Mobile EduFun School Application

by

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Dissertation submitted in partial fulfilment of
the requirements for the
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CERTIFICATION OF APPROVAL

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A project dissertation submitted to the
Information and Communication Technology Programme
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In partial fulfilment of the requirement for the
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Approved by,

_____

Dr. Wan Fatimah Bt. Wan Ahmad

UNIVERSITI TEKNOLOGI PETRONAS
TRONOH, PERAK
JANUARY 2014

CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.

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FRANCELINO EDSON MANUEL MURELA

ABSTRACT

Recently, modern handheld devices such as smartphones, tablets, and PDAs have become increasingly powerful in our society. However, dramatic breakthroughs in technology have allowed the automation of education teaching processes in which resulted in opening doors to a wide range of learning possibilities. For instance, most smartphones regularly include cameras and processors comparable to the personal computers from only a few years ago. Nonetheless, there are quite considerable applications that allow much passing of the knowledge and information to the young generation such as mobile educational applications. Therefore, the objective of the project is to develop a Mobile EduFun School application on android platforms that will guide the children step-by-step throughout the numeracy basis by providing basic counting and arithmetic exercises that will challenge yet increase the children's ability to solve basic mathematical operations while understanding the idea of simple mathematics and applying mathematical skills in everyday life. The scope of the study will be to put emphasis on numerical or arithmetic operations for children of ages of 7 to 9 years old and the development will undergo incrementally and iteratively based on modern mobile application architecture. Furthermore, the project will be developed using a Java Programming Language for the coding and it will have as a tool Eclipse Classic Integrated Development Environment (IDE) and Android Software Development Kit (SDK) that includes the necessary libraries and custom tools used on android platforms. The progress in the first phase of final year project results in positive response from preliminary surveys and completion of first prototype which is a mock up or basic framework interface of the application.

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Francelino Edson Manuel Murela

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ABBREVIATIONS AND NOMENCLATURES

App: Application;

FYP1: Final Year Project 1;

FYP2: Final Year Project 2;

GTP: Government Transformation Programme;

ICT: Information and Communication Technology;

JAVA: Computer programming language;

LINUS: Literacy and Numeracy Screening;

MySQL: Open-source relational database management system;

MIREM: Ministry of Mineral Resources;

Pre-SEDEX: an event organized before Science and Engineering Design Exhibition;

3Rs: Reading, wRiting, and aRithmetics;

UTP: Universiti Teknologi PETRONAS;

VIVA: Thesis presentation.

CHAPTER 1

INTRODUCTION

1.1 Background

With the evolving technology and new trends in the area of Information and Communication Technology (ICT) with regards to the field of education, controversy and debate issues among researchers have taken place for a certain period of time. However, due to the highly dynamical introduction of computer technologies in the educational reality among various societies (for instance, European and Western) and the influence of researches that were somehow related, computer aided learning has been proven to be more realistic than it was once. Hence, gradually replacing any initial resistance towards the use of ICT in a learning environment.

In addition, a wide range of ICT applications have become increasingly accepted as developmentally appropriate education resources for children of preschool and primary school age (Zaranis & Kalogiannakis, 2011a, Zaranis, 2012).

Furthermore, the exercise of traditional educational activities in primary schools have always been a reality accepted and known to everybody. So, solving mathematical exercises on a white or black chalkboard was a way not solely to assess students' understanding but also to assess student's abilities to solve mathematical operations and learn the alphabetical letters. Later on, such practices started to be used infrequently as schools were engaging to new technological means such as using desktop computers to assess the student's ability to reason while solving mathematical operations.

Meanwhile, researchers have broadened the content of the term ICT to deal not solely with the desktop computers but portable technologies as well embedded in various devices (Gjelaj, 2013) such as digital cameras, electronic tablets, and smartphones.

Notwithstanding, ICT can play an essential role in aiding children reduce the low level of literacy of the kindergarten curriculum or primary schools in all areas and subjects if provided appropriate educational software applications through which would be embedded in appropriate educational scenario (Zaranis & Kalogiannakis, 2011b).

1.2 Problem Statement

In Malaysia, the national education system put on the shoulder of the Ministry of Education the responsibility to handle matters pertaining to preschool, primary school, secondary school and post-secondary school. Despite the fact that the national education system has successfully built the human capital of the country, there still exist some gaps in educational attainment, particularly in issues related to literacy and numeracy proficiency of students in preschool aged 4 to 7 years old.

According to the Government Transformation Programme (GTP) through LINUS (Literacy and Numeracy Screening), one of their main targets is to ensure that by 2020 there will be a 100% literate preschool pupils that shall have mastered Reading, wRiting, and aRithmetic (3Rs, known in Malaysia as "3M"). However, the current situation highlights that there is still exist the issue of low literacy rates at primary school and about the 3Rs at the primary level.

Furthermore, the need to produce people who are literate and possess strong arithmetic background through the education system also has to do with the quality of life of the country. Being that said, although the students living in rural areas are provided equally free education as the students living in urban areas, developing the mathematical skills and/or literate skills may be more difficult in low-income families because these families have a high tendency to simply rely on schools to teach some of the basic skills that could be taught at home when on the other hand, teachers may be expecting that those kids would have learnt them at home. Nevertheless, this is an issue because it gives both parents and teachers the idea that it is not their responsibility to teach the children basic skills, when it happens to be everyone's responsibility to do so.

1.3 Significance of Project

The mobile application that shall be developed for this project shall serve as a platform for children to learn the alphabetical letters by introducing phonemic sounds, and arithmetic operations while using their cognitive abilities to reason every single solution they may encounter. However, as the letter recognition and phonemic awareness are the two fundamental predictors of reading ability, by developing an application that applies these two predictors together in human literacy, children have the potential to become good readers and communicators.

Therefore, it is essential to develop an application that will not be "just another application in the market" but an application that is in-line with the curriculum being implemented in the kindergarten and / or preschool in order to ensure a parallel teaching process and mutual gain for both teachers and children as the children would have more time to practice whatever is being taught in kindergarten and preschool and while not in class would be practicing similar exercises and enunciation of the alphabetical letters and numerals.

1.4 Objective of Project

The objectives of the project can be resumed into three main points:

- To identify suitable learning theory(ies) to be used in developing numeracy conceptual framework;
- To design and develop mobile application on learning the alphabetical letters, basic counting, and mathematical operations;
- To test and assess user's behavior based on their experience in using the developed mobile application.

1.5 Scope of Project

In this project the scope shall be resumed on the emphasis on arithmetic operations such as addition, subtraction, multiplication, and division as well as basic counting and alphabetical letters proficiency. As many people come up with education applications that focus entirely on one module, be it basic counting or simple addition operations, in this project a different strategy (fusion/hybrid modules) will be used.

Having that said, this project will focus on depth and breadth which means that the application will provide various modules while offering the children as many alphabetical and/or numerical fundamentals as possible so they can spend as much time studying as possible.

In addition, one of the sub-modules will be quantification, that is, a child's ability to associate collection of objects with corresponding numbers. This sub-module will help children to perform pre-assessment and post-assessment of the skill learned.

In one hand, in order to perform pre-assessment, children will have to recognize numbers from 1 to 10 correctly and be aware of the sequence in which numbers from 1 to 10 are organized. Therefore, these skills could serve as pre-assessment of the quantification sub-module.

On the other hand, after a child has successfully completed the module, the application should test if the child accurately understands quantification or not.

Moreover, this application will be developed in an android operating system which will be the system platform for this mobile application because there is 1 billion android-powered devices in 2014 where one out of every two devices will run on android by 2015.

CHAPTER 2

LITERATURE REVIEW

2.1 Early Childhood Classroom Environment and learning theories

In the early stages of development, it was noticed that children learn by playing. In fact, play, in a developmentally appropriate environment, inspires the child to relate oneself to the environment while making sense of the infinite elements where the children unites internal processes with external influences. Therefore, as children play, they learn. This theory demonstrates that the children learn while having fun. As the children internalize the sensations of the environment, they somehow integrate personal experiences to hypothesize the so-called impossible. This brings us to the concept of imaginary play where such play is constant as children relate their hopes and experiences to the new sensations. However, as their minds translate external experiences with personal meaning, children become masters of their environment and such environment may be defined as a continuum between the imaginary and the sensory (Bodrova and Leong, 2006)**.** In addition, complex yet accessible relationships occurring in the classroom enrich the mental processes of young students. This is proven when children reflect on their environment, as they instinctively classify experiences according to both individual personality and the surrounding culture (DeVries, 2008). As children become familiar with the syntax of social knowledge, their worlds are somehow shared with one another to form a social imagination. According to Gardner (2007), a child struggles to comprehend new experiences, he or she will naturally utilize scientific notions of problem-solving and critical thinking. As the child begins to understand experience, social cooperation augments skills of perspective and interpretation. In one hand, shared activity provides a meaningful social context for learning and social interaction provides support in a physical sense as well as motivational sense. On the other hand, through talking and communication, the gaps and flaws in one's thinking become explicit and accessible to correction. That's when thought becomes sequential and visible to the thinker (Bodrova and Leong, 2006b).

