements to young children by providing digital tools that support, but not replace, the kindergarten teachers' activities. We need to mention that developing edutainment applications for preschoolers is considered a support tool in regular activities. Statistics show that the role of kindergarten teachers is a complex one and it has a small probability of being replaced by computers [4].

As such, education experts have become the key for building fundamental digital skills in young children. Educators themselves need to integrate technology as a teaching/learning tool in their activities. The digital resources must be appropriate for teachers' tasks and for children's age. Nowadays, different solutions of teaching using technology are used depending on the children's age. However, when the learners are preschoolers (aged 3-6 years in Nigeria) supplementary constraints on the design of edutainment applications occur. These constraints are determined by children's age and capabilities limitations. One of the proposed approaches in designing interactive applications that fit the educational requirements is to actively involve teachers in the design of these products. For edutainment applications for preschoolers, the kindergarten teachers are the most appropriate design partners, as they master the content children should learn, and, at the same time, they know their preferences and limitations. Children also play a role in the design of technology, but they cannot always be involved due to their early age and the educational role of the final products. In this paper, we describe the

approach we have used for designing edutainment applications for preschoolers. The paper begins with a brief introduction to the challenges in introducing technology into the teaching process of preschoolers, followed by a description of how edutainment can support this activity by including kindergarten teachers as co-designers.

Thus, the need to have digital skills formed from early ages, preschool stage, even earlier [3]. In [5], it started with preparing teachers, giving them the possibility to participate to special courses in order to achieve certain digital competencies, promoting e-learning, continued with introducing computers, useful devices and internet in schools in order to provide resources to improve, ease and increase the benefits of education, it continued with preparing children, an ongoing process that needs a special attention. Using technology in teaching and teaching children how to learn using it seems to be the challenge of the 21<sup>st</sup> century in Nigeria.

Preschool stage, kindergarten time is dominated by discovering the world through games and playing. This stage is the proper start in making acquaintance with using devices in a joyful and pleasant way. It include making a transition from listening to a song or a story to pressing a button to listen to them, to interact according to rules and pay attention to the process of interacting. This brought the idea of building applications to serve the teaching environment as well as the learning process and cover the entertainment side of the process [6]. As Techopedia states, Edutainment is a portmanteau of the words education and entertainment that refers to technologies and software products which combine education with entertainment in some way. In the digital age, many of these products and technologies seek to make education more attractive to young people and students, Edutainment technology comes in many forms. A streaming video platform or a prepackaged learning product can be categorized as edutainment if it has both entertainment and educational value. Edutainment is very much an issue in developing modern digital and hybrid curriculum for the classroom, and for supplementary educational use. [7] Recent studies and research show a great interest in involving several institutions in the process of developing digital teaching-learning materials, as a partnership between university and school, with students building lessons for a computing school and visible results in classroom. In the next section, the introduction of edutainment applications in kindergarten will be described from the perspective of a process providing content, co-design and actual teaching based on them.[8]

## **II. PREVIOUS RELATED WORKS**

Introducing technology in the learning activities involves a mix between entertainment and educational content, to be acceptable. Edutainment applications provide both characteristics, being interactive applications that promote fun while providing educational content. The use of edutainment for preschoolers' activity seems an appropriate solution to help them build their fundamental digital skills and to support the development of an appropriate attitude towards technology. Children should be made to be aware of the fact that we are using technology not only for fun, but also to learn new things or to create new things. This way, children get support in understanding technology as a tool for achieving goals it must accomplish. That is, being educative but also fun at the same time. The final users of the edutainment applications are preschoolers (aged 3-6 years). This age bracket cannot read, write, focus for long period, and desire rewards for accomplishing tasks. Deep understanding of what fun means for preschoolers and what are the goals and means of education at this age is highly needed. Therefore, the participation of kindergarten teachers in the design process is the appropriate method to ensure an appropriate solution. [9].

While the need of schools, students, educators and parents for apps that take advantage of the latest mobile and touch screen technology is high, the majority of educational apps that are available in popular stores such as Google Play and Apple's App Store (both free and fee-based), have no guarantee of educational value.[10].

