Whiz ICT: An Interactive Android-Based Computer Learning Application For First Graders

Thomas Henaku, Augustus Buckman, Solomon Amenyo

Abstract: With the rising awareness of people in Android-based applications, it has been perceived that mobile devices can be used to surge the educational skills of children instead of allowing them to use all their time for playing games. Therefore, the development of an educational application is essentially required, especially, to improve the computer-related knowledge of children. There is the necessity to create a simple, interactive and easy to use Android-based application to enhance the knowledge of children in basic computer concepts. In this work, we developed an educational application, named "Whiz ICT" with Android Studio. It also expounds on the methods taken to make the project come into reality. The ADDIE (Analysis, Design, Development, Implementation, and Evaluation) model of the System Development Life Cycle was used to make sure the project meets the requirement of each and every stage. Furthermore, user and system requirements were the main components taken into consideration which helped in making the project come into existence.

Index Terms: Android-based, Children, Computer, Educational, ICT, Whiz, Interactive

1 Introduction

One of the great aspects of mobile phones, digital technology to children is the ability to learn individually, practice, study, and have fun with different subjects and basic concepts. This can be attained through young children's skills to explore and learn with mobile devices in ways that are normal to them through touch and repetition. The motive is that touchscreen devices (mobile devices) are invented in such a way that very young users can use them effortlessly [1].

Since technology is growing at a rapid speed, ICT has become an important aspect of Ghana's educational curriculum. Identifying the effect of new technologies in our daily lives, today's educational establishments attempt to streamline their educational curriculums to include technology. Presently, ICT and "e-learning" have turned out to be vital notions in Primary, Senior High School, and Tertiary education in Ghana. Although Ghanaians are not extremely grown in technology use as compared to the advanced countries, Ghana can be counted along with nations that see the incorporation of technology in education as very necessary [2].Balanskat et at. [3], argues that though teachers seem to acknowledge the worth of ICT in schools, they continue confronting difficulties during the processes of implementing these technologies into their tutoring and studying. These technologies comprise computers; digital video cameras and digital cameras; creativity and communication software. These technologies will guarantee that Ghanaian children have access to ICT which presents them opportunities to develop all-purpose skills and also increase their precise knowledge of that technology. Meanwhile, observation made by the researchers in a number of schools around the country does not suggest much is being done.

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According to Asante [2], the technological resources needed to help in the learning of ICT are not available and the most common resource available in the schools is the Computer which is not even adequate. It also came to light that most of the teachers are not trained, have little or no knowledge in the use of ICT to enable children to appreciate the learning of ICT.

2 Conceptual Framework

ICT became popular in education in the early 1980s when microcomputers were readily available at the consumer market. The expectation was that computers would enhance educational standards thereby making it more beneficial in both teaching and learning [4]. Therefore, when properly implemented, it could support and transform the learning situation in the classroom.

2.1 Related Research

2.1.1 ICT and Early Childhood Education

Computers and mobile technologies are revolutionizing what we know and how we know it, and hence what we learn and how we can learn it [5]. ICT offers teacher and children both technological tools and resources which are beyond the boundary of their classrooms [6], [7],[8]. Children are in the middle of a huge, unintended experiment, surrounded by digital technologies that were not accessible but 5 years ago [9]. They are growing up in a technologically advanced society so there is a need for them to catch up with happenings in the 21st century [10]. Van Scoter et al. [11] Demonstrated various ways in which ICT can create rich impacts on children's literacy development, in the four interrelated regions of speaking, listening, reading, and writing. For example, they have argued how "talking" word processors aid young children's investigation as they play with language. But individuals have opposed this. As computers began to be employed in the playroom, there was a general debate about whether this integration was suitable for early learners [12], [13], [14]. Although ICT encompasses a wide range of technological products and applications, the most significant for many of us in recent years has been the computer [12], [15]. The majority of educators' arguments have ensued over children's use of computers and computer games. Early contestations in the literature came from Elkind

[16] about the isolating nature of computer use, from the Alliance for Childhood [17] who believed computers to be dangerous for emotional, physical or intellectual development, and from Healy [18] who had similar issues and was also concerned by the influence of sponsorship by private technology companies.

