Center for Open Access in Science ▪ https://www.centerprode.com/ojit.html
Open Journal for Information Technology, 2023, *6*(1), 7-32.
ISSN (Online) 2620-0627 ▪ https://doi.org/10.32591/coas.ojit.0601.02070

Design and Implementation of an Edutainment Games Application for Kindergarten Kids

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Received: 4 January 2023 ▪ Revised: 1 March 2023 ▪ Accepted: 11 March 2023

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. This paper is a report of introducing an edutainment application into the formal kindergarten system. The implication of this paper is to provide the design and implementation of an edutainment games application for Kindergarten kids. During the last decade, there has been an explosive increase in the number of mobile apps that are called educational and target children aged three to six. Research has shown that only a few of them have been created taking into consideration young children's development and learning processes. The key question that emerges is how parents, custodians, or teachers can choose appropriate, high-quality educational apps.

Keywords: mobile educational applications (apps), smart mobile devices, kindergarten children, parents, edutainment, education.

1. Introduction

1.1 *Background of study*

Educational system has faced several reforms along the last twenty-eight years regarding curriculum, forms of organization, 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 (Moldovan, 2019).

Only primary and secondary school are compulsory for the moment, but further legislation in the area states that preschool stage will become as well. Political, social, and economic development following the transition from dictatorship to democracy came with mandatory changes regarding education. Along the way, measures taken were meant to improve the teaching-learning process and get better results at national exams and international contests,

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as well as developing competencies and skills needed to integrate youngsters in different work fields. Thus, the need to have digital skills formed from early ages, preschool stage, even earlier (Moldovan, 2019).

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 21st 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, 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 (Piaget, 2017).

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 (Rapeepisarn, 2019).

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 (Kharuffa, 2019).

1.2 *Statement of the problem*

Basic number concepts applied in kindergarten classroom to set the foundation for learning more advanced math concepts in future. Early exposure to math and number activities will make children more comfortable with the skills. If the children are not comfortable with math and number concepts at a young age, they will be lack of confidence in their abilities and may lead to hesitation when more advanced math concepts are introduced. When this problem happens, they may start believing that they are not good in math and will have risks beginning a self-fulfilling cycle of failure.

To solve this issue, Edutainment game mobile application has been introduced as an alternative to help the children to learn basic numbers in an easy way. Math learning is most exciting for children when hands-on manipulatives are combined. Manipulatives give children physical illustrations of the numbers and counting concepts. However, children will also easily feel bored if the teachers using the same and traditional way to apply in their teaching. Therefore, the introduction of the electronic-based educational game will be a great solution to help the teachers to teach math in a fun and easy way so that the children can have additional opportunities to practice these skills, yet it will increase their confidence when working with math and number concepts.

1.3 *Research questions*

1. Can a better structure be implemented in teaching kindergarten students?
2. How can an edutainment game application teach kindergarten students?
3. What are the problems that affect the current way of teaching kindergarten kids?
4. What are the benefits of edutainment game application?
5. What are the requirements needed for developing an edutainment games application for kindergarten kids?

1.4 *Research objectives*

This study aims to develop a new system to improve the current way of teaching kindergarten kids in the form of game to increase their learning approach.

The following are the objectives of this research:

1. To answer the research questions in the course of the entirety of the rest of this project.
2. To design an efficient edutainment game application.
3. To implement the edutainment mobile application.
4. To evaluate the performance of the proposed system.

1.5 *Scope of study*

The focus of this project will be mainly on development of an edutainment game application for teaching kindergarten children basic number through game using mobile app. Moreover, this project also studies and compare between the effectiveness of learning basic numbers through game using educational game board and with the manual teaching. The software implementation of the design is using Android studio IDE. Android Studio IDE is used for designing and developing mobile apps.

1.6 *Significance of study*

With the rapid development of computer technology in all fields of operation high demand for e-learning, it has become a necessity to develop an edutainment games application to teach kindergarten kids more effectively:

1. Kindergarten kids would enjoy the learning process.
2. Make it easier for kids to easily adapt to the digital world.

The outcome of this work would be beneficial to a lot of institutions. This work is intended to implement various software and automation processes for an edutainment game application. By doing so, it is hoped that it would establish a broader understanding of the edutainment game application in order to automate or add additional improvements to such systems successfully.

1.7 *Organization of the project*

This chapter contains introduction, Chapter 2 explains the Literature review for the chosen project. Chapter 3 explains the design methodology. Chapter 4 covers the implementation and documentation of the proposed project. Chapter 5 concludes with the summary and conclusion.

1.8 *Definition of terms*

Edutainment is a media designed to educate through entertainment or games.

Entertainment is the action of provided or being provided with amusement or enjoyment.

E-Learning: A learning system based on formalized teaching but with the help of electronic resources.

2. Literature review

2.1 *Educational apps*

While the need of schools, students, educators, and parents for apps that take advantage of the latest mobile and touchscreen 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 (Papadakis, 2020).

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', suggesting that parents should be wary of those claims (Vaiopoulou, 2020).

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, Martens, Rinnert and Andersen reported that the presence of ads, including pop-ups 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 (Martens & Andersen, 2018).

Kucirkova, Messer, Sheehy and Panadero 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, Hirsh-Pasek and her colleagues 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 (Kalogiannakis, 2020).

Shuler, Levine & Ree 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 (Stamovalsis, 2020).

Martens et al. 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 (Larkin, 2013).

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 (Martens, 2018). Researchers such as Hirsh-Pasek et. al and Kucirkova also emphasize the fierce competition in the app market.

Kucirkova 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 (Kucirkova, 2016).

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 (Kaufman, 2015).

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 (Flewitt, 2014).

2.2 *Are there tools to help the general population to choose appropriate apps?*

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. In 2019, using the validated PRISMA methodology (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) (Papadakis, 2020).

Various databases and digital repositories were searched for studies that met the following inclusion criteria:

1. Field study in smart mobile devices.
2. Describes an educational app assessment tool.
3. Reports on educational apps for children.

4. Scientifically sound.

The results collected during the 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. According to the researcher, the term 'nonscientific-based tools' refers to freely available online tools for the evaluation of educational apps that present their quality criteria without a focus on research methodology and scientific evidence (Papadakis, 2020).

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.

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.

2.3 *Serious games for education*

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 (Raju, 2017).

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 (Kuo, 2017). 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 (Wouters, 2013). 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 (Gachkova, 2018).

3. Design methodology

This chapter explains the various research techniques and methodologies that I used to conduct this research project.

3.1 *Requirement elicitation*

3.1.1 *Interviews*

I interviewed teachers on the way an edutainment mobile game application can improve the current way of learning and areas that can be improved for proper user experience. I also examined the current way kindergarten kids are being taught and areas that need to be improved.

3.1.2 *Evaluation of papers related to the topic*

Papers have been gathered from various educational platforms: (i) Research Gate; (ii) Academia; and (iii) Google Scholar.

