A KIRK PATRICK EVALUATION OF INFOGRAPHICS INSTRUCTIONAL PACKAGE ON THE PERFORMANCE OF UPPER BASIC SCHOOL STUDENTS IN BASIC TECHNOLOGY

M.Ed Research Proposal

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CHAPTER ONE
INTRODUCTION

Background to the Study

Technology enhanced instruction can promote better understanding of concept and influencing skill acquisition in learning. The Nigeria Educational Research and Development Council (NERDC, 2007) stated clearly that the knowledge in learning a particular skill definitely influences the learners to develop creative ability, muscle control and appreciation of good craftsmanship towards the use of a particular medium of learning. FGN (2004) section 5 confirmed that for effective functioning in the modern world, there is need to integrate information and communication technology (ICT) into education in Nigeria. Onasanya and Adegbija (2007) posited that, there has never been any time than now in Nigeria where we need a technologically base instruction if wish to make policies in education a big success. Instructional media technology in this context refers to technology that is employed in the classroom for the purpose of instruction. Instructional package could be inform of multimedia package, infographics, graphics designs and computer designs. According to Hadley and Sheingold (1992) at every level of education, instructional media technology is perceived as a vehicle for curriculum enhancement. Hackbarth (2002) have indicated that instructional media technology has the potential for enhancing learning.
Graphics in instruction helps to facilitate and enhance teaching and learning. Graphics materials are visual materials which only appeals to the sense of seeing. According to Levie and Lentz (1996) graphics materials attract and capture the attention of the learners. Graphic materials also enhance enjoyment or affect emotions and attitudes. The cognitive use of graphics involves using pictures to increase comprehension i.e providing elaboration for a text explanation and to improve recollection and retention, or to provide information that is not otherwise available. Graphics illustrations can facilitate the acquisition of learning when they are presented with text materials (Levie, 1996).

Infographics are visual representation of information, data or knowledge intended to present complex information quickly and clearly (Doug, 2004). Infographics can improve cognition by utilizing graphics and the human visual systems ability to see pattern and trends (Heer, Bostock & Ogievetskey, 2010). The process of creating infographics can be referred to as data visualization, information design or information architecture (Card, 2009). Infographics encourage students to create their own graphics using a variety of tools. It encourages engagement in the classroom and a better understanding of the concept they are mapping into the graphics. The three parts of infographics are the:

1. The visual
2. The content
3. The knowledge
Generally, students understand the information presented by the visuals better. It is said “a picture is worth a thousand words”. Understanding occurs when a visual interacts with the psychological process active centre in the person who receives it (Saloman, 1979). Infographics will assist in the teaching and learning of basic technology in Nigeria. The students tend to learn better with the use of instructional material and visual materials (Bostock, 2010). Infographics are a good source of visual communication and it can deliver the textual message effectively. It will capture the attention of the students by arranging the components spatially and they thereby use particular capacities of human visual system for perception of spatial configurations (Schnotz, 1993). The purpose of infographics in teaching and learning is not a mere accessory of texts or to decorate the text and thus appeal the readers. Rather, infographics in teaching basic technology will illustrate abstract concepts, organize complex set of information and integrate new knowledge into existing knowledge structure. It will also facilitate retention of information and foster the process as of thinking and problems solving which are effective aids for learning (Heinch, 1993).

In science instruction, diagrams are often used to present the information (Lowe, 1993). Larkin and Simon (1987) have supported the effect of diagrams on learning with the empirical studies emphasizing the advantages of constructing a mental representation and cognitive processing because of diagrams.

Evaluation is a tool for understanding the value of a phenomena and judging them. There are several models and patterns in order to determine the
value of educational courses. The Kirkpatrick evaluation model is one of the most important ones. Most popular evaluation models in recent years are based on the four-level educational evaluation model which was first presented by Kirkpatrick (1959). This pattern is described as a comprehensive, simple and practical model for the most of the educational opportunities and is known as a criterion in this field by most of experts. Kirkpatrick has defined the evaluation as a determination for effectiveness in training program and divided the evaluation process into levels (Reaction, Learning, Behaviour and Result). The criteria of level 1 and 2 (Reaction and Learning) are gathered before learners go back to their job and the criteria of level 3 and 4 (Behaviour and Results) are measured with a degree which education leaner use in their job. It means that level 3 and 4 are used to determine the converting rate of training to the job.

Stufflebeam (1985) defines evaluation as the systematic assessment of the worth or merit of some object. He also defines an evaluation process as an ongoing check on the implementation of a plan. Lynch (1996) defines evaluation as the systematic attempt to collection information in order to make judgment or decisions. Baumgartner and Jackson (1995) said evaluation often follows measurement, taking the form of judgment about the quality of a performance.

There is substantial confirmation that creating visual spatial structures improves people’s ability to recall and understand (Bellezza, 1983). Bellezza (1986) concluded that subjects recalled more words when they were presented with visual presentation because the visuals were encoded as intact images in
memory and were retrieved intact in response to cue words. The visuals were helpful in organizing the information in the brain and cues served a connection between stored information and thus retrieved it effectively (Kulhavy, Lee & Caterino, 2007). It is expected that creating structural arrangements improves recall and comprehension of information in visuals by helping students organize the information (Winn, Li & Schill, 2004). When the information is visually presented, it is encoded as it is presented. Meaning is then assigned to it, and it is connected with previous information already in store (Hirtle & Jonides, 1985). Careful spatial construction makes it easier for people to organize the visual representation meaningfully (Winn et al, 1991). According to the dual coding theory Paivio (2007), the information that is presented verbally and visually is expected to integrate within the learner’s working memory. When both visual and verbal modalities are used to process the information, the encoding simplifies and results in better retrieval. If the information is actively processed by the learner at that moment it is passed on to the long term memory. If the information is so passively attended to, it is lost forever.

An infographics is a type of picture that blends data with design, helping individuals and organizations concisely communicate messages to their audience (Mark, 2012). Infographics is defined as a visualization of data or ideas that tries to convey complex information to an audience in a manner that can be quickly consumed and easily understood (Doug, 2004). Infographics can be used in their
simplest forms with elementary students or combined to create visual essays for students.

Basic technology is a subject that introduces student at the junior secondary school in Nigeria to the Basic rudiment of technology (FME, 2004). The National Policy of Education (2004) defined it as the aspect of education which leads to acquisition of practical and applied skills as basic scientific knowledge. In order to reduce ignorance about technology and help to lay a solid foundation for true national development, basic technology subject has been accorded a place in the school curriculum as a core subject like Mathematics and English Language (NERDC, 2008). Technology is a broad concept that deals with knowledge of tools and craft and how it affects human being (Merrian-webster dictionary, 2008). The human race use of technology began with the conversion of natural resources into simple tools. The prehistorically discovery of the ability to control the available resources of materials and the invention of the wheel helped humans in travelling and in controlling their environment (Forret Abag, 2009). According to Isehunwa (2009) basic technology is the acquisition and application of basic scientific intelligence to practically produce and economically utilize the materials and need of the society. Ebuh (2008) said basic technology can be acquired in three major ways, namely self development effort, copying from others and through transfers from formal or informal instructions.

In basic technology, computer based learning provides students an opportunity for self growth rather than being taught. In Nigeria, basic technology
is an elementary subject comprising woodwork, metal work, technical drawing and so on that are taught at the junior secondary school (NERDC, 2008). Adeyi (2007) stated that, the objectives of the junior secondary school education are to develop the student manipulate skills. Technology cannot be bought, borrowed or even transferred because technology is a culture that has to be developed. The introduction of basic technology into our educational system is a right decision in a right direction. According to Ajala (2008) the new national policy on education has all the necessary ingredients for landing Nigeria into the future technologically, politically, socially and morally. Basic technology is a compulsory subject in the (9) years basic education program. Its purpose is to contribute to the achievement of the national education goals by;

1. Inculcating of technology literacy that is basic understanding and capability of using technology.

2. Exposure of student to the world of work to match their talent and interests for wise vocational choice and;

3. Inculcation of positive attitudes towards work as a source of human identity, livelihood and power.

The revised basic technology curriculum became necessary due to technological development and national policy orientation to the teaching of technology as interest part of world globalization trends in education (NPE, 2004). Basic technology as a technology education for all is based on the understanding that in a world increasingly driven by technology, it would be a disaster for any
person or society not to inculcate basic technological skill. The responsibility of every school is to provide opportunity for all the acquired technological literacy. This is in line with the current goals of the National Economic Empowerment and development strategies (NEEDS). In pursuit of its objectives, this revised curriculum covers nine (9) themes:

1. The student and technology  
2. Safety  
3. Material and processing  
4. Drawing practice  
5. Tools and machine  
6. Applied electricity and electronics  
7. Energy and power  
8. Maintenance  
9. Building  

The content under each theme are made to reflect the basic technology i.e knowledge, skill, creativity and attitude (NPE, 2004).  