In the United States, a report from the New America Foundation and the Joan Ganz Cooney Center at Sesame Workshop characterizes the current state of the 'educational' app Sustainability market aimed at young children as a 'Digital Wild West<sup>1</sup>', suggesting that parents should be wary of those claims. [11].

For parents and educators, choosing an appropriate educational application is a great challenge. The issue of what constitutes an educational app is therefore strikingly complex, since it implies the consideration of various scientific aspects. Thus, sometimes it is easier to identify what constitutes a lack of quality. For instance, [12] reported that the presence of ads, including pop-tips and pop-unders, poor or inadequate design, and non-functional elements are disruptive to the educational process, while privacy violation issues, etc. further diminish the value of an app. [12]

[13] state that researchers who aim at proposing a conceptual framework for mobile learning applications face many of the same challenges as those researching educational software used for desktop computers. To highlight that, [14] describe the current app market as the 'first wave of application development', in which already-existing non-digital material is being converted into a digital format. Indeed, most of them are found to be reproductions of their print-based counterparts of simple, enjoyable activities offering just passive learning experiences, even though apps with educational value should focus primarily on promoting education, and not just being entertaining. [15]

[16] analyzed the best children's educational apps by evaluating the 100 educational apps available for

the iPad and iPhone devices (200 apps in total). They found that more than 80% of top-selling paid apps in the Education category target children, 72% of which are designed for preschool-aged children. The study also revealed that developers' target audience was primarily parents seeking to cultivate a creative environment at home for their children. For anyone that is not a mobile educational technology expert, finding high-quality and appropriate educational apps requires a great deal of time, effort, and luck because this procedure is not only hampered by both the sheer volume available in the stores and the inconvenient digital store user interface, but also by factors such as the lack of description, the misleading scoring system, the subjective user comments, ineffective and unworkable search algorithms.[17].

[12]. noted that a simple search in the Apple App Store using the terms 'A, B, C' or 'Alphabet' returned approximately 279 to 286 results. Indeed, the world's two major smart device app stores do not provide the users with a user-friendly interface in which navigation is easy and reliable. Moreover, the information included on the principles followed and the methodology used by the development team is often not sufficient for successful decision-making. Although one might argue that information about apps is available in digital stores. This information cannot be used as a general criterion for evaluating the educational value. In fact, this content often comes from the app's creator, and therefore cannot be considered as accurate or reliable. [18]

In addition, there are very few tools for evaluating applications. Although there may be assessment tools in the form of rubrics and checklists developed by researchers at universities, parents and teachers either ignore their existence or find it difficult to use and interpret the results [12]. Researchers such as [14] and [19] also emphasize the fierce competition in the app market.

[19] states that developing an application is a costly endeavor; the average cost ranges from 10,000 to 70,000 USD. At the same time, the average fee is about 3 USD, while most Android and Apple apps are available for free download. [19]

Given that the app market is highly competitive with dozens of new products introduced every week, commercial success is not just a result of their quality; it is also a matter of luck. In fact, success relates closely to the number of users who have chosen any given app from a plethora of similar products. Therefore, rapid growth in production and sale is a survival bet for most of the developers that may be a possible explanation about the phenomenon that lots of children's apps offer the same content with a slightly modified design, resulting into lack of effectiveness in academic terms while choosing among the most popular educational apps. [14]

user reviews, star ratings, or the number of installations is often misleading for parents and teachers, who make a choice based solely on the aforementioned subjective and therefore unreliable criteria. [20]

The low quality of the majority of educational apps targeting preschool-aged children highlights the need for a tool to help parents and educators to evaluate the self-proclaimed educational apps for their real value.[10]

The results collected during our review reinforced the importance of evaluation tools for educational apps. The study found 11 articles describing two different assessment approaches. Six studies present a rubric and five studies present a checklist. Additionally, the study also identified seven nonscientific-based tools. Four web sources present a rubric and three sources present a checklist. [10]

In conclusion, the digital market is full of apps that are promoted as educational, but they have little or no pedagogical value because they are often made with limited input from educators or developmental specialists. Moreover, the majority of the tools presented in the relevant literature are not available for the parents, caregivers, and educators of young children, as they are stored in copyrighted digital repositories and databases. However, even if they were available, several questions arise in terms of their appropriateness, the time needed to complete an evaluation, etc. On the other hand, the freely available tools are considered as outdated and not appropriate in terms of their depth and scientific evidence.

