EFFECTS OF KAHOOT GAME SUPPORTED INSTRUCTION ON ACHIEVEMENT, RETENTION AND INTEREST IN BASIC TECHNOLOGY AMONG SECONDARY SCHOOL STUDENTS IN MINNA, NIGER STATE

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ABSTRACT

This study assessed Effects of Kahoot Game Supported Instruction on Achievement, Retention and Interest in Basic Technology among Secondary School students in Minna, Niger State. The study adopted quasi-experimental research design. A purposive sampling technique was used to select 438 students that constituted the sample of this study. The researcher designed an Achievement, Retention test and Student Interest inventory questionnaire that were used for data collection. The instruments used were subjected to validation and reliability checks. They were administered once using KR21 and Cronbach Alpha formula were used to determine the internal consistency of the items. Reliability coefficients of 0.87 and 0.78 were respectively obtained. Nine research questions were raised, and nine corresponding null hypotheses were formulated and tested at 0.05 alpha level of significance. Data gathered were analysed using Mean, Standard Deviation and Analysis of Variance (ANOVA) as well as Independent T-test formula. The post test mean score for student achievement in research question is 27.44, 29.44 and 29.07 for lecture method, individual-play and group-play kahoot respectively. Similarly the findings unveiled the male and female mean achievement score of 29.22 and 29.56 respectively for student taught basic technology through individual-play kahoot. The p-values obtained from the analyses hypotheses with P = 0.00 hence significant difference exits among the three groups of individual-play kahoot, game-play kahoot and lecture method. Also, P = 0.403 hence, significant difference exists in the mean achievement scores of male and female students taught basic technology. The results reveals that a significant difference exist in the achievement, retention and interest of students when taught basic technology through individual-play kahoot, group-play kahoot and lecture method. Also, a significant difference in the gender achievement and interest was reported but there was no significant difference in their retention. Based on the findings, it was recommended that application of kahoot should be incorporated in teaching basic technology in secondary schools. Serving teachers should be trained on the use of Kahoot in teaching Basic Technology to motivate students' interest, improve their achievement and retention. The use of Kahoot should be introduced in teachers training, workshops, seminars and other training programmes. Technological and non-technological teacher training institutions should adopt kahoot as an instructional technique to enhance effective classroom interaction and presentation of Basic Technology.

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CHAPTER ONE

1.0 INTRODUCTION

1.1 Background to the Study

Technological knowledge is paramount in the 21st century. Technology education holds the potency of making individuals or group to relate knowledge of technology to everyday problem being encountered and therefore develops the individual's to a level of being intellectually and economically stable. The rapid increase in the availability and affordability of interactive technologies have contributed to the adoption of games in instructional science and higher education teaching to foster collaborative learning, exploration and discovery (Licorish *et al.,* 2018). Students are eager to experiment with different technologies to support their learning, largely because they are skilled in the use of mobile technology and enjoy using applications and games designed for such devices (Roehl *et al.,* 2013). Educational games and game-based Applications (GA; gamification techniques integrated into student response systems) both increase student achievement and retention of technological concepts (Wang & Lieberoth 2016), especially in circumstances where conventional lecture style or "chalk and talk" teaching are resented by students and induce boredom (Cheong *et al*., 2013; Graham,, 2015; Roehl *et al*., 2013).

In order to eradicate boredom in teaching and learning of Basic Technology concepts, educational games and gamification elements are required to stimulate students response systems (SRSs) in mid to large lectures, leading to the development of Game Applications (Plump & LaRosa, 2017). Although the gamification process is not new in education, the technologies that are supporting these interventions have been evolving, from single use to collaborative and distributed contexts (Holmes & Gee, 2016). Thus,

this study will focus more specifically on the role of gamification on student academic achievement, retention and interest of basic technology concepts.

Early use of gamification elements in education appeared to improve student response systems (SRSs), with promising outcomes, but limited impact on engagement and motivation (Wang, 2015). SRSs are frequently used to display multiple-choice questions to offer opportunities for students to interactively answer quizzes in classrooms as part of a formative assessment regime (Sellar, 2011). However, Kay and LeSage (2009) pointed out that the key challenges relating to the use of these technologies include the time needed to learn and set up these technologies, creating appropriate content, and providing students with useful and timely feedback. With the wide spread use of gamification in the learning environment, there has been a noticeable shift from student response systems such as "iClicker" and "Poll Everywhere" to more contemporary game-based Application (GA) such as Kahoot & Socrative (Wang, 2015; Plump & LaRosa, 2017).