Behaviorist learning theories define learning as a change in observable behaviors due to the environmental stimuli. So, these theories simplify lessons so that the child's focused attention

remain specific. Because of the efficiency of a behaviorist lesson plan in terms of planning, execution, and assessment, the teacher has more time for alternate classroom tasks. In a nutshell, the behaviorist learning theory is beneficial for children who are easily distracted or over-stimulated but the categorical focus of this theory can be wearisome for children in need of variety and stimulation. Another learning theory of this research is social cognitive learning theories, which reflect the natural tendencies of children to alter personal behaviors based on the observed behavior of others. So they are effective because they are natural, simply as that. For instance, in classroom groups, children often rely on each other for support and guidance in both explicit and implicit ways. However, excessive use of modeling to influence children can lead to unnecessary competition which in turn can affect the inherent motivation of a children in a variety of ways. Moreover, another theory takes place where children has the ability to use their cognitive skills to solve a particular problem or to reflect on what measures to take on a particular scenario. Cognitive learning theories differ from other theories in a sense that cognitive learning theories include thought as an active pursuit, a foundation of experience used to organize new information, a personal perspective regarding new information, a social environment to acquire new knowledge, and the use of practice to further differentiate between experience and new information (Chard & Katz, 2001).Using cognitive learning theories in a classroom setting allow teachers to offer a variety of experiences to approach information, assess understanding and summarize the combination of information and understanding. It also infuse the classroom curriculum with meaningful interaction as children grow together in intricate ways not all experiences can be measured equally, because everyone's experience is utterly unique. Chard & Katz (2001) believe that" Behaviorist, Social Cognitive, Cognitive, and Constructivist learning theories represent a continuum of approaches available for teaching young children where Behaviorist theories are described by categorical processes based on observed behavior because these theories focus on molding the child's repertoire of behaviors using the array of behaviorist methods of classical and operant conditioning. Social Cognitive theories elaborate the behaviorist ideas of observed behavior by using the notion of modeling as the main approach. So, by capitalizing on the notion of human beings are inherently social creatures, teachers can use social feedback to augment the curriculum" such that" Cognitive learning theories focus on the thinking processes of the learner rather than the behavior of the learner". Educational mobile

applications are viewed as a pathway to put the children in a position of learners where the learning is an active process taking place in the largely unobservable domain of the human brain. Therefore, the learner approaches information using first senses and later reflection.

More studies indicate that young children are able to define their own experiences both individually and as collective. As children process and revisit experience, they define social knowledge according to their experiences of their culture. Nevertheless, the learning community becomes a scientific cooperative, dedicated to researching and celebrating the world (Bodrova and Leong, 2006c).

2.2 ICT and Children referred to as ”iLearners”

Researchers Christie and Johnson (2009) indicate that digital media has now permanently settled in the lives of young children. As pointed out by Lavidas, Komis, & Gialamas (2012), many times children surpass adults in their modern technological knowledge even before attending kindergarten. Hertzog and Klein (2005) define a distinct line between the current generation of children and their parents. They very aptly report that children do not need to adapt to the new technological society because they were born in it; unlike their parents who have acquired their technological knowledge as somewhat of a foreign language at an advanced age. Consequently, according to Prensky (2001), young children can be described as “digital natives” since they are growing up in the digital world. Most recently, Prensky (2010) refers to today’s students as “iLearners” deriving from the fact that digital devices such as smart-phones and tablet computers dominate the daily lives of children in Western societies from the age of 6 months. The Lieberman, Bates and So (2009a) report that several studies have shown that digital media can introduce children to abstract concepts that were previously considered too advanced for their age. In her research, Yelland (2005) has shown that activities entailing the use of digital media, within the school environment, facilitate collaborative learning for young children and the development of logical thinking while reinforcing their ability to solve problems. Therefore, digital learning activities may encourage children to work together. They have been found to be more effective than traditional learning activities (Zaranis, 2011; Zaranis & Kalogiannakis, 2011a). Orlando (2012) commented that portable devices fit perfectly in the lifestyle of young children as they do not need to sit at a table or an office to use the device, they do not need to handle a mouse, while the interface offered with a single touch on the

touchscreen is irresistible. Children now use the new technology at a younger age than ever before (Common Sense Media, 2011).

Young children have access to new technologies not just in the school environment but also out of school, at home (Somekh, 2007). For some children, the first educational experience with computers begins in the kindergarten age, between 4 to 6 years old. Existing studies have shown that children of this age can successfully handle computers with the appropriate instruction (Zaranis, 2011; Zaranis & Kalogiannakis, 2011a). In a study of the comparison between learning at home and in the kindergarten classroom, Plowman, Stephen and McPake (2010) found out that ICT is used to promote three main areas of learning. The extension of knowledge about the world (cognitive objects), the acquisition of functional skills (such as the operation of the mouse) as well as the development of the propensity for learning (by strengthening a range of emotional, social and cognitive functions of learning).

Recent studies have identified a number of emerging digital devices, such as tablets, as being appropriate for the education and entertainment of children (Verenikina & Kervin, 2011). Lieberman et al., (2009a) commented that young children age three to six years old play with a vast variety of digital learning activities, now available on desktop monitors and portable screens, spending a constantly increasing amount of time doing so.

A study including Australia, New Zealand, USA and Great Britain showed that most children ages two to five years are more able to interact with a tablet than to tie their shoes (Orlando, 2012). Moreover, the possession of smart mobile devices by children ages four to fourteen years old has doubled since 2005 (NPD Group, 2008).

2.3. Learning through Mobile Devices

Sharples, Taylor and Vavoula, (2007) define mobile learning as any kind of learning that takes place in learning environments and areas which take into account the mobility of technology, the mobility of learners and the mobility of learning. Therefore, mobile learning through the use of tablets and smartphones presents new opportunities for strengthening the learning experiences in ways that simply other devices cannot achieve (Lam & Duan, 2012).

In one hand, high-resolution screens allow tablet users to share static content and resources such as images and videos in an easy way. Most tablets have no phone features making them ideal tools for education since disruptive elements for the learners' attention such as incoming text messages or unwanted calls that are present in phones and smartphones alike, are absent. On the other hand, tablets are able to offer the benefits of mobile applications in a broader context in all levels of education, not only as an affordable solution for one-to-one learning but also as a feature rich tool for work inside and outside the classroom.

Wakefield and Smith (2012) indicate that the technological analysts characterize the tablet as an ideal tool for all levels of education. However, after the introduction of tablets in the classroom of several schools in the United States, students report that they want to participate in learning activities due to the novelty of the medium, the visual characteristics and ease of use. In the classroom, tablets can be used to create text, audio or video notes. Students, independent of age, can store educational materials in a digital portfolio. Being that said, using a tablet learning can be achieved through the active participation of students and the use of interactive activities and animations. Additionally, the attractive appearance of the working environment and the innovative touch interface are considered key learning facilitators for young children and students with learning disabilities.

2.4 Previous Research

Scout's 123 Carnival

This is another educational mobile application in the market devoted to teach the children basically how to count from 1 through 20 with a couple of characters. Although, the application targets preschoolers learning numbers, 123 Carnival guides children, using both verbal and visual cues. So, the application solely teaches the children on how to count using sounds and characters but it does not teach them how to perform mathematical operations.

FIGURE 2.1 Scout's 123 Carnival

Bugs and Numbers

This is a complex educational mobile application devoted to solely teach the children math concepts like matching, counting, sorting, sequencing, addition, subtraction, fractions, money, measurements, and telling time. However, it does not state a specific age group. Furthermore, similarly to 123 Carnival educational app, Bugs and Numbers display a similar functionality with respect to when wrong answers are met , a "oops" sound is provided and that wrong chosen option disappears. Nevertheless, there are still no explanations or demonstrations of the correct answer. Hence, this makes it difficult for the children to understand what the correct or incorrect answer is.

FIGURE 2.2 Bugs and Numbers

2.5 Impact of visual aids and phonemic sounds in early childhood

Visual aids play an important role in the early developmental stage of children. However, they are important to show the children what they are actually learning. In addition, besides clarifying what is being taught to a child, the use of visual aids such as colorful pictures of objects and animals, etc., make learning more permanent than other teaching techniques. Researches have proven that we all use our five senses (taste, smell, touch, hearing, and seeing) to learn something. Nevertheless, seeing seems to be the sense where most of our learning comes from. Hence, the most efficient and effective way to clarify and bring understanding to what is being taught is to actually show the children. Through visual aids children are capable of mentally representing a particular object and visualizing different representations of that particular object and as to for what it is used for. Nonetheless, through representation of alphabetical letters and sounds of their phonetics children are capable of learning how to read and enunciate such letters. Thus, improving the chances of making them good readers and communicators. Despite the existence of various mobile educational applications such as Scout's 123 carnival, AB alpha, Bugs and numbers there still lacks an application that is able to sustain neat visual aids and standardized phonemic sound awareness in such a way that children can easily grasp what is being taught to them. Therefore, EduFun application comes to fulfill the existing gap by providing an application with various aid representations of animals to enrich the children vocabulary and facilitate learning while entertaining them with amazing characters, objects, and funny mathematical exercises.

FIGURE 2.3 Class Environment

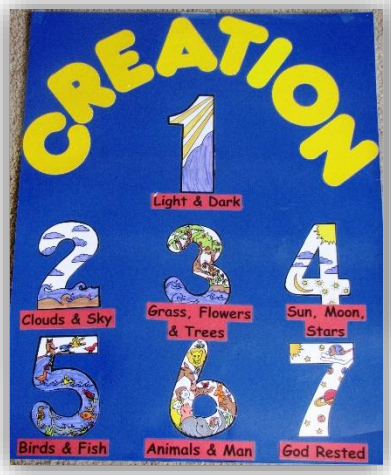

FIGURE 2.4 Teaching Help

FIGURE 2.5 Teach autistic child how to count

2.6. Learn the Alphabet (ABCs)

The Internet is flooded with alphabet apps for children, but EduFun School Application can hold its head high as one of the best examples. It's just won an award (1st runner place) from Student Professional Development Engineering Conference (SPDEC) for being one of the best mobile designed apps for kids, after all. You have to be imaginative when it comes to finding enough animals to match the alphabet. Expect 24 animals and two special magical creatures. However, EduFun incorporates phonemic awareness for the 26 alphabetical letters and displays an animal that starts with the prefix of the alphabetical letters. Learn the Alphabet is an app that incorporates numerous modules to teach the upper and lower case of the alphabets, and provides videos to teach the children how to say each letter. It is a pretty cool application for kids but the modules could be simplified and the upper and lower cases along with the phonemic awareness could be embedded into one single activity. Therefore, there's where EduFun School Application steps into the picture and simplifies what seems to be hard to implement in a simple yet clear manner so that the children don't have to jump through different modules to have access to information that could be condensed in one module alone.