Being an integrated instrument for complementary education, serious games play an important role in the learning process and help students concentrate on the given subject. Perceived usefulness, ease of use and clear goals are benchmarks for satisfaction and effectiveness of serious games. When learners clearly understand the goals and easily use the game controls, they are willing to focus on the actual content.

[21] latest research in the field of serious games shows that there are specific factors, which influence the learning process - production, realism, artificial intelligence and adaptability, interaction, feedback and debriefing. Production describes the final product of serious games. Realism is the degree to which serious games meet users' expectations. Artificial intelligence and adaptability include any algorithms that improve user experience by meeting individual needs, Interaction in a serious game includes communication of the user with the game, other users or the teacher. Feedback and debriefing are means to evaluate and analyze the in-game experience and content. Designers of serious games should consider all these factors and integrate them in their games, to bring the best experience and maximum results to the learners [22]. Serious games can be used to effectively increase cognitive abilities and improve the result of education. They help learners reach their academic goals and encourage their participation in learning activities. Education that is based on games has been proved effective in social and cultural training,

due to their cognitive and motivational effects [23]. To that moment, there is no unified classification of serious games, but the following major categories have been identified - Game-based learning, Gamification of learning, Organizational-dynamic games, Simulation games and Edutainment. Game-based learning uses video and electronic games for education.

The main purpose of these games is to combine the realization of learning goals and entertainment, offered to the player. Gamification of learning integrates game elements and techniques in the e-learning process. This is an educational approach for motivating students to gain knowledge in an interesting way. Its main goal is to increase the satisfaction and involvement of the learners, by capturing their interest and inspiring them to keep studying the given resources. The actual game elements and techniques, used in the e-learning process are borrowed from existing board and/or computer games. One such element is the plot - in electronic games, players go through a predefined series of events, and in e-learning, students follow a plan set by the teacher [24].

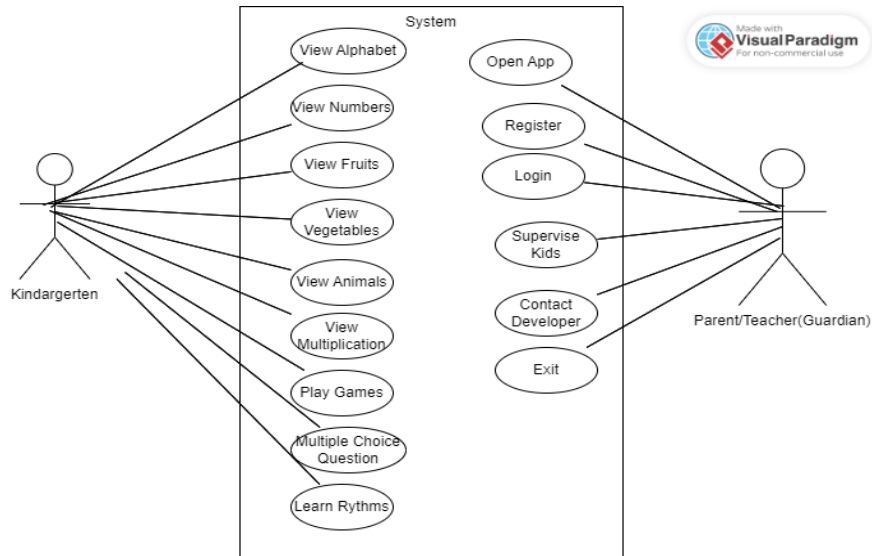
Despite the increased popularity of Game Based Learning (GBL), there is a lack of empirical evidence to support its validity. Addressing concerns [25] undertook an extensive systematic literature review of empirical evidence about the positive impacts and outcomes of computer games and GBL with respect to learning and engagement. It examined papers published between January 2004 and February 2009 which reflected "the growing interest during that time in the use of digital games for learning and behavior change. The papers identified were very diverse with respect to the phenomena researched, the purpose of the studies, the underlying theoretical models and methodological approaches adopted. A key aim of Connolly's review was to develop a workable framework for categorizing digital games and their outcomes. A multi-component analysis of games and their outcomes was advocated distinguishing games in terms of game genre, i.e. the kind of games and associated game mechanics such as whether the games were role playing, strategy games, adventure games, simulations; the platform used or method of delivery such as computer game, video console, mobile, online; and the subject discipline or curricular areas that the game addressed. The outcomes and impacts of playing games also differed primarily with respect to the learning and behavioral outcomes of the games.