2.1.2 Use of Mobile Devices (ICT Tools) by Children

Mobile phones have emerged as a truly pervasive and affordable Information and Communication Technology (ICT) platform in the last decade [19]. The popularity of smart mobile devices is growing fast. These digital devices signify a new cohort of technological tools that present outstanding access to content as well as chances for innovative use even by young children. Young children explore and learn with mobile devices in ways that are natural to them (touch, repeat, trial and error [20]). Touchscreen technology offers a mode of interactive experience that mirrors the child's natural constructivist learning [21]. Touchscreen devices (tablets) are also invented in such a way that even young users can use them effortlessly [22]. Smart mobile devices or mobile devices do not require the variety of separate peripheral devices used for computer input such as a mouse, trackball, touchpad, TrackPoint and keyboard [23]. Their mobility and ease allow children to learn in a variety of settings instead of the traditional desk and chair [24]. Those qualities allow children the flexibility of placing the device on their lap, on the floor or moving with it to any part within their home [25]. Smart devices complementing applications (apps) can produce thrilling and valuable learning environments for learning and instruction in early childhood [1], [26].

2.2 Survey of Related Systems

2.2.1 Kid's Online Typing Game (Cabaran Keyboard)

The "cabaran keyboard" was developed by Nor Hazwani Binti Abdul Rahman. The purpose of the "kids online typing game (caraban keyboard) for kids' between 7-10 years old is to improve the efficiency of the students typing. Furthermore, this is to make the students know how to spell some words and understand the words. The main aim of this project is to make students exposed to technology. The software and languages used are XAMPP application, PHP language, HTML language, CSS language and JavaScript language and the methodology used is the ADDIE model [27].

2.2.2 Math Tutor App

The math tutor app is an Interactive Android-Based Numeracy Application for Primary Education which was developed by Zainab Masood and Rashina Hoda. The Android-based application - Math Tutor - targeted for classroom teaching and was designed specifically to be used both by students and teachers. A part of the application is designed to help students learn and practice single digit addition and subtraction using numbers and images. The children are encouraged to learn by using the simple technique of earning medals when they complete a particular level. The intended users of this application are children between 5-6 years of age and the teachers who will be assisting and using the application to manage students. The application was developed using the scrum methodology. Adobe Photoshop and Adobe Illustrator were used as image customization and processing tools. The Android framework was chosen as the platform for the development of the application. Eclipse was used as the Integrated Development Environment (IDE) with Java as the programming language. Android 14 was used as the version of the Software Development Kit (SDK) for compatibility with the Android device selected for this project [28].

3 METHODOLOGY

3.1 Requirement Gathering

The first stage of the development cycle is requirement gathering. Requirements gathering or collection is a preliminary stage of the software development lifecycle after planning the stages of the lifecycle and specifying the boundaries and scope of the system in terms of application areas and users. It involves the collection of potential requirements for the new system and analyzing these collected requirements to eliminate conflict and ambiguity. In Ghana, public schools' activities performed are in line with Ghana's education curriculum, which is a framework designed by the Ministry of Education (MoE) to give schools in Ghana the direction for teaching and learning. Therefore, all teachers are required to teach and design their school activities in line with this curriculum provided. The curriculum indicates what must be taught to students at schools and specifies the learning areas.

3.2 User Requirements

The user requirements section describes some of the functionalities that the potential users expect the application to perform. The key requirements include:

- ✓ Choosing a level
- ✓ Can skip any welcome messages
- ✓ Congratulate the user for completing the previous level
- ✓ Go back to the levels page when they want

3.3 Functional Requirements

Sommerville [29] defines functional requirements as services that the system should provide, how it should react to inputs and how it should behave in particular situations. The behavior is expressed as tasks, functions, and services that the system is required to perform. Simply speaking, the functional requirements specify what the system does and can be affected by the approach taken by the organization when writing the requirements, the software users, and the software to be developed.

