DEVELOPMENT OF INTERACTIVE MOBILE APPLICATION ON IDENTIFICATION OF NUMBERS AND LETTERS FOR ELEMENTARY CLASS PUPILS

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2015/1/58319BT

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A RESEARCH PROJECT SUBMITTED TO THE DEPARTMENT OF EDUCATIONAL TECHNOLOGY, SCHOOL OF SCIENCE AND TECHNOLOGY EDUCATION IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF DEGREE OF BACHELOR OF TECHNOLOGY (B. TECH) IN EDUCATIONAL TECHNOLOGY.

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ABSTRACT

This study is on development of interactive mobile application on mathematics numbers and English letters identification for elementary class pupils.10 Educational Technology experts, Computer Science experts, Mathematics experts and English language experts participated in the study. Questionnaires were adapted and validated for data collection with 10 items each in Educational technology, Mathematics and English language while the questionnaire for the Computer science experts had 5 items. The questionnaires were then administered to get response from the experts. Five research questions was raised. The result was analyzed using SPSS v23 to find the mean and standard deviation of the responses. The average mean responses of experts in Educational Technology, Computer Science, Mathematics, and English language were 4.29, 4.24, 4.04 and 4.15 respectively which are all greater than 2.50, which indicates that the experts agree that the package is useful in teaching and learning identification of numbers and letters for elementary class pupils.

Based on the findings, it was recommended that interactive mobile application on identification of numbers and letters for elementary class pupils should be used in teaching and learning identification of numbers and letters in elementary schools as the package is rated to be suitable.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

The use of mobile devices such as laptops, tablets, and smartphones in teaching and learning has expanded significantly in recent years. A mobile device which is typically characterized by mobility, small form factor and communication functionality and focuses on handling a particular type of information and related tasks (Papadimitriou, 2008). A mobile device is a pocket-sized computing device with a display screen that functions by touch input or a miniature keyboard (Rodríguez-Díaz, 2011). Mobile devices may include devices such as cell phones, smart phones, netbooks, laptops, tablets, iPods, iPads, eReaders such as the Kindle, Nook, etc., palms, Treo, and other **devices** that are typically lightweight, portable and connect to the internet (Wingerden et., 2016). These devices are portable and can be used by children of all ages due to their dynamic features.

Researchers have discovered that children younger than 2 years of age can play and learn using mobile devices and/or multitouch displays (Cohen, 2011). The Guardian (2020) reported that according to a study, majority of children own a mobile phone by the age of seven. The study indicated that devices have become a fundamental part of life for most young people. Many admit that they are fearful of being without their phone and more than half sleep with it by their bed. Overall, children spend about three hours and 20 minutes each day messaging, playing games and being online, young people most likely use mobile devices to access the internet. This report coincides with Kılıç (2019) who observed that the exposure to *mobile devices* is high *in young children* aged 1-60 months, Mobile phones and other similar mobile devices are now embedded in the daily lives of children. In the same rein, Radesky et al., (2020) opined that Child mobile device

use is increasingly prevalent with up to 75% of young children having their own tablets, and infants are estimated to start handling mobile devices during the first year of life.

Different investigations have revealed that children as young as two years would simply interact with a touchscreen, in the same way they will use natural instincts to play with a new toy (Sharkins *et al*., 2015). These mobile devices come with preinstalled applications and some of these applications can also be downloaded such as YouTube, internet browser, streaming video services etc (Radesky et al., 2020)

Nizamuddin et al., (2019) defined a smartphone application as a program that is designed to run on a mobile platform. Applications can have various uses, such as setting reminders, doing calculations, and so on. Al-Razgan *et al.,* (2015) defined smartphone application as an application developed for portable devices and generally come preloaded on the handheld device, it can also be downloaded by users from application stores or the Internet. There are some applications that support various types of media such as audio, video or a combination of; audio-visual.

At its best, touchscreen technology offers a mode of interactive experiences that reflect the child's natural constructivist learning (Papadakis and Orfanakis, 2014). Ideally, applications in smart devices can create exciting and viable learning environments for learning and instruction in early childhood (Goodwin, 2012; Papadakis *et al*., 2016). Mashhadani (2018) argued that the rapid growth of *mobile apps* has helped make *mobile* devices a new *tool for learning. Most of these applications can be used to carry out the teaching and learning process (Wali & Omaid, 2020)*

English Language and Mathematics are very important academic subjects offered right from the elementary level in Nigeria that take up significant portion of the students' time in school. A huge

percentage of the total curriculum time is devoted to these two subjects as the students have English and Mathematics lessons every day. The nature of the two subjects is different – the learning of English focuses on the expression of one's ideas and thoughts through the use of text and multimedia to develop not only language skills but also media literacy, whereas the learning of Mathematics focuses on acquisition of problem-solving skills and concepts. Hence, due to the differences in terms of the content of the two subjects, the pedagogical approaches could be different and this may in turn influence how mobile application could be used to teach these subjects. Kuensel (2019) observed that primary schools should emphasize on English and Mathematics, the use of mobile devices which are visual in nature can enhance the academic performance of students and aid in retention and collaborative learning skills.

Visual aids are important in teaching and learning. Visual aids allow the speaker to use verbal and nonverbal communication to solidify the message and provide a point of reference for the mind. Using visual aids refreshes the mind and engages it in a different way, renewing the attention span (Suresh, 2016). Visual aids when combined with ICT encourage students learning processes and make learning easier and more interesting. Visual aids are the best tool for making teaching effective and the best disseminator of knowledge. Findings of Cuban (2001) indicated the importance of visual aids as under 1% of what is learned is from the sense of TASTE, 1.5% of what is learned is from the sense of TOUCH, 3.5% of what is learned is from the logic of SMELL, 11% of what is learned is from the logic of HEARING and 83% of what is learned is from the sense of SIGHT.

Gagnon (2019) stated that visual media helps readers clarify and comprehend information because they are able to develop their own perception of the content and avoid misinterpretation. SERC (2021) noted that the use of media to enhance teaching and learning complements traditional

approaches to learning. Effective instruction builds bridges between students' knowledge and the learning objectives of the course. Using media engages students, aids student retention of knowledge, motivates interest in the subject matter, and illustrates the relevance of many concepts. Yarhouse (2015) defined visual media as any image that can be seen by the human eye as opposed to aural, tactile or auditory stimuli. Technology and the use of visual media are often used as a learning aid and are now considered a mandatory aspect in quality classroom teaching.

Video as a form of visual media is visually appealing and stimulating to students as it motivates them by presenting content in a fun and engaging manner and captures the viewers' attention (Ritchie, 2017). Videos are one of the most engaging mediums you can use to engage learners. They strike a deep connection and elicit strong emotional responses. Bevan (2020) outlined some benefits of the use of video in the classroom; Videos create a more engaging sensory experience than using print materials alone. Learners actually get to see and hear the concept being taught, and they can process it in the same way they process their everyday interactions. They provide a go-to resource that can be watched from anywhere with an internet connection. Videos are accessible on a multitude of devices including laptops, tablets, and smartphones. This allows for viewing at the student's convenience and from wherever they are. Videos also increase knowledge retention, since they can be stopped and replayed as many times as needed. They can also be reviewed long after the initial lesson was taught. They greatly assist in the learning of all subjects, but particularly those topics that are complex and/or highly visual, such as step-by-step procedures, problem-solving, or science and math formulas. They increase proficiency in digital literacy and communication, which are important 21st-century skills.

The purpose of this study is to develop a video and audio supported mobile application for elementary class pupils to identify numbers and letters.

1.2 **Statement of the Research Problem**

The bed rock of learning Mathematics and English language is the identification of numbers and letters and its pronouncing them properly. A child needs to understand the basics of this to be able to grasp the concepts been taught in English and Mathematics. it is therefore important to give more attention to these areas.

Teachers from different parts of Nigeria have different intonations due to diverse languages across the country which could also affect the student's way of pronunciation, this is a problem because pupils in elementary classes tend to imitate the way their teachers pronounce the letters of the alphabets even when a teacher pronounces the letters wrongly. There is a need to address this area using mobile technology applications that will repeat the same thing over and over again without changing the way each letter is been pronounced.

Another problem is lack of concentration by students, this is one of the major challenges faced by teachers at the elementary school level, when teaching is going on, children are easily distracted by what is going on in the environment. It is therefore necessary to employ what will catch their attention and also make learning possible at the same time. Mobile learning platforms use colours, music and mannerisms that have been found to attract and keep children's attention for longer periods of time. Hence this study would focus on the development of video-supported mobile application for learning to identify numbers and letters in elementary class in Nigerian.

1.3 Aim and Objectives of the study

The aim of this study is to developt a video-supported mobile application for learning to identify numbers and letters in elementary class in Nigerian, specifically the study will:

1. Determine the processes involved in the development of the mobile application.
2. Determine the rating of Educational Technology experts on the suitability of the mobile application.
3. Determine the rating of Computer Science experts on the suitability of the mobile application.
4. Determine the rating of English language experts on the suitability of the mobile application.
5. Determine the rating of Mathematics experts on the suitability of the mobile application.

1.4 Research Questions

The following research questions were answered in the study:

1. What are the processes involved in the development of the mobile application?
2. What is the rating of Educational Technology experts on the suitability of the developed mobile application?
3. What is the rating of Computer Science experts on the suitability of the developed mobile application?
4. What is the rating of Mathematics experts on the suitability of the developed mobile application?
5. What is the rating of English language experts on the suitability of the developed mobile application?

1.5 Significance of the Study

The findings of this study will be useful to Mathematics and English teachers, parents, pupils, stakeholders at the elementary education level, curriculum planners and the nation at large.

Mathematics and English teachers at the elementary and beginner levels will benefit from these findings because it will enhance their work because pupils have extra time to study outside the classroom and at their own pace.

Parents would also be able to occupy their children with positive learning experiences. It would help the pupils to identify numbers and letters better due to the inclusion of audio-visual approach in the application development.

This approach will also help stakeholders at the elementary education level, curriculum planners to provide a better way of teaching and learning letters and numbers by employing the use of mobile application in classroom.

1.6 Scope of the Study

The scope of this study is basically designing a mobile application that will teach elementary class pupils' identification of letters and numbers. The mobile application would be developed using Flutter and Dart programming language. The Dart programming language is one of the easiest and mostly used programming languages for developing mobile applications.