This literature review pointed out the lack of reliable and easy-to-use evaluation tools and highlighted the need for a new, improved one to help everyone who is interested to choose apps with increased educational value. That tool must be easy to use, reliable, short enough, and able to be used as more than a general guideline.

### **III. HOW THE SYSTEM WORKS**

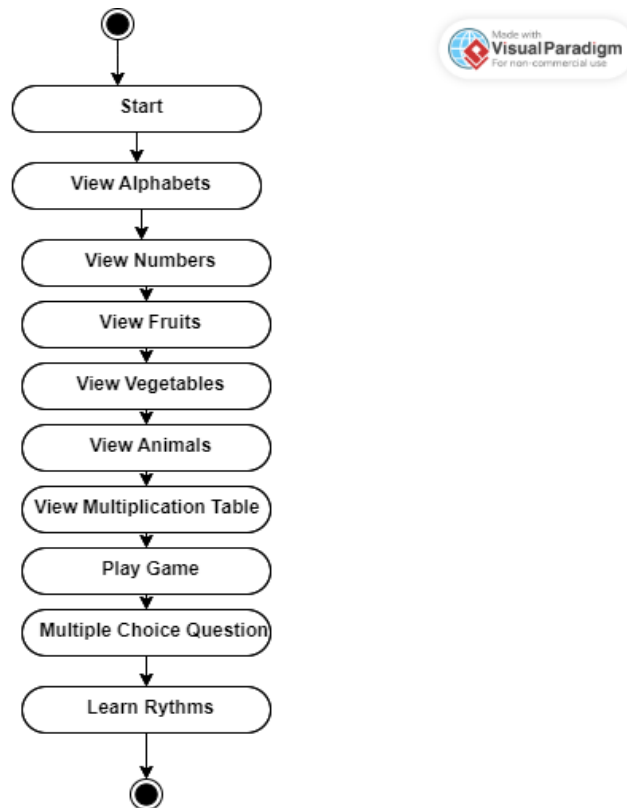
Various classes of Comprehensive School of Management and Technology (CSMT) Nursery and Primary School, Abakaliki, were visited during this study. where some class teachers and some parents were interviewed and some teachers lesson plans and note were also spotted. CSMT was characterized with a combination of manual style of teaching Mathematics and English, that is writing on the white marker board and a display of print materials for the kids to see and a television where some recorded nursery school rhythms will be singing on display through a CD plate with the help of a DVD player. The short comings of the existing system includes: Inability of kids to learn on their own without the help of the teacher or parents, Teaching materials are less exciting and attractive hence kids become bored, Kids often dirty their uniforms with crayons and pencil, Does not permit kids to gain interaction with a click of numbers, alphabets, animals, fruits and rhythms.

Object Oriented Analysis and Design Methodology (OOADM) was adopted for the software development process. Unified Modeling Language (UML) diagrams, such as Use Case Diagrams, Activity Diagrams, Sequence Diagrams were used for analysis and design of the system. This aids in visualizing software applications using variety of diagrams. Use Case diagrams serve to visually represent the system's primary actors, roles, actions, artifacts or classes. Some of the modules in these diagrams would be broken down to provide further details and information about the workings of the new system. The Use Case and Activity diagrams will be used for the behavioral UML diagrams while the block diagram will be used for the structural purposes. The Use case diagram shows the key actors in the new system and the function they perform. Figure 1 illustrates the Edutainment Games Application Use Case Diagram. The system has two users which are teachers/parent and the student. Both of the them interacts with the system in different ways. In the 6 cases at the right hand, only the teacher/parents can interact with the system while in the 9 cases at the left hand side, the kid can interact with the system.