Kahoot is an example of a gamification approach that makes use of game principles and student response systems tools to support learning achievements, motivation, retention, interest and fun during the learning process. Kahoot is a free online game based learning tool that makes learning FUN (enjoyable). It is an extremely useful educational technology tool that requires minimum technical expertise for creating quiz, surveys and discussions. It can be used for learners of all ages and for all subjects. Currently this platform offers 41 languages to create exciting and engaging learning experiences.

The quiz is usually created by the educator/trainer and the students make use of devices such as computers, laptops, tablets or smartphones, to respond to the quiz. It is a synchronous type of interaction where the questions are displayed on teacher's screen

and students have to reply using their devices. Teachers can use readymade Kahoots that have been created by others. Students then have the capability to answer questions through a variety of devices and using colours and shapes to connect to the answer. The website even tracks student achievement by looking at what the student did during the Kahoot, as well as overall achievement while logged in. The goal for the students is to answer the correct answer as fast as possible to get as many points as possible. The use of kahoot in the form of gamification requires participants to activate prior knowledge and assess their performance as they play and learn the content of a subject (Méndez & Slisko, 2013; Plump & LaRosa, 2017). Kahoot enhance students' attention, learning achievements, motivation, retention and enjoyment beyond traditional methods (Barrio, *et al*. 2016; Wang & Lieberoth, 2016). They also promote autonomy in learning as students can operate Kahoot on their mobile devices. Similar to earlier interventions involving SRSs, Kahoot improves overall class attendance (Cardwell, 2007; Kay & LeSage, 2009), but at an individual level, they also motivate students who may not normally participate in class discussion (Wang, 2015). However kahoot can be played individually (challenge) or in group (live Host). Furthermore, lecturers found GA to be useful teaching tools in supporting personalisation of learning (Wang, 2015). Thus, teachers have been encouraged to incorporate gamification into their classroom environments.

The potential effectiveness of GA may be understood through Poon's (2013) model of meaningful learning, which distinguishes between students' deep and surface learning approaches. The model conceptualises learning as a process in which teachers select meaningful material for students based on their existing knowledge. Next, teachers encourage students to engage in deeper learning rather than rote memorising, which occurs during GA use. This requires student to experiment, reflect and evaluate

knowledge and receive feedback through the follow-up (post-game) discussions. Students who have been taught through deep learning strategies (such as GSRS use) become highly engaged and, as a result, are able to apply their deep learning strategies to their study practices. For example, by relating course information to everyday behaviours and their own experiences, and through detailed explanation of the lecture content. In contrast, when lecturers promote shallow learning strategies and rote memorization strategies (associated with conventional, didactic teaching), their students are more likely to be disengaged and are less likely to have the "tools" and strategies they need for deep learning (Exeter, *et al*. 2010). This theoretical model suggests that because GSRS promotes greater involvement of learners, learning may increase beyond what would be expected from traditional methods.

To understand the potential effectiveness of GA as learning tools, a study by Oyarinde (2019) generalized from game-based learning models, namely the Experiential Gaming Model which is similar to Jui-Mei *et al.* (2011) model of meaningful learning, this model posits that students learn through direct experience and reflective observation, which, in turn, induces experiences of "flow", characterized by (but not limited to) concentration and complete absorption as long as the task difficulty is set above that of the students' skill level (Ismail & Mohammed, 2017), and the interfaces are user-friendly and do not detract attention from the task (Leaning, 2015). More specifically, students are presented with challenges that require completion based on clear goals. They engage in the generation and testing of ideas during problem-solving, with a process monitored through feedback. Students then use the feedback to reflect on successful verses unsuccessful problem-solving strategies, and form schemas about how knowledge can be used in the future. Because GSRSs lack the game-play simulation, students are unlikely to experience some characteristics of flow (e.g. complete

absorption and loss of self-consciousness); however, "game play" is not vital for this experiential learning process to occur as other learning platforms such as computer-based tutors also promote reflection on feedback and knowledge consolidation (Becker, 2014; Baker *et al*., 2010). Indeed, GSRSs facilitate the key experiential components of flow: challenges, clear goals, real-time feedback and playfulness Kay & LeSage, (2009); Plump & LaRosa, (2017), which increase concentration and sense of control and create the optimal learning environment.