Statement of the problem  
Several challenges have been militating against the development of educational sector in particular in the teaching and learning process. There are attempts made by different researchers to eradicate the problems associated with instructional delivery. Elliot (1988) asserted that, during the last two decades, science and technology policy experts have come to realize that the teaching and
learning of basic technology has not been positively influence through lack of appropriate instructional package, unavailability of instructional materials, epileptic power supply, poor funding, lack of tools and equipment and lack of conscious efforts by instructors to integrate instructional materials into their teaching.

Eden (2004) confirmed the educators view by citing the fact that most of the textbooks available for teaching and learning basic technology are not well integrated and packaged to suit the teaching and learning objectives. Nigerian Educational Research and Development Council (2007) advocated that, for effective teaching and learning of basic technology, pictures and other visual materials should be combined and well integrated for instructional presentation. National Board for Technical Education (2006) affirmed that, most of the teachers of basic technology are not professionally qualified. According to them, for smooth and effective technical educations, teachers should be given mandate to acquire necessary skills needed for teaching and learning.

Fakomogbon, Jolayemi, Omiola and Adebayo (2012) designed, developed and evaluated a computer assisted instructional package for teaching basic technology. The researchers confirmed that the developed CAI was effective and suitable for the intended users (pg 129-135). Eziagbighala (2012) worked on the integration of ICT in Science Education in secondary schools. The researcher asserted that ICTs are veritable tools in making teaching and learning effective and meaningful in secondary schools. According to Eziagbigbala, the sciences
especially biology can be taught interestingly to students by the use of an array of ICTs and advised that the government needs to have a change of attitude as well as embrace the service of information and communication technology.

Badimus (2013) developed and evaluated a WebQuest application on educational technology concepts for selected undergraduate students in Nigeria. The researcher confirmed that the utilization of this WebETC for learning educational technology concepts for undergraduates’ students allowed better understanding of the concepts and improve students’ performance in general. Olumorin (2002) designed plastic instructional package for use in secondary schools art teaching. Soetan (2008) designed video puppetry instructional package for teaching fine art in junior secondary schools. Fakomogbon (1997) developed captioned video tape for the hearing impaired students at the junior secondary school level. After the production, he subjected the video tape to a field tryout. The result revealed that academic performance of students improved significantly after viewing the tape. Yusuf (1997) worked on the effects of videos and slide tape instructions on students’ performance in social studies in some junior secondary schools in Nigeria. The researcher confirmed that the instructional package was effective. Adejumo (2007) worked using audio graphic instructional package on wood working machine and building construction. The researcher confirmed that the instructional package was effective. Lawal (2011) designed and developed a Webquest instructional package for teaching computer studies in
Nigeria Junior Secondary Schools. The researcher confirmed that the developed webquest HCIP was effective and suitable for the intended users.

However, among the works reviewed in Nigeria, no one seemed to have been able to produce instructional package like infographics for Basic Technology subject in Junior Secondary Schools in Ilorin, Nigeria. Therefore, the present study would involve a Kirkpatrick’s Evaluation Model of Infographics instructional package for teaching basic technology in Nigerian Junior Secondary Schools.

**Purpose of the study**

The main purpose of the study is to design, develop and evaluate an infographics instructional package to teach Basic Technology in Junior Secondary School. Specifically this study will:

1. Design infographics instructional package to teach basic technology.
2. Develop infographics instructional package to teach basic technology.
3. Evaluate the appropriateness of the package on the student using two levels of Kirkpatrick evaluation model which is reaction and learning.

**Research Questions**

The following research questions would be postulated to assist in carrying out the study:

1. What are the stages involved in the design of the infographics instructional package for teaching Basic technology?
2. What are the procedures involved in the development of infographics instructional material for teaching basic technology?

3. How do experts evaluate the objectives, content, technical quality of the infographics and to test the appropriateness of the package using the two levels of Kirkpatrick evaluation model?

**Research Hypothesis**

H₀₁: There is no significant difference between the educational technologist experts, computer experts and teachers to evaluate the appropriateness of the developed infographics as an instructional package.

H₀₂: There is no significant difference between the reaction and extent in which the students learn from infographics instructional package in Basic Technology.

H₀₃: There is no significant difference between the performance of students exposed to the use of infographics and those taught with the conventional classroom instruction (CCI).

**Scope of the study**

This study will focus on evaluating infographics instructional package adopting Kirkpatrick Evaluation Model. The infographics instructional package will be designed on woodwork machines practice for Upper Basic School Students. The content in the woodwork machines are:

1. The definition of woodwork machines
2. Types of woodworking machineries

3. List and explain four types of handheld tools

4. List and explain four types of stationary machines

Two levels of Kirkpatrick evaluation model will be used to evaluate the content and quality of the package, to teach the student and to test the appropriateness and effectiveness of the instructional material on teaching and learning process on student performance.

Clarification of Terms and Variables

**Design:** It is the practice of creating instructional experiences which make the acquisition of knowledge and skill more efficient, effective, and appealing.

**Development:** It is the production of a package for instruction on a specific topic or subject content as specified in the design, the materials, stages of development and the steps leading to the production of the package.

**Infographics:** Infographics are visual representation of information, data or knowledge intended to present complex information quickly and clearly.

**Instructional Package:** Instructional packages in its simplest terms are the materials or package that allow teachers to teach with ease and allows students to learn without stress.

**Upper Basic School:** The first three years in the Nigeria Secondary School system.

**Performance:** It is the result of the pretest and posttest of students before and after exposure to infographics instructional package.
**Basic Technology:** This is the acquisition and application of basic scientific intelligence to practically produce and economically utilize the materials and needs of the society.

**Reaction:** A learned predisposition to respond in a consistently favourably or unfavourable manner with respect to a given object.

**Evaluation:** The making of a judgement about the amount, number, or value of something; assessment.

**Evaluation Model:** They are different types of models which can be used to evaluate, assess and judge an instructional material.

**Kirkpatrick Evaluation:** Kirkpatrick has defined the evaluation as a determination of effectiveness in training program and divided the evaluation process into levels (Reaction, Learning, Behaviour and Result). The criteria of level 1 and 2 (Reaction and Learning) are gathered before learners go back to their job and the criteria of level 3 and 4 (Behaviour and Results) are measured with a degree which education learner use in their job. It means that level 3 and 4 are used to determine the covering rate of training to the Job.

**Significance of the study**

The result from the package would help basic technology teachers to discover talents and hidden potentials among student and it will encourage self-reliance as learners create and develop things that would contribute to Nigeria’s economic growth. The package will serve as an instructional material which will help teachers in basic technology to facilitate teaching and enhance effective
communication to the students. Infographics will encourage student create their own graphics using a variety of tools, encourages engagement in the classroom and a better understanding of the concept been taught. Teachers of basic technology will also gain insight on how they can package their learning resources for effective teaching and learning.

The following people are likely to benefit from the findings of this study: Educational technologist, curriculum developers, students and teachers in secondary schools, government at all levels and researchers. The study may be a guide to educational technologist on how modern technology can be used for secondary schools. It also enables governments to formulate and implement appropriate policies that will assist the harmonization of indigenous and modern technologies for secondary schools in Nigeria.

It will also be useful for the curriculum developer who might find the result of this study useful when reviewing the existing basic technology curriculum to inculcate the needs of teachers and activities that will improve student learning. The outcome of this study may also be of significance to the State and Federal Ministry of Education in the area of policy making and other agencies of education.

Finally, the outcome of this study may provide educational researchers a basis for further research. The study may be an important source of reference in the academic world. It will greatly assist researchers who might want to conduct similar studies in future.
CHAPTER TWO
REVIEW OF RELATED LITERATURE

In this chapter, attempt will be made to review related literature in the following sub-headings;

1. Definition and Meaning of Infographics
2. Relevant of Instructional package to Teaching and Learning
3. Evaluation Models in Educational Technology
4. Meaning, Objectives and Content of Junior Secondary School Basic Technology
5. Problems Associated with the Teaching and Learning of Basic Technology
6. Appraisal of Literature Review

**Definition and Meaning of Infographics**

Infographics are visual representation of information, data or knowledge intended to present complex information quickly and clearly (Doug, 2004). They can improve cognition by utilizing graphics and the human visual systems ability to see patterns and trends (Mark, 2012). The process of creating infographics can be referred to as data visualization, information design or information architecture (Card, 2009). Infographics can be in form of data visualization, geography instruction, organization, chronology, anatomy and process.