**Figure 1.** Use Case Diagram for the Edutainment Games Application for Kindergarten

On the Activity Diagram in Figure 2, the kids will performs the above tasks of learning the alphabets, numbers counting, view various fruits and vegetables and know their names, run through arithmetic operator (addition, subtraction, multiplication and others), play games , answer multiple choice question and learn rhymes in English and Igbo languages.



**Figure 2:** Activity Diagram (Kids) Edutainment Game Application

Figure 3 is the Activity Diagram of the parent/teacher. They will start the application, register the kid for login details, supervise the kids through the learning process, contact the developer for any complaint or other details of interest and exit the application

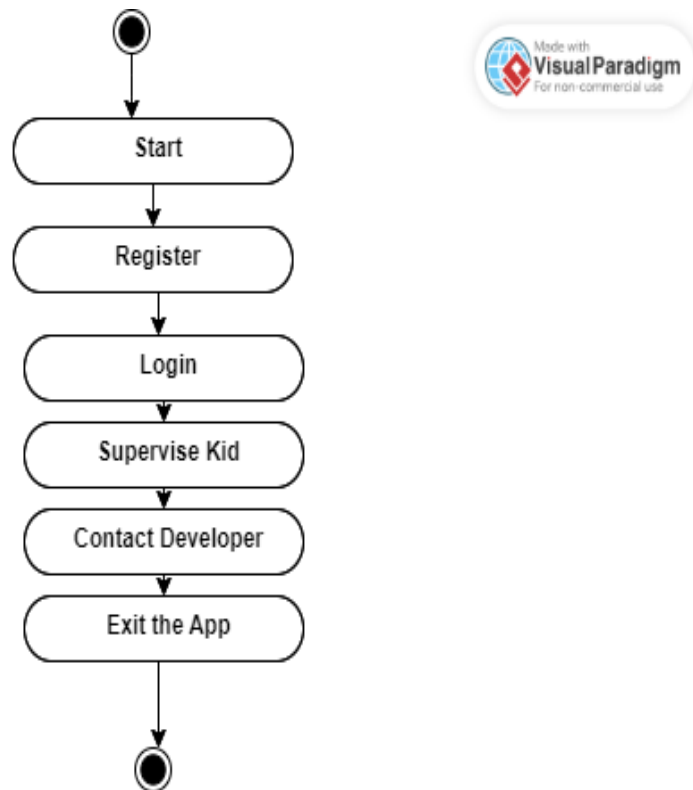


Figure 3: Activity Diagram (Parent/Teacher) Edutainment Game Application

#### IV. SYSTEM DESIGN, RESULT AND DISCUSSION

The main menu provides links and buttons for accessing modules within the system. Design of the main menu emphasized the action buttons, links that perform description at various stage and process and the color scheme. The arrangement, placement, structure, operation and performance of all input in the developed system were so specified so as to capture data at any point in time. There are three main inputs to the system, registration/sign up input, Login input and the contact us input. The system user is expected to register as a new user wherein he/ she will enter some of their personal details to gain access to the variety resources and services offered by the system. In the Login Input, one will provide enter his/her email as username and his chosen password. Output specification entails the result from a given input to the system, or information obtained from processing of data which has been fed into the computer. From the developed system the output comes with sound of the object been clicked on. The database of the system describes an organized collection of data and its specification refers to the explicit requirements to be satisfied by the system database.

The system can run either as an android based APP or web-based. The application requires an android phone with a version of 5.0 and above or a computer system. It has a characteristic of mobility, autonomy, collaborative behavior and adaptability that makes it to use less space in its environment. The internal memory size of 2GB is enough to execute the mobile App version. The Random access memory (RAM) should be at least 1GB with Hard Disk Drive of at least 50GB should enable smooth running of the web version.