Kahoot allows teachers to control learning environment and draw on course content to construct quizzes in which students participate as players in a "game-show" (Wang, 2015), thus integrating gamification principles (e.g. audio and a score board with a points system) into an informal assessment procedure. Plump and LaRosa, (2017) found that Kahoot was easy for teachers to use in their classroom and required no prior training to implement. For instance, teachers can easily utilise Kahoot to project quiz questions as regular lecture slides to which students respond using a web browser on their digital devices. Quizzes can be enhanced with images and videos, and the teacher is able to control the pace of play. Students are awarded points for answering questions correctly, and the timeliness of correct responses also impacts the points awarded. Displaying students' points on the screen motivates students to get to the top of the leader board. Kahoot, like other GA, fosters content interest, achievement and retention Barrio, *et al*. (2016); Wang and Lieberoth, (2016) and improves classroom dynamics as the system provides students with real-time feedback of their performance, and to some extent adapt teaching activities based on students' responses to quizzes (Plump & LaRosa, 2017). Moreover, the anonymous aspect of Kahoot also implies that students' privacy is not easily compromised. In addition, since Kahoot incorporates social media, it enables students to create, share and exchange content with others in the class, and

hence, fosters a sense of community (Wang, 2015). Further, time constraints are minimal as Kahoot collates and aggregates individual responses to questions within minutes. Therefore, teachers can focus on designing questions, administering the quiz, and, afterwards, facilitating discussion about the (in) correct responses.

The designed questions and administration of the quiz does not change gamification ("game-show") process of Kahoot, rather may increase teachers' concerns over student boredom. However, unlike other computer-mediated learning tools and games, the questions and problem-solving strategies vary with each Kahoot usage based on the students' needs. Therefore, Kahoot was chosen GSRS on which to explore the way such tools impact students' achievement, retention and interest. However, despite strong evidence that Kahoot and other GA increase student interest, achievement and retention, it remains unclear whether Kahoot leads to greater learning outcomes than traditional methods (Méndez & Slisko, 2013; Plump & LaRosa, 2017). Also, which method of playing kahoot produce greater outcome on students' achievement, retention and interest in Basic Technology Concepts.

Kpolovie (2017) defined achievement as a psychological test which measures learners' cognitive and intellectual traits. The result of this test is very crucial in the academic decision making by the teacher concerning learners because it helps the teacher and guardian to ascertain the progress of the learners. Academic achievement as described by Lipi, (2013) is a college point average and the success of both teachers and students. It points to excellence in all academic discipline as well as the attainment of educational goals measured by standardized test scores. Academic achievement measures the extent to which students fails or succeed in a given cognitive academic task. Anyichie & Onyedike (2012) in a study stated that academic achievement is the ability of the learner to attain its set educational goal within the specific duration of the programme. They

tested the effect of self-instructional learning strategy on secondary school students' academic performance in solving world problems in Nigeria. The study indicated a significant main effect of treatment on the student's world problem of performance. The findings revealed that students' academic achievement depends on the instructional approach used by the instructors in content delivery and student interest.

Interest could be defined as the focusing of the sense organs on or giving attention to some person, activity, situation or object. It is an outcome of experience rather than gift. It could either result or cause motivation. It could also be regarded as a pre-determinant of one's perceptions that is, what aspect of the world one is mostly likely to see always (Essien *et al.,* 2015). It could also be viewed as a condition in which an individual associates the essence of certain things or situation with his needs or wants. Essien *et al.* (2015) maintained that one's interest is enkindled or killed through participation, experience, familiarity, study and work. It is what one perceives in these engagements that shapes interest as well as foster retention.

The definition of retention in educational settings "refers to the act of keeping, holding, or ability to remember things particularly in basic technology. Retention is the ability to memorise and reproduce the learnt materials when the need arises. Retention is the ability to respond to a new stimulus using the previously learnt responses. James (2011) showed that retention was an act where "some students persist and graduate, and others do not". By contrast, student success occurs when students enter into high school, college, and university, and are able to complete the programmes through either personal intrinsic motivation, school organized advising interventions, tutoring programs, or counseling (Kim, *et al*., 2010). Retention plays a pertinent role when it comes to the effective or correct application of whatever a pupil or student has learnt. This is because a student retrieves the information he/she has retained in his/her

memory when the need arises (may be during a test or examination). So what has been learnt and assimilated by the students can be measured by their ability to answer questions given to them in either test or examination.