The following are the functionalities to be delivered by the system:

- ✓ Primary one student will learn the uses and parts of the computer.
- ✓ Students will learn about the computer keyboard and the types of keys on it.
- ✓ Students will learn how to use a computer mouse.
- ✓ Students will learn how to start, restart, and shutdown a computer.
- ✓ Students will learn how to work with Microsoft paint.

3.4 Non-Functional Requirements

Sommerville [29] defined non-functional requirements as constraints on the functions and services offered by the

system. They apply to the system as a whole and do not just apply to individual system services or features.

The non-functional requirements of the system to be developed are as follows.

- ✓ Performance: The response time of the application must be fast. For example, when the 1st grader chooses a level, the application must be fast with showing the level.
- ✓ Reliability: The application must not encounter errors when it is running.
- ✓ Ease of use: The application should be very easy to use as the user interface should be simple and not complicated for the students so that they can use the application to learn the course that is provided. For example, it should have a game – like interface.
- ✓ Availability: The application should function or can still be used without internet access.

3.5 System Analysis and Design

After gathering enough information from our requirement stage, we moved to performing an analysis on the logics to be used, the use case and other design methods. We also designed the layout and the parts that will work together to make sure the system functions as expected.

3.5.1 Wireframe for the System

Figure 3.1 (a) shows the homepage that will be available to the system user. It has a simple design that very young children will be able to understand the action required of them. Figure 3.1 (b) displays the levels available in the system that a user can choose. Fig 1 (c) and (d) depicts how ICT learning materials will be aligned for easy navigation and understanding.

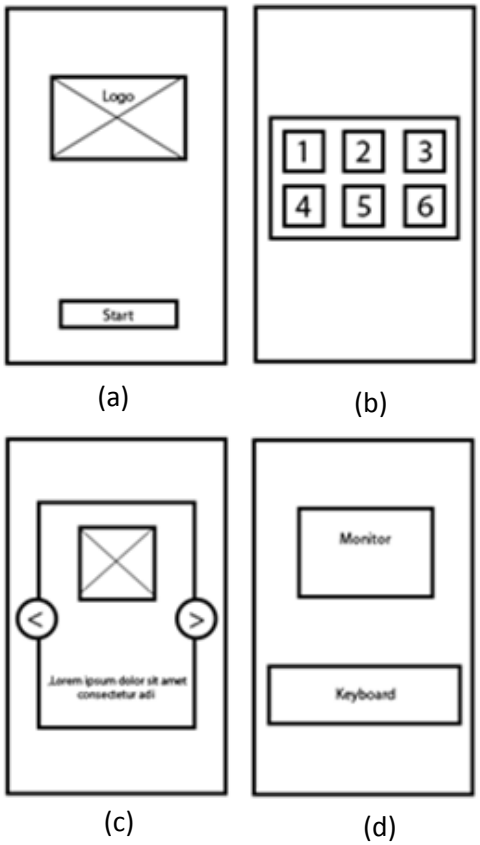


Fig 1: Wireframe - (a) Homepage, (b) Level page, (c) Level 1, (d) Level 5

3.5.2 Use Case Diagram

The figure below shows how the various actors (system users) interact with the application and what they can do.