Papers and similar projects to the scope of study of this project. All the papers have been analyzed and reviewed. This study and implementation aim to further improve such systems.

3.1.3 *Stakeholder analysis*

The Researcher analyzes the interest that should be taken into account when developing or implementing the system.

Stakeholders

1. Teachers
2. Kindergarten kids
3. Parents

3.2 *System analysis and design*

Analysis of a system specifically involves reviewing a system, testing its functions, analyzing its effectiveness, specifying necessary changes and upgrades, and the quality of the output. Design of a System is the blue print of what the designer wants to implement.

3.2.1 *Analysis of the existing system*

The findings of this study reveal that the current way of teaching kindergarten kids needs improvement, with the introduction of games, it makes the learning experience more fun and exciting.

3.2.2 *Description of the proposed system*

The proposed system is a mobile application with that allows various users to access all the various services outlined in 1.6 of this report. It incorporates:

1. It allows quick tests for kids on Mathematics and English in the form games.
2. It has a feature for kids to draw in their mobile phone.
3. It has multiplication table for kids to easily understand the multiplication table.
4. Kids can view the alphabetical order in the form of picture to quickly understand and learn.
5. Kids can play games to improve their memory, to remember things easier.

Output specification

The proposed system has 1 output: Gives Result after the Task in the form of game.

3.2.3 *Feasibility study*

The feasibility research came to the following conclusions: Java (Android studio IDE) can be used to create an edutainment game application.

3.2.4 *Software development model*

The method of research used for this investigation is the Iterative Development Model of the SDLC method. A concurrent development cycle focusing on the iteration of each development process stage is the iterative model. It is often utilized for large projects. A rudimentary implementation of a short set of system requirements begins the iterative process, which uses development iterations to improve the system versions until the system fulfills its needs and can then be deployed. A new version of the software is produced at the end of each loop. A functioning model of the software was generated on the basis of the iterative model.

Iterative Development Model Process

The iterative process is an incremental process that consists of iterations that add more features after each iteration. The process of each iteration consists of:

1. *Planning & Requirements*: This step is to establish the requirements and prepare the required components for the upcoming iteration.
2. *Analysis*: Analysis is performed to pinpoint the appropriate business logic, process flow, and data models
3. *Design*: Any technical requirements (languages, services, tools, libraries) that will be utilized are also outlined in the design stage.
4. *Coding and Implementation*: The actual implementation and coding process involves the programmers writing programs to carry out the functions outlined in the requirements while following the analysis and design outlines.
5. *Testing*: On the completion of the programming phase, the output software would then go through a series of tests and trials to identify bugs or issues with libraries being used, and then correction procedures would follow.
6. *Evaluation*: Once all the previous phases are completed, the software would then go through an evaluation. This phase would allow all the stakeholders to examine whether the software meets its goal and what can or should be changed.

Then the most recent build of the software is created and the whole process is then brought back to the planning and development stage and the process repeats itself all over again until the software is completed.

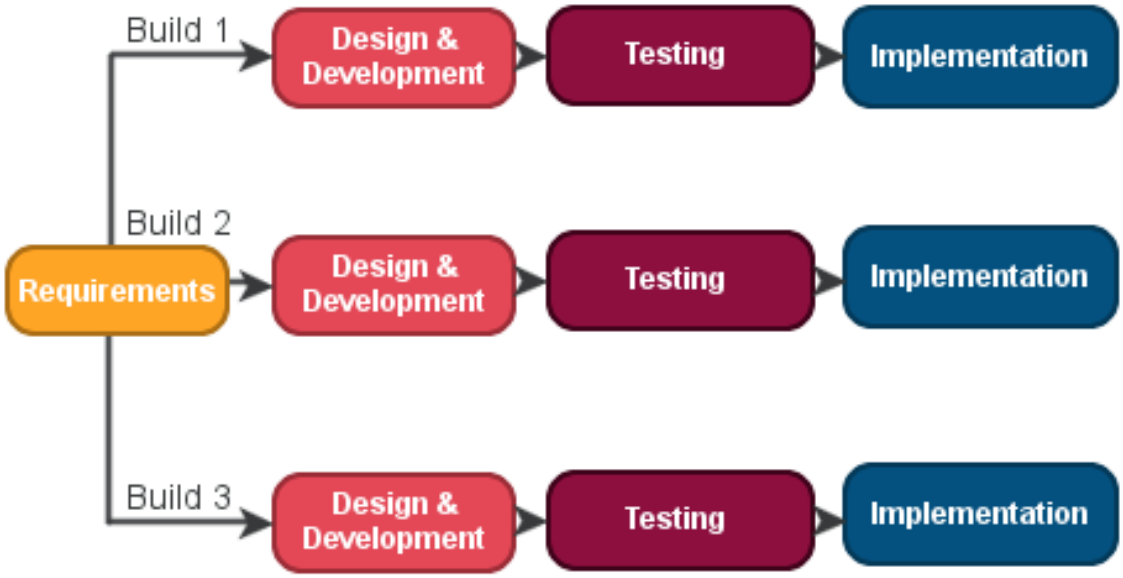

Figure 1. Iterative model of system development life cycle (t4tutorials.com)

It has the following phases: Requirements gathering and analysis, Detailed Design, Implementation, Testing, Deployment, Review, and Maintenance.

This SDLC method was chosen because:

1. It enables project development to begin with only a skeleton of a requirement definition.
2. It allows early detection of faults.
3. Encourages user feedback.
4. The amount of time spent on paperwork is reduced.
5. Software development takes up more time.
6. Some features and requirements may change in the future.
7. New technology is being used.