1.2 Statement of the Research Problem

The trend of gamification as instructional strategy is not in use in Nigeria education system of teaching and learning especially in basic technology. This could be due to the lack of resources, facilities or information on the utilization of game-based learning. Learners' achievement according Niger State Ministry of Education JSSCE result (2017/2018) had been relatively poor due to the lack of interest and weak learners retention of the concepts because of the use of the age long method of teaching (lecture Method). The researcher therefore thought of a way to reconcile the effective participation of both the teacher and learners of basic technology in order to produce greater achievement, retention and interest. The researcher then adopts the use of kahoot platform to create quiz and discussions that will be used to teach basic technology concepts. This study however, investigates the effects of Kahoot game supported instruction on achievement, retention and interest in basic technology among secondary school students in Minna, Niger State.

1.3 Aim and Objectives of the Study

The purpose of this study is to determine the effects of Kahoot game supported instruction on achievement, retention and interest in basic technology among secondary school students in Minna, Niger State. Specifically, the study tends to:

1. Determine students' achievement when taught using individual-play Kahoot, group-play Kahoot and lecture method in Basic Technology Concepts.

2. Examine male and female students' achievements when taught Basic Technology using individual-play Kahoot.
3. Determine male and female students' achievements when taught Basic Technology using group-play Kahoot.
4. Find the effects of individual-play Kahoot, group-play Kahoot and lecture method on students' retention in Basic Technology Concepts.
5. Investigate male and female students' retention when taught Basic Technology using individual-play Kahoot.
6. Determine male and female students' retention when taught Basic Technology using group-play Kahoot.
7. Determine the effects of individual-play Kahoot, group-play Kahoot and lecture method on students' interest in Basic Technology Concepts
8. Investigate male and female students' interest when taught Basic Technology using individual-play Kahoot.
9. Examine male and female students' retention when taught Basic Technology using group-play Kahoot.

1.4 Research Questions

The study will attempt to answer the following research questions:

1. What is the difference in the mean achievement score of students taught Basic Technology using individual-play Kahoot, group-play Kahoot and lecture method?
2. Is there any gender influence in the mean achievement score of male and female students taught Basic Technology using individual-play Kahoot?
3. Does group-play Kahoot have any influence in the mean achievement score of male and female student's taught Basic Technology?

4. Is there any difference in the mean retention score of students taught Basic Technology using individual-play Kahoot, group-play Kahoot and lecture method?
5. Is there any influence of gender in the mean retention score of male and female student's taught Basic Technology using individual-play Kahoot?
6. Does group-play Kahoot have any influence in the mean retention score of male and female students taught Basic Technology?
7. Is there any difference in the mean interest responses of student's taught Basic Technology using individual-play Kahoot, group-play Kahoot and lecture method?
8. Is there any gender influence in the mean interest responses of male and female student's taught Basic Technology using individual-play Kahoot?
9. Does group-play Kahoot have any influence in the mean interest responses of male and female student's taught Basic Technology?

1.5 Research Hypotheses

The following Null Hypotheses are tested at 0.05 level of significance.

Ho_1: There is no significant difference in the mean achievement score of student's taught Basic Technology using individual-play Kahoot, group-play Kahoot and lecture method?

Ho_2: Gender has no significant influence on student's achievements in Basic Technology when taught using individual-play Kahoot.

Ho_3: Gender has no significant influence on student's achievements in Basic Technology when taught using group-play Kahoot.

Ho_4: There is no significant difference in the mean retention score of student's taught Basic Technology through individual-play Kahoot, group-play Kahoot and lecture method.

Ho_5: Gender has no significant influence on students' retention in Basic Technology when taught using individual-play Kahoot.

Ho_6: Gender has no significant influence on students' retention in Basic Technology when taught using group-play Kahoot.

Ho_7: There is no significant difference in the mean interest responses of students' taught Basic Technology through individual-play Kahoot, group-play Kahoot and lecture method.

Ho_8: Gender has no significant influence on student's interest in Basic Technology when taught using individual-play Kahoot.