In addition, Learn the Alphabet provides videos that serve as tutorials to teach the children on how to say the whole alphabet. It is a pretty cool move although it lacks animated visual aids such as cute objects or lovely cartoon animals to make the watching experience more appealing and less boring. Being that said, the EduFun app tried to implement a very simple concept to gather the attention of the kids through the aesthetics features of the applications. Even the fiercest animals look the cutest thing in EduFun application making it more attractive and less bizarre for the children to grab what is being taught to them.

FIGURE 2.6 Learn the Alphabet

FIGURE 2.7 Letter K

Furthermore, the backgrounds of Learn the Alphabet application somehow do not look as appealing as they ought to be. Being kids at early stage, people who get captivated by colorful items or objects, they tend to enjoy learning when factors such as the aesthetic of the application is taken into consideration. Even the buttons themselves are not so cheerful, so EduFun app tackles such tiny yet huge important details that make a lot more difference when included in an application for kids. The video displays the alphabetical letters but it would be more fun if there were cartoon or animated characters instead of a Human being singing.

FIGURE 2.8 video playing K

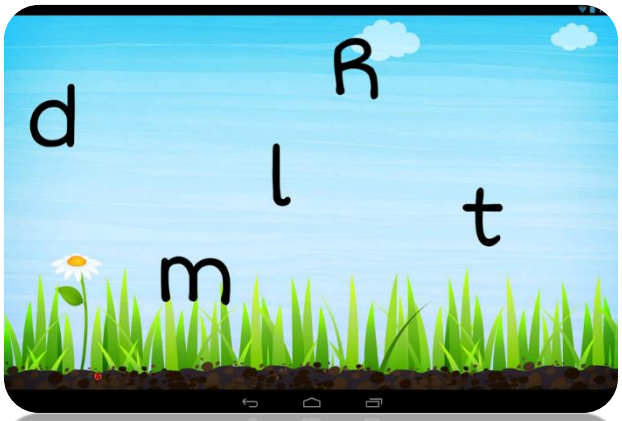

FIGURE 2.9 Alphabet song

Lastly, what is verified in the Learn the Alphabet application is the lack of animated visual materials or characters that could make the application more appealing and joyful to the children. A clear picture can be understood from the figure below.

FIGURE 2.10 complete alphabet

CHAPTER 3

METHODOLOGY/PROJECT WORK

3.1 Model Framework

The approach or the model framework of the project development is iterative and incremental development, that is, iterative and incremental development is a discipline for developing systems based on producing deliverables. Therefore, the basic idea behinds this approach is to develop a system through repeated cycles (iterative) and in smaller portions at a time (incremental), allowing developers to take advantage of what was learned during development of earlier parts of the project. Specifically saying, in incremental development different parts of the system are developed at various times and integrated based on their phases while in iterative development, parts of the system will be revisited in order to revise and improve them. Nevertheless, successful deliverables are acquired through modifying targets of the system consulted by users in order to get feedbacks.

This approach is ideal for this project because the operating system involved in mobile application is flexible to be built with minimal purchase of hardware and tools required to complete. Apart from that, the time constraint happens not to be an issue of relevance because the time given is enough to iterate the phases whenever it is necessary. Notwithstanding, the research can be focused on constantly improving the system to ensure meeting the objectives of the project.

3.2 Initial Planning

In this stage, a preliminary survey/questionnaire is conducted to gather early data requirements as well as general responses with regards to the proposed project. However, the targeted audience is this survey are fathers from Tricubes Berhad along with students of Universiti Teknologi PETRONAS. In addition, the research method utilized was e-mail questionnaires or surveys spread through e-mail. Upon receiving the results of the questionnaires, they were keyed in into a Microsoft Excel spread sheet in order to generate graphs and table to represent the answers in terms of percentage.

3.3 Planning

In planning, milestone acts as an indicator in which an event is the project schedule has completed when a deliverable has been achieved. However, they possess zero duration because they simply symbolize an achievement, that is, a point of time in a project. These milestones help in the production of a study plan which allows a proper segregation of time so that each key task is tracked. Nevertheless, a Gantt chart is then generated to illustrate the project schedule.

3.3.1 Key Milestones

a) FYP 1 (Duration - 14 Weeks)

TABLE 3. 1. FYP 1 Milestones

N°	Milestone	Week
1	Submission of Extended Proposal	6
2	Prototype: Basic Interface Design	11
3	Proposal Defense	11
4	Submission of Interim Report Draft	13
5	Submission of Interim Report	14

b) FYP 2 (Duration - 16 Weeks)

TABLE 3.2. FYP 2 Milestones

N°	Milestone	Week
1	Progress Report	4
2	Pre-SEDEX	11
3	Dissertation (1st Draft)	12
4	Online Submission of Technical Report and Dissertation	13
5	VIVA	15
6	Final Dissertation (Hard Bound)	16