Visualization is any technique for creating images, diagrams or animations to communicate a message (Mark, 2012). Visualization through visual imagery
has been an effective way to communicate both abstract and concrete ideas since the dawn of man. Infographics have been around for many years and today they can be seen all around us, everywhere from newspaper to children books to maps to blogs (Mark, 2012). The proliferations of a number of easy to use, free tools have made a creation of infographics available to a large segment of the population. Social media sites such as facebook, twitter, skype etc has also allowed for individual infographics to be spread among people around the world.

Infographics encourages student to create their own graphics using a variety of tools, encourages engagement in the classroom and a better understanding of the concept they are mapping onto the graphics (Mark, 2012). The three parts of all infographics are the visual, the content, the knowledge.

The visual expectation about emerging is comprised of colours and graphics. There graphics are included in all infographics and represent the underlying visual representation of the data. One of the important aspects of infographics is that they contain some sort of insight into the data that they are presenting (Bostock, 2010). Infographics are effective because of their visual element. Humans receive input from all five of the senses (sight, touch, hearing, smell and taste) but they receive significantly more information from vision than any of the other four. Fifty percent of the human brain is dedicated to visual functions and images are processed faster than text. The brain processes pictures all at once but processes text in a linear fashion, meaning it takes much longer to obtain information from text.
Generally people understand the information presented by the visuals better; it is well said "a picture is worth a thousand words." Understanding occurs when a visual interacts with the psychological process active in the person who receives it (Salomon, 1979). It requires that perceptual and cognitive processes act on the representative elements of visuals and become influenced by them (Winn, 1991). Infographics have been used to stimulate interest in students and increase their involvement for instructional purposes (Mark, 2012). There is a general consent on the beneficial contribution of infographics with the related text information for the readers (Morrison, Ross & Kemp, 2001). Infographics are a good source of visual communication and can deliver the textual message effectively (Levie & Lentz, 1982). Infographics capture the attention of the learner by arranging the components spatially and they thereby use particular capacities of human visual system for perception of spatial configurations (Schnotz, 1993).

Instructional material consists of written texts and graphics such as maps, charts, graphs, diagrams, etc (Bostock, 2010). The purpose of graphical displays in text is not a mere accessory to texts or to decorate the text and thus appeal the readers. Rather, graphics to illustrate abstract concepts, organize complex sets of information, integrate new knowledge into existing knowledge structures, facilitate retention of information, and foster the process as of thinking and problem solving which are effective aids for learning (Schnotz, 1993). Comprehension of abstract subject matter with the aid of graphics is helpful; graphics explain the spatial relationships described in the text (Bostock, 2010).
Infographics are used to engage learners and are an integral part of many subject areas. Although learners prefer to process instructional materials with illustrations and graphics, they are not aware of the benefits of visualizations and, accordingly pay only little attention to the texts (Mark, 2012).

Comprehension of infographics is a process of constructing meaning, which learners acquire within an active processing framework and the prior experience with the stimuli (Schnotz & Kulhavy, 1994). Task expectations and ability make a difference in how the individuals learn (Schnotz & Kulhavy, 1994). Infographics can serve various functions like depicting data, explaining complex relationships, organizing information, improving memory for facts, and influencing problem solving. These functions are not inherent in graphics, however, but result from the way in which such graphics are processed cognitively (Mark, 2012).

Infographics are visual representation of information, data or knowledge intended to present complex information quickly and clearly (Doug, 2004). They can improve cognition by utilizing graphics and the human visual systems ability to see patterns and trends (Mark, 2012). The process of creating infographics can be referred to as data visualization, information design or information architecture (Card, 2009). Infographics can be inform of data visualization, geography instruction, organization, chronology, anatomy and process.

Visualization is any technique for creating images, communications diagrams or animations. It is an effective way to communicate both abstract and concrete ideas which can be on newspaper, children books, maps or blogs (Mark,
The proliferations of a number of easy to use, free tools have made creation of infographics available to a large segment of the population. Social media sites such as facebook, twitter, skype etc has also allowed for individual infographics to be spread among people around the world.

Today infographics surround us in the media, in published books both pedestrian and scientific, in newspapers; infographics are commonly used to show the weather, as well as maps, site plans in road signs and manuals. They illustrate information that would be unwidely in text form. Some books are almost entirely made of information graphics, visual shorthand for everyday concepts such as stop and go. By the year 2000, adobe flash-based animations on the internet had made use of many key practices in creating effective infographics in order to create effective and engaging products and games. Television has begun to incorporate infographics into the viewers’ experiences.

Furthermore, it is estimated that 65% of the population are visual learners as opposed to auditory or kinesthetic, so the visual nature of infographics caters to a large portion of the population. When designing the visual aspect of an infographics a number of considerations must be made to optimize the effectiveness of the visualization. The six component of visuals encoding are; spatial, marks, connection, enclosure, retinal properties and temporal encoding. Each of these can be utilized in its own way to represent different types of data. However, studies have represented numerical data and lead to the fastest and easiest understanding by viewers. Therefore the designer should consider spatially
representing the most important relationship been depicted in an infographics. If visualization can be effectively used on their own many modern infographics combine multiple types into one graphic along with less standard features such as illustrations and text. Some modern infographics do not even contain data visualization and instead are simply a colourful and succinct way to present knowledge.

In instruction, diagrams are often used to present the information (Lowe, 1993). Larkin and Simon (1987) have supported the effect of diagrams on learning with the empirical studies emphasizing the advantages of constructing a mental representation and cognitive processing because of diagrams (Glenberg & Langston, 1992).

There is substantial confirmation that creating visual spatial structures improves people’s ability to recall and understand (Bellezza, 1986). Bellezza (1986) concluded that subjects recalled more words when they were presented with visual presentation because the visuals were encoded as intact images in memory and were retrieved intact in response to cue words. The visuals were helpful in organizing the information in the brain and cues served a connection between stored information and thus retrieved it effectively (Kulhavy, Lee & Caterino, 1985). It is expected that creating structural arrangements improves recall and comprehension of information in visuals by helping students organize the information (Winn, Li & Schill, 1991). When the information is visually presented, it is encoded as it is presented. Meaning is then assigned to it, and it is
connected with previous information already in store (Hirtle & Jonides, 1985). Careful spatial construction makes it easier for people to organize the visual representation meaningfully (Winn, Li & Schill, 1991). According to the dual coding theory Paivio (1971), the information that is presented verbally and visually is expected to integrate within the learner’s working memory. It builds referential connections (Mayer & Sims, 1994). When both visual and verbal modalities are used to process the information, the encoding simplifies and results in better retrieval. If the information is actively processed by the learner at that moment it is passed on to the long term memory. If the information is so passively attended it is lost forever.

An infographics is a type of picture that blends data with design, helping individuals and organizations concisely communicate messages to their audience (Mark, 2012). Infographics is defined as a visualization of data or ideas that tries to convey complex information to an audience in a manner that can be quickly consumed and easily understood. Infographics can be used in their simplest forms with elementary students or combined to create visual essays for students.
Figure 1: An infographic design showing the total annual spending of some countries in the world.

Figure 2: An infographic design
Infographics can contribute to the development of an educational multimedia project in three major areas;

1. It gives a clear concept of what is taught
2. It allows easy communication and understanding of a particular concept been taught
3. It also provides background of information which will enable students to make intelligent judgement in daily life.
4. It develops a visual concept
5. Developing effective visual communication
6. Developing conceptual ideas

**Relevant of instructional packages to teaching and learning**

Instructional packages are the human and nonhuman materials used in disseminating meaningful instructions to the learners during teaching and learning (Adedotun, 2007). According to him, instructional packages are instructions that aid learning through the sense of sight. Murray (2007) stressed that visuals are utilized very well and at the right time, they perform the under-listed functions namely:

1. They make learning real
2. They save teaching time
3. It brings accurate impressions
4. Its arouse learners interest
5. It facilitates learning and enhances teaching.

Instructional packages help the teaching and learning process. They accelerate the rate at which students learn and also make teaching and learning interesting and comparatively easy. Visual instruments are materials which help learning though the sense of sight (Murray, 2008).

Mayer’s Principles: The “Multimedia Principle” and “Contiguity Principle” are described briefly below.

Mayer (2001) offers a scientific approach to the development of design principles. He has supported his principles with research aimed at understanding how people learn from words and pictures. The findings of the research support two design principles.

The Multimedia Principle: According to the multimedia principle Mayer (2001), students learn better from words and pictures than from words alone. Learners build picture-based and word-based representations in their minds; they build systematic connections with them. If words alone are presented, students make a verbal mental model. Due to the absence of pictures, they are less likely to make a visual mental model, and an association between the visual and verbal mental models is deficient.