The user interface of any application is one of the most important aspects of the application because it is the part of the application that the users interact with. Figure 4 is the main menu design with its various input and buttons.

Welcome To  
**EDUTAINMENT GAMES  
APPLICATION FOR KINDERGARTEN**

≡

**IMAGE**

**REGISTER**    **LOGIN**    **USER**

**LEARN**  
--  
**ALPHABETS**  
--**NUMBERS**  
--**FRUITS**

**TIMES**  
**TABLE**

**PUZZLE**  
-**GAMES**  
-

**VIDEOS**

**CONTAC**

**GIVE YOUR CHILD PROFFSSIONAL BASIC  
EDUCATION**

**Figure 4: Main Menu Design**

The inputs as they relate to form for entry text that will enable one get access to variety of learning tools the system offers are admin login, user login, registration and contact us. Admin Form Login Input is illustrated in Figure 5.

**Admin Login**

**User Name:**

**Password:**

**Submit**

**Figure 5: Admin Login**

The input form was implemented using the software user interface that can allow the specified data types to key into the computer for processing. Each module was implemented to be user friendly. Figure 6 and 7 are the Home Page and Sign Up Page Implementation Screenshots respectively.



**Figure 6: Home Page**

UserName

Password

Re-Enter Password

Phone No

E-Mail Id

Address

City

State

**Figure 7: Sign Up page**

The Alphabets and Numbers Display Pages are presented in Figure 8 and 9 respectively.



**Figure 8: Page to Learn Alphabets**

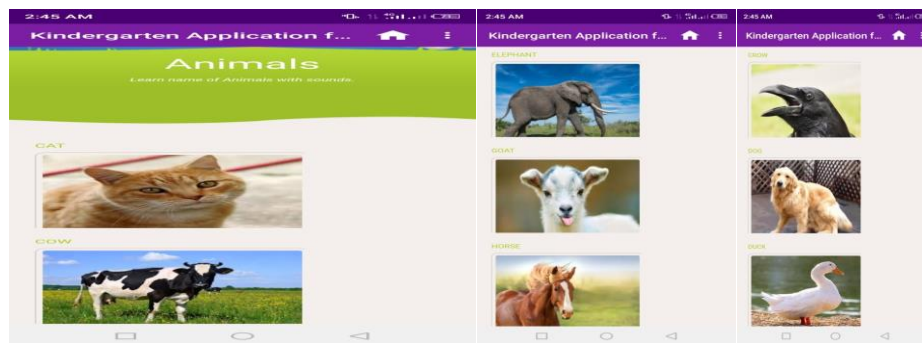


**Figure 9: Page where kids can learn Numbers**





**Figure 10: page for viewing and learning different fruits**



**Figure 11: Page to learn different kinds of animals and they sounds they make.**



**Figure 12: page where kids learn popular nursery rhymes**

## VIII.CONCLUSION AND RECOMMENDATION

### Conclusion

E-Learning applications are considerably expanding the reach of current schools, both by providing learners enrolled with a broader choice of educational materials and by providing learning opportunities to individuals. This paper shows the innovativeness of Kindergarten edutainment application that benefits the users.

For the kids, the system could bring a new way and experience of learning when playing the games application using mobile phone, for interaction with play-based concepts which will help developers and researchers to make education games suitable for kids. While for the parents, having this product for their kids could help both of them to enjoy the concept of play to learn together at home. In fact, the system also has the potential as a teaching tool for the teachers to teach their students and create a new way of interactive learning at school. In addition, the system has its own special features emphasizing educational value through its applications, where it focuses on fostering learning in key areas such as creative problem solving, languages and mathematics. It is hoped that this innovation would advance and promote further research in the Edutainment Game Application.

## Recommendations for Further Research

There is still no scientific evaluation process in this work. Therefore, the next steps for this work are to evaluate the performance improvement of the games. Gamification of the application must be evaluated so it is suitable for the kids. Comparison between the acceptance of the usage of play-beyond the screen concept and without it can be evaluated in the future.

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