3.3.2 Gantt Chart

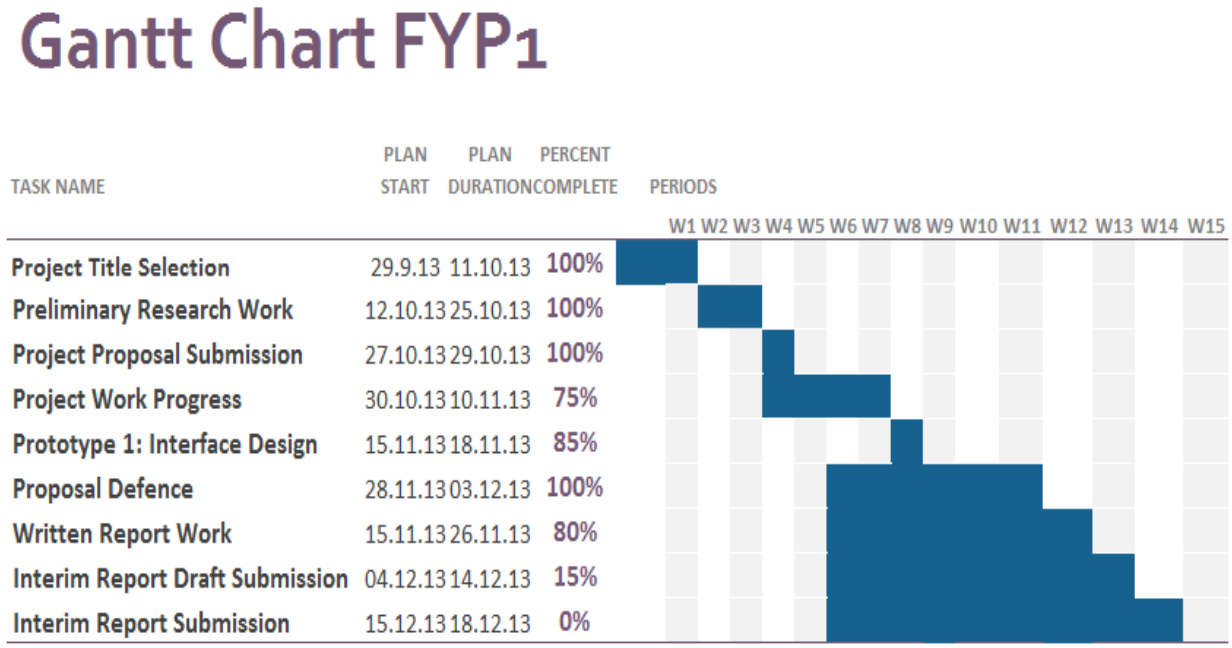

FIGURE 3.1. FYP1 Timeline

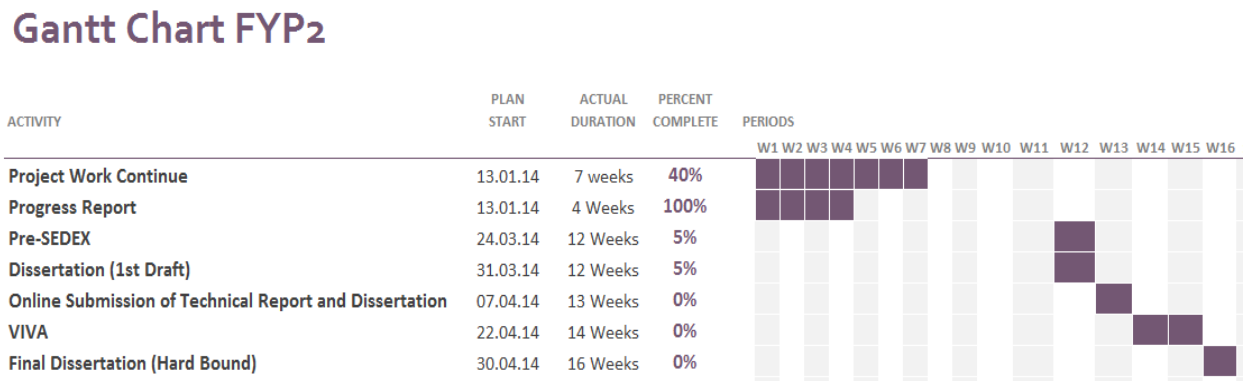

FIGURE 3.2. FYP2 Timeline

3.4 Requirement, Analysis & Design

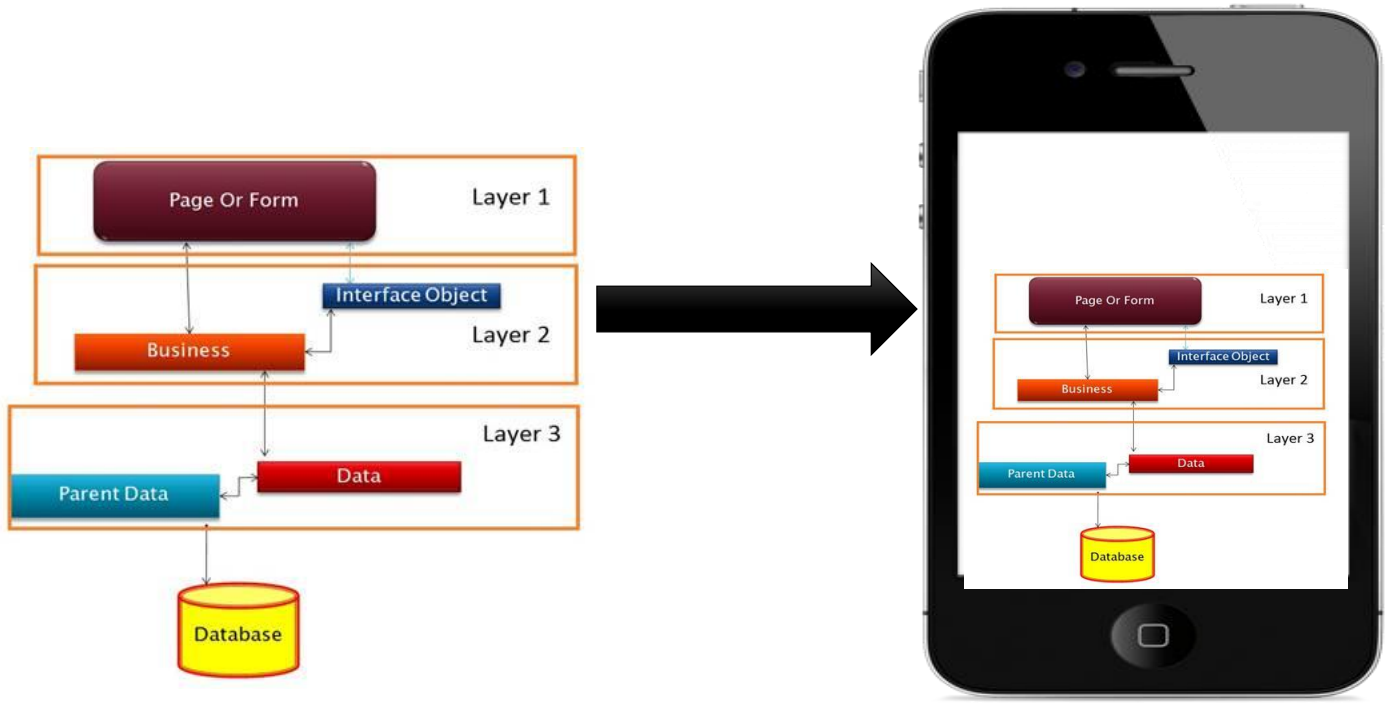

FIGURE 3.3. Android Mobile Application

The application that will be developed in this project will follow the android mobile application architecture as illustrated in the figure above. The architecture consists of the following:

I. Page or Form Layer

The interface will reside on the device. The user will interact with the device in a conducive way guided by a set of steps to reach its end goal.

II. Business or Logic Layer

Here the user will directly interact with the graphical user interface to establish connection with the database. The framework of the interface will be programmed using JAVA language.

III. Database

Although for this version there is no need for a database, future versions may require a database to store user details and score records acquired throughout the exercises.

3.5 System Development Progress

At the moment, the application is completely developed meeting the requirements established beforehand. The user interface have suffered a couple of changes since its development until now and all the functionalities for every single module is working flawlessly as planned. In addition, a great emphasis were not solely put on the functionalities themselves but the user interface as well as this serves as the foundation layer in order to ease the synchronization of the functions themselves.

In one hand, the focus of the project was to develop the first prototype that represents the basic design framework of the application. Upon its completion, a colorful and full of nature user interface was developed.

Apart from it all, the following prototype of the application consisted of a running user interface in a tablet phone with basic navigation which is currently developed and running as smoothly as predicted.

TABLE 3.3. Progress of the Project Architecture

Task	Status
Basic Framework	Complete
Graphical User Interface (2nd Prototype)	Complete

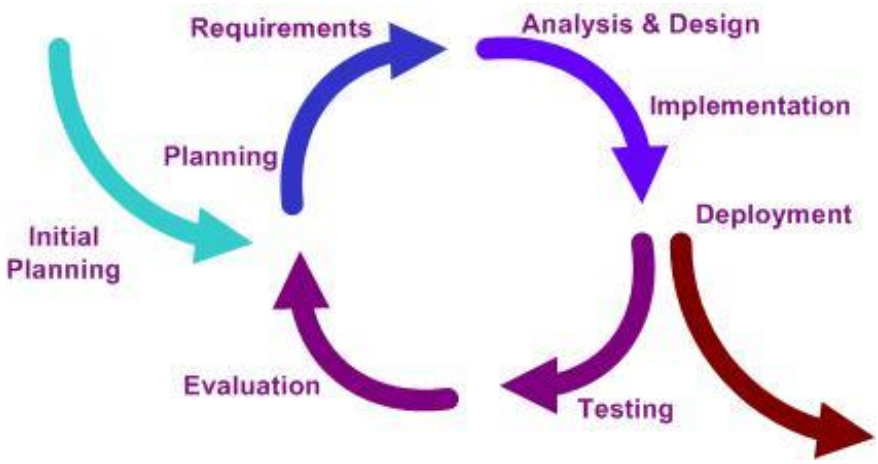

FIGURE 3.4. Iterative and Incremental Development

CHAPTER 4

RESULTS AND FINDINGS

4.1. EduFun School Application Hierarchical Chart

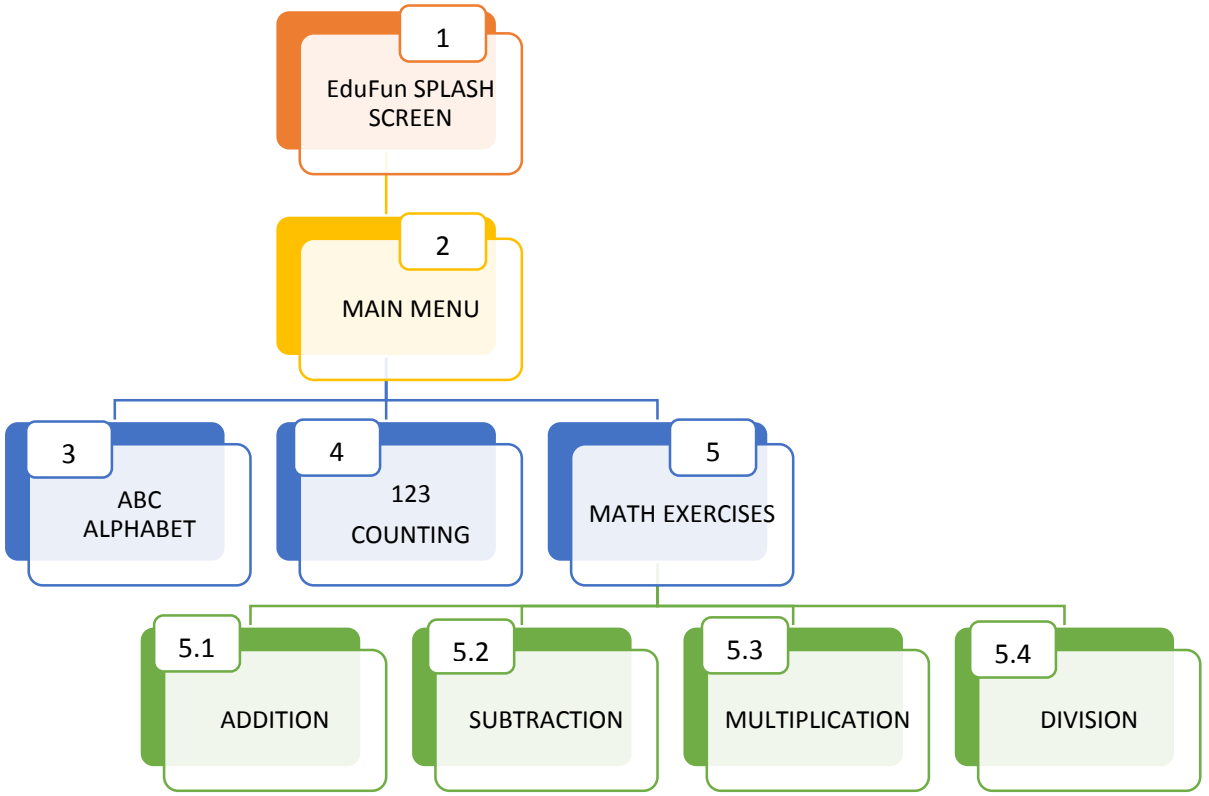

FIGURE 4.1. EduFun Hierarchical Chart

4.2 User Interface

Splash Screen: this is intro page of the application or the first page being displayed when the application is launched.

TABLE 4.1 Splash Screen description

Name	Description
EduFun School	Name of the application
Loading	Gathering and checking all contents before redirecting to menu page.

Splash Screen is the first page being displayed when the application is launched. It illustrates to the user the apps logo along with the name. However, the splash screen is mere displayed for a particular time period and automatically leads to the main menu screen where all the modules are arranged and ready to be explored by the user.

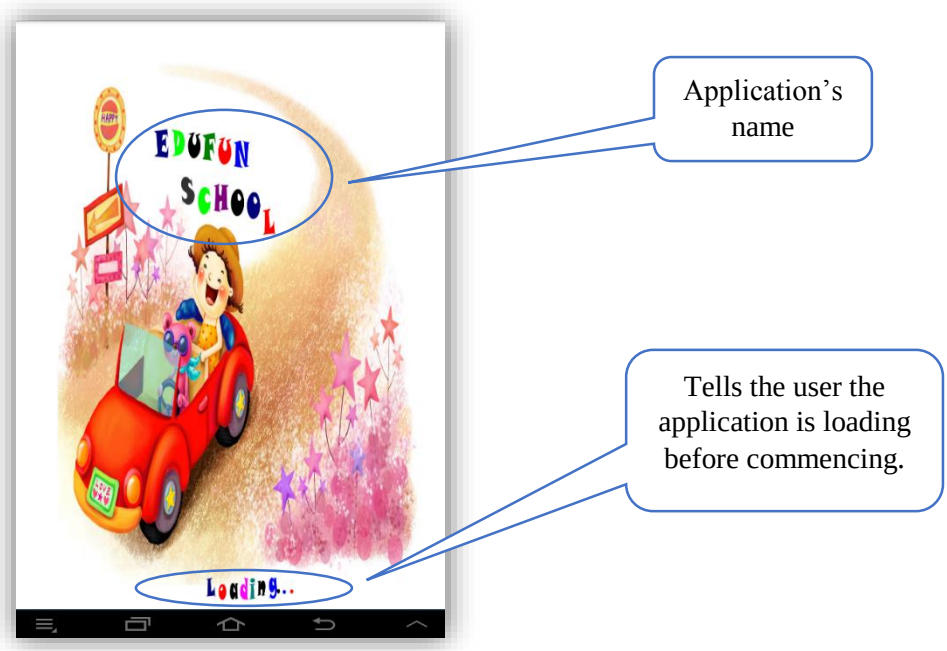

FIGURE 4.2 Splash Screen

4.3. Main Menu

The main menu of EduFun app is composed by three (3) main modules:

ABC Alphabet, 123 Counting, and Math Exercises in this exact order.