Contiguity Principle: Students learn better when corresponding words and pictures are presented near rather than far from each other on the page or screen. The results supporting this principle are coherent with three assumptions underlying the cognitive theory of multimedia learning – dual channel, limited capacity and
active processing. Mayer supports that, when presenting coupled text and images, the text should be embedded within the images. This reduces the cognitive workload of the learner, as she/he does not have to search visually for the image with corresponding text. The learners are more likely to be able to hold the information in working memory and to make better connections.

According to Murray (2008), the following are the values of instructional materials:

1. Instructional materials arouse interest: No one learns very much if he does not pay attention and show interest in the subject. There are many ways of gaining attention and holding interest of the learners but one of the best ways is to use something visual.

2. Instructional materials can create accurate instruction: Visuals define facts and information easily and precisely, they can identify describe in concrete term and give meaning to words.

3. They save teaching time: Visual speeds up the learning process, diagram or pictures will present information very much more quickly than long wordy descriptions and sentences.

4. They help the memory: Visuals makes learning process more real, it helps to remember better what is taught.

5. It stimulates active thinking: Adequately drawn diagrams and corrections should often be a starting point for thought, discussion and
understanding. It is also a quick way of acquiring facts. A stimulating picture may provide different levels of learning experience at the same time.

By studying a situation or picture with the one to whom you are trying to communicate, you can enter into an experience to which you can both relate your conversation (Adebimpe, 2007). Most of instructional materials also make use of power of pictures, words and sounds to compel attention to help an audience understand ideas and acquire information too complex for verbal explanation alone and to help overcome the limitations of the time size and space. According to Babafemi (2000), instructional materials are self supporting devices that can be used by educators to present a complete body of information in the teaching process which is also applicable to basic technology as a subject, the four elements viz-curriculum, teacher’s practitioners, students and facilities have to be involved. This implies that, instructional media are of great important to basic technology in terms of the materials, resources and the main media employed to facilitates teaching.

Instructional materials are various carriers of information. They include materials such as objects, realia, specimen, postals with the view to facilitate teaching and learning. Olarewaju (2003) observed that instructional materials or media play very significant roles in teaching and learning. They are powerful to convey instructions when systematically designed, developed and utilized. Also, they are capable of motivating learners to learn, when the learners need, interest
and attention are matched to the media. They provide appropriate feedback and thus facilitate learning. There are varieties of instructional media available in the world today. These could be classified into three (3) categories; audio, visual and audio-visual instructional materials (Onasanya & Adegbija, 2007).

Audio: This is a medium in instructional practice that appeals to the sense of hearing but the most commonly used tool for the job is the spoken word. Gadgets for magnifying and reproducing audio sound include radio set, record player, reel to reel audio tape, cassette player/recorder (Olarewaju, 2003).

Visual: This could be regarded as a medium that appeals to the sense of sight in teaching/learning situation. These are things one can see, feel or touch either projected or non-projected. They could be either charts, flannel graphs, still or flat pictures and slides. The non projected visuals neither need the use of battery nor electricity before they function adequately well.

Audio-Visual: This is a medium that appeals to the sense of sight and hearing at the same time.

**Evaluation Models in Educational Technology**

There are so many evaluation models in educational technology. They include Kirkpatrick Evaluation Model, Bates Action Model, Eltimi model etc.

A Kirkpatrick Evaluation

Donald Kirkpatrick has developed a very popular evaluation model that has been used since the late 1950s by the training community. The focus is on
measuring four kinds of outcomes that should result from a highly effective training program.

Kirkpatrick’s model includes four levels or steps of outcome evaluation:

- Level 1 Evaluation—Reaction
- Level 2 Evaluation—Learning
- Level 3 Evaluation—Behavior
- Level 4 Evaluation—Results

Figure 3: Kirkpatrick Four Evaluation Model
In Kirkpatrick's four-level model, each successive evaluation level is built on information.

Assessing Training Effectiveness often entails using the four level model developed by (Donald Kirkpatrick, 1994). According to this model, evaluation should always begin with level one, and then should move sequentially through levels two, three, and four. Information from each prior level serves as a base for the next level's evaluation. Thus, each successive level represents a more precise measure of the effectiveness of the training program, but at the same time requires a more rigorous and time-consuming analysis.

Figure 4: Kirkpatrick Evaluation Model (1994)
The model was defined in 1959 by Donald L. Kirkpatrick in a series of articles that appeared in the US Training and Development Journal. The idea behind the model is for an organization to have meaningful evaluation of learning. The degree of difficulty increases as you move through the levels.

The four levels of the model are:

- Level 1: Reaction
- Level 2: Learning
- Level 3: Behavior
- Level 4: Results

Reaction: Just as the word implies, evaluation at this level measures how participants in a training program react to it. It attempts to answer questions regarding the participants' perceptions. How well did the learners like the learning process? According to Kirkpatrick (1994), every program should at least be evaluated at this level to provide for the improvement of a training program. In addition, the participants' reactions have important consequences for learning.

Learning: What did they learn? The extent to which the learners gain knowledge and skills.
To assess the amount of learning that has occurred due to a training program, level two evaluations often use tests conducted before training (pretest) and after training (post test). Assessing at this level moves the evaluation beyond learner satisfaction and attempts to assess the extent students have advanced in skills, knowledge, or attitude. Measurement at this level is more difficult and laborious than level one. Methods range from formal to informal testing to team assessment and self-assessment. If possible, participants take the test or assessment before the training (pretest) and after training (post test) to determine the amount of learning that has occurred.

*Figure 5: Comparison of test performance*
Behaviour: This level measures the transfer that has occurred in learners' behavior due to the training program. Evaluating at this level attempts to answer the question - Are the newly acquired skills, knowledge, or attitude being used in the everyday environment of the learner? For many trainers, this level represents the truest assessment of a program's effectiveness. However, measuring at this level is difficult as it is often impossible to predict when the change in behavior will occur, and thus requires important decisions in terms of when to evaluate, how often to evaluate, and how to evaluate.

Result: What are the tangible results of the learning process in terms of improved quality efficiently?

![Kirkpatrick Evaluation Model (1994)](image)

*Figure 6: Kirkpatrick Evaluation Model (1994)*
Level four can be difficult because you must determine what final results occurred in the teaching and learning. It is important to determine whether the conditions set forth above in Level 3 have been met.

Here are some guidelines for evaluating results:

1. Use a control group if it is practical

2. Allow time for results to be achieved

3. Measure both before and after the assessment

Donald Kirkpatrick concept is quite important as it makes an excellent planning and evaluating.

Bates Action Model (1995): A generic framework developed at the British Open University to help in analyzing and selecting the appropriate technology.

Access:

1. How accessible is a particular technology for learners?

2. How flexible is it for a particular target group?

Cost

1. What is the cost structure of each technology?

2. What is the unit cost per student?
3. What are the opportunity cost vs. other technology choices

Teaching and learning

1. What instructional approaches will best meet these needs?

2. Can the content be adapted to the technology?

3. What skills does the technology develop?

Interactivity and user – friendliness

1. What are the organizational requirements to provide stability and support?

2. What are the barriers to using this technology successfully within the institution?

3. What changes need to be made within the organization to incorporate the technology?

Novelty

1. How new is the technology?

2. What are its technical capabilities?

Speed

1. How quickly can courses be created and distributed with this technology?

2. How quickly can materials be changed?
Eltimi model (1999): A three step model considers the elements of the learning process and used for selection and evaluation of technologies to enhance the quality of teaching and learning.

1. Educational issues: what makes quality teaching and learning

2. Technologies issues: what technologies enable learning

3. Management issues: what are the logistical constraints

This study will be evaluated using Kirkpatrick Evaluation model to test the effectiveness of the instructional package on the Junior Secondary School Basic Technology student.

**Meaning, objectives and content of junior secondary school basic technology**

Basic technology is a subject that introduces student at the junior secondary school in Nigeria to the basic rudiment of technology. At the inception of the 6.3.3.4 system of education, it was called “introductory technology” but currently in the 9.3.4 system of education it is called “basic technology”. The National Policy of Education (2004) defined it as the aspect of education which leads to acquisition of practical and applied skills as basic scientific knowledge. In order to reduce ignorance about technology and help to lay a solid foundation for true national development; basic technology subject has been accorded a place in the school curriculum as a core subject like mathematics and English language (NPE, 2004).
Junior secondary school is an education programme which provides a foundation for acquisition of knowledge, skills and competencies in reading, writing, numeracy and other fields of human endeavour. The children are expected to acquire a nine year free and compulsory education, that is they are to spend six years at primary level and transit automatically to junior secondary schools to spend three years. Also included in the programme is adult and non-informal education at primary and junior secondary school levels (National Policy on Education FRN, 2004). In essence, the programme is universal as all categories of people in the country benefit from it, their socio-economic, religions, political ethnic and other differences not withstanding. As in instrument for effecting national development, universal basic education (UBE) has the following objectives for junior secondary schools:

1. To live meaningful and fulfilled lives
2. To contribute to the development of the society
3. To derive maximum social, economic and cultural benefits from the society, and
4. To discharge civic responsibilities competently (FME, 2003)

The objectives of UBE constitute four difference aspects of human resources development. When they are well addressed, the human resources become agents for further development in various sectors of the nation’s economy. In the first instance, national development starts from the development of an individual. The skills and competencies in him become manifest and he is able to
utilize them for his well being. Thus it has become a useful and productive member of the society. This would make him live a meaningful and fulfilled life (UBE, 2004).