The project covers majorly two sections: the Mathematics section which deals with identification of numbers and the English section which covers letter identification and pronunciation.

1.7 Operational Definition of the Terms

Elementary class: This are nursery school pupils between 2 to 5 years.

English Language: a West Germanic language that was first spoken in early medieval England and eventually became a global lingua franca.

Letters: A letter is a segmental symbol of a phonemic writing system also known as alphabet.

Mathematics: an abstract representational system associated with figures, forms, design and the associations between them.

Mobile application: A mobile application also referred to as a mobile app or simply an app, is a computer program or software application designed to run on a mobile device such as laptops, tablets, and smartphones.

Numbers: A Mathematical object used to count, measure and label.

Video-Supported-Mobile App: An electronic medium for the recording, copying, playback, broadcasting, and display of moving visual media.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Conceptual Framework

2.1.1 Concept of English language and Mathematics

English is an international language used all over the world allowing people from different

countries to communicate for different needs (McKay, 2010). Mathematics is the language of sciences but it is also a language which is used for communication and for describing different situations in everyday life (O'Halloran & Doran, 2017). Although both English and Mathematics are perceived as languages, they are considered by schools and colleges as two completely distinct disciplines.

A language is based on a set of rules relating symbols to meaning which allow the forming of an infinite number of utterances from a finite number of elements (Leshem and Markovits, 2013). The rules are what we call the grammar of the language, the system underlying our use of language. These rules are abstract rules of a language which we use to construct our sentences in speech and writing (Leshem & Markovits, 2013).

The fact that human language is a learned symbolic system allows flexibility: language changes, words are transformed and new words are created. Language evolves in response to changing historical and social conditions and people in different places in the world speak diverse languages. However, the need for social or commercial communication brought about "lingua francas", one language used by common agreement (Mufwene, 2010). English is one of the basic languages for international communication and is nowadays used by more nonnative than native speakers. English has developed from "the native language of a small island nation to the most widely taught read and spoken language that the world has ever known" (Leshem and Markovits, 2013). Since the second half of the twentieth century, the English language has spread around the world to an extent unknown in any other historical period or for any other language (Jenkins, 2006). It has turned to be the nativized language for what Kachru terms as the Outer Circle (Kachru, 1985).

English also serves as a lingua franca among non-native speakers of English. Beneke (1991) as

cited by Leshem and Markovits (2013) estimated that about 80 percent of verbal exchanges in which English is used as a second or foreign language do not involve any native speakers of English. For the first time in history, a language has reached truly global dimensions, and as a consequence, is being shaped, in its international uses, at least as much by its nonnative speakers as its native speakers (Seidlhofer, 2004). The language is also used more and more for practical purposes by people with varied norms and scopes of proficiency. Thus, English as a language, according to many linguists, is undergoing a process of internationalization and destandarization (Melchers & Shaw, 2003). The native speaker norms, in light of the internationalization of English, have been a debated issue for quite some time. Actually, the 1990s were a revolutionary decade, according to Crystal (2003) due to proliferation of new linguistic varieties arising out of the world-wide implementation of the Internet. The consequences were a public recognition of the global position of English. English is now the language most widely taught as a foreign language in over 100 countries and in most of these countries it is emerging as the chief foreign language to be encountered in schools, often displacing another language in the process. Since the 1960s, English has become the normal medium of instruction in higher education for many countries. About 80 percent of the world's electronically stored information is currently in English. Crystal (2003) argues that a global language is particularly appreciated by the international academic and business communities. English is the medium of a great deal of the world's knowledge, especially in areas such as science and technology. The reason why so many nations have in recent years made English an official language, or chosen it as their chief foreign language in schools, is educational. The rapid change, the growth in international contacts, the mobility of people, the "global village" have provided the circumstances needed for a global language "There has never been a time when so many nations were needing to talk to each other so much. There has never been a time when so

many people wished to travel to so many places. Never has the need for more widespread bilingualism been greater, to ease the burden placed on the professional few and never has there been a more urgent need for a global language". This has also aroused thoughts among TESOL (Teaching English for Speakers of Other Languages) teachers about the consequences it might have on the conceptualization, development and teaching of English, about how far should students, classroom teachers and teacher educators conform to native-speaker norms (Timmis, 2002) to discover the best way to prepare learners for international communication if second language pedagogy should not aspire for intelligibility for native speakers' receivers (Jenkins, 2002)

Galileo Galilei said that: "Mathematics is the language with which God has written the universe." (Ozarde, 2019). Mathematics is the language of numbers, symbols notations and grammar. Using numbers and mathematical symbols, one can write "words" and "sentences". When appropriate, several "sentences" together might form a "mathematical story" (solutions of exercises, problems, etc.). Mathematics also has grammar – the mathematical logic which determines whether statements are valid or not. Jamison (2000) used linguistic terms to describe mathematics and argued that not many see mathematics as a language. He suggested that treating mathematics as a language would help to increase its understanding: "I want to show how making the syntactical and rhetorical structure of mathematical language clear and explicit to students can increase their understanding of fundamental mathematical concepts. Regrettably, many people see mathematics as a collection of arcane rules for manipulating bizarre symbols – something far removed from speech and writing." Gough (2007) suggested that mathematics is not a natural language but a formal language, artificially constructed, using our natural everyday language in teaching the mathematical language. In the document "Making Mathematics Count' released by the

Department of Education and Skills of Great Britain, mathematics is described as a 'powerful universal language" (Making Mathematics Count, 2004). And indeed, mathematics is a universal language, since the same numbers and symbols, in most cases, are used around the world by billions of people. If a person in China would write a letter (written in Chinese) to a person in the United States it is almost sure that the person in the United States will not be able to read it (Leshem & Markovits, 2013). But if, instead, he sends a simple mathematical equation with its solution, it is almost certain that the person in the States will be able to "read" the solution and most probably understand it. Mathematics as a universal language is important to the modern society. It is being used in technology, sciences, business and financial services and at many workplaces around the world (Making Mathematics Count, 2004). It is a language taught in school and learned all around the world from first to twelfth grade and it is also part of the activities children are engaged in during pre-school. Leshem and Markovits (2013) refers to mathematics as a language and suggests teaching it as a language to children with learning disabilities. He even compares Mathematics to English and says that: "Mathematics may be viewed as a language – a simpler, more consistent and more regular language than English. This is especially the case with Mathematics facts. Numbers represent nouns, while operational signs (+, -, x, /, =) serve as verbs. Both components are governed by rules of syntax. Mathematics facts, such as 2 x 3 = 6, may be thought of as math sentences. Students should be encouraged to speak in complete sentences, to convey an entire thought, and to develop a consistent rehearsal pattern for the Mathematics fact. Mathematics at the simple sentence fact level is a much easier language than English. Although Mathematics has an infinite number of nouns, it has only five verbs (+, -, x, /, =) associated with four basic operations. Some students, however, may need to have the syntax, as well as the coding (place value) and number theory, explicitly taught to them." Mathematics is also a language of communication in

our everyday life. Newspapers and television broadcasts, for example, include graphs, percentages and other mathematical concepts to convey important information. Mathematics as a language of communication is also emphasized in mathematics curricula around the world. For example, The NCTM (National Council of Teachers of Mathematics) in the United States refers to mathematics as a language of communication in The Standards for School Mathematics (NCTM, 2000) and states that "Instructional programs from pre-kindergarten through grade 12 should enable all students to communicate their mathematical thinking coherently and clearly to peers and others and use the language of mathematics to express mathematical ideas." The language of mathematics and mathematical skills are an integral part of our everyday life. Small children have in their lexicon phrases such as, "3 candies", or "one half". We use mathematical language in recipes when we describe ingredients (200 grams of flower or 3/4 cup of sugar). During sales prices go down by 20 percent. Thus, we all actually speak "mathematics" without even being aware of it. Mathematics as well as English as a second language do not develop naturally as a child develops a natural language, they need to be learned. Learning entails conscious practice which adheres to "skill learning theory" (Dekeyser, 2007): providing concise rules which the learner can rehearse; offering abundant repetition and drilling; providing open-ended activities to practice the skill in a wider applicability range. Classroom activities in Mathematics and English should engage learners in authentic, real-life functional use of the languages. Thus, English and Mathematics as languages are similar and yet different. They both are languages of signs and symbols which combine to "words" "sentences" and "stories". These "stories" have a grammar, which is universal and hence makes them languages of international communication. Albeit these similarities, there are some principal differences. The language of mathematics for example, is precise and less flexible - it cannot afford ambiguity, while natural languages contain constructive ambiguity derived from

their cultural and contextual wealth of meanings. Having this in mind, we wondered whether these commonalities and differences are part of teachers' beliefs and how they could affect the teaching strategies.

2.1.2 English curriculum in Nigeria

The English curriculum for Primary school is focused around six key areas – Writing and Representing, Reading and Viewing, Listening and Viewing, Speaking and Representing, Grammar and Vocabulary (Oladunjoye, 2016).

i. Writing and Representing

Writing is a crucial element in the English curriculum. Some children may struggle with this area, but mastering this skill will prove valuable throughout your child's school life and beyond. At the primary level, your child will learn to plan and organise ideas to produce a range of texts, for example, a narrative or a letter. Class activities include writing and editing a variety of text types, developing characterisation using narrative techniques and learning how to use appropriate text features such as headlines and sub-headings. Using paragraphs and punctuation to organise texts will also be taught.

ii. Reading and Viewing

Through analysing a range of written texts, your child will learn to take notes and identify the main ideas and details of the texts. Your child will also be taught how to make simple generalisation, predictions and inferences and eventually respond to different texts, for example, retelling a story or sharing their opinions.

iii. **Listening and Viewing**

The Listening and Viewing component is an interactive and engaging part of class. Here, your child will have the opportunity to explore a wide range of media, such as poetry and film. Similar to the reading component, your child will be expected to identify details and main ideas as well as make predictions and inferences.

iv. Speaking and Representing

Does your child find it a challenge to speak up in class? As part of the English curriculum, your child will be expected to produce spontaneous and planned spoken texts. The purpose of this is to learn to speak with accurate pronunciation and intonation, building confidence to read aloud and present ideas clearly. In addition, your child will also collaborate, share ideas and points of view with his classmates, allowing him to demonstrate his understanding of spoken grammar.

v. Grammar

A basic building block of the English language, your child will be taught the language in use through verbs, nouns, adjectives, etc. This will lead your child to apply his knowledge of grammar to complete written and oral assignments based on specific themes.

vi. Vocabulary

Vocabulary is what makes the language interesting and helps your child develop creative compositions. As part of the English curriculum, your child will be guided to develop a greater range of vocabulary as well as skills for deducing the meaning of unknown words. Your child will

also be expected to apply the words and phrases they have learnt to support their development of reading, writing, listening and speaking.