Ho_9: Gender has no significant influence on student's interest in Basic Technology when taught using group-play Kahoot.

1.6 Significance of the Study

This study is of immense benefit to various stakeholders relating to the field of education, which include students, teachers, lecturers, specialized institution of technology, parents/guidance, curriculum planers & evaluation bodies of technology, secondary education policies makers and the government:

The students of secondary schools offering Basic Technology, as the study will motivate their interest in the subject which will improving their academic achievements and retentions of Basic Technology Concepts, when the teacher employs either individual-play or group-play kahoot in his teaching of this subject matter.

Secondary school teachers of Basic Technology, to assist them in teaching Basic Technology Concepts easily, efficiently, effectively and funfully. The study will also help them to innovate in their teaching methods thereby improving learners' achievement, retention and interest against all odds.

Lecturers to adopt as instructional strategy that allow learners to learn by having fun

Specialist of Institutions of Technology, to improve in the planning, modify and inculcate kahoot as a methods of teaching Basic Technology Concepts.

Parents/guardian help to educate them on the advantage of the use of Kahoot thereby encouraging their children/wards of the use of Kahoot game since most kids are addicted to game in order to motivate their interests and improve achievements and retentions of Basic Technology Concepts. This will also lead them to encourage the schools to purchase basic facilities that will facilitate effective teaching and learning of informative teaching in schools. The study could motivate parents to offer financial assistance to school where the need arises as well as provide their words with mobile technologies for educational purposes.

Curriculum planners and evaluation bodies of Technology to in-cooperate Gamification/Game-based method of teaching especially kahoot into the system of education to improve learners' motivation, interest, achievement and retention.

The study will also help the secondary education policies makers to understand the importance of allowing the use of mobile technologies in schools for educational purposes, because it can be used for educational games, learning management system (LMS) and search information on other learning platforms.

The government, as the study will help to improve Technology Education thereby improving the Technological skills that will positively affect the Nation's economy. The

study will further help the government to realize the need to make provision for projectors and other information and communication technology ICT facilities especially the internet to facilitate electronics teaching and learning which is the trending and innovative teaching and learning avenue around the globe.

1.7 Scope of the Study

The study investigates the effects of Kahoot game supported instruction achievement, retention and interest in basic technology among secondary school students in Minna. The study was delimited to Juniour secondary schools in Minna where Basic Technology is taught. The class used is junior secondary two (J. S. 2) students and the selected topic is "Properties and processing of materials" which was extracted from the J. S. 1 & 2 scheme of work. The reason for choosing this topic was because its complex (Niger State Ministry of Education). The independent variables are individual-play and group-play Kahoot game while the dependent variables are Achievements, Retention and interest, the moderating variable is Gender. The study lasted for six weeks.

1.8 Operational Definition of Terms

Gamification: is the application of game-design elements and game principles in non-game contexts when learning basic technology. It is also the use of game-based thinking and game-related functions to help users solve problems and to draw their interest in basic technology.

Game-based learning: is a type of game play which defined learning outcomes in Basic Technology.

Kahoot: is a free internet-based game learning tool that makes learning FUN (i.e exciting). It is an extremely useful educational technology tool that requires minimum

technical expertise for creating quiz, surveys and discussions. It can be used for learners of all ages and for all subjects with basic technology inclusive.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Conceptual Frame-work