Furthermore, a well developed individual automatically becomes an agent of development that is, he will be able to assist other people to develop their skills and competencies (NPE, 2004). The nation natural and material resources are also developed by the skilled and competent members of the society. Hence, development of the society would be achieved through the educated individuals. Through UBE, the government intends to develop an enlightened citizen who will be aware of what goes on around and be able to derive maximum benefits from his environments. Ability to adapt to new inventions and discoveries, knowledge of what goes on in the environment and ability to influence the life of others become better in the educated member of the society (FME, 2003). Another important objective which the government wants to achieve through UBE is to enable an individual discharge civic responsibility competently. The programme is expected to assist the beneficiary to be aware of government policies, understood his rights and performs his duties as good citizen of the country. However, achievement of UBE objectives cannot be accidental.

The programme has to be consciously and consistently pursued by all stakeholders in general and by the educators at the grassroots in particular. Specifically, the heads of primary and junior secondary schools who are the supervisors of their schools have to ensure that right things are done at the right
time, therefore the new curriculum for universal basic education designed by Nigerian Educational Research and Development Council (NERDC) which was conducted in 2007. The lower basic primary one to three, middle basic primary four to six and upper basic is the junior secondary school (JSS) an examination is conducted, the child who passes qualify to proceed to the next three year and that will qualify the child who passes to proceed to the senior secondary school (SSS). The new curriculum encourages the learner to be self-reliant because of the kind of training received in various disciplines. The NPE (2004) put it that there is the need for functional education for the promotion of a progressive united Nigeria. School programme needs to be relevant, practical and comprehensive.

JSS Basic Technology as a technology education for all is based on the understanding that in a world increasingly driven by technology, it would be a disaster for any person or society not to inculcate basic technological skills (FME, 2004). The responsibility of every nation and every school is to provide opportunities for all to acquire technological literacy (FME, 2004). This is in line with the current goals of the National Economic Empowerment and Development Strategies (NEEDS). In pursuit of its objectives, the revised curriculum covers the following nine (9) themes,

1. The student and technology
2. Safety
3. Materials and processing
4. Drawing practice

5. Tools and machines

6. Energy and power

7. Maintenance

The content under each theme are made to reflect the basic nature of technology, i.e knowledge, skill, creative attitude. According to NPE (2004) curriculum, it is recommended that the following activities should be carried out under each theme for all J.S.S. students.

The student and technology: Under this theme, it is recommended to teach the following topics: concept of technology, technology and society, information and communication technology. Teachers are hereby advice to use some instructional materials to teach each concept such instructional materials includes Films, Video Cassette, pictures of technology products and pictures of technology practitioners on site. At the end of each topic, the teacher should evaluate the students’ performance.

Safety: NERDC (2007) recommend that the following topics should be taught: workshop safety rule and regulation and first aid materials. It is also recommended that teachers should make the following their performance objectives i.e students should be able to list the types of workshop equipments, fire fighting materials and equipment, list first aid material. It is also recommended that teachers should make use of instructional materials when teaching the student such as first aid box,
safety devices e.g. fire extinguishers, sand bucket etc and also teach them the necessary safety rule and regulation when using the instructional material.

Materials and Processing: The following is recommended to teach: properties of materials, uses of materials, and production of material. The instructional material recommended to teach the topic includes various types of wood, metal materials, specimen, chain saw etc. The curriculum recommend that if teaching and learning should take place effectively, teacher should have the following performance objective i.e students should be able to identify, state and describe the properties of instructional materials.

Drawing Practice: Basic technology curriculum (2007), recommends that the following topics should be taught under this theme; Drawing instrument and materials, Geometrical construction, isometric drawing, oblique drawing, orthographic projection and one – point perspective drawing.

Tools and Machine: The following are to be taught: woodwork hand tools, metal work hand tools, woodwork machine, simple woodwork machine, simple wood work project, metal work machine etc. The instructional materials required to be used includes; measuring tools, cutting tools, model of shaped blocks, portable wood work machine etc. It is recommended that at the end of the lessons, the teacher should evaluate the student by asking them to answer some questions.

Energy and Power: Topics recommended for this theme are; concept of energy and power, energy based technological appliance and mechanical energy transmission system. The NERDC recommends that for teaching and learning to
take place, the following instructional materials should be utilized e.g. fan, battery, regulator, electric iron, old clock, bicycle etc. for effective teaching and learning to take place, the teacher should evaluate the students at the end of the lesson by asking them to identify, define, list the concept of energy and power.

Applied Electricity and Electronics: The following are to be taught; transmission of electricity, simple electrical wiring and basic electronics devices. The instructional materials recommended for this topic are resistors, capacitor, diode, insulators, aluminum cables, hammer, pliers, nails etc.

Maintenance: The following are to be taught; concept of maintenance, periodic maintenance, fault detection and simple maintenance should be taught under this theme. It is also recommended that some of the instructional material to be used when teaching the topic which are; grease, engine oil, tools and machine parts.

NERDC (2007) states that for effective teaching and learning to take place, the following performance objective must be considered such as: student should be able to name and state the uses of tools, list and describe types of maintenance practices etc.

It is hoped that students’ assessment would be based on these elements. Teaching and learning are therefore facilitated by the use of real life experiences through visits, use of information and communication technology (ICT), instructional materials and other audio-visual aids. The purpose of the Basic Technology is to;
1. To provide a solid foundation for prevocational subjects

2. To stimulate the interest of students in the basic science, which are the stones of engineering and technology

3. To motivate the student at their formative stages, to develop inquisitive minds and therefore an interest in technology

4. To provide every student with the fundamentals of technology so that they can develop the ‘do-it-yourself” ability, their later professional calling in life notwithstanding.

5. To improve the communication skill of the students at least in the technical areas.

Basic technology is one of the core and compulsory subjects offered at junior secondary school level NPE (2004). In the junior secondary curriculum basic technology includes a broad range of fields of study and subject such as auto mechanics, applied electricity, building, ceramics, metal works, woodwork, plastics, rubber, food preservation, storage, technical drawing and other miscellaneous topics NPE (2004). The basic technology course is meant to provide a holistic view of technology to students. The subject guidelines and contents have been carefully structured into a teaching sequence which consists of clear explanations and descriptions of how results are obtained by using different tools, machines and materials. Basic technology is also a skill development course, which aims at providing students with technical literacy for everyday life.
According to Nigeria Federal Core Curriculum, the objectives of basic technology are to:

1. Provide pre-vocational orientation for further training in technology
2. Provide basic technology literacy for everyday living, and

Basic technology at this level is also meant to provide basic technology about industrial technology. It is designed to develop in students an appreciation of technology and an interest in specific areas of industrial technology. On completion of junior secondary schools, according to FGN (2004) students are streamed into:

1. Senior secondary school;
2. Technical college;
3. An out of school vocational training center; and
4. An apprenticeship scheme

This is based on results from the junior secondary school certificate examination (JSSCE) whose purpose is to determine their academic ability, aptitude and vocational interests. The curriculum used to teach the subject of Basic Technology was developed by various subject specialists. For instance, those who studied electrical and electronics were asked to write chapters on textbooks related to the subject, those who studied architecture and building focused on related subjects, and those who studied engineering were asked to contribute to engineering related subjects. Most are controlled by National Educational
Research and Development Council (NERDC). The review of the textbooks usually carried out after five years. The textbook used in teaching basic technology in schools are an important source of course content. A textbook can be used to define the boundaries of content, the order in which specific topics are taught and most importantly, how they are presented Jones (2007). In technology classes, a textbook can be a source for problems solving, explanations and a means of connecting the students with the emerging technologies Jones (2007). For several reasons, it seems that textbooks significantly influence the content and emphasis of course teaching about technology in classes for elementary teachers.

A textbook according to Jones (2007) is a book that contains information about a subject that students study. Also, it is a book that students use regularly during a set of lessons. Textbooks treat subject comprehensively and it is used by students as a basis for study. To achieve the stated objectives of the subject of basic technology, student and teacher need comprehensive textbooks, which will serve as a guide (FME, 2004).