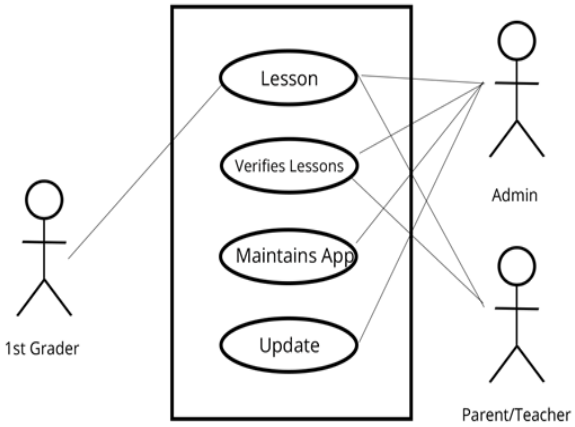


Fig 2: Use Case Diagram

3.5.3 System Architecture

The Figure below shows the system architecture of the application. It shows the flow of information from the App Logic to the User Interface.

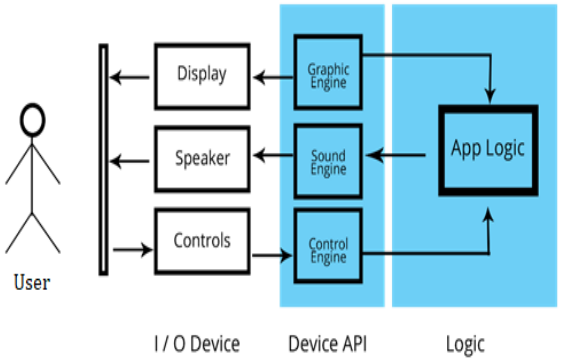


Fig 3: System Architecture

4 System Implementation and Testing

This section explains the various implementation iterations that were used in developing and testing the system.

4.1 Implementation Stages

4.1.1 First Iteration

We installed pre-requisite development applications such as Android SDK and Android Development Tools (ADT) to get a running environment. For developers, Android SDK provides a rich set of tools, including debugger, libraries, handset emulator, documentation, sample code, and tutorials. Android applications can be easily developed with Android Studio Development Environment (IDE). The first development iteration involved implementing the home screen and the levels page. The home screen was designed and programmed with the use of Adobe Photoshop and XML.

4.1.2 Second Iteration

In this iteration, we worked on the various object images (e.g. the keyboard image) by editing them with Adobe Photoshop after downloading them from Freepik, Pintrest and Vecteezy. We took out the white background in most of the images because they were JPEG files. We also had to resize some of them to our desired size and change the colours of some of the images. Each image had to be carefully edited and inserted into the activities. This iteration also involved the modification of Home screen activity and the level activity.

4.1.3 Third Iteration

We started this iteration by implementing the text–to–speech functionality of the system. Our system is an educational application that helps students to learn through the use of automatic audio readability. Hence, the audio to be used must be clear and also sound natural to the reader. All pronunciations and punctuations must be noted when reading to the user. To achieve this, we sort to use natural reader, an online text–to–speech platform. The voices available to us were tested until we chose a suitable one to incorporate into our system. To incorporate the text–to–speech functionality, we stored all the audio files in the default raw folder in android studio.

4.1.4 Fourth Iteration

This iteration started with making necessary adjustments after testing the system on the Nox player. Then we moved to creation of the other activities, which include: the parts of the keyboard activity and the mouse activity. All the activities were designed according to the prototype and then integrated into the system. During the integration, we had a few errors which took time to fix.

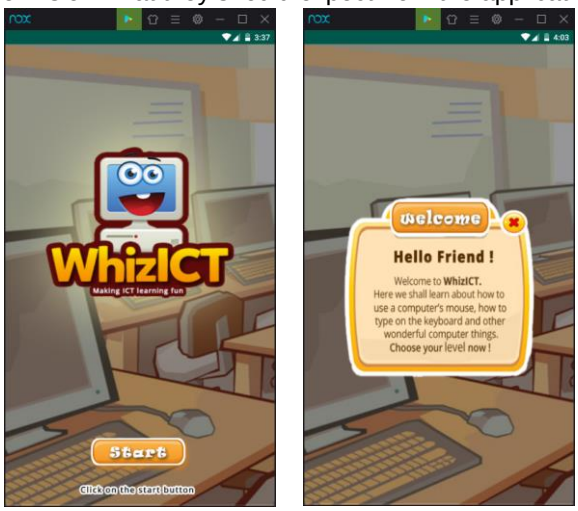
4.1.4 Fifth Iteration

The final iteration involved the creation of the rest of the activities; the computer mouse activity, MS paint activity, and Notepad activity. All iterations were followed by testing the system on the Nox player to ensure the functionality of the application meets the user requirements. Errors were fixed and the application was tested on different Android devices and OS versions.