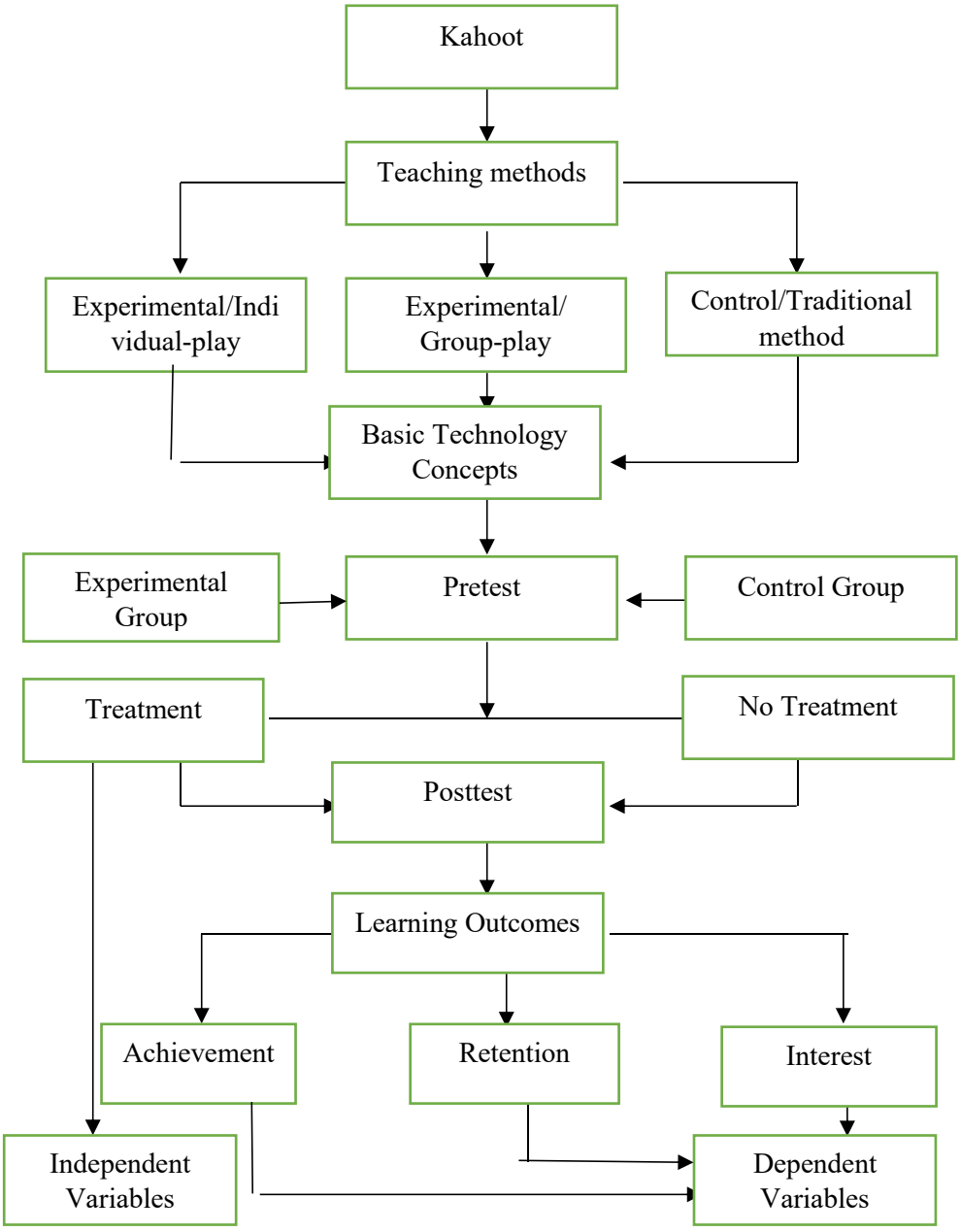

Table 2.1: diagrammatic representation of the major concepts.

In the diagram above, the main independent variable Individual-play and Group-play Kahoot Teaching Methods. These Kahoots developed are used to find its effect on students' academic achievement, retention and interest in Basic Technology. The

methods involved the experimental/innovative methods and control/traditional method. These methods have been applied in the studies by the researcher. The experimental groups received treatment by being taught using the Individual-play Kahoot and Group-play Kahoot (independent variables) while the control group received no experimental treatment as they were taught using traditional method during the study. Both groups were subjected to pretest before commencement of the treatment to get their base line academic level. Both groups were also subjected to post-test after the period of teaching. From the post-test results of the three groups, learning outcomes were obtained regarding their achievement, retention and interest which are the dependent variables.

2.1.1 Information and communication technology in nigerian educational system

Information and Communication Technology (ICT) is defined as computer instruments used by people to work with the information and using technology to process the needs of an organization. It includes both hardware and software computer components and several other devices such as audio, audiovisuals, visuals, video, photography, camera and so on that convert information into common digital form. Onuma, (2007), stated that ICTs are wide range of technologies that is enabled by electronic means in the acquisition, storage, process, transmission and dissemination of information in form of text, voice, graphics and video.