**Problems associated with the teaching and learning of basic technology.**

Elliot (1988) asserted that, during the last two decades, science and technology policy experts have come to realize that the teaching and learning of basic technology has not been positively influenced through the lack of appropriate instructional package, unavailability of instructional materials, epileptic power supply, poor funding, lack of tools and equipment, lack of laboratory and lack of conscious efforts by instructors to integrate instructional
materials into their teaching. Agbalaham and Eden (2004) confirmed the educators view by citing the fact that, most of the textbooks available for teaching and learning basic technology are not well integrated and packaged to suit the teaching and learning objectives.

Nigerian Educational Research and Development Council (2007) advocated that, for effective teaching of basic technology, pictures and other visual materials should be combined and well integrated for instructional presentation. National Board for Technical Education (2006) affirmed that, most of the teachers of basic technology are not professionally qualified. According to them, for smooth and effective technical educations, teachers should be given mandate to acquire necessary skills needed for teaching and learning.

The supervision and control of information and ideas found in textbooks and other printed materials for student are very important. There is a clear need to carefully analyse textbooks, journals and other communication media for the purpose of uncovering parts thought to be dated, offensive or irrelevant. Thus as important rationale for a content analysis of textbooks is to improve the quality of the content conveyed by the schools to students.

While high-quality textbooks and learning materials are especially important for students, they may contain incorrect technology related information. For instance, many researchers have found that some textbook contain factually incorrect information. There is no up to date study of the quality of basic technology textbook used in Nigeria and the extent to which they enable students
to acquire the intended curricular contents. There is also a need to examine whether the technology textbooks are:

1. Easy to read
2. Easily comprehend
3. Help student develop a basic orientation to the technological world and describe a range of student activities.

For learning to be effective, it must be adapted to the cultural context of the learners (Sianjuna, 2008). One of the major educational resources required for teaching and learning of basic technology in Nigeria junior secondary school is quality textbooks (FGN, 2004). Basic technology requires the use of textbooks to achieve its objectives as enshrined in the National Policy on Education. A textbook according to Jones (2007) is a book that contains information about a subject that students study. Also, it is a book that students use regularly during a set of lessons, textbooks treat subject comprehensively and is used by student as a basis for study. To achieve the stated objectives of the subject of basic technology, students and teachers need comprehensive textbooks which will serve as a guide (FGN, 2004). In some junior secondary schools in Nigeria, they lack the recommended textbooks in such context, teachers teach either with their notes or end up without the use of any text. Well organized textbooks thus assist students to effectively comprehend the intended content of the subject (Okoro, 1999). Many teachers have access to inadequate or outdated resources. Poorly trained teachers are in a weak position to produce the teaching material they are expected
to deliver. Ogunyemi (2004) found that some basic technology textbooks lack the required content, science authors have not carried out a comprehensive review of a field before writing the textbook and some lack student-centered activities.

Adejumo (2007) in his research work on the Effect of Audio-photographic illustrations on Junior Secondary School student’s performance in Basic Technology also identified the problems of inadequate educational facilities; his findings revealed that urban students perform better than rural students because they have access to educational facilities which may not be readily come by in the rural area.

The poor status of Basic Technology as a core subject in the Junior Secondary School (JSS) classes has led to the drastic reduction in the enrolment of student for the subject. This would not have been the case if the subject has been given the same recognition as the other core subjects like English Language, Mathematics and Integrated Science.

However, some useful basic technology experiences can still be provided when equipment and textbooks are inadequate. This could be done by making available to the schools appropriate instructional media such as video tapes, instructional television and films, overhead transparency, slides and audio tapes. Appropriate provision of media would enhance effective implementation of basic technology programme in upper basic school because there is a long tradition among media experts that the use of some technology will improve learning. Instructional television in the form of broadcast or video programme can be used
to implement basic technology programmes since this subject is supposed to be taught with much emphasis on practical.

Onatola (2000) stated that the government policy on technical education is good but the preparation is far below expectation. For instance, preparation was not made in terms of infrastructure facilities, staffing, machinery, tools and the training materials. The effect of this was the state of inability to regularly enroll candidates for technical subjects in senior secondary school certificate examination and the students’ loss of interest in technical subjects.

The study carried out by Aleburu (2003) and Science Teachers Association of Nigeria identified the following as part of the problems that are confronting the effective teaching and learning of technology in education in Nigeria:

1. Lack of co-ordination of technology programmes.
2. Lack of facilities for teaching and learning at various levels of educational institutions. Many institutions do not have the required facilities such as machines and computers to effectively carry out the implementation of the goals in the curriculum.
3. Inadequate provision of the infrastructure needed.
4. Traditional methods of teaching are still adhered to in all educational institutions.
5. Poor funding
6. Overcrowded classrooms
7. Lack of proper planning during implementation has made the achievement of the set goals impossible

8. Incessant strikes in educational sectors

9. Wrong method of educational policy and

10. Lack of proper co-ordination of technology programmes

Fakomogbon (1997), Ibrahim and Gegele (2007) observed that imported equipment for teaching Basic Technology in mid 1980’s were not installed but rather they were earlier kept in stores or left outside. This eventually led to rusting as a result of misuse. They equally observed that much equipment cannot be operated without supply of electricity while most school in the cities and villages do not have electricity supply. Similarly, Ibrahim (2010) stated that there were no enough human and non human instructional resources for teaching basic technology in junior secondary schools in Ilorin. The curriculum objectives are obviously inadequate as they do no cover the broad range of objectives for prevocational studies. The content coverage for the three years appeared to be too broad and treated in dept for the levels of students. He also added that effective implementation of the Basic Technology curriculum is seriously constrained by lack of adequacy trained teachers. The researcher hopes that lasting solution will be employed to solve all these identified constraints. As a result of this, the teaching of technology will improve drastically. Furthermore, students are greatly motivated for subsequent learning activities. They become more interested and
willing to learn. Also, it provides opportunities for acquiring basic interpersonal ethnics generally. It broadens learners’ horizon of knowledge (Ajelabi, 2000).

**Appraisal of literature review**

The literature reviewed on this study would be on the following; Definition and Meaning of Infographics, Relevant of Instructional package to Teaching and Learning, Evaluation Models in Educational Technology, Meaning, objectives and content of junior secondary school basic technology and problems associated with the teaching and learning of basic technology.

The literature review on the meaning of infographics as the visual representation of information, data or knowledge intended to present complex information quickly and clearly (Doug, 2004). The objective and content of junior secondary school basic technology curriculum revaled the objectives of 9-3-4 system of education and its successful implementation in Nigeria School Curriculum reform which stated that the nation education goals include the development of physical, mental, social activities and acquisition of appropriate skill Federal Republic of Nigeria (2004) therefore, vocational training becomes a strategy for achieving the Federal Republic of Nigeria’s (2000) intention that Universal Basic Education (UBE) is to prepare the students for useful living within the society.

The literature review also gives an insight into the problems and prospect of problems associated with the teaching of basic technology in schools (Azeez, 2004). Teacher have been teaching the practical oriented subject using the
conventional classroom approach, lack of fund and inadequate trained technical manpower, over crowded curriculum, insufficient textbooks, no large classes, no laid down standard for assessing practical work by various examinations bodies, lack of facilities etc. Olarewaju (2003) observe that instructional materials or media play very significant roles in teaching and learning.

Literature was reviewed on Kirkpatrick four model of evaluation. The definition and various types of evaluation were reviewed. Kirkpatrick model enabled the researcher to be aware of the elements to be evaluated in any developed instructional product. The information gathered from the literature will assist in evaluating students’ reaction to developed infographics and the effectiveness of the instructional product to instruction delivery of Basic Technology in the Junior Secondary Schools.

Badimus (2013) developed and evaluated a WebQuest application on educational technology concepts for selected undergraduate students in Nigeria. Soetan (2008) designed video puppetry instructional package for teaching fine art in junior secondary schools. Fakomogbon (1997) developed captioned video tape for the hearing impaired students at the junior secondary school level.

This present study would involve designing and developing of infographics instructional package to teach basic technology in junior secondary school. The package will serve as an instructional material which will help teachers in basic technology to facilitate teaching and enhance effective communication to the students. Infographics will encourage student create their own graphics using a
variety of tools, encourages engagement in the classroom and a better understanding of the concept been taught. Teachers of basic technology will also gain insight on how they can package their learning resources for effective teaching and learning.
CHAPTER THREE

RESEARCH METHODOLOGY

This chapter is concerned with the research methodology that would be adapted in design and evaluation of infographics package on basic technology. The research methodology includes; Research type, sampling and sampling techniques, research instrument, validation of instrument, procedure for data collection and data analysis techniques.