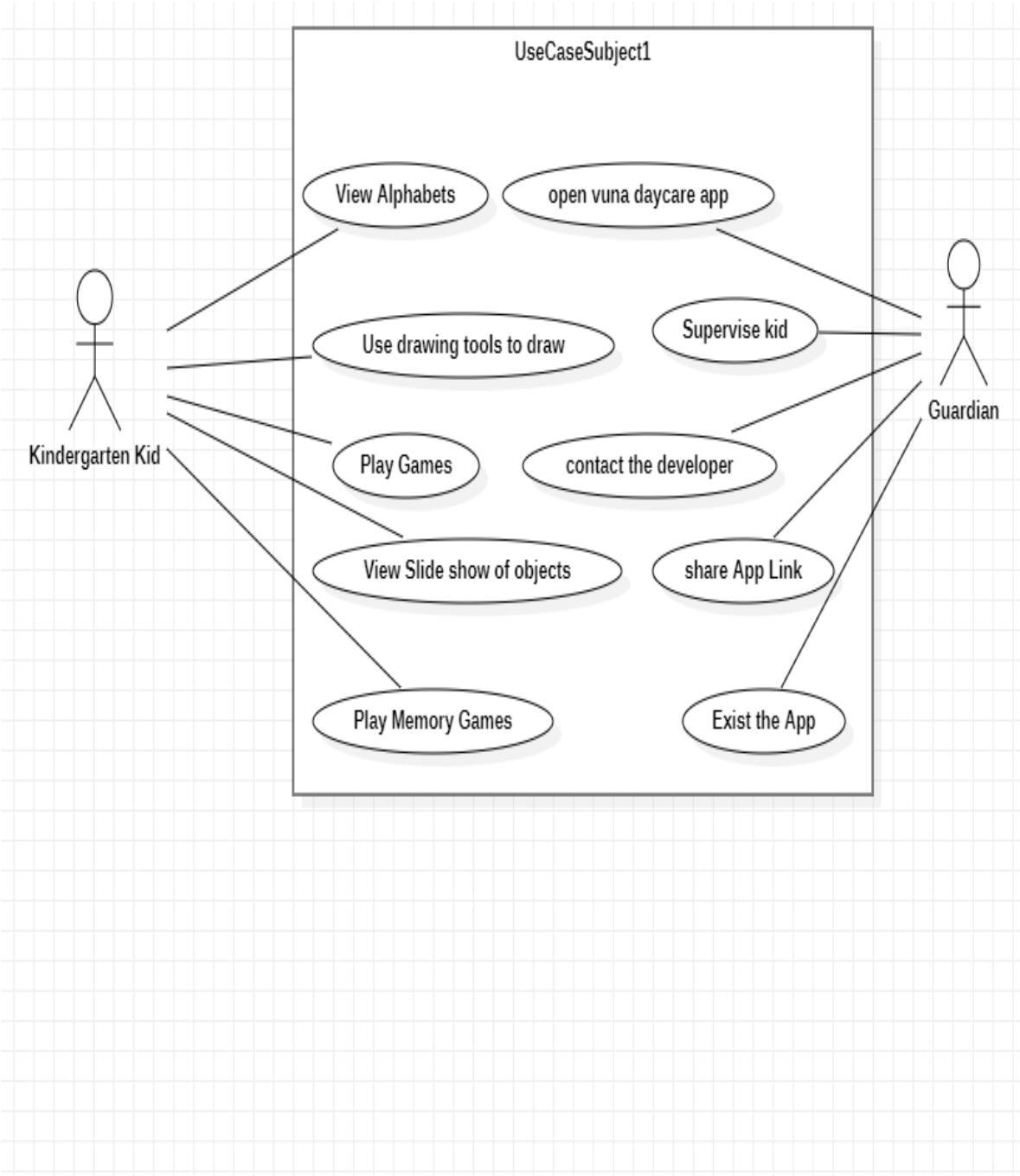

Figure 2. UseCase diagram of an edutainment game application

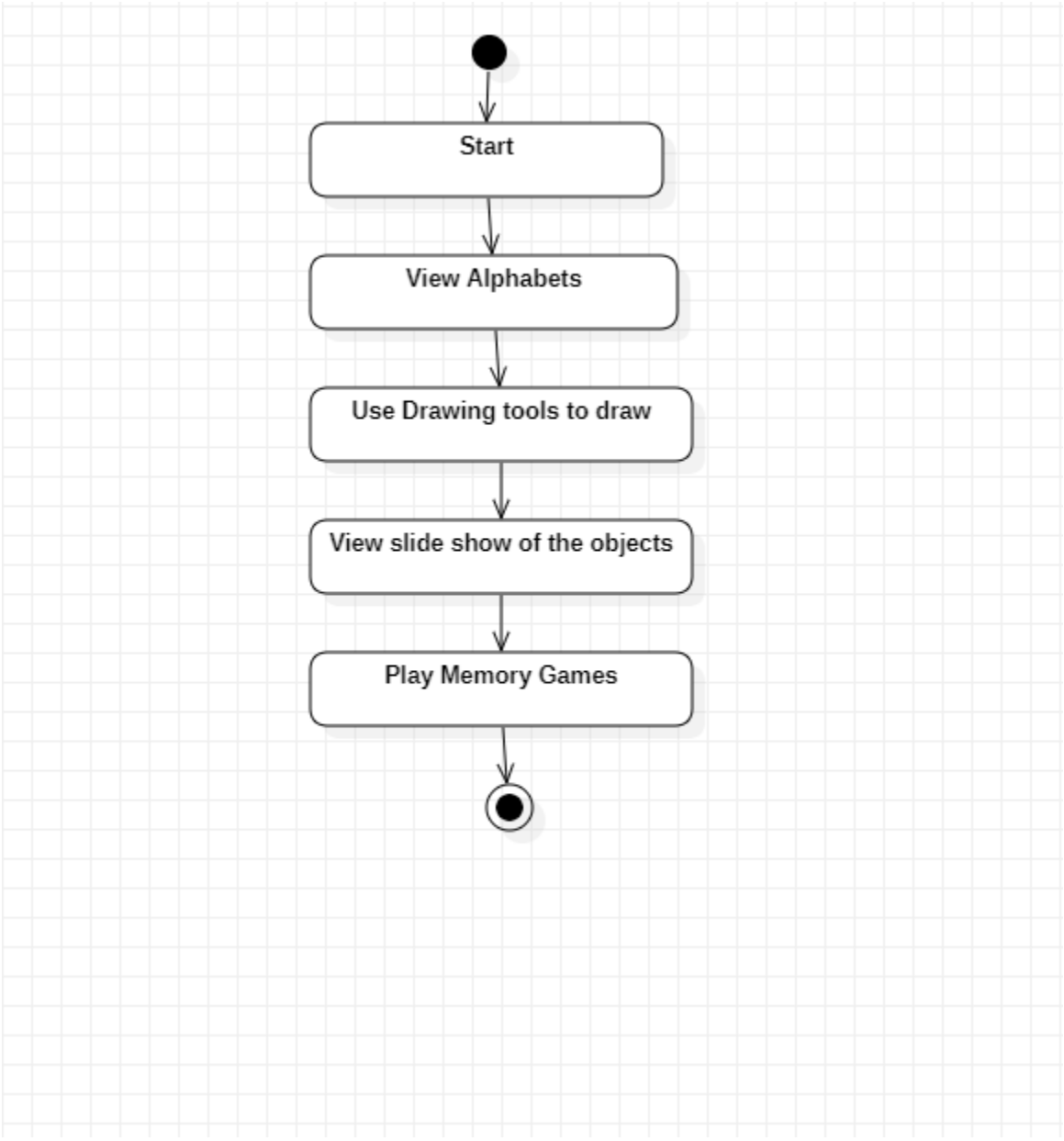

Figure 3. Activity diagram (Kindergarten kid) edutainment game application

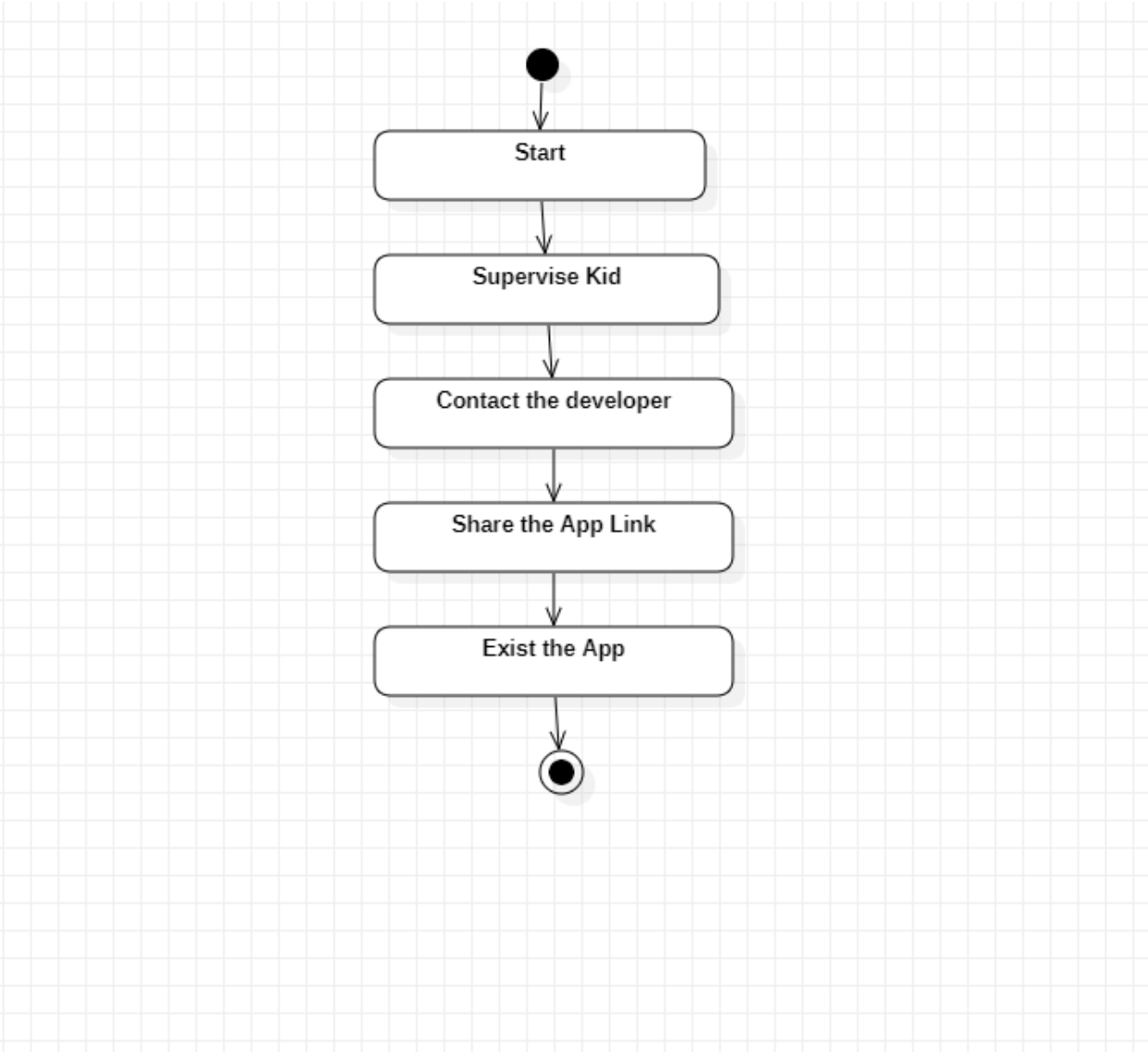

Figure 4. Activity diagram (Guardian) edutainment game application

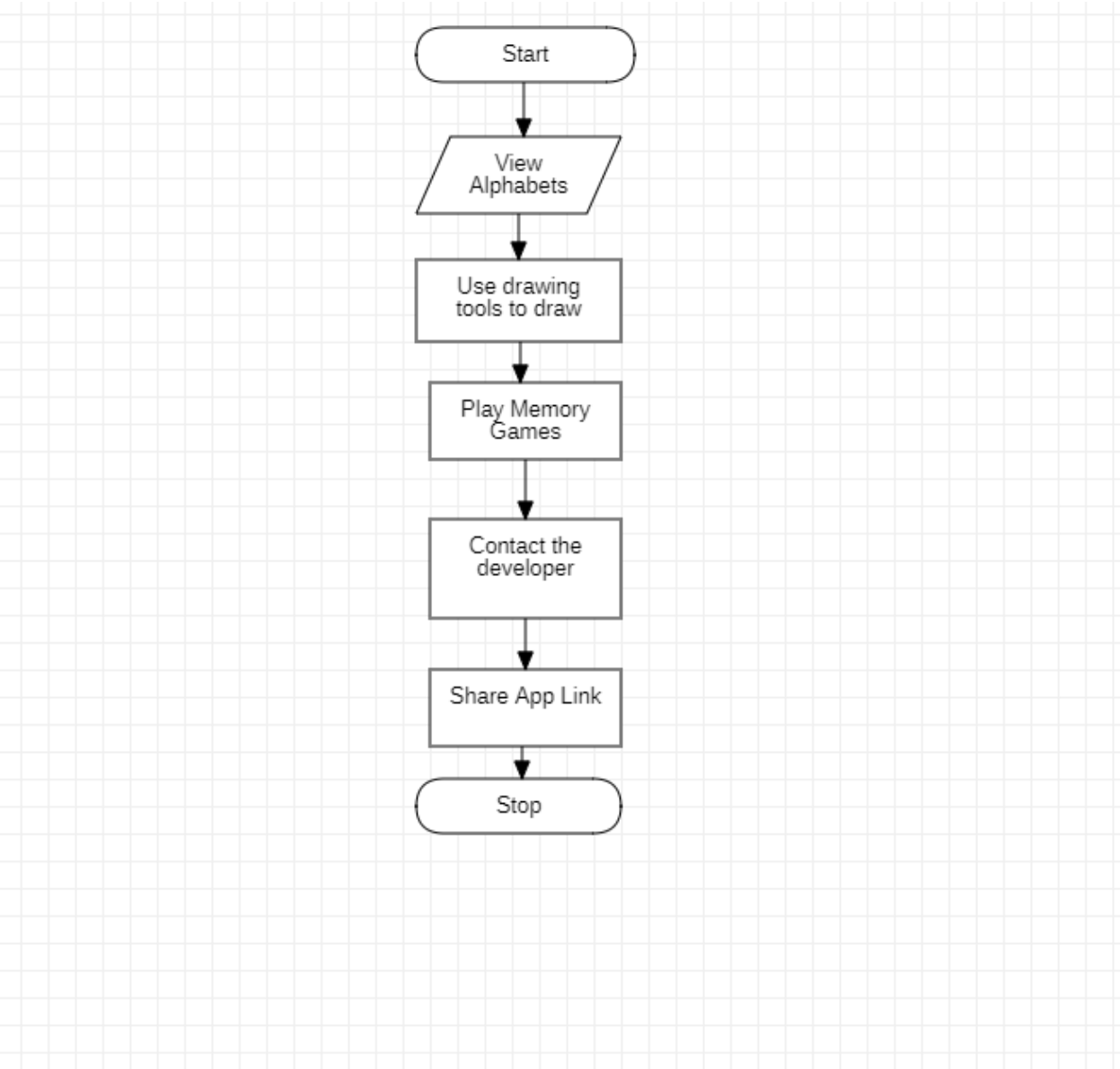

Figure 5. Flowchart of an edutainment game application system

3.2.5 *Development methodology*

The method of development of the application is object-oriented. OOP is a programming paradigm which portrays software design processes as objects for real life. These objects are entities with data fields (attributes describing the object) and processes known as methods connected with them. Objects in code format are usually class instances and interact to construct a computer application and programs.