A major component of the Basic Education-Programme is to ensure quality in teaching and learning process. One way of achieving this is through systematic capacity building for teachers as well as provision of seasoned articles that will be practical and down to earth such that each teacher would be empowered with confidence and competence (Oladunjoye, 2016).

2.1.3 Mathematics curriculum in Nigeria

Education is depicted as the totality of backgrounds that individuals secure, and which empowers them to adapt to and get fulfillment from living on the planet Babafemi (2007).

The national objectives of Nigeria as expressed in the national strategy on training FRN (2009) are as follows:

1. A totally free as well as democratic society
2. A simply just as well as egalitarian society
3. A fantastic as well as active overall economy
4. A territory rich in shiny opportunities for all people

Eze (2011) noted that Nigeria produced as well as implemented your Nationwide Economical Empowerment Advancement Technique (NEEDS) in 2004 as part of it is country wide plan. NEEDS have several crucial things the following:

1. Price re-orientation,

2. Lower income removal,

3. Prosperity creation as well as

4. Work creation.

The national approach has since quite a while ago received instruction as the instrument for change and advancement. As the main impetus of the ebb and flow world request and globalization Wushishi & Kubo, (2011) because of continuous national and worldwide changes in the social, physical and monetary settings, the Nigerian Educational Research and Development Council (NERDC), with educational program advancement as one of its center orders, created the 9-year Basic Education Curriculum, the Senior Secondary Education Curriculum and34 Trade/Entrepreneurship educational program for utilization at both the fundamental and senior optional training levels in the nation the then Federal Government attempted deliberations to discover the kind of instruction best Suited to Nigeria's advancement, consequently the distinguishing proof of "6-3-3-4 arrangement of training"

As indicated by Omolewa (1986), the historical backdrop of 6-3-3-4 arrangement of training dated once more to eighth September 1969 amid the (International Literacy Day) when the Federal Commissioner for Training, Mr. Wenike Briggs initiated a gathering which formed the thoughts prompting the 6-3-3-4 system.

Omolewa (1986), expressed that the programme was considered as an instrument of national Unity, it was intended to infuse usefulness into the Nigerian educational system. The 6-3-3-4 was formed to create graduates who would have the capacity to make utilization of their hands, the head and the heart (the 3hs of instruction). When it was at long last presented in 1982, there had been inputs by different divisions of Nigerian expert group.

The actual vast aims connected with extra training inside total Nigerian training policy usually are:

(a) Getting ready regarding helpful existing inside society and also

(b) Getting ready regarding advanced schooling. (National Policy on Education, 2007)

Nigerian students will be taught and prepared to think basically in tackling issues, and settling on choices so they can meet nearby and worldwide requests. Sadly, Nigeria's educational program does not enough plan understudies, in spite of compelling open approach. This is as an issue of deliberate weaknesses that neglect to acknowledge government objectives. With a specific end goal to accomplish national objectives through training, government has presented arrangement of strategies. At first, the reason for training was to create people to help the advancement of the country. In the 21st century the objectives of instruction incorporates enhancing future work power, creating individual's cognitive aptitudes, uprooting obstructions of investment, and bringing issues to light about social obligation. These progressions in Nigerian educational module are proposed to be all the more viably adjusted to the strategy objectives. Also, this is the thing that the 9-3-4 school educational module expects to accomplish by making sound and powerful instruction. However, these objectives are not coordinated into the configuration and operations of showing and learning (Marinho, 2009).

The national Mathematics Curriculum for basic education programme in Nigeria has

the following objectives:

1) To get statistical literacy essential to perform within the facts age group.

2) To develop this understanding as well as app of mathematics expertise as well as principles

essential to prosper inside ever before modifying technical earth.

3) To build up the essential part of issue handling, communication, thinking as well as link in the research of mathematics.

4) To know these main concepts of mathematics allowing for the earth offers changed which is even now modifying (NERDC, 2007).

Mathematics education aims to enable individuals to:

(1) Acquire the important scientific ideas and aptitudes for ordinary life, and for persistent adapting in mathematics and related orders.

(2) Develop the fundamental procedure aptitudes for the procurement and application of scientific ideas and abilities.

(3) Develop the numerical intuition and critical thinking abilities and apply these aptitudes to form and take care of issues.

(4) Recognize and use associations among scientific thoughts, and in the middle of math and different controls.

(5) Develop uplifting demeanor towards arithmetic.

(6) Make successful utilization of a mixed bag of numerical devices (counting data and correspondence engineering instruments) in the learning and application of math.

(7) Produce inventive and imaginative work emerging from numerical thoughts.

(8) Develop the capacities to reason intelligently, impart numerically, and learn agreeably and

freely (educational program arranging and advancement division 2006)

Broad objective

(1) Implement statistical principles and processes, and strategy and put into practice methods to issues, in a range of contexts

(2) Connect and exhibit statistical suggestions, processes and leads to mouth and published style

(3) Create statistical contacts in mathematics itself, throughout additional themes, and within purposes associated with mathematics within useful everyday contexts

(4) Cause, check out and theory with habits and interactions within mathematics

(5) Implement ideal standard and non-standard procedures with many different instruments and manipulative

(6) Call to mind and comprehend statistical language, truth, classifications, and formulae. (curriculum planning and development division 2006)

2.1.4 Concept of Instructional Materials

Instructional Materials in its simplest term are those materials that help the teachers to teach with ease and the learners to learn without stress (Ajoke, 2017). Instructional materials appeal to the senses of seeing, touching, smelling, feeling, and hearing. Instructional materials refer to those alternative channels of communication, which a classroom teacher can use to concretize a concept during teaching and learning process.

Traditionally, classroom teachers have relied heavily on the 'talk-chalk' method during their

teaching (Agbo, *et al*, 2019). But recently, instructional materials help to provide variations in the ways in which messages are sent across. In using instructional materials teachers and students do not only extend the range of sense organs we use but also extend the range of materials used for convening the same message through the same organ. For instance, in teaching a topic a teacher can manipulate real objects or use their stimulators.

Instructional materials therefore constitute the media of exchange through which a message transaction is facilitated between a source and a receiver. In addition to extending the range of materials that can be used to convey the same instructional message to learners' instructional materials also facilitate the 'process' nature of communication. In this passage, the process nature of communication implies that both the source and the receiver of a message are actively involved in a communication encounter. In fact, it means that both the receiver and the source share and exchange ideas, feelings in any communication.

Instructional materials include projected, non-projected, printed and others such as objects/relia, 3-dimentional 4 objects that are produced through locally sourced materials, program instruction, instruction package among others.

2.1.5 Types of instructional materials

Amadioha (2009) noted that six types of instructional materials exists and they include:

1. Graphic materials: - This represent charts, graphic, posters and diagrams, cartoons, comics, maps and globes which we draw on a cardboard paper or on a piece of cloth and present to our learners to help them visualize what we would have labored so hard to explain verbally. Graphic materials belong to the family of two- dimensional material and proportional relationships that

may exist among variables in a phenomenon. Graphic materials are used to compress information, to focus and captivate attention, to vary stimuli presented and as an aid to recall. Graphic materials when properly produced can help in attaining all processes in the information processing model of learning as well as serve as avenue for applying principles from other learning theories.

(2) Three - Dimensional Materials: - They are different from charts and graphs which are illustration of two- dimensional materials because of the incorporation of a third element depth. Thus, whereas graphs and charts embrace the length and width of a visualized object, a three-dimensional embraces this third element depth, a feature that makes the three- dimensional material a replica of the real thing. Different types of three-dimensional materials exist, namely: Models and mock-ups, realia, specimen, kits and dioramas-which is the creation of a scene in an event.

(3) Still pictures:- This refers to flat opaque pictures which we take during festivals or when we are commemorating an event. They also refer to pictures we find in journals and magazines. They are called still pictures because in admiring them, we hold them in our hands or place them on a surface, that is we do not view them with the aid of projector, as is the case with motion pictures or still projected pictures. Like graphic materials, still pictures belong to the group of two - dimensional materials.

(4) Still projected pictures:- Still projected pictures is a class of instructional materials which our learners may not be familiar with. Therefore, in order to assist them to better understand what is meant by still projected pictures, is the negative format. Still projected pictures can be projected with a projector. The projector has powerful electronic bulbs, which throw light on to the image on the negative, and the image is finally projected on to a screen or wall. Therefore, when dealing

with still projected pictures, one is automatically dealing with a whole range of materials (such as slides, overhead transparency, filmstrip etc) whose image are imprinted in a negative/film and which has to be projected using different types of projector. A major characteristic of still projected pictures is that the images are projected one frame at a time. This is a major difference between still projected pictures and motion pictures. This characteristic enables a still projected picture to stay for as long as a learner wants it on a screen.

(5) Motion pictures:- Motion pictures are distinct from the other types of pictures because of the speed at which they are projected. It is this speed of projection that in fact gives the impression of motion. Motion pictures range from the 8 mm standard format to 8 mm super and finally to the 16 mm format. The width of the film thus constitutes a basic for classifying them. Motion picture films have sprocket holes along both edges or along only one edge. The presence of sprocket holes facilitates projection. Motion pictures can be projected at 16 or 24fps (frame per second.) They can be silent or accompanied with sound. Sound films use either a magnetic tape or optical sound track for sound recording. If a film is sound, only one edge bears the sprocket holes while the other edge bears the sound components.

(6) Audio Materials:- This is a class name for tape recordings and discs. A disc or record as it is popularly called here is a round and flat acetate containing grooves, which produces sound vibrations through the action of a needled. Discs usually come in different sizes and play at different speeds. The clarity of sound production from a disc rests on the quality of needle, the speed and state of the grooves. Obviously, in developed countries records exist for almost all subjects. People in music department appreciate the importance of records in their studies. Special effects such as the sound of thunder the cry of an owl at night, the noise produced in a factory during work hours can all be recorded on disc and synchronized with other events to create special

effects during production. However to use a record, a teacher has to specify his objectives thoroughly. Hence, students can listen to a record as a group or individually.