Research Design

This is a pretest-posttest experimental research. Kirkpatrick 4 level evaluation model would be employed or used to evaluate the instructional package on Upper Basic school students’ performance in Basic Technology. The evaluation model will be limited to levels 1 and 2 of Kirkpatrick 4 level evaluation model i.e (reaction and learning). The package will be designed to teach Basic Technology in Junior Secondary School. The Dick and Carey (2005) version of “ADDIE” model is the type of Instructional System Design (ISD) model that would be adapted for use in developing and evaluating the package but the evaluation stage of the instructional design model will be substituted with the Kirkpatrick two levels of evaluation which is reaction and learning. The evaluation of the developed infographics utilizing Kirkpatrick model of evaluation would be tested using the pretest-posttest quasi experimental design to find out the difference in the students’ performance in Basic Technology. The study would adapt ADDIE model of instructional design. The stages of ISD include Analyses,
Design, Development, Implementation and Evaluation. An adapted Kirkpatrick evaluation model (reaction and learning) would be used to evaluate the effectiveness of the infographics.

**Sampling and Sampling Techniques.**

The target population for this study would be all the Junior Secondary School Students in Ilorin metropolis. The sampled population would be St Joseph Secondary School, Ilorin. The strategy of selection would be through purposive sampling technique. An intact class will be used for the experiment. St Joseph Secondary School, Ilorin would be purposively selected for this study for the following reasons:

1. The school has well-equipped computer laboratory that can be used for the study.
2. The students in the school are computer literate to access the infographics package by themselves.

Also, three educational technology experts, three subject matter experts, and two computer experts would validate the appropriateness and quality of the infographics instructional package.

**Research Instrument**

The instrument that would be used for this study are: the treatment instrument (infographics instructional package); educational technologist’s validation questionnaire; computer expert’s validation questionnaire; subject
content validation questionnaire; student’s response questionnaire and the pre-test and post-test.

**Questionnaire 1:** (Educational Technology validation questionnaire). The package instrument conforms to the educational technology standard. Experts would express their opinions about the structure, adaptivity, interactivity, navigation and screen design of the infographics instructional package and rate it accordingly. Necessary corrections recommended by the experts would be taken into consideration.

**Questionnaire 2:** (Computer Expert validation questionnaire). The package instrument conforms to the graphics designer’s standard.

**Questionnaire 3:** (Subject content validation questionnaire) The questionnaire would be designed and administered to three junior secondary school basic technology teachers to ascertain the adequacy of the content of the infographics with regard to the content of Nigerian Junior Secondary School basic technology curriculum. It contains ten questions with respondent’s ratings from poor to excellent.

**Questionnaire 4:** (Student Response Questionnaire). The questionnaire would be designed to determine the reaction based satisfaction level of students to infographics package for instruction. Responses include Strongly Agree, Agree, Disagree and Strongly Disagree.

The questionnaires would be designed by the researcher to gather necessary data for this study.
Validation and reliability of Research Instrument

As a means of ensuring that the research instrument achieves its target objectives, the instrument would be validated by three educational technology experts in the University of Ilorin to ascertain the extent at which the package conforms with educational technology standard, three subject content experts and two computer experts. A pilot study would be conducted to test the reliability of the research instrument in a place different from where the research work will be carried out.

Procedure for Data Collection

In order to administer the questionnaires on validation, the researcher will personally give out the instruments to all the experts that would be involved in the validation process. They include educational technology lecturers from University of Ilorin, Basic Technology teachers and students. The develop infographics would be shown to the experts to go through for their contributions, corrections, suggestions and recommendations. The scores obtained from the ratings of infographics would be used in making decisions about the quality of the package.

To test the students reaction (i.e attitude of students toward infographics) and the effectiveness of the infographics (Learning). The sample would be drawn from Junior Secondary School JSS 2 in Ilorin, where the students would be taught with the pretest and the posttest. An intact class would be used for the study. The pretest would be done in the first week and the lesson would be carried out by the researcher. The posttest would be conducted in the third week for the same set of
students. The research would look out for evaluation criteria like how easy or difficult the student learned using infographics instructional package. At the end of the pretest and posttest, questionnaire would be administered to the students and retrieved immediately they respond to it. The completed questionnaire will be collected immediately from the respondents for further analysis.

**Data Analysis Techniques**

Data Analysis would be carried out using descriptive statistic of frequency counts, mean scores and percentages, while the hypothesis would be tested using t-test statistic.
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APPENDIX I
DEPARTMENT OF EDUCATIONAL TECHNOLOGY
FACULTY OF EDUCATION
UNIVERSITY OF ILORIN, ILORIN, NIGERIA

Title: A Kirkpatrick Evaluation of Infographics Instructional Package on the Performance of Upper Basic School Students in Basic Technology

Target Audience: UBE 8

Dear Sir/ma

The purpose of this evaluation format is to validate the developed instructional material (infographics) on the performance of upper basic school students in basic technology.

Consequently upon the above, you have been selected to participate in the evaluation process. This is in respect of a master’s research being conducted in the Department of Educational Technology, University of Ilorin. All information collected will be used strictly for research purpose and would be treated confidentially.

Thank you

Tolorunleke, Emmanuel Adebayo

EXPERT EVALUATION FORM

SECTION A: BIODATA

1. Department of the Respondent…………………………………………………………..

2. Male or Female…………………………………………………………………………………

3. Educational Technologist Expert, Lecturer and Teacher……………………………...
4. Respondents Highest Qualification: (a) Doctorate Degree [ ] (b) Master’s Degree [ ] (c) Bachelor Degree [ ] (d) Others, Please Specify

SECTION B:

**Instruction:** Please read each statement carefully and give your ratings to each category of the development under the column against each statement from 1 to 5 i.e from (1) Poor, (2) Fair, (3) Good, (4) Very Good and (5) Excellent.

<table>
<thead>
<tr>
<th>SELECTION CRITERIA OBJECTIVE</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>SECTION A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EXPERTS</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Evaluation of the content</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1   The content is reliable</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>2   Balanced presentation of information</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>3   Bias-free viewpoints and images</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4   Correct use of grammar</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5   Current and error free information</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6   Concepts and vocabulary relevant to learners abilities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7   Information relevant to age group curriculum</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Structure</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8   The content is structured in a clear and understandable manner</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9   The structure of the package permits learners to advance, review, see examples and repeat the unit or escape to explore another unit.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adaptivity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10  The package encourages discussion and collaboration among learners</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The package contains assignment that can be executed by a group of learners.

The package facilitates learning by doing.

The package promotes collaborating learning.

### Design Factors

#### Interactivity

The interactivity of the package is according to the maturity of the students.

The package provides opportunities for interaction at least every three or four screens/frame.

The package asks students to apply what they have learnt rather than memorise it.

The package uses rhetorical questions during instruction to get students to think the content.

The package allows learners to discover information through active exploration.

#### Navigation

Help key to get procedural information

Glossary key for seeing the definition of any term

Menu key for returning to the main page

#### Feedback

The package provides feedback immediately after a response.

The placement of feedback is varied according to the level of objectives. (provide feedback after each response for lower level objectives, and at the end of the session for the higher level ones)

The package provides feedback to verify the correctness of a response

#### Screen Design

Screens are designed in a clear and understandable
The presentation of information can captivate the attention of students

The design does not overload students memory

The use of text follows the principles of readability

The color of the text follows the principles of readability

The number of colors in each screen is no more than six

There is consistency in the functional use of colours

The quality of the text, images and graphics is good

Presented pictures are relevant to the information included in the text.

A high contrast between graphics and background is retained.

The integration of presentation means is well coordinated

**Technical support and update process**

The content has durability over time

The content can be updated and/ or modified with new knowledge that will appear soon after the development of package

The package can be used in different platforms

Thanks.

Comment..................................................................................................................................................

..........................................................................................................................................................

Overall grade:..................................................Date:.................................
APPENDIX II

DEPARTMENT OF EDUCATIONAL TECHNOLOGY

FACULTY OF EDUCATION

UNIVERSITY OF ILORIN, ILORIN, NIGERIA

COMPUTER EXPERTS QUESTIONNAIRE

SECTION A: BIODATA

1. Name of School: ............................................................................................................

2. Male or Female............................................................................................................

SECTION B:

Instruction: Please read each statement carefully and give your ratings to each category of the development under the column against each statement from 1 to 5 i.e from (1)Poor, (2)Fair, (3)Good, (4)V. Good and (5)Excellent.