Justification for the use of this development methodology

An Object-Oriented software enables:

1. Enhanced comprehension – The software development process is made easier by presenting object-oriented analysis.

2. Simplicity: it simplifies software design by presenting each module as an object and offers an efficient means of communication. The qualities, behaviors and relationships of the objects are described.

3. Code Reusability: The code for a certain feature is arranged in one file, it can be reused as much as possible.

Easy to maintain: One file does not have problems with the other files. The diagnosis can be identified and remedied easily to the source.

3.3 *System requirements*

Functional requirements

1. The system would be able to teach kids mathematics and English in the form of games.

2. The system would be able to make it for both teachers and parent in the learning process for kindergarten kids.

Non-functional requirements

1. The system would be easy to use.
2. The system would be safe to use.
3. The system would be fast and accurate.
4. The system would be user friendly and have good user interface and user experience.

Requirements:

- Laptop
- Internet Connection
- Mobile Phone

Software requirements

There would be no need for pre-installation of another software, the application just needs to be installed and then be able to run on a mobile device.

Hardware requirements

Mobile device.

People

1. Teachers
2. Kindergarten kids
3. Parent

3.4 *Proposed methods*

Hardware components

Mobile Phone: a mobile phone would be needed to run the application.

4. Implementation and documentation

System implementation means the conversion of the conceptual and logical designs of the system into operational life, resulting in a mobile application for this project. Deployment includes programing languages and libraries to be selected/installed, code written, debugged/test, documented/manual generated. This study included the installation of Android studio, Android studio is an IDE that is used to design and develop mobile application. The program works well on a mobile phone according to the design architectural structure.

4.1 *Development environment*

The development environment is the Android Studio. *Android Studio* is the official integrated development environment (IDE) google android operating system, built on JetBrains IntelliJ IDEA software and designed specifically for Android development. It is available for download on Windows, macOS and Linux based operating systems or as a subscription-based service in 2020. It is a replacement for the Eclipse Android Development Tools (E-ADT) as the primary IDE for native Android application development.

Android Studio was announced on 16 May 2013, at the Google conference. It was in early access preview stage starting from version 0.1 in May 2013, then entered beta stage starting from version 0.8 which was released in June 2014. The first stable build was released in December 2014, starting from version 1.0.

4.1.1 *Technology to be used*

1. Java: Java is a programming language that may be used to write programs. Java is used to write applications for different platforms that run JRE and supports applications that run on a single device like a desktop or mobile phone. Java can also be used to develop applications that work in a distributed manner.

2. XML: XML (Extensible Markup Language) is a markup language similar to HTML, but without predefined tags to use. Instead, you define your own tags designed specifically for your needs. This is a powerful way to store data in a format that can be stored, searched, and shared.

In this Project, the focal point would be on developing an edutainment game application for kids.

4.2 *Program structure*

The application is organized into components in its library it will include:

1. Front End: These are the static pages for the mobile application. (XML)

2. Android Studio IDE: This is the environment that deals with developing the mobile app.

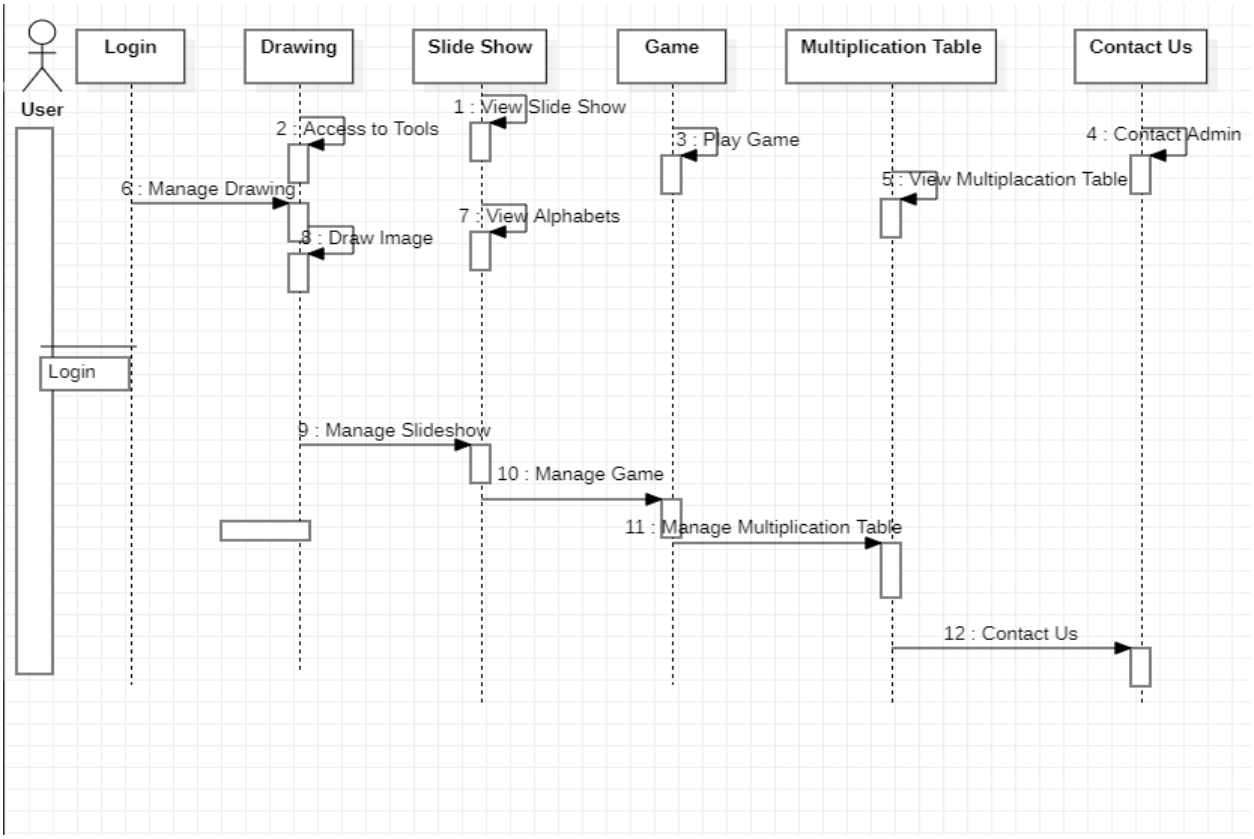

Figure 6. Sequence diagram of an edutainment game application system

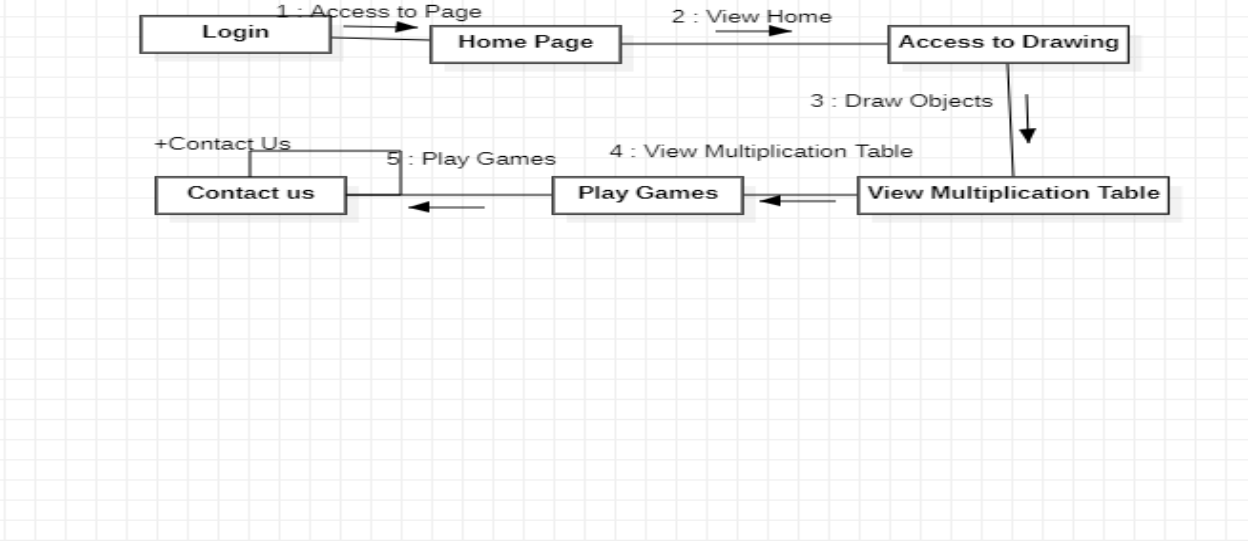

Figure 7. Communication diagram of an edutainment game application system

4.3 *Design tool*

The unified modeling language is the design tool employed in this work. This is a common graphic description for the study and design of software. UML uses symbols to define the application process and document it. If UML notation is employed, it gives an effective communications method and a complete system design explanation.

The system contains only 2 actors and the following can be modeled on administrators using a UML diagram.

4.6 *Documentation*

This documentation contains procedures to replicate the application and to install it. The Mobile Application is created in JAVA and XML using Android studio IDE; hence it must be installed for their environment.

4.6.1 *Software installation*

The process to install the software would be the same as installing applications on a mobile phone. All that is needed is for the application files to be transferred to the chosen system.