2.1.6 Video in instructional delivery

Nomass (2013) stressed that multimedia are a mixture of text, graphics, sound, video, and animation. Multimedia computer programs can increase the motivation of learners to develop their vocabulary and reading skills. The use of video to deliver instruction can stimulate students by presenting exciting and engaging content that are made palatable by the teacher for classroom teaching and learning.

Ikram (2015) observed that video technology has become a vibrant and easily accessible tool used in the field of education. Technology, of one type or other, has been a vibrant tool for teaching children for decades (Ikram, 2015). Learning becomes meaningful when teachers are well trained and equipped to implement the technology-integrated curricula (Batane & Ngwako, 2017). Thus, technology and media support young children's learning if technology is age appropriate, educationally unique in nature, and provided under the guidance of an adult. Ikram (2015) documented that technology yields positive results if it is engaged in school programs, and the future of education could be bright if educators retain technology in the system it is vital for a school to integrate technology. Duttweiler and Madden reported that technology is the key to success for teaching and learning (Ghavifekr & Rosdy, 2015). Similarly, Branigan found a significant impact of using educational technology on student performance (Khanlarian & Singh, 2015). Ikram (2015) noted that since January 2001, numerous schools have provided opportunities to their students for using videos on the Internet because the use of videos, aligned with the curriculum, in the classroom increase achievement.

A recent survey of more than 1,000 parents of children age 2–6 revealed that parents want more media in the classroom, as 89 percent of parents agreed that media can help to educate their kids (Ikram, 2015). Due to the demand for the videos, many public television stations have partnered with local educators to support classroom instruction. Unfortunately, teachers in low-income communities usually have less opportunities for professional training and have limited access to educational resources to prove their effectiveness. Such teachers can help their students to learn better if they have resources and trainings to effectively integrate learning media such as videos into the curriculum (Ikram, 2015).

Nomass (2013) stated that the academic institutions should bring modern technological equipment and laboratories to expediate the teaching process. Educational media technologies such as videos, photographs, games, and animation can be used to make learning more tangible. Penuel *et al*. (2009) found that pre-school children, especially those from low-income families, develop early literacy skills if they experience media-rich curriculum that includes educational videos.

In today's world of the Internet, there are numerous platforms (Youtube, TeacherTube, Academic Earth, MIT Open Courseware, YouTube Edu, PBS Learning Media, Khan Academy, unitedstreaming TM, Neweggs) that mostly offer thousands of free streaming educational videos for every class. Such platforms provide versatile, accessible, and affordable videos to the teachers to engage their students in learning, energize classroom discussion, and meet course-learning goals. The benefit of online videos is that they can be reused and replayed. Also, video clips could have a role as either a beginning or ending of instruction or a class session (Ikram, 2015). The digital form of videos provides the opportunity to interactively control video functions such as play, pause, stop, or repeat (Merkt *et al,* 2011). Since, the delivery method of educational videos has been changed from broadcasting to short digital video clips, teachers can now infuse video

clips in their Microsoft PowerPoint presentations, traditional lectures, and electronic reports. Although, short video clips usually lack the context of the lesson, and sometimes such clips are not directly aligned with pedagogical and instructional content, teachers can assemble such raw material and use them in the classroom (Ikram, 2015).

Bonk (2008) surveyed 1,000 participants and found that short videos of 1–4 minutes duration are ideal for learners, and leaners prefer humorous, informative, current, interesting, and engaging videos. There are also series of studies by PBS and public television stations to help teachers to locate, use, and incorporate videos in instruction (Ikram, 2015). Teachers need learning media to be organized by subject area and grade level so they can search by keywords. Also, teachers want platforms which can easily be controlled and which deliver content according to students' needs. Likewise, the Web-Based Education Commission Report also highlighted the importance of easily accessible and standardized videos that should be aligned with learning needs (Ikram, 2015). Conversely, some researchers found little or no impact of videos on students learning. Some research studies argued that videos are less effective for students' learning as compared to text (Ikram, 2015). However, according to Bonk (2008), videos provoke students' interest in the topic when embedded in the instruction, and video technology will spread its horizon and will find its role in teaching and learning in this century.

Video lectures are becoming more and more popular, especially since, the main advantages in the use of video lectures were the ability to

a) help working-students by bridging the gap given by their absence during regular lectures;

b) support regular students by giving them the opportunity to recover lectures lost due to forced or elective absence;

c) assist students having difficulties with the lecture's spoken language;

d) give students a mean to review critical sections and check their notes.

Ikram (2015) noted that although students typically appreciate video lessons, the most obvious disadvantage of this technological choice is that the level of interaction between students and teacher or between students and their colleagues is zero. Even though this is not much worse than the interactivity level achievable in crowded classes, it is certainly not improving the traditional lecture model. Pursuing an electronic enhancement of the passive learning by means of (shared) annotations of learning materials has been attempted, but does not radically solve the problem of improving the quality of students' participation and understanding. On the other hand, also the traditional learning model based on frontal lectures held in class corresponds generally to a passive student approach, and as such it has been highly criticized. Video lessons can be used to change the style that the teacher uses in class, allowing for a more effective teaching (Ronchetti, 2010)

2.1.7 Development of Video-Supported Mobile applications

Mobile applications consist of software/set of program that runs on a mobile device and perform certain tasks for the user (Islam, Islam and Mazumder, 2010). Farrah, Khalid and Abu-Dawood (2018) defined Mobile applications as software designed for mobile devices. Mobile application is a new and fast developing segment of the Global Information and Communication Technology. Mobile application is easy, user friendly, inexpensive, downloadable and able to run on most of the mobile phone including inexpensive and entry level phone. The mobile application has wide uses for its vast functioning area like calling, messaging, browsing, chatting, social network communication, audio, video, game etc In large number of mobile application some are preinstalled in phone and others user can download from internet and install it in mobile phone.

This large mobile application market served by increasing number of mobile application developers, publishers and providers. From the technical point of view, the different mobile applications can be run in different managed platforms like iPhone, BlackBerry, Android, Symbian, windows; and also on some virtual machine such as Java/J2ME, BREW, Flash Light, Silverlight.

Frydenberg and Andone (2016) observed that mobile applications for video development inspires creativity and critical thinking, the creation of such videos provide an effective way to demonstrate student learning and digital literacy skills. Yang and Chen (2013) observed that Text-based lecturing is not optimal for visual and spatial learners and as mobile technologies continue to advance, faculty demand more support for creating content and immediate sharing through mobile tablet devices while on the go. Screencasting apps that allow lectures or interactive tutorials to be voice-recorded are also powerful mediums for communicating ideas and delivering content. The widespread adoption of mobile devices in addition to traditional desktops and laptops in schools has shifted teaching and learning into a new paradigm. Traxler (2009) stated, "Mobile learning technologies clearly support the transmission and delivery of rich multimedia content". To embrace 21st century technology for education, many schools have adapted the android as a 1:1 technology tool for teaching and learning.

Fojtik (2014) emphasized the usage of mobile technological means in the educational process. schools should adapt their methods of teaching for mobile technologies, which will bring students better choices of means of learning. Benedict and Pence (2012) advocated for the use of mobile devices for the creation of videos, they noted that videos help students to visualize concepts taught by teachers. Usman *et al* (2018) opined that as mobile technology continues to increase in different sectors of society, it is imperative that mobile applications are used to design and create learning

content. Mobile applications allow teachers to build their own educational applications. Paulins, Balina and Arhipova (2015) noted that there is a continuously increasing demand for mobile technology-based learning materials, and this has rendered the adoption of educational resources for these requirements. Saran, Cagiltay and Seferoglu (2008) noted that instructional materials can be delivered through mobile phones operated in second generation GSM technology in order to improve English language learners' vocabulary acquisition.

Instructional videos have found widespread use in content provision and assessment because of the integration of technology into schools. Students are able to learn at a self-regulated pace and may revisit the material on demand when needed. Mobile applications can be used to develop instructional content that can be video based, these videos can be created on the "get go" as mobile devices are portable, reliable and multi-faceted. Teachers can create videos easily with little expertise since smartphones have gained familiarity in the society and these applications can be accessed at the swipe of a finger.

2.1.8 Impact of video instruction on academic performance

Educational videos are now widely available thanks to cheap internet and video content creators (Ali, 2019). Information and communication technologies (ICTs) have become an indispensable part of the education system. The system allows incorporating digital technology in a variety of teaching and learning process in higher education (Johnson, Becker, Estrada, & Freeman, 2014). Teaching and learning are changing because of information technology which is the change agent and provides rich sources of information for teachers and students in academic institutions. Many educational institutions around the world have utilized different information and communication technologies in education, e.g., multimedia classroom (Schmid, 2008). Some scholars and

professors also encourage the implementation of updated computer technology, online learning, and social media in classrooms (Tang & Austin, 2009). The uses of modern multimedia equipment and advances in displaying videos on a computer monitor have increased due to lower prices and recent improvements in multimedia computing and digital video instruments. These advantages allow instructors and students to record experiential videos they themselves performed (Escalada & Zollman, 1997). Videos engage students and generate a higher amusement value than other technologies (Caudron, 1997; Salomon, 1984). People like videos and consider videos as having more enjoyment than other technologies (Fulk *et al*., 1995). Videos can have a powerful impact on the human mind and senses. Videos can be downloaded from the internet or bought CDs from shops so people can watch videos over and over again (Berk, 2009). Videos can be replayed and reused so many times as well as mashed-up with other content after its creation (Bonk, 2011). Online videos have the advantages of accessibility, versatility, breadth of content and up-to-date materials which help teachers and students to form and contribute to course content and improve students engagement in classroom activities.

In higher education teaching and learning, people are increasingly using online videos. For faculty and students, YouTube has become one of the leading examples of videosharing resources that can empower students in their education, engaging classroom discussion, and achieve learning goals effectively inside as well as outside of the classroom (Sherer & Shea, 2011). Renowned universities in the world are using their own YouTube channels with different subject areas (Orús *et al*., 2016). Khan Academy, a non-profit educational organization, has videos of different subjects that enable learners to learn online according to their own pace and review unknown content (Khan, 2015). Mobile phones, a valuable form of technology, has become common among the younger generations. Videos using cell phones are good instruments that teach students on

proper skills and improve learning outcomes. It can also lead to a significantly higher level of learning motivation, confidence in learning skills and class satisfaction (Lee *et al*., 2016). Online video resources and materials can boost a traditional course (Bonk, 2011). The research findings by Tan & Pearce (2011) indicated that the use of video in education is an effective way to engage students and support their understanding. The benefits would be providing different ideas and opinions on subjects, several delivery mechanisms, and getting regular examples to explain points. Furthermore, the question numbers were decreased profoundly due to the growing capacity of self learning among students (Bravo, Amante, Simo, Enache, & Fernandez, 2011). To use video as a learning tool, Brame (2016) focused on the following principles to be considered by an instructor.