FIGURE 4.3 Main Menu

- **ABC Alphabet:** this module is completely devoted in teaching the early age children the 26 letters of the alphabet along with phonemic awareness and an animal corresponding for every particular letter of the alphabet. In total, there are 26 different animals which help the children identify not solely the letter of the alphabet but an animal that starts with that particular letter of the alphabet.

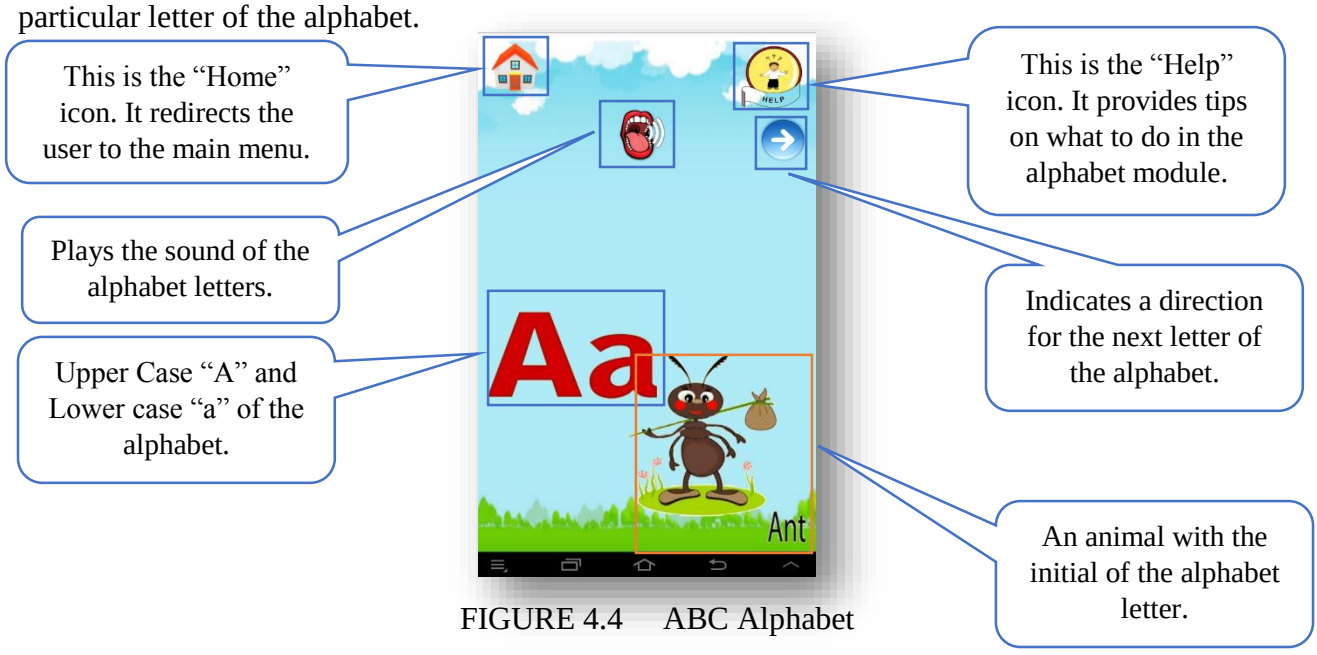

FIGURE 4.4 ABC Alphabet

- **123 Counting:** this module uses the same strategy as the ABC Alphabet module. However, on this one there is something interesting about the numbers and the objects that represent those numbers. In addition, for every number being displayed, there is a correspondent object of that particular number, i.e., if number one is displayed, there will be "ONE" object attached to the number, if number two is displayed, there will be "TWO" objects attached to the number, and so on and so forth. This is to teach the children how to count and relate the numbers with objects that correspond to those particular numbers. This way the children will be able to know the numbers and relate it to representation of their surroundings.

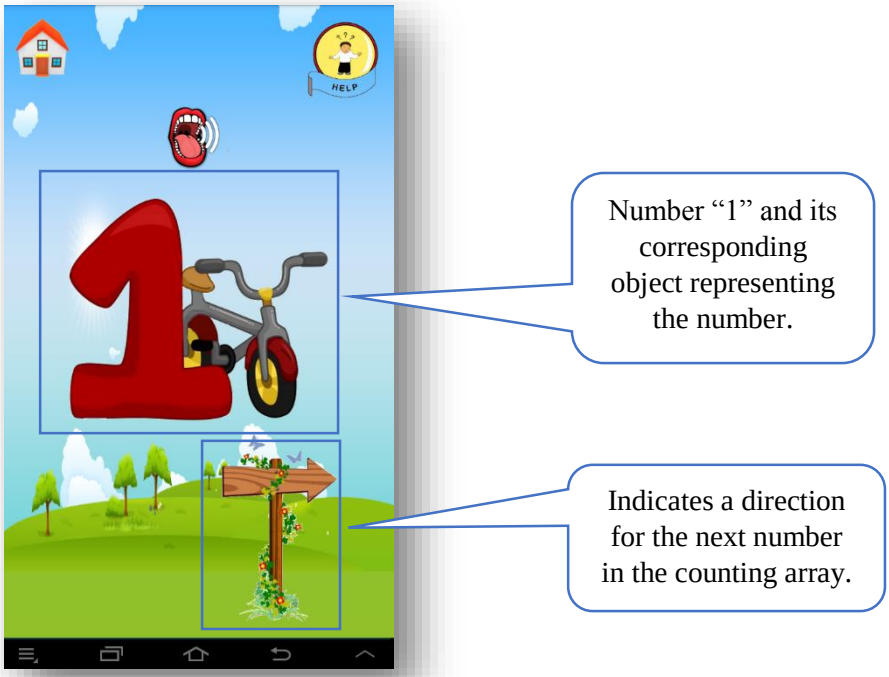

FIGURE 4.5 123 Counting

- **Math Exercises:** in this module, the children is provided with basic arithmetic exercises, i.e. addition, subtraction, multiplication, and division in that exact order. However, the sub-modules are segregated vertically and labeled so that the children can be able to differentiate between the modules.

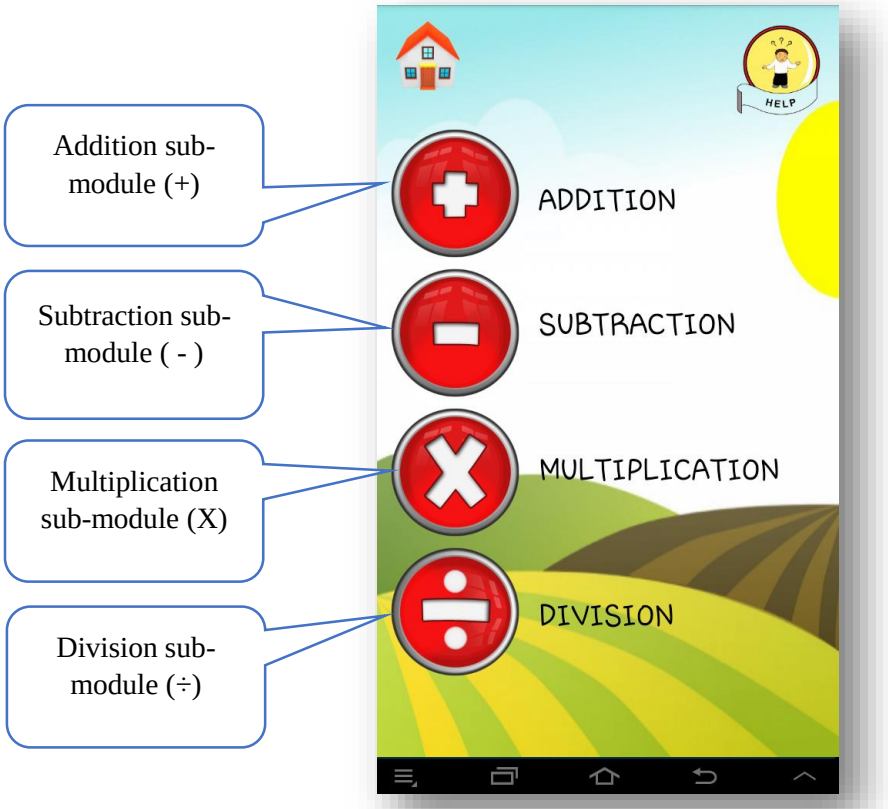

FIGURE 4.6 Math Exercises sub-modules

- **Addition:** teaches the children the basic addition exercises while providing 3 options where one of the options is the correct one and the remaining two options are the wrong ones. The options also come along with a phonetic sound for an incorrect and correct answer. Furthermore, this sub-module applies a ***"Counting On"*** principle whereby it allows a child to continue counting objects added to a previously counted group without recounting the entire group. For instance, one banana will be displayed and the child will be asked to count it. Then, another pealed banana will be added to the banana also being displayed. Counting on would involve the child applying ***"one – to – one correspondence"*** to the additional pealed banana by counting "one, two". This is an important skill being taught to the children because it is time-consuming and impractical to recount a group of items each time additional pieces are added.