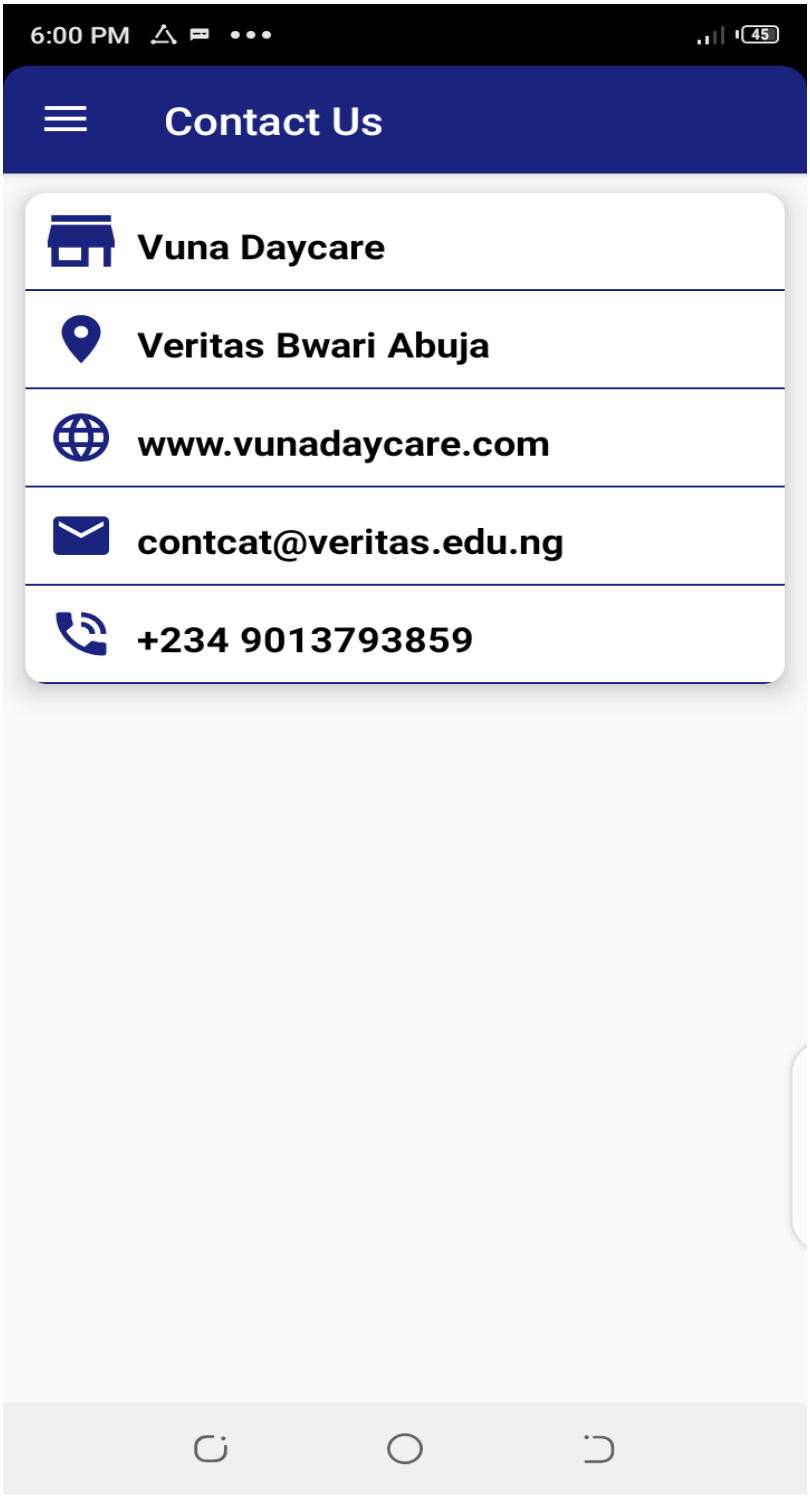

Figure 8. Contact page: Provides more information about the application

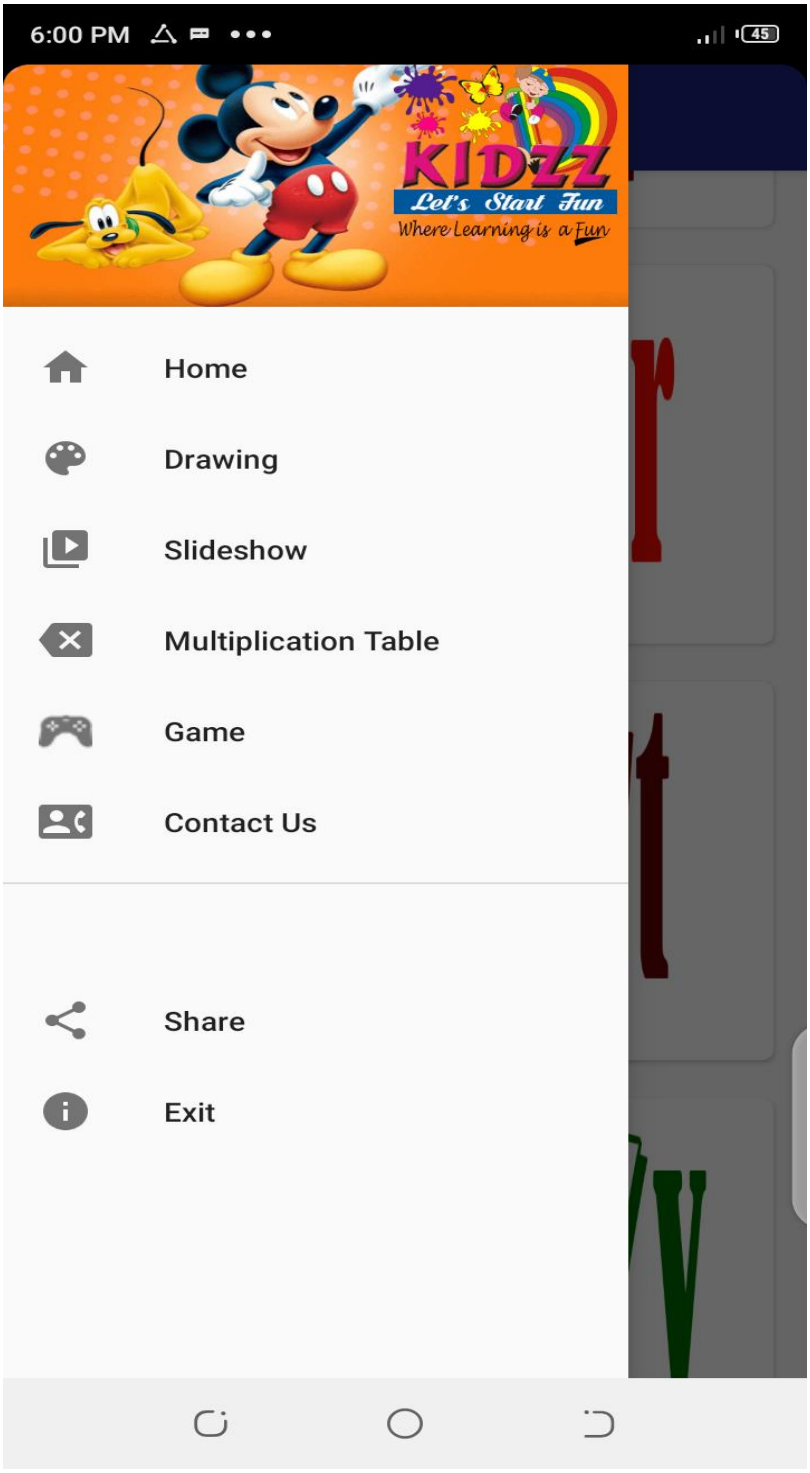

Figure 9. Menu page: It can link to the home, drawing, slideshow, multiplication table, game and contact us page