• Keep videos short and target learning goals.

• convey right parts of an illustration.

• Focus on important concepts and ideas.

• Utilize an enthusiastic and conversational style to increase engagement.

• Embed videos in a context of active learning by interactive elements, using guiding questions, or associated homework assignments.

Choudhury (2011) indicated that watching video clips has a statistically significant effect on student performance, videos are naturally stimulating and excite students because of their multimedia features. Carmichael, Reid and Karpicke (2018) observed that students are showing an increasing desire to be more independently in control of their learning journey and to create "personalized learning environments" in and outside of the classroom, Videos provides that opportunity for students to take fuller control over their learning (Rasi and Poikela, 2016), videos

provide both the flexibility over when it's watched as well as a tool to create video material as part of their act of learning.

2.1.9 Mobile Learning

Ally and Prieto-Blázquez (2014) opined that the evolution of wireless technologies and the development of applications for mobile devices have been spectacular. Hashemi et al. (2011) defines mobile learning as 'the exploitation of ubiquitous handheld technologies, together with wireless and mobile phone networks, to facilitate, support, enhance and extend the reach of teaching and learning. Mehdipour & Zerehkafi (2013) opined thhat any sort of learning that happens when the learner is not at a fixed, predetermined location, or learning that happens when the learner takes advantage of the learning opportunities offered by mobile technologies. Mobile learning can take place in any location, at any time, including traditional learning environments such as classrooms as well as in workplaces, at home, in community locations and in transit. Mobile technologies include mobile phones, smartphones, PDAs, MP3/ MP4 players (e.g. iPODs), handheld gaming devices (e.g. Sony PSP, Nintendo DS), Ultramobile PCs (UMPCs), mini notebooks or netbooks (e.g. Asus EEE), handheld GPS or voting devices, and specialist portable technologies used in science labs, engineering workshops or for environmental or agricultural study. Mobile learning involves connectivity for downloading, uploading and/or online working via wireless networks, mobile phone networks or both, and linking to institutional systems e.g. virtual learning environments (VLEs) and management information systems (MIS).

Mobility needs to be understood not only in terms of spatial movement but also the ways in which such movement may enable time-shifting and boundary. Learners tend to move between using desktop computers and mobile devices, and maybe touch-screen displays in public areas, often for

different parts of a learning task (Krull & Duart, 2017). Interactions mediated by technology are interspersed with direct interactions with people. The learner's mobility creates an ever-changing environment for learning: the mobile technology, while essential, is only one of the different types of technology and interaction employed. The learning experiences cross spatial, temporal and/or conceptual borders and involve interactions with fixed technologies as well as mobile devices. Weaving the interactions with mobile technology into the fabric of pedagogical interaction that develops around them becomes the focus of attention.

Almarwani (2011) highlighted some of the rationale for mobile learning; Most mobile devices are useful in education as administration, organization and teaching aids for practitioners, and also as learning support tools for learners. Learners can interact with each other and with the practitioner instead of hiding behind large monitors. Mobile learning is much easier to accommodate, it is easier to have several mobile devices in a classroom than several desktop computers. PDAs or tablets holding notes and e-books are lighter and less bulky than bags full of files, paper and textbooks, or even laptops. Handwriting with the stylus pen is more intuitive than using keyboard and mouse.

The size, shape, weight and portability of mobile devices make them particularly effective for users with disabilities. The organizer functions usually included in mobile devices are extremely useful for learners with learning difficulties to help them organize their lives and achieve some independence. PDAs often also incorporate dictionaries and thesauruses, which provide handy reference tools for learners with dyslexia or other learning difficulties. Tablet PCs include text-to-speech and voice recognition as standard tools, are valuable for users with disabilities or learning difficulties.

2.2 Theoretical Framework

2.2.1 Technology Acceptance Model

The Technology Acceptance Model (**TAM**) is an information systems theory that models how users come to accept and use a technology, this model was proposed by Davis in 1989 (Charness, 2016).

The actual system use is the end-point where people use the technology. Behavioral intention is a factor that leads people to use the technology. The behavioral intention (BI) is influenced by the attitude (A) which is the general impression of the technology.

The model suggests that when users are presented with a new technology, a number of factors influence their decision about how and when they will use it, notably:

- Perceived usefulness (PU) – This was defined by Fred Davis as "the degree to which a person believes that using a particular system would enhance his or her job performance". It means whether or not someone perceives that technology to be useful for what they want to do.
- Perceived ease-of-use (PEOU) – Davis defined this as "the degree to which a person believes that using a particular system would be free from effort" (Davis 1989). If the technology is easy to use, then the barriers are conquered. If it is not easy to use and the interface is complicated, no one has a positive attitude towards it.

Technology Acceptance Model (TAM) is a theory majorly in information systems. It focuses on modeling computer users and showing them on how they can accept and adopt a new technology. It was designed to predict the technology adoption decisions of users. Technology Acceptance Model is usually used to predict. It indicates that there are only two components that determine

the users' acceptance of a computer system. The two components that determine computer acceptance are the perceived usefulness and the perceived ease of use of the system. The main aim of this model is that it emphasizes the potential of the users. In other words, it underscores, for example, when a developer of a given technology believes that his or her system is friendly to the users. Inversely, the system is not to be accepted by the users not unless the developers share the benefits and advantages of the technology system, as stated by Ibrahim *et al*. (2017).

The perceived usefulness component in Technology Acceptance Model is the degree to which a computer system user believes that using a particular computer system will enhance his or her performance (Opoku, 2020). It usually refers to consumers' perceptions based on the outcome of their experience. The existence of perceived usefulness has significantly been recognized in many businesses, primarily in the banking sector. In other occurrences, it is regarded and taken as a determinant of actual behavior whereby a user is encouraged to use an innovative and user-friendly self-service technology to improve and establish greater autonomy in performing some transactions. However, in the banking industry, the perceived usefulness component is based on the services offered by the bank, such as applying for loans, checking balances, checking, and paying utility bills.

On the other hand, the perceived ease of use of the system is how a user accepts and agrees that using an existing model is not difficult. Therefore, it is not hard or difficult to understand the perceived innovation. In this model, consumers perceive a new service better than its substitutes. This is because they can easily experiment with the latest innovation and evaluate its benefits.

With the incorporation of the Technology Acceptance Model in schools, the main aim of the model is to change how students and teachers analyze, determine and organize information. It has democratized information in a school setting. It has also helped in differentiating instructions,

especially for students with disabilities. Lubis *et al*. (2019) argued that many schools today are privileged to integrate Technology Acceptance Model into their systems. Technology Acceptance Model has been used in special needs children to maintain, increase and improve the capacity and capabilities of the students. Thus, incorporating the Technology Acceptance Model has also benefited the students with disabilities, specifically those who are in a better position to interact with the lesson using this model. On the other hand, teachers are also in a better place to customize and change the learning process for students with special needs, as Louissaint *et al*. (2020) stated.

Also, with the widespread of databases in educational settings, Technology Acceptance Model is used to track individual progress of each student. However, teachers and the staff are encouraged to identify and differentiate the learning objectives and instruction, respectively, based on the student's needs. Also, teachers and the team use TAM to attempt to present education. It makes it easy for them to learn new teaching styles. Students with special needs are educated alongside their non-disabled peers in their entire schooling activities through the Technology Acceptance Model. Therefore, it leads to increased knowledge, personal control, and flexibility among the students. It also impacts the teachers since it makes them have a clever use of information which leads to better productivity in the educational setting.

The acceptance of the Technology Acceptance Model has wide-ranging applications in the educational setting (Granic & Marangunic, 2019). Applying a well-developed model, the Technology Acceptance Model, in the academic environment significantly influences the students and the teachers. A lot of research conducted between the students who are the consumers and the information systems is devoted to classification systems. Therefore, the development of a classification system is usually developed for domestic technologies to impact a valuable paradigm for future research positively. On the findings, it is clear that an emerging within the domain of

assistive technologies such as the Technology Acceptance Model is usually designed to allow disabled and people with disabilities to gain knowledge and live independently. Thus, this critical aspect of increasing integration through TAM has increased complexity in an educational setting (Tan & Hsu, 2018).

The technology acceptance model (TAM) is a critical aspect in many sectors, including the education sector. When it is in place, people have the intention and attitude to use technology. However, they may have different perceptions regarding the model based on their age, gender, and other unique differences. For instance, in an educational setting, the technology acceptance model (TAM) has been used by teachers to change their teaching styles. In this study, there is need for the usage of mobile applications by both learners and the teachers, if they do not perceive the use of application as useful, there is possibility for the non-utilization of the mobile applications in teaching and learning. This will dramatically impact the students. It will give students the critical knowledge they need to depend on themselves.

External variables such as social influence is an important factor to determine the attitude. When these things (TAM) are in place, people will have the attitude and intention to use the technology. However, the perception may change depending on age and gender because everyone is different.

2.2.2 Constructivism Theory

Constructivism is the theory that says learners construct knowledge rather than just passively take in information (WGU, 2020). As people experience the world and reflect upon those experiences, they build their own representations and incorporate new information into their pre-existing knowledge (schemas). The constructivism theory was proposed by Vygotsky in 1934 and related to this theory are the processes of assimilation and accommodation (Kurt, 2020).

- **Assimilation** refers to the process of taking new information and fitting it into an existing schema.
- **Accommodation** refers to using newly acquired information to revise and redevelop an existing schema.

For example, if I believe that friends are always nice, and meet a new person who is always nice to me I may call this person a friend, assimilating them into my schema. Perhaps, however, I meet a different person who sometimes pushes me to try harder and is not always nice. I may decide to change my schema to accommodate this person by deciding a friend doesn't always need to be nice if they have my best interests in mind. Further, this may make me reconsider whether the first person still fits into my friend schema.