FIGURE 4.7 Addition Exercises

- **Subtraction:** teaches the children the basic subtraction exercises while providing 3 options where one of the options is the correct one and the remaining two options are the wrong ones. The options also come along with a phonetic sound for an incorrect and correct answer. In here, the children will learn how to subtract two items. This sub-module contains a different background image so that the children don't get bored with the same one used in addition. Plus, it illustrates that this is a different sub-module performing a different math operation.

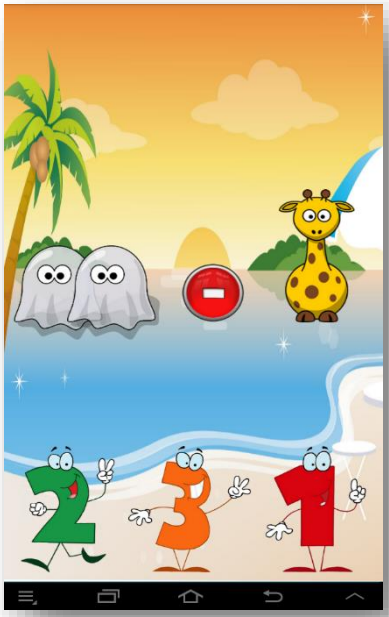

FIGURE 4.8 Subtraction Exercises

- **Multiplication:** follows the same concepts used in the previous sub-modules but it differs from others in terms of the operation the child has got to perform. Besides having a different background, the child has to multiply a group of items and pick the right answer. Therefore, upon choosing a right answer, the child will be eligible to move to the next activity and so on and so forth until it reaches its end.

FIGURE 4.9 Multiplication Exercises

- **Division:** follows the same concepts used in the previous sub-modules but it differs from others in a sense that here the child performs division operations where items are divided among themselves. This sub-module also incorporates a different background image from previous sub-modules. Meanwhile, different items are alternated among sub-modules in order to enrich the children's vocabulary with respect to various animals existing on their surroundings. Plus, through cute and colorful items and backgrounds, the children are able to spend much time on the exercises learning while having fun, simultaneously. In the end of every sub-module, an applause audio is played when the child presses the right answer of the last exercise. Nonetheless, that congratulation page will be described next.

FIGURE 4.10 Division Exercises

- **Congratulation's page:** in this page, the children are congratulated for finishing a particular sub-module successfully. With that, they are cheered up with applauses and congratulation audio as well as motivating "good job" audio. All they have to do is press the icons that the audio will be played accordingly. This concept is implemented in order to teach the children that when they work hard, there is often (if not always) a reward for their effort and hard work. Nevertheless, they feel happy when reaching the finishing line of every sub-module and feel motivated to keep moving forward in the next exercises.

FIGURE 4.11 Congratulation's page

- **Tips:** this is a page that explains to the user what to do and how to use the app in general. For every particular module, there is a tip page that can be triggered when pressing the 

icon on the top right corner of the page.

  In addition, it explains the functions of all the icons used in a particular module as to tell their purpose.

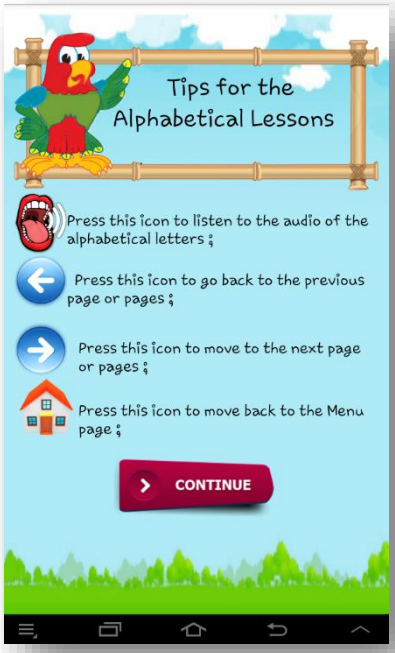

FIGURE 4.12 Tip's page

4.4. Usability Testing

Usability testing which is a black box technique, refers to evaluating a product or service by testing the ease with which interface can be used. However, it tests whether the application built is user friendly or not. In addition, while performing usability testing on **EduFun School App** participants (children) attempted to complete typical tasks of the modules being offered while I observed, listened, and took notes. Nevertheless, the goal was to identify any usability problems, collect qualitative data, and determine the participant's satisfaction with the product. In this line of thought, one of the main objectives of this testing was to check whether the users felt comfortable with **EduFun School App** according to different parameters such as: the flow, navigation and layout, speed and content specially to comparison with prior educational apps previously developed.

Being that said, the following features of the **EduFun School App** to be tested are:

- How easy is to use the software and accomplish basic tasks the first time they encounter the design (**Learnability**): the participants left me flabbergasted with their first interaction with the application. At first, their attention was caught by the sound played when the

application was first launched. They jumped on my legs and grabbed the mobile device from my hands and took over. She was so into the application that she couldn't let me help her out. As it can be seen in the picture below, she immobilized my thumb refraining me from touching the screen. This was how easy she could use the application and maneuver it as if she has had her first contact before.

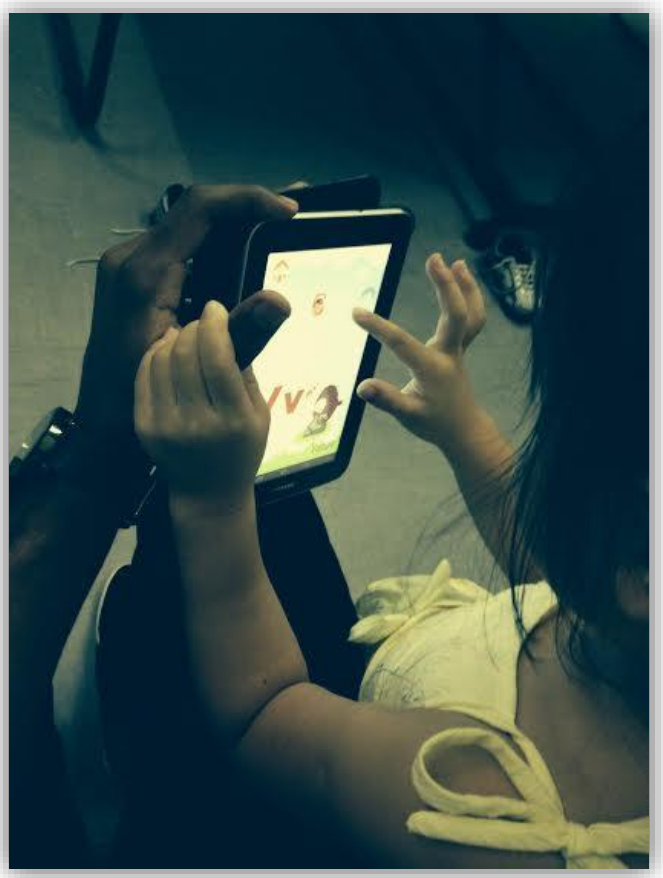

FIGURE 4.13 4 Years old girl first interaction with EduFun School App

- How easy is to learn the application and how fast experienced users can accomplish tasks (**Efficiency**): the users showed an unbelievable reaction and performance while interacting with the application. They would go from one module to another in a quick pace and most of the times without even hesitating on which button to click or else what to do to go to another module. This proves that they learn by seeing others doing.

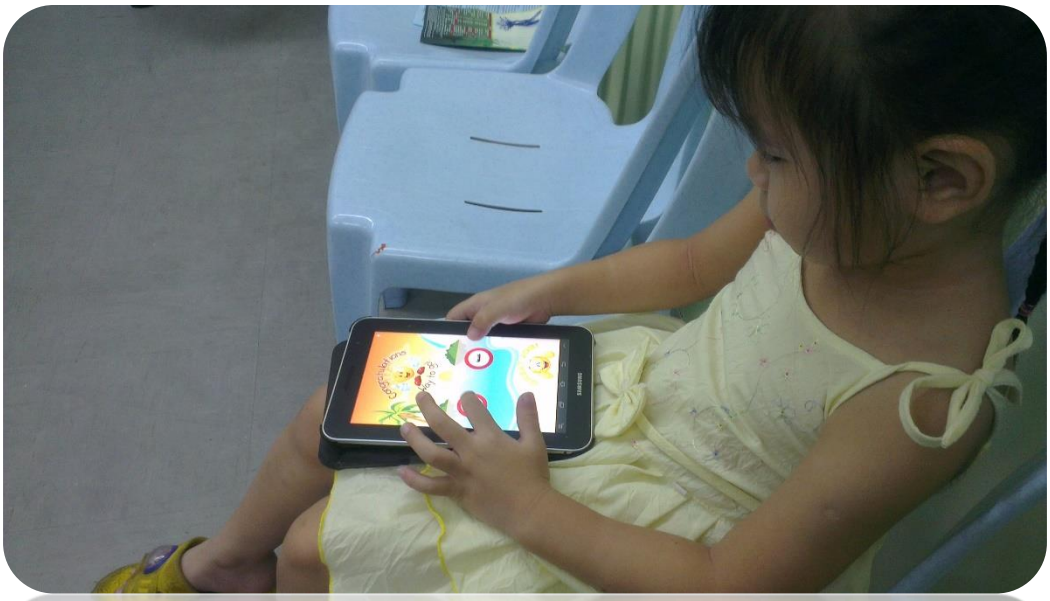

FIGURE 4.14 Usability Testing – 4 years old little girl

- How convenient is the application to the end user and when users return to the design after a period of not using it, does the user remember enough to use it effectively the next time, or does the user have to start over again learning everything **(Memorability)**: according to the observations taken, and the feedback from parents who witnessed the first and second time interaction with the EduFun app, the children seemed to master it even better on their second interaction with the application. It looked convenient to them because they were so focus and lost on their own world that nobody else could take the mobile device from them. The user interface played a major role in easing the learning process and the phonemic awareness easily grasped their attention and provided much joy while using the app. I couldn't contain myself of much happiness as for their second interaction with the app they could remember how to use it even without a guide. Upon witnessing she was being spotted, she jumped off to another chair and started learning by herself.