4.2 Application Interfaces

4.2.1 Start page and Welcome page

The start page is the page that the system user sees when the application is launched. As shown in Fig 4 (a), the user interface was design with children as the primary target group. The welcome page as shown in Fig 4 (b) gives the user the general overview of the system. Users are able to envision what they should expect from the application.

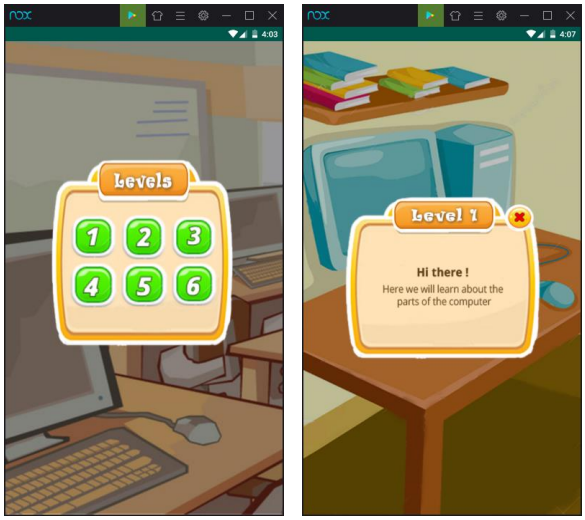


(a) (b)

Fig 4: Start page and Welcome page

4.2.2 Levels page and Level 1 Welcome page

The levels page is well designed to give the application users what they can be able to do. Different levels can be selected based on the user's preferences as shown in Fig 5 (a). Fig 5 (b) is a sample welcome message that introduces users to each level selected.



(a) (b) Fig 5: Levels page and Level 1 Welcome page

4.2.3 Sample Exercise in Level 1

The screen in Fig 6 is an example of an audio-visual exercise interface available for the user. The user can skip an exercise or go to previous exercise.

Fig 6: Sample Exercise in Level 1

4.3 System Testing

We conducted series of simple tests with children between the ages of 6 to 8 and adults who teach in basic schools. This was done to ensure that the application performs well to meet both the functional and the non–functional requirements. The development team was able to detect flaws based on the experience of the users. Some of the application logic changed during the testing as we noticed user experience was different from what we assumed. During testing, we realized that certain aspects of the application were irrelevant to some group of people, but those aspects were still relevant to the project. These tests provided an opportunity to fail-proof the application.

5 Summary, Conclusion, and Recommendation

5.1 Summary

A lot of effort was put into this project to meet its stated requirements. Measuring the project against the initial specification, this project has been successful in terms of delivering on its aim which is to develop a computer skill learning application system to help first graders with basic computer skills using mobile phone. Now the probability of students studying ICT has become higher, hence, promoting the use of computer related applications.

5.2 Conclusion

The rapid growth in technology and classroom teaching shows that touch-based mobile devices and engaging applications can be integral part of future classrooms. The use of these mobile devices amongst children is increasing by leaps and bounds. We believe WhizICT can serve to be a good foundation for grade one (1) students who are between the ages of 6 to 8 to learn ICT.

5.3 Recommendations

We recommend this application to state agencies like Ministry of Education (MoE) and Ghana Education Service (GES) to help integrate this application into Ghana's education system. Educational institutions in Ghana should also play their part by making sure this application is introduced at their conferences and seminars so that a huge target group will be met. Researchers need to come on board to explore more ways and strategies that children can learn ICT with ease.

6 References

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