Consequences of constructivist theory are that:

- Students learn best when engaged in learning experiences rather than passively receiving information.
- Learning is inherently a social process because it is embedded within a social context as students and teachers work together to build knowledge.
- Because knowledge cannot be directly imparted to students, the goal of teaching is to provide experiences that facilitate the construction of knowledge.

A traditional approach to teaching focuses on delivering information to students, yet constructivism argues that you cannot directly impart this information. Only an experience can facilitate the construction of their own knowledge by the students. Therefore, the goal of teaching is to design these experiences.

The use of the constructivism theory is relevant to this study since students are actively engaged as they make use of mobile applications to learn in the classroom. They do not become mere passive listeners but actively engage with the learning content.

2.3 Empirical Studies

Tanriverdi and Kılıç-Çakmak (2013) developed an m-learning application to assist e-learning and it was supplied for learners who attended distance education to use. As a result of the study, it was possible for learners to attend educational events without real time and place limitations in reality via using m-learning as an assistant for e-learning. Furthermore, learners were provided to be information about course cancellations, assignment deadlines, exam dates, they could access announcement by school administration immediately, and so on. As a result of the study, learners' views of this application were taken into consideration and it was stated that m-learning application was effective for learners in education at anytime wherever they may be.

Abildinova *et al,* (2016) developed a mobile application on the Android operating system, that had the extensive use of mobile devices and a convenient application development toolkit. This mobile application can simplify the students' acquisition of information that is required for an effective educational process. The mobile application reaches a wide audience that includes both students and teachers of various disciplines. A pedagogical experiment was conducted as part of this research at the S. Toraighyrov Pavlodar State University; the experiment proved the need for and effectiveness of the developed mobile application in the field of education. The software can be used in educational institutions; it can simplify the organization of the educational process significantly.

Amasha *et al* (2021) determined the effects of a mobile application on student achievement in a primary school mathematics course in Saudi Arabia. Java was used in the development of the application. The study adopted a quasi-experimental design. The sample comprised 40 students from the Unaizah International School. The data collection instrument was a test in a mathematics course. The test had a reliability of >0.84. The pre- and post-test scores were analyzed with a *t*-test, which was used to examine the two null hypotheses at the 0.05 level of significance. The findings revealed that mobile applications are more effective than traditional methods for improving student outcomes in mathematics. This indicates the need for support to be provided for such activities in primary school classes. The results further indicate the effectiveness of this current application in developing students' cognitive skills and improving their mathematical abilities.

Basal *et al* (2016) investigated the effectiveness of a mobile application in teaching 40 figurative idioms from the Michigan Corpus of Academic Spoken English (MICASE) corpus compared to traditional activities. Quasi-experimental research design with pretest and posttest was employed to determine the differences between the scores of the control (n=25) and the experimental group (n=25) formed with convenience sampling. Results indicate that participants in the experimental group performed significantly better in the posttest, demonstrating the effectiveness of the mobile application used in this study on learning idioms. The study also provided recommendations towards the use of mobile applications in teaching vocabulary.

Mansor *et al* (2020) investigated the implementation of smartphone mobile application in assisting teaching and learning towards low achieving students in tertiary education. Specifically, this study concentrated on teaching and learning mathematics in English at tertiary level where English is considered as a second language in Malaysia and used as a medium of instruction in the learning

process at Universiti Teknologi MARA (UiTM). Unbalanced quasi pre and post-test experimental design was used in this study to determine the impact of English medium mathematics mobile application towards the performance of low achieving students. This study limited the participation to the students to students whose scores were under the low achiever's category only. As such, students who entered the undergraduate's diploma program through a special entrance program (i.e., the MDAB program under UiTM) were selected in this study. These students were divided into two groups, one group used the mobile application (Treatment Group, n = 24) and the other one did not used the mobile application (Control Group, n = 27). Bayesian t-test using JASP open-source statistical software was carried out to test the existence of significant change in students' performance based on the marks they scored on a test for a specific topic before and after the introduction of mobile applications in students learning process. Based on the analysis carried out, results show that the treatment group which use the mobile application in learning process had a slightly better performance compared to the control group. In the future, it is recommended that a specific mobile application is developed respective to the syllabus content and introduced in the early schooling process in order to fill the students with a better understanding of the fundamental concepts before they enter the tertiary education.

Grant and Barbour (2013) described two projects to integrate mobile teaching and learning into K-12 (primary) schooling. First, we consider the rationale for increased use of mobile devices with today's students, and we describe a professional development program to deploy iPads to classroom teachers. The researchers discussed the growth of K12 (primary school) online learning, and we describe a project for students enrolled in an online Advanced Placement course was delivered through a mobile learning content management system. Lastly, they discussed some of

the lessons learned from these pilot projects and some of the promise and challenges of mobile teaching and learning.

2.4 Summary of Reviewed Literature

From the literature review, the concept of Mathematics and English was examined as well as the Nigerian curriculum on English and Mathematics. The researcher also reviewed literature in regards to the concept of instructional materials and the various types that are utilized for instructional delivery, the use of video to deliver lessons in class was also discussed as the researcher examined several literatures on the impact of mobile applications that supported video for teaching and learning. From the literature reviewed, the researcher discovered that video and mobile applications had a significant impact on student's academic performance as video and mobile applications were found to be stimulating and exciting for teaching and learning. Two theories/models were found to support this study and this include; the technology acceptance model and the constructivism theory, the constructivism theories advocated for students to construct their own knowledge from prior experience, the teacher acts as a facilitator as he guides the learners to construct meaningful learning experience. The technology acceptance model explained how people perceive the use and adoption of various technologies. Finally, the empirical studies showed the results of various studies from past literatures on the development of video supported mobile applications for teaching and learning Mathematics and English. The findings from the empirical studies revealed that mobile applications and videos were effective in enhancing teaching and learning in the classroom.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter discusses procedures used in carrying out this research.

3.2 Research Design

The type of research used for this study is Design and Development Research (DDR). It includes a six-phase framework that involves; identifying the problem of the research, describing the

objectives, designing and development of the artefact, subjecting the artefact to testing, evaluating and communicating the results (Ellis & Levy, 2010).

3.3 Population of the Study

The population of this study consists of available educational technology experts, computer science Experts, mathematics expert and English experts in Federal University of Technology Minna in the 2019/2020 academic session.

3.4 Sample and Sampling Techniques

The sample for this study will be made up of (10) Educational Technology experts, (10) Computer Science experts (10) Mathematics experts and (10) English experts.

3.5 Research Instrument

Five Research instrument will be used in conducting this research. They are:

1. Interactive Mobile Application for learning Numbers and Letter recognition in elementary schools.

The application was produced utilizing Flutter and Dart programming language.

Flutter is a free and open-source mobile UI framework created by Google, it was used to create the user interface of the application, this includes the button widgets, colours, navigation buttons, text inputs, sliders, and so on. Dart is the programming language used in executing the code that was used in developing the application, it has its own built-in tools such as its own package manager, various compilers / transpilers, a parser and formatter.

2. Mathematics Expert Validation Assessment Report (MEVAR)

3. English Expert Validation Assessment Report (EEVAR)
4. Computer Science Expert Validation Assessment Report (CSEVAR)
5. Educational Technology Expert Validation Assessment Report (ETEVAR)

3.6 Validation of Research Instruments

The research instrument will be validated by two Educational Technology Experts from the Department of Educational Technology, Federal University of Technology Minna, Niger State.

3.7 Method of Data Collection

Before going to the field, the researcher sought a research permit from the supervisor, Department of Educational Technology, Federal University of Technology, Minna, Niger state, that authorized him to carry out the research with the selected experts. The researcher then proceeded to collect the data from the experts and teachers. The researcher self-administered the questionnaire to the experts after giving them the mobile application to evaluate. After a few days the questionnaire was collected from the respondents.

3.8 Method of Data Analysis

Research question one will be answered by explaining the steps involved in developing the mobile application. Research question two, three, four and five will be answered using qualitative data derived from the reports issued to Mathematics Experts. English Experts, Software Development Expert and Educational Technology Expert. The collected data was analyzed using descriptive and inferential statistics. A five point Likert type rating scale of strongly agree (5points), agree (4points), undecided (3points), disagree (2point), strongly disagree (1point) was used to weigh the

responses of the experts in Mathematics, English, Computer Science and Educational Technology to the items in the questionnaires. Mean response below 3.0 was considered disagree while a mean response above 2.50 and above was considered agree.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1 Introduction

This chapter shows the results gotten from the study and their corresponding analysis. The data collected were analyzed using mean and standard deviation,

4.2 Research Question 1: What are the processes involved in the development of the mobile application?

The application was produced utilizing Flutter and Dart programming dialects.

Flutter is a Dart framework for creating cross-platform applications with a single code. Unlike other multiplatform frameworks such as Ionic, the code of a Flutter application is compiled into native code, so the performance achieved is superior to applications based on web-views. Also, unlike React Native, Flutter doesn't use native components, instead it comes with its own components, called widgets, so the same app will look the same on any device, regardless of its operating system or version.

Dart is an open source language developed in Google with the aim of allowing developers to use an object-oriented language with static type analysis. Dart is a new programming language meant for the server as well as the browser. Introduced by Google, the Dart SDK ships with its compiler – the Dart VM. The SDK also includes a utility -dart2js, a transpiler that generates JavaScript equivalent of a Dart Script.

4.3 Research Question 2: What is the rating of Educational Technology Experts on the suitability of the developed mobile application?

In answering research question 2, the researcher collated data on Educational Technology Experts Validation Assessment Report to know if the application is suitable for elementary pupils. 10 Educational Technology Experts responded to 10 questionnaires items and their responses were analyzed using mean and standard deviation. The result is presented in table 4.3.1

Table 4.3.1: Mean responses of Educational Technology Experts on the suitability of the developed mobile application.