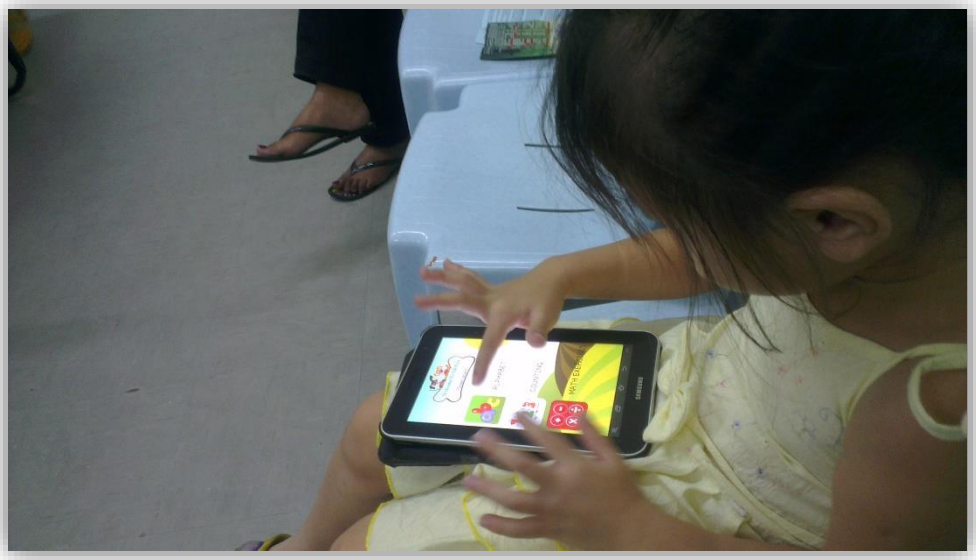

FIGURE 4.15 Usability Testing – 2nd time interaction with EduFun app

FIGURE 4.16 Usability Testing – 4 year old girl learning the alphabet

Upon performing all the usability testing, results concluded that when first learning to count, the children count by rote of memorization. This means that they're able to say the numbers in order not because they know it but because they've memorized the order of the names of the number. For example: "one, two, three, four, five… ten". As for the alphabet, they get entertained by the images and carried away by the phonetic sounds once the screen is tapped. Furthermore, at first,

they learn the sequence or flow of the application. How to move from one module to another, how to go back to the menu, and so on. Then, they start learning how to count, how to say “A up to Z”.

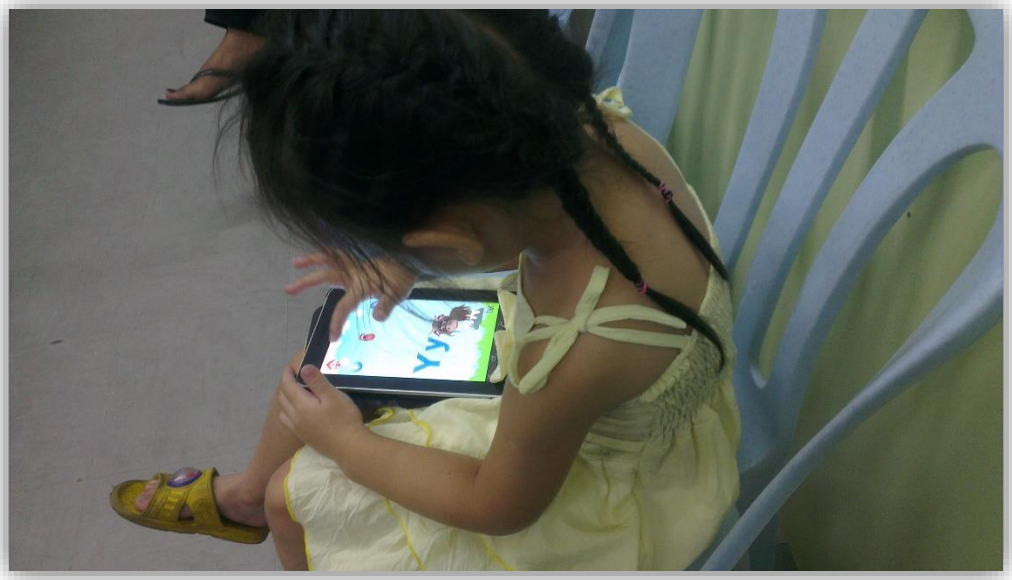

FIGURE 4.17 Usability Testing – 4 year old girl transitioning from one activity to another.

Another point that could be verified is that the child is so smart and curious that, without knowing, performed try and error by pressing on the three modules in the menu at once simultaneously to see what it would do. After trying it for several times, she realized that she has to pick and tap on one of the modules in order to proceed.

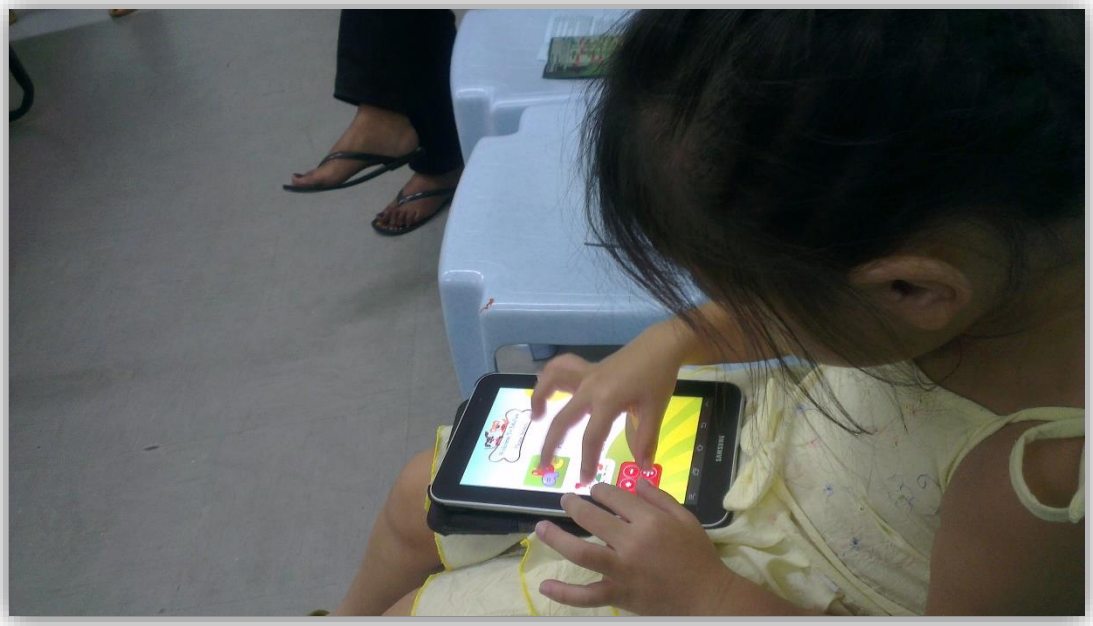

FIGURE 4.18 Usability Testing – 4 year old girl try and error.

4.5 Preliminary Questionnaires

The preliminary survey was conducted among Tricubes Berhad Co-workers and Universiti Teknologi PETRONAS students who happen to be fathers as a part of initial planning stage of the project development. The first question was addressed:

- Do you have a smartphone?

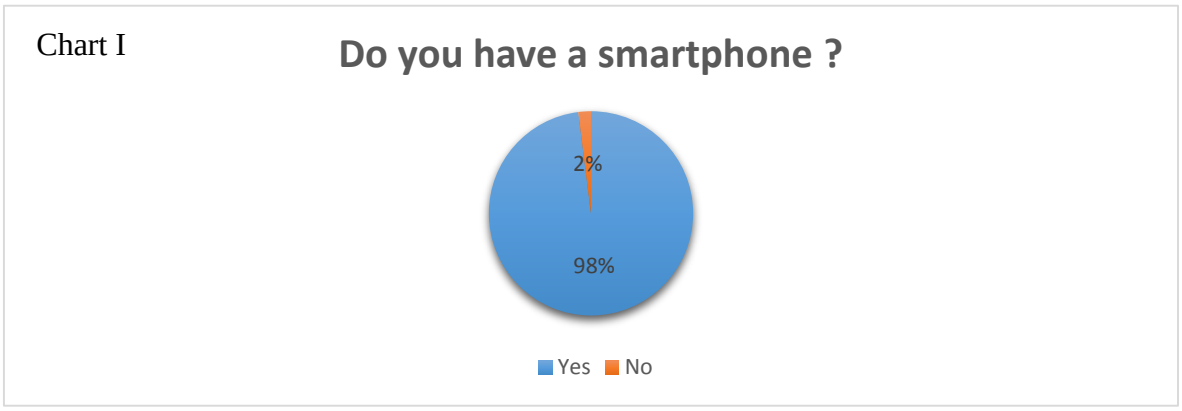

FIGURE 4.19 Results for the question "Do you have a smartphone?"

Based on figure 15, majority of fathers who responded the survey possess a smartphone device. This reflects that a smartphone device has penetrated in the market so deep that it is atypical not to possess a smartphone device. This explains why many children outsmarts adults nowadays because they have their first contact with technology in a very early stage contrary to the generation of most of their parents.

The second question was:

- Do you have children/a child?

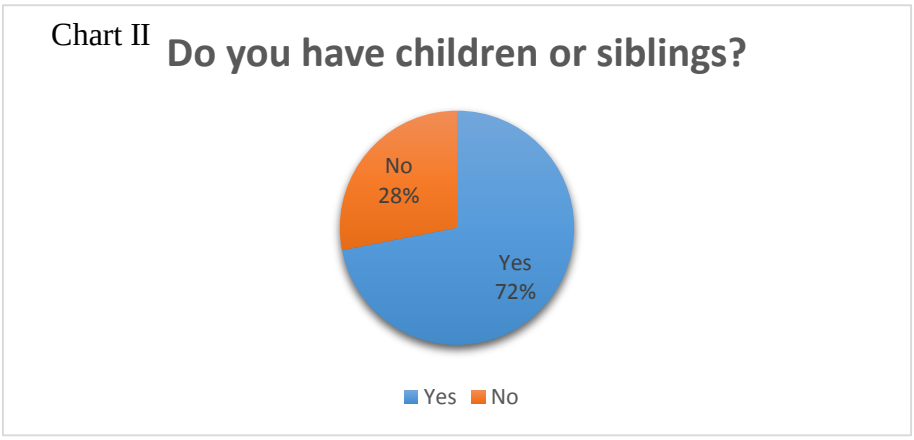

FIGURE 4.20 Results for the question "Do you have children?"