<table>
<thead>
<tr>
<th>Components</th>
<th>Ratings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Help key to get procedural information</td>
<td></td>
</tr>
<tr>
<td>2 Answer key for answering a question</td>
<td></td>
</tr>
<tr>
<td>3 Glossary key for seeing the definition of any term</td>
<td></td>
</tr>
<tr>
<td>4 Objective key for reviewing the course’s objectives</td>
<td></td>
</tr>
<tr>
<td>5 Content map key for seeing a list of options available</td>
<td></td>
</tr>
<tr>
<td>6 Summary and review key for reviewing whole or</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>7</td>
<td>Menu key for returning to the main page</td>
</tr>
<tr>
<td>8</td>
<td>Exit key, for exiting the program</td>
</tr>
<tr>
<td>9</td>
<td>Comment key for recording a learners comment</td>
</tr>
<tr>
<td>10</td>
<td>Example key for seeing examples of an idea</td>
</tr>
<tr>
<td>11</td>
<td>Key for moving forward or backward in a lesson</td>
</tr>
<tr>
<td>12</td>
<td>Key for accessing the next lesson in a sequence</td>
</tr>
<tr>
<td>13</td>
<td>The package considers the individual differences of the learners</td>
</tr>
<tr>
<td>14</td>
<td>The package considers the different learning styles and experience</td>
</tr>
<tr>
<td>15</td>
<td>The package facilitates learning by doing</td>
</tr>
<tr>
<td>16</td>
<td>The packages promotes collaborating learning</td>
</tr>
<tr>
<td>17</td>
<td>There are instructions for the installation and use of the package</td>
</tr>
<tr>
<td>18</td>
<td>The package can be used in different platforms</td>
</tr>
<tr>
<td>19</td>
<td>The updating, modifying and adding procedures are relatively easy for the average user.</td>
</tr>
</tbody>
</table>

Thanks.

Comment:……………………………………………………………………………………………

Overall grade:…………………………………………Date:…………………………
TEACHER EVALUATION FORM

Target Audience: UBE 8

Title: A Kirkpatrick Evaluation of Infographics Instructional Package on the Performance of Upper Basic School Students in Basic Technology

Dear Sir/ma

The purpose of this evaluation format is to validate the developed instructional material (infographics) on the performance of upper basic school students in basic technology.

Consequently upon the above, you have been selected to participate in the evaluation process. This is in respect of a master’s research being conducted in the Department of Educational Technology, University of Ilorin. All information collected will be used strictly for research purpose and would be treated confidentially.

Thank you

Tolorunleke, Emmanuel Adebayo

SECTION A: BIODATA

1. Name of School: 

2. Male or Female: 

SECTION B:

**Instruction:** Please read each statement carefully and give your ratings to each category of the development under the column against each statement from 1 to 5 i.e from (1) Poor, (2) Fair, (3) Good, (4) V. Good and (5) Excellent.

<table>
<thead>
<tr>
<th>SUBJECT CONTENT</th>
<th>Ratings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>1 Objectives are clearly stated and relevant to the concept.</td>
<td></td>
</tr>
<tr>
<td>2 Content of the instructional package match the objective</td>
<td></td>
</tr>
<tr>
<td>3 Presentation leads to acquisition of knowledge sought for.</td>
<td></td>
</tr>
<tr>
<td>4 Content is up to date and effective for learning.</td>
<td></td>
</tr>
<tr>
<td>5 Adequate and relevant content to intended learning outcome.</td>
<td></td>
</tr>
<tr>
<td>6 Relevant to JSS curriculum needs</td>
<td></td>
</tr>
<tr>
<td>7 Design of the package is based on reliable learning and instructional theories and is directly related with the content of the curriculum.</td>
<td></td>
</tr>
<tr>
<td>8 The application of the package is possible in various</td>
<td></td>
</tr>
<tr>
<td></td>
<td>topics in the curriculum</td>
</tr>
<tr>
<td>---</td>
<td>-----------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>9</td>
<td>The application of the package is possible on issues related with the curriculum</td>
</tr>
<tr>
<td>10</td>
<td>The package can be used by learners alone, without the need of other instructional objects (i.e. book)</td>
</tr>
</tbody>
</table>

Thanks.

Comment: ........................................................................................................

........................................................................................................

........................................................................................................

Overall grade: ........................................... Date: ...............................
APPENDIX IV

DEPARTMENT OF EDUCATIONAL TECHNOLOGY

FACULTY OF EDUCATION

UNIVERSITY OF ILORIN, ILORIN, NIGERIA

QUESTIONNAIRE ON STUDENTS’ ATTITUDE TOWARDS
INFOGRAPHICS INSTRUCTIONAL PACKAGE

STUDENTS RESPONSE QUESTIONNAIRE

SECTION A: BIO DATA

Name of School: ..............................................................................................................

School Location: ...........................................................................................................

Class: ............................................................................................................................

Gender: Male [ ] Female [ ]

Key:

SA = Strongly Agree

A = Agree

D = Disagree

SD = Strongly Disagree
SECTION B:

**Instruction:** Please read each statement and give your opinion by ticking (√) the appropriate column against each statement. There are four opinions ranking from Strongly Agree, Agree, Disagree and Strongly Disagree.

<table>
<thead>
<tr>
<th>S/NO</th>
<th>ITEM</th>
<th>SA</th>
<th>A</th>
<th>D</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I am aware of infographics instructional package beforehand</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Every expectation I have for this lesson has been exceeded?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Have you been able to learn using infographics instructional material</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>I am eager to take more courses through the use of infographics instructional material</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>I find the content of this lesson interesting</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Do you actually learn using infographics instructional package</td>
<td></td>
<td></td>
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<tr>
<td>7</td>
<td>I spent some time of the time looking at the material not related to</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>The infographics instructional material provide little opportunity for learning</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>9</td>
<td>The content in the lessons had not met the standard compared to textbooks</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>My feelings about the infographics instructional package in this lesson are positive.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>As a participant in the activities I found that I want to do more</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Thanks.

Comment: …………………………………………………………………………………

……………………………………………………………………………………

……………………………………………………………………………………

Overall grade: ………………………………………Date: …………………

81
APPENDIX V

STUDENT ASSESSMENT TESTS ON INFOGRAPHICS AS AN INSTRUCTIONAL MATERIAL IN UPPER BASIC SCHOOL.

Time Allowed: 30min

Instruction: Answer all questions

1. A machine that is intended to process wood is called
   (a) Drill Machine (b) Scroll Machine (c) Woodwork machine (d) Sanders Machine

2. Woodworking machines can be divided into how many parts
   (a) 4  (b) 7  (c) 2  (d) 3

3. Which type of machine is stationed while the material or wood are moved over the machine
   (a) Handheld Power tools  (b) Stationary machine (c) Drill machines (d) Spindle Moulder machine

4. Which type of machine is moved over the material or wood for processing
   (a) Handheld Power tools  (b) Spindle Moulder machine (c) Drill machines (d) Stationary machine
5. Which tools are fitted with attachments which can be used to drill holes in different materials

(a) Sanders (b) Drill Machine (c) Bandsaw (d) Bench Grinders

6. A saw that is small electric of pedal operated saw useful for cutting intricate parts in cases where a jigsaw or coping saw is not appropriate is called

(a) Power Milter Saw (b) Panel Saw (c) Scroll Saw (d) Bandsaw

7. A ____________ is a type of bench top grinding machine used to drive abrasive wheels

(a) Drill (b) Bandsaw (c) Scroll Saw (d) Bench Grinder

8. A ______________ is a power tool which uses a blade consisting of a continuous band of metal with teeth along one edge to cut various work pieces.

(a) Bench Grinder (b) Bandsaw (c) Drill (d) Scroll Saw

9. A saw used by cabinets shops to easily cut panels, solid woods, profiles, plywood, laminates and plastics into sizes or cabinet components is called

(a) Panel Saw (b) Bench Grinder (c) Drill (d) Scroll Saw
10. A power tool used to make a quick accurate crosscut in a work piece at a selected angle is called

   (a) Spindle Moulder (b) Power Miter Saw (c) Panel Saw (d) Bench Grinder

11. A ________ is a type of tools used to drive nails into wood or some other types of materials

   (a) Biscuit joiner (b) Nail Gun (c) Nail Gum (d) Hammer

12. A ______ is a type of saw in which the cutting action is achieved a pull and push motion of the blade

   (a) Nail Gun (b) Reciprocating Saw (c) Recipro Saw (d) Saw

13. A portable machine saw powered by electricity which can be used for tree felling, limbing, bucking and pruning is called

   (a) Reciprocating Saw (b) Chain Saw (c) Saw (d) Hard Saw

14. A handheld power tool that can be used with a variety of rotating accessories and attachments which can be used for cutting, polishing and sanding is called

   (a) Rotary tool (b) Rotate tools (c) Hand held sanders (d) Sanders

15. A power tool used to smooth surfaces by abrasion with sandpaper is called

   (a) Sandpaper machine (b) Abrasion machine (c) Sanders machine (d) Drill