S/N	statement	N	SD	D	U	A	SA	Mean	S.Dev.	Decision
1.	The use of audiovisual in the app makes learning more interesting	10				6	4	4.4	0.52	Agree
2.	The presentation of information in the app is attractive	10				3	7	4.7	0.48	Agree
3.	The tasks in the mobile app is well arranged and easy to comprehend	10				9	1	4.1	0.32	Agree
4.	The use of interactive buttons makes it interesting	10				5	5	4.5	0.53	Agree

5. The audio sounds in the mobile app are clear				10		2
	8	4.8	0.42	Agree		
6. The use of colour is very appealing				10		4
	6	4.6	0.52	Agree		
7. The quality of images, text, graphics and video are adequate				10	2	5
	3	3.9	1.1	Agree		
8. The use of images, text, graphics and video make the app interesting				10		9
	1	4.1	0.32	Agree		
9. The language used for construction of the task is simple for the pupils to comprehend.				10		8
	2	4.2	0.42	Agree		
10. The app would be useful in teaching pupils identification of numbers and letters				10	3	4
	3	3.7	1.25	Agree		
	Average Mean					
	4.39					

Table 4.3.1 above shows the Mean responses of Educational Technology Experts on the suitability of the developed mobile app. on mathematics numbers and English letters identification for elementary class pupils. The mean response of Educational Technology expert's to each of the ten items is above 3.0 while the average mean of experts' responses of all the items is 4.39. This indicates that Educational Technology Experts agree that the mobile application can be used in learning numbers and letters identification in Nigeria elementary class.

4.4 Research Question 3: What is the rating of Computer Science Experts on the suitability of the developed mobile application?

In answering research question 3, the researcher collated data on Computer Science Experts Validation Assessment Report to know if the application is suitable for elementary pupils. 10 Educational Technology Experts responded to 5 questionnaires items and their responses were analyzed using mean and standard deviation. The result is presented in table 4.4.1

Table 4.4.1: Mean responses of Computer Science Experts on the suitability of the developed mobile application.

S/N	statement	N	SD	D	U	A	SA	Mean	S.Dev.	Decision
1.	The presentation of information in the app is attractive	10				8	2	4.2	0.42	Agree
2.	The use of buttons and page navigation is easy to									

understand				10			1
9	4.9	0.32	Agree				
3. The use of proper lettering (fonts) in terms of style							
and size makes the information legible				10	2		6
2	3.8	1.0	Agree				
4. The colours used for various pages are quite appealing				10		3	5
2	3.9	0.74	Agree				
5. The quality of images, text, graphics and video are				10			6
4	4.4	0.52	Agree				
interesting							
Average Mean							
4.24							

Table 4.4.1 above shows the Mean responses of Computer Science Experts on the suitability of the developed mobile app. on Mathematics numbers and English letters identification for elementary class pupils. The mean response of Computer Science expert's to each of the five items is above 3.0 while the average mean of experts' responses of all the items is 4.24. This indicates that Computer Science Experts agree that the mobile application can be used in learning numbers and letters identification in Nigeria elementary class.

4.5 Research Question 4: What is the rating of Mathematics experts on the suitability of the

developed mobile application?

In answering research question 4, the researcher collated data on Mathematics Experts Validation Assessment Report to know if the application is suitable for elementary pupils. 10 Educational Technology Experts responded to 10 questionnaires items and their responses were analyzed using mean and standard deviation. The result is presented in table 4.5.1

Table 4.5.1: Mean responses of Mathematics Experts on the suitability of the developed mobile application.

S/N	statement	N	SD	D	U	A
	SA Mean S.Dev. Decision					
1.	The developed topic on identification of numbers adequately covers the elementary class curriculum	10		2		6
	2 3.8 1.0 Agree					
2.	The number sounds can be understood by elementary class pupils	10				8
	2 4.2 0.42 Agree					
3.	The numbers can be understood by elementary level Pupils	10				9
	1 4.1 0.32 Agree					
4.	The audio of the mobile app. Is clear enough for the					

Pupils				10			6
	4	4.4	0.52	Agree			
5. The colours in the app are catchy enough to attract							
pupils attention				10			2
	8	4.8	0.42	Agree			
6. The task given in the quiz is clear enough for the							
pupils to understand				10		4	4
	2	3.8	0.79	Agree			
7. The task given in the quiz conforms to required standard							
at the elementary level.				10		1	7
	2	4.1	0.56	Agree			
8. The language used for construction of the task is simple							
for the pupils to comprehend.				10	4	2	3
	1	3.1	1.1	Agree			
9. The pupils can easily use the mobile app themselves				10	2		6
	2	3.8	1.0	Agree			
10. The application would be useful for teaching pupils							

identification of numbers.				10				7
3	4.3	0.48	Agree					
Average Mean								
4.04								

Table 4.5.1 above shows the Mean responses of Mathematics experts on the suitability of the developed mobile app. on numbers identification for elementary class pupils. The mean response of Mathematics experts to each of the ten items is above 3.0 while the average mean of teachers' responses of all the items is 4.04. This indicates that Mathematics experts agree that the mobile application can be used in learning numbers identification in Nigeria elementary class.

4.6 Research Question 5: What is the rating of English experts on the suitability of the developed mobile application?

In answering research question 4, the researcher collated data on English Experts Validation Assessment Report to know if the application is suitable for elementary pupils. 10 Educational Technology Experts responded to 10 questionnaires items and their responses were analyzed using mean and standard deviation. The result is presented in table 4.6.1

Table 4.6.1: Mean responses of English Experts on the suitability of the developed mobile application.

S/N	statement			N	SD	D	U	A
	SA	Mean	S.Dev.	Decision				
1.	The developed topic on identification of letters							

adequately covers the elementary class curriculum 10 3

7 4.7 0.48 Agree

2. The letters sounds can be understood by elementary

class pupils 10 2

8 4.8 0.42 Agree

3. The letters can be understood by elementary level

Pupils 10 4

6 4.6 0.52 Agree

4. The audio of the mobile app. Is clear enough for the

Pupils 10 2

8 4.8 0.42 Agree

5. The colours in the app are catchy enough to attract

pupils attention 10 2 4

4 4.2 0.79 Agree

6. The task given in the quiz is clear enough for the

pupils to understand 10 2 6

2 3.8 1.0 Agree

7. The task given in the quiz conforms to required standard

at the elementary level.			10	4	2	4
3.0	0.94	Agree				
8. The language used for construction of the task is simple						
for the pupils to comprehend.			10		3	5
2	3.9	0.74 Agree				
9. The pupils can easily use the mobile app themselves			10	4	2	3
1	3.1	1.1 Agree				
10. The application would be useful for teaching pupils						
identification of letters.			10			4
6	4.6	0.52 Agree				
Average Mean						
4.15						

Table 4.6.1 above shows the Mean responses of English experts on the suitability of the developed mobile app. on letters identification for elementary class pupils. The mean response of English experts to each of the ten items is above 3.0 while the average mean of teachers' responses of all the items is 4.15. This indicates that English experts agree that the mobile application can be used in learning letters identification in Nigeria elementary class.

4.6 Discussion of the Results

The response gotten from the questionnaires administered to Educational Technology experts,

Computer Science experts, Mathematics teachers and English teachers on the suitability of the developed mobile application is a good one and would help elementary class pupils to learn Mathematics numbers and English letters identification.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the summary of the research study, procedures adopted, implications of the study and conclusion of the study, recommendations as well as suggestions for further study.

5.2 Summary of the Study

This study was carried out to know the processes involved in the development of interactive mobile application on numbers and letters identification for elementary class pupils which was done using flutter framework and dart programing language.

The study also determine the rating of Educational Technology experts, Computer Science experts, Mathematics experts and English experts on the suitability of the developed mobile application. a well structured 10 items, 5 items, 10 items and 10 items questionnaires was given to the experts and teachers respectively to get their response. The result was computed, a statistical mean and standard deviation was also used to analyze the results obtained.

Findings on ratings of Educational Technology experts, Computer Science experts, Mathematics experts and English experts on the suitability of the developed mobile application, the result shows that the mobile application would help elementary class pupils to learn Mathematics numbers and English letters identification.

5.3 Implications of the Study

The following implications can be drawn from the findings of the study:

1. The study shows that the interactive mobile application on Mathematics numbers and English letters identification for elementary class pupils can be developed using flutter framework and dart programing language.
2. The study shows that the use of interactive mobile application on Mathematics numbers and English letters identification will help elementary class pupils hence there should be availability of mobile phones or tablets to run the mobile application
3. The adoption of interactive mobile application on Mathematics numbers and English letters identification for elementary class pupils would help the pupils to learn at their own pace

and have fun at the same time.

5.4 Limitation of the Study

The following elements are the constraining of this project;

Finance: A development of this sort of application need funds; money pertaining to sourcing apparatus, software's and guides.

Time: A project of this nature needs enough time to be able to develop better yet appealing application.

Availability of materials and equipment: Resources necessary for better and faster development are expensive we're able to suggests ways and also use resources that are readily available.

5.5 Conclusion

From the analysis of data collected, it indicates that:

1. The learning contents of numbers and letters identification were effectively captured in the interactive mobile application. because Mathematics experts and English experts rated the mobile adequate.
2. The information obtained from the Educational Technology experts and Computer Science experts shows that the mobile application can be used for learning numbers and letters identification by elementary class pupils. because Educational Technology experts and Computer Science rated the mobile application adequate.

5.6 Recommendations

The following recommendations were made based on the finding of this study:

1. School authorities, teachers and parents should embrace the use of interactive mobile application in their schools
2. Governments should support schools with adequate funding in order for interactive mobile app. to be effective in elementary classes.
3. The findings should be properly disseminated to educational research institutes for further research.
4. Curriculum planners should include the use of mobile app. in learning Mathematics numbers and English letters identification in the curriculum for elementary classes.

5.7 Suggestion for Further Studies

This research work was based on some learning of numbers and letters for entry level pupils therefore there is room for further studies. The following are suggestions for further investigation.

1. Mobile applications for teaching other concepts in English language and Mathematics can also be developed.
2. Large population of teachers in elementary schools can be used to further determine the findings of the study.
3. This research can also be carried out on other subjects apart from Mathematics and

English, this could enhance the performance of students in other subject areas.

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APPENDIX I

DEPARTMENT OF EDUCATIONAL TECHNOLOGY

SCHOOL OF SCIENCE AND TECHNOLOGY EDUCATION

FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA, NIGER STATE.

COMPUTER SCIENCE EXPERT ASSESSMENT REPORT

Dear Respondent,

The purpose of this questionnaire is to evaluate an educational mobile application for learning numbers and letter identification, specifically for elementary class.

Consequently, you have been selected to participate in the evaluation process. This is in respect of an undergraduate research being conducted in the Department of Educational Technology, Federal University of Technology Minna. All information collected will be used strictly for research purpose and would be treated confidentially. However, you are to respond to the items given in this questionnaire as honestly as possible.