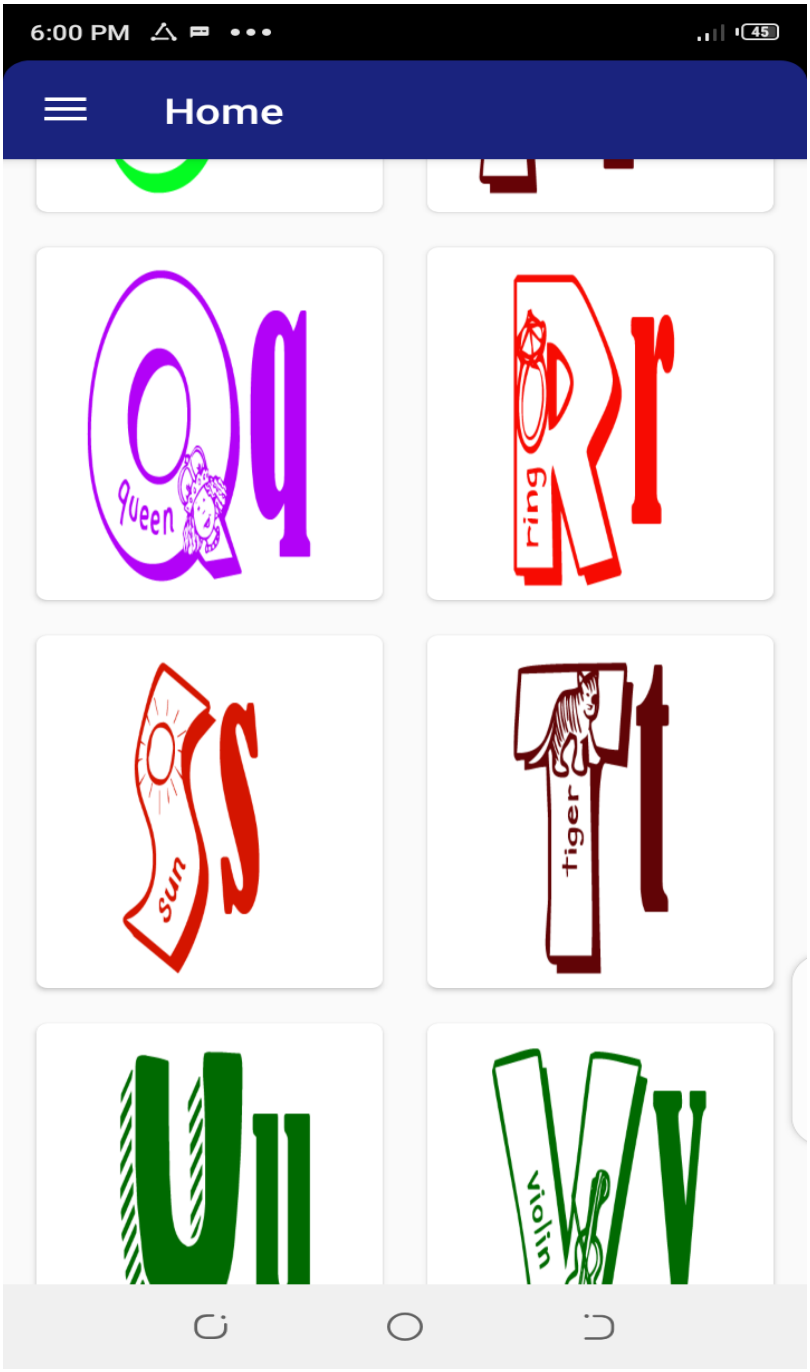

Figure 10. Home page: Where kids can view alphabets

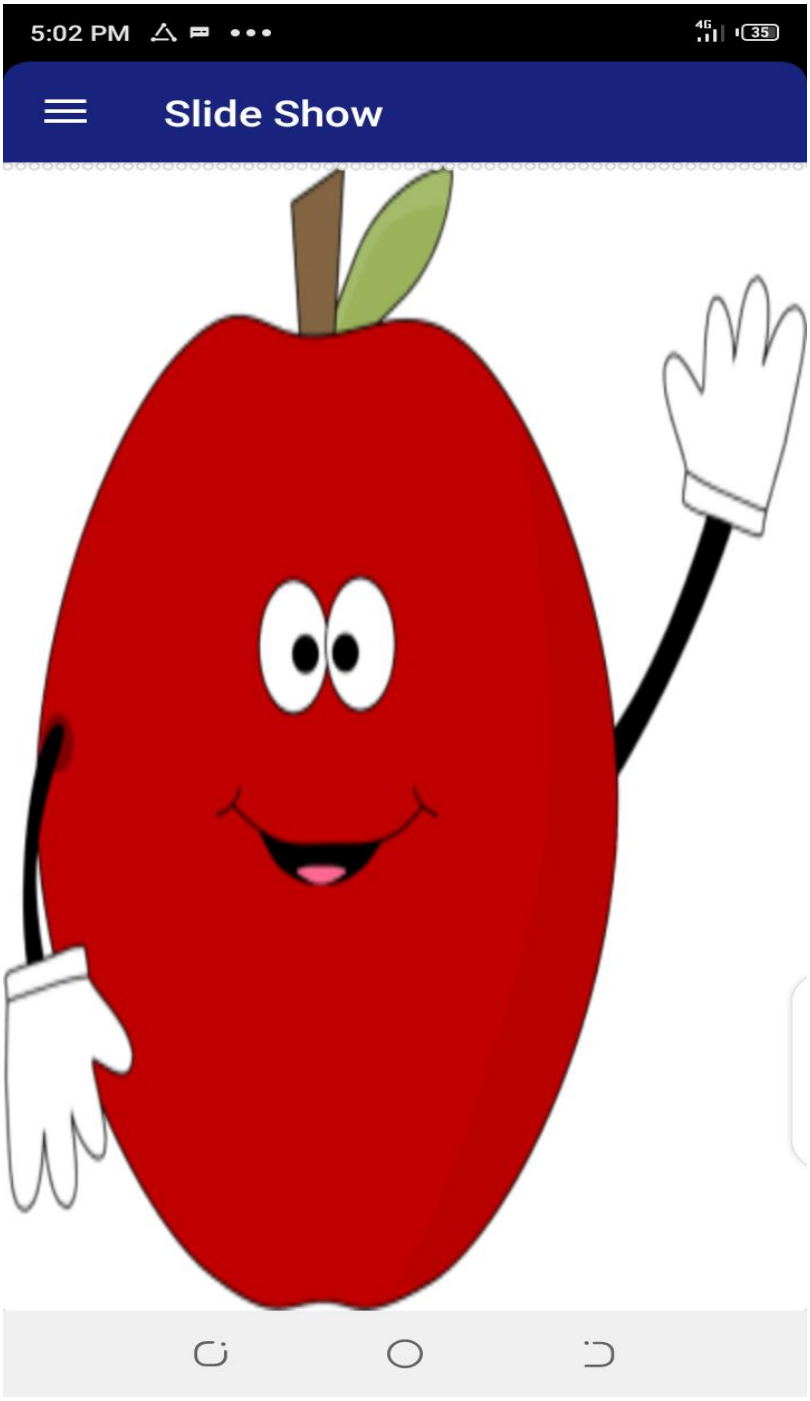

Figure 11. Slide show page: It shows the alphabets in English with imagery for quick remembrance

Figure 12. Drawing page: The page contains all the necessary tools for kids to draw

5. Summary and conclusion

This project would be a well-required solution for teaching kindergarten kids through the use of mobile phones and the kid need to properly supervise by the guardian for understanding of the proposed system. Kindergarten kid learning on a mobile phone is far better because the learning is self-paced and the kid would see the learning process in a more fun or interactive way.

The Edutainment Game Application developed is an automated solution to teach kids how to easily learn mathematics and English in a fun and interactive way compare to the kids been taught physical. It can be applied to many day-care institutions. The development of the system arose because of the high increase in the demand of E-learning, This System is to provide accurate teaching for the kindergarten kid, for easier understanding and to have good foundation on interacting with digital devices at a very young age. A lot of students have problem with Mathematics and English due to a very poor background at a very young age, this is a scenario of one of the problems an edutainment game application would solve.

Therefore, the new system targets to ensure an effective way of teaching kindergarten kids through an edutainment game application. Observing the high chance of learning physical without understanding. The new system is developed with the capability for kindergarten kids to understand, process and analyze information easily.

5.1 *Recommendations*

While developing this solution there were emerging issues that would require further automation. It is hoped that these issues would advance and promote further research in the Edutainment Game Application.

The system is expected to have high level of supervision by the guardian or teacher to reach the full potential of the mobile application.

Limitations of study

1. Support for other languages.

2. Limited to only Mathematics, English and Memory games.

5.2 *Conclusion*

E-Learning applications are considerably expanding the reach of current schools, both by providing students enrolled with a broader choice of educational materials and by providing learning opportunities to individuals. This paper shows the innovativeness of vuna daycare 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 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.

5.3 *Area of further research*

As stated earlier in the limitations of the study, further research is needed for the effectiveness of an edutainment game application system. There is a need to research areas that can be used for future 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. For this, gamification

developed for the games must be improved for users, especially kids, to become more fun to play. 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.

Acknowledgements

This research did not receive any specific grant from funding agencies in the public commercial, or not-for-profit sectors.

The authors declare no competing interests.

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