Based on figure 16, 72% of the participants have at least one child. As a major number of participants have at least a child, their answers are held accountable.

The third question was:

- Do you let your child/ children play along with your smartphone?

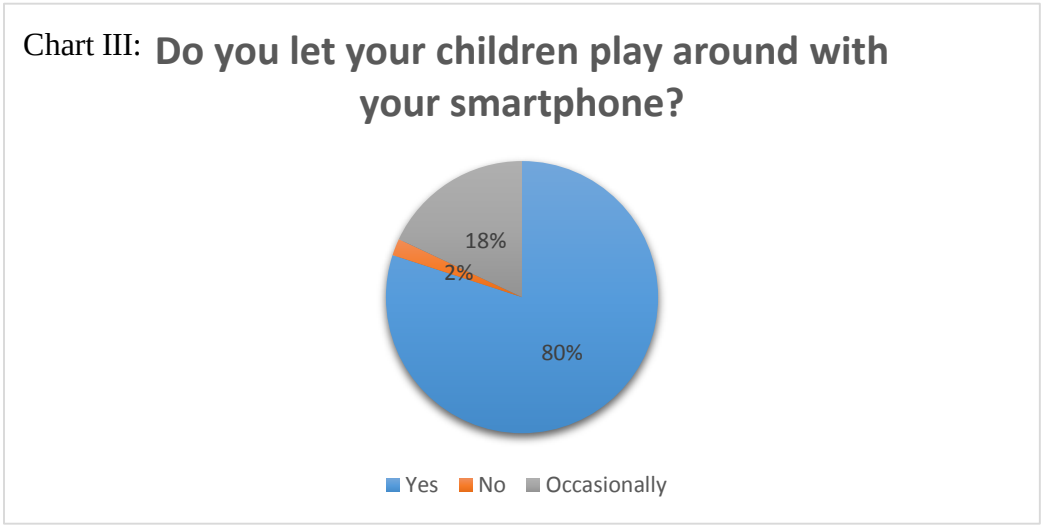

FIGURE 4.21 Results for the question "Do you let your children play around with your smartphone?"

Based on figure 17, most parents at least occasionally allow their child to use their smart mobile device. However, of the parents who do let their child regularly play with their mobile device, they let their child do so fairly frequently. So, the majority (80%) report that they allow their child to use their smartphone at least a few times a week. In addition, there's a small portion of parents who do not allow use and about two percent (2%) of the parents in the survey say they rarely or never allow their child to use their mobile device.

The fourth question was: “what applications you download the most?”

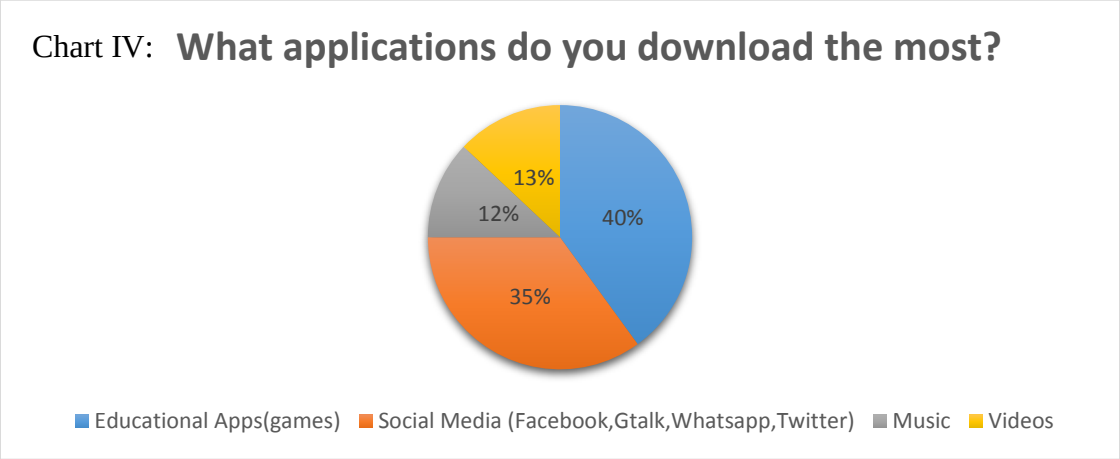

FIGURE 4.22 Results for the question “what applications do you download the most?”

Based on figure 18, there is a significant portion of parents who download educational apps for their children to play around with. Other parents spend much of their times surfing on social networks (Facebook, Twitter, Whatsapp). Other parents opt to download Video clips and music tracks to spend their time listening to and watching them (see chart IV). Forty percent of the parents download educational apps, mostly for their children to play around with. Other thirty-five percent of the parents spend their time on social networks. The remaining twenty-five percent spend their time downloading video clips and songs for their leisure.

The last question was:

- Would you keep an application that teaches your children basic numeric operations?

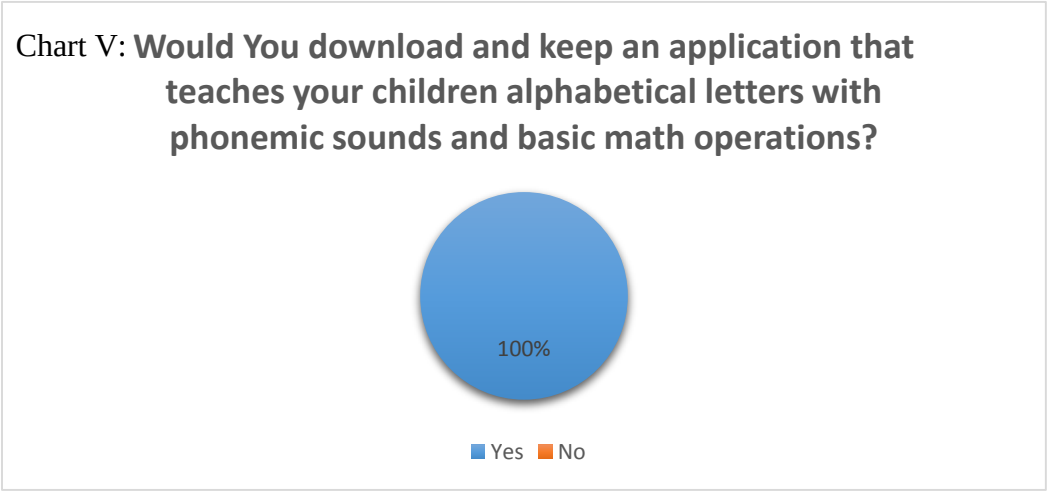

FIGURE 4.23 Results for the question “would you keep an application that teaches your children basic numeric operations?”

Based on figure 19, all the participants affirmed that they would keep an educational application that would teach their children basic numeric operations. This just proves that EduFun School application will be welcomed and downloaded by such parents who are concerned on the education of their children. Nevertheless, no one has objected the fact that such educational application would not be downloaded.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

As already mentioned, the purpose of this project is to provide a better understanding of the characteristics and the effect of ICT and mobile learning in the context of preschool education. It also was attempted to examine children's knowledge by comparing the learning outcomes of teaching using specially designed applications for smart mobile devices (tablets) and the thematic teaching in mathematics, specifically targeting "Realistic Mathematics", for children ages 4 to 7 years attending kindergarten and primary schools, respectively.

Early evidence indicates that children can learn from well-designed educational apps. The implications and insights raised by the related studies and researches reported here are significant ones that should help shape innovation in industry, content development, research design, and practice.

Through knowledge of the alphabet of a particular language children can read or speak words that are otherwise unfamiliar to them.

Cognitive, Behavioural, and Constructive learning theories are suitable in developing the conceptual framework of EduFun.

The challenge now is how to carefully target pressing educational needs tied to literacy, and numeracy in the early years, considering the distinct potential of mobile apps in our daily life.

5.2 Recommendations

Based on these key findings, suggestions were made as follow.

In the next versions of the Mobile EduFun School Application, there should be included animations in the application in order to provide more fun to the children so that they can spend as much time as possible with the application and should be created a User Registration page through which the application can segregate the modules available accordingly to the age of the children. If possible, it should be made as much simpler as possible so that the children would easily maneuver the application without a parental guiding.

More modules could be added to teach the children the difference between positive and negative numbers so that the children can be able to differentiate between them. The basic counting category could be expanded from 1 through 10 to 1 through 50 or 100 and provide phonemic awareness to all these numbers in order to teach the children how to properly enunciate them.

There could be created a score board along with a time frame for mathematical operations to track how much time a child takes to solve the exercises in each module (addition, subtraction, multiplication, and division).

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APPENDICES

Survey for EduFun School Application

Father ☐ Yes ☐ No Mother ☐ Yes ☐ No Brother/Sister ☐ Yes ☐ No

PART 1: Tick (/) accordingly to the questions asked.

No.	Question	Yes	No
1	Do you have a smartphone?		
2	Do you have children or siblings?		
3	Do you let your children play around with your smartphone?		

PART 2: Tick (/) accordingly to the questions asked.

No.	Question	Educational Apps	Music	Social Media	Video	Others
1	What applications do you download the most?					

PART 3: Tick (/) accordingly to the questions asked.

No.	Question	Yes	No	Others
1	Would you download an app that teaches your children or siblings alphabetical letters with phonemic awareness and math operations (All-in-one) app?			

Note: Your answers will dictate whether this app can be developed for children or not.

Thank You for Your time.