Thank you.

ADENIRAN, Stephen

SECTION A

RESPONDENT'S DEMOGRAPHY

1. Address of the respondent ……..……..
2. Discipline of the respondent …….

3. Respondent's Highest Qualification: (a) Ph.D [ ] (b) M.Ed. [ ] (c) B.Ed. [ ]

SECTION B

Instruction: Please read each statement and tick as appropriate.

S/N	ITEM	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
1	The presentation of information in the app is attractive					
2	The use of buttons and page navigation is easy to understand					
3	The use of proper lettering (fonts) in terms of style and size makes the information legible					
4	The colours used for various pages are quite appealing					
5	The quality of images, text, graphics and video are interesting					

Suggest any correction you think could be made on the task in the developed topic

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APPENDIX II

MATHEMATICS TEACHER ASSESSMENT REPORT

Dear Respondent,

The purpose of this questionnaire is to evaluate an educational mobile application for learning numbers and letter identification, specifically for elementary class.

Consequently, you have been selected to participate in the evaluation process. This is in respect of an undergraduate research being conducted in the Department of Educational Technology, Federal Univesity of Technology Minna. All informations collected will be used strictly for research purpose and would be treated confidentially. However, you are to respond to the items given in this questionnaire as honestly as possible.

Thank you.

ADENIRAN, Stephen

SECTION A

RESPONDENT'S DEMOGRAPHY

1. Address of the respondent ……..……..
2. Discipline of the respondent …….
3. Respondent's Highest Qualification: (a) Ph.D [ ] (b) M.Ed. [ ] (c) B.Ed. [ ]

SECTION B

Instruction: Please read each statement and tick as appropriate.

SN	ITEM	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
1	The developed topic on identification of numbers adequately covers the elementary class curriculum					
2	The number sounds can be understood by elementary class pupils					
3	The numbers can be understood by elementary level pupils					
4	The audio of the mobile app. Is clear enough for the pupils					
5	The colours in the app are catchy enough to attract pupils attention					
6	The task given in the quiz is clear enough for the pupils to understand					
7	The task given in the quiz conforms to required standard at the elementary level.					
8	The language used for construction of the task is simple for the pupils to comprehend.					
9	The pupils can easily use the mobile app themselves					
10	The application would be useful for teaching pupils identification of numbers.					

Suggest any correction you think could be made on the task in the developed topic,

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APPENDIX III

ENGLISH TEACHER ASSESSMENT REPORT

Dear Respondent,

The purpose of this questionnaire is to evaluate an educational mobile application for learning numbers and letter identification, specifically for elementary class.

Consequently, you have been selected to participate in the evaluation process. This is in respect of an undergraduate research being conducted in the Department of Educational Technology, Federal Univesity of Technology Minna. All informations collected will be used strictly for research purpose and would be treated confidentially. However, you are to respond to the items given in this questionnaire as honestly as possible.

Thank you.

ADENIRAN, Stephen

SECTION A

RESPONDENT'S DEMOGRAPHY

1. Address of the respondent ……...……..
2. Discipline of the respondent …….
3. Respondent's Highest Qualification: (a) Ph.D [ ] (b) M.Ed. [ ] (c) B.Ed. [ ]

SECTION B

Instruction: Please read each statement and tick as appropriate.

SN	ITEM	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
1	The developed topic on identification of letters adequately covers the elementary class curriculum					
2	The letter sounds can be understood by elementary class pupils					
3	The letters can be understood by elementary level pupils					
4	The audio of the mobile app is clear enough for the pupils					
5	The colours in the app are catchy enough to attract pupils attention					
6	The task given in the quiz is clear enough for the pupils to understand					
7	The task given in the quiz conforms to required standard at the elementary level.					
8	The language used for construction of the task is simple for the pupils to comprehend.					
9	The pupils can easily use the mobile app themselves					
10	The application would be useful for teaching pupils identification of letters.					

Suggest any correction you think could be made on the task in the developed topic,

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APPENDIX IV

EDUCATIONAL TECHNOLOGY EXPERT ASSESSMENT REPORT

Dear Respondent,

The purpose of this questionnaire is to evaluate an educational mobile application for learning numbers and letter identification, specifically for elementary class.

Consequently, you have been selected to participate in the evaluation process. This is in respect of an undergraduate research being conducted in the Department of Educational Technology, Federal Univesity of Technology Minna. All informations collected will be used strictly for research purpose and would be treated confidentially. However, you are to respond to the items given in this questionnaire as honestly as possible.

Thank you.

ADENIRAN, Stephen

SECTION A

RESPONDENT'S DEMOGRAPHY

1. Address of the respondent ……..……..

2. Discipline of the respondent …….

3. Respondent's Highest Qualification: (a) Ph.D [ ] (b) M.Ed. [ ] (c) B.Ed. [ ]

SECTION B

Instruction: Please read each statement and tick as appropriate.

SN	ITEM	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
1	The use of audiovisual in the app makes learning more interesting					
2	The presentation of information in the app is attractive					
3	The tasks in the mobile app is well arranged and easy to comprehend					
4	The use of interactive buttons makes it interesting					
5	The audio sounds in the mobile app are clear					
6	The use of colour is very appealing					
7	The quality of images, text, graphics and video are adequate					
8	The use of images, text, graphics and video make the app interesting					
9	The language used for construction of the task is simple for the pupils to comprehend.					
10	The app would be useful in teaching pupils identification of numbers and letters					

Suggest any correction you think could be made on the task in the developed topic,

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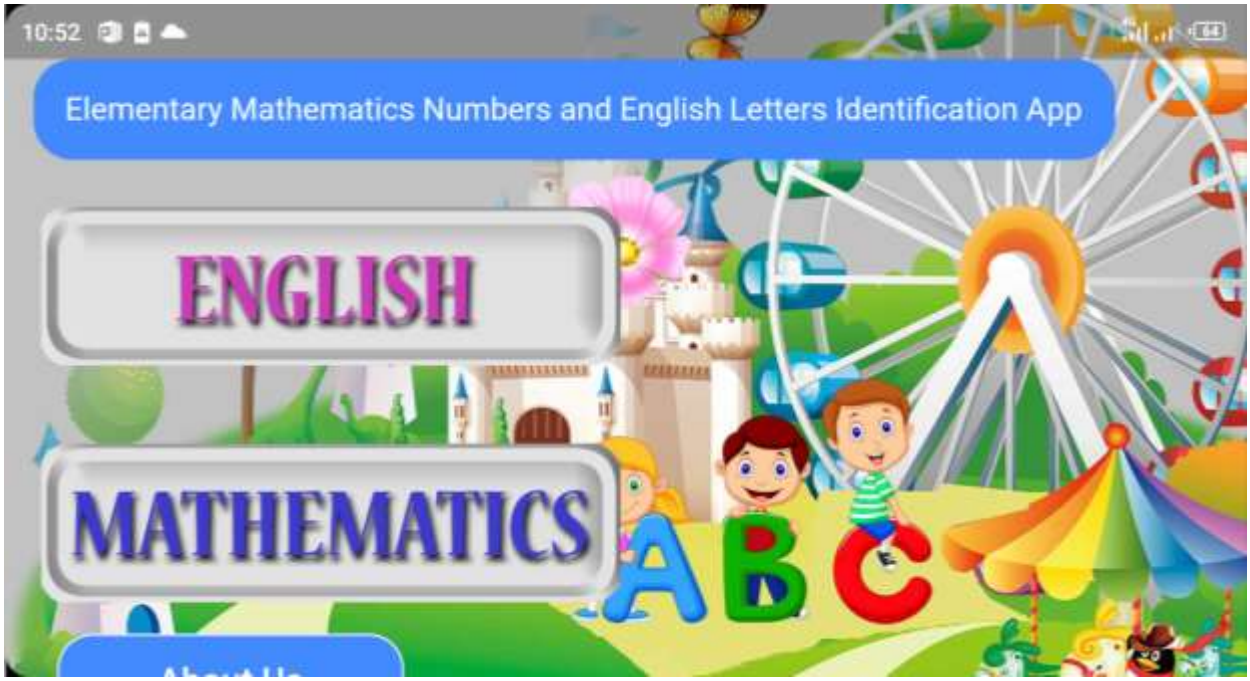
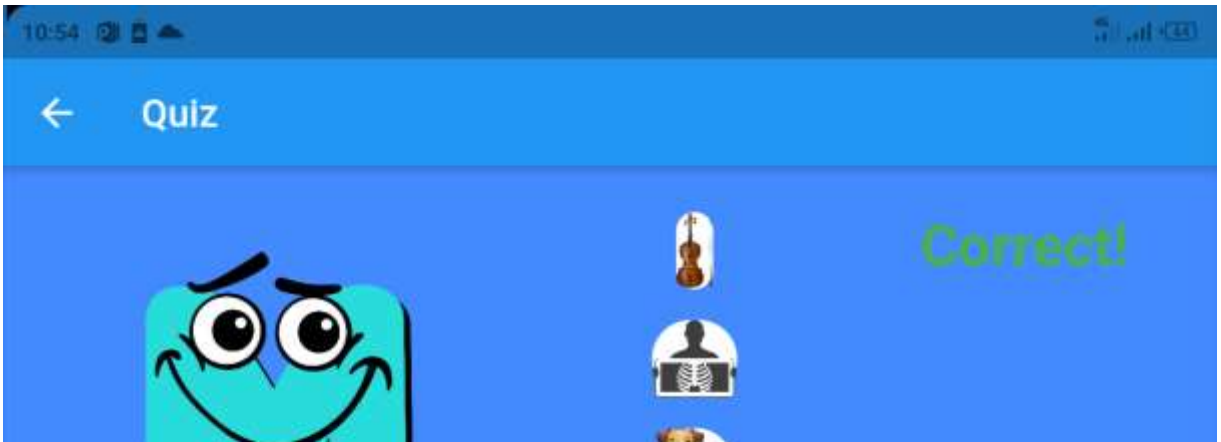
APPENDIX V

SCREEN SHOTS OF INTERACTIVE MOBILE APP. ON MATHEMATICS NUMBERS AND ENGLISH LETTERS IDENTIFICATION FOR ELEMENTARY CLASS PUPILS




10:54
B Video
B B B


10:54
Quiz
Correct!