Education can be define as a teaching-learning process between the teacher and the learner in a conducive environment in which knowledge is gained and such knowledge brings about change in learners behavior. Babafemi (2007) described education as the totality of life experiences that people acquire over time which equip them in order to survive and get satisfied when living in the world. The use of ICT enhances an interactive learning environment which translates teaching and learning process to such that learners can interact with knowledge medium in an active and constructive way

(Yusuf, 2005). National Policy on Education mission statement recognized the need to use ICT for education by: empowering students with information and technology skills needed for global competitiveness, integrating ICT into the mainstream of education and training, establishing new technology institutions (FRN, 2009).The evolution of Information and Communication Technology (ICT) and the Internet has been the (enabler) driving force behind new mode of teaching and learning which has transforms the entire educational landscape and altered the educational equation in a fundamental ways (Aduwa-Ogiegbaen, 2013). ICT is therefore an important instrument in supporting and creating new ways of teaching and learning thereby developing students' skills of cooperation, communication, problem solving and life-long learning. ICT integration is the amalgamation of ICTs into the whole school structure of the school system. As Karadeniz, *et al* (2007) stated, integration of ICT means using ICT effectively and efficiently in all dimensions including necessary infrastructure, teaching programs and teaching-learning program.

The national goals as stated on National Policy on education (FRN, 2009) are building of:

1. A free and democratic society,
2. A just and egalitarian society,
3. A united, strong and self-reliant nation,
4. A great and dynamic economy,
5. A land full of bright opportunities for all citizens.

The philosophy of Nigeria on education is based on: fully integrating an individual into the community, developing an individual into a sound and effective citizen, and provision of equal access to educational opportunities for all citizens at primary, secondary and tertiary levels. In other for the philosophy to be in harmony with Nigeria's national goals, education has to be channeled towards national consciousness,

national unity, self-realization, individual and national efficiency, better human relationship, effective citizenship, as well as economic, social, cultural, political, scientific and technological progress (FRN, 2009).

The Federal Republic of Nigeria (2009) in its National Policy on Education adopted education as a significant tool for national integration, socioeconomic development and technological growth therefore ICT innovations is important in harmonizing National Policy on Education with Nigeria's national goals and also to improving the quality of education offered to students in general who are in and graduating from Nigerian schools. This fact is based on the truth that ICT tools, if utilized well, will help to enhance and maintain the quality of education by making new ways of acquiring and disseminating knowledge, teaching and learning, achievement and retention of basic skills.

2.1.2 Concept of basic / introductory technology

Technology is the process by which humans modify nature to meet their needs and wants. Technology according Otamba, (2013) is the use of the product of creativity, inventions and scientific research in the service of man. To achieve these, Government of Nigeria introduced technology into the school curriculum for children to learn. Technology is an integration of components of woodwork, metalwork, basic electronics, applied electricity, water flow technology, airflow technology, food preservatives, automobile, technical drawing, physics, rubber technology, chemistry, plastics, basic building technology, and ceramics. Technology gives opportunities to students to use tools and machines, which are used in the industrial processes. This helps to develop good attitudes towards technology and the industry. Technology which is the only core subject among the prevocational subjects of the Junior Secondary Schools in Nigeria, involves the academic and practical study of materials, and sources of energy with the

ultimate intention of applying knowledge from the study to provide a comfortable environment for man. This study of Technology helps also to reduce ignorance about technology. The subject has three main objectives as stated by Federal Republic of Nigeria (Federal Ministry of Education, 1985):

1. To provide pre-vocational orientation for further training in technology;
2. To provide basic technological literacy for everyday living and
3. To stimulate creativity.

Basic technology is a subject in Junior Secondary School which exposes students to basic ideas and concepts of technology and skills development in the various subject areas that make up the subject. Federal Government of Nigerian (2009) stipulated that a prevocational course (Introductory technology) be studied in Junior Secondary School that is aimed at instilling appreciation of technology, creation of awareness; acquisition of knowledge, work habits and attitude as well as orientation to basic manipulative skills. The National policy on Education (2004) expressed some concern about correcting the society's attitude to technology as well as providing trained manpower at the sub – professional level for the technological development of the country. According to Fasikun, (2005), introductory technology is expected to be a foundation on which future technological development and skills can be built either in technical colleges or secondary schools or tertiary institutions for those who will proceed to higher levels. It is a practice – oriented course where practical application of day – to – day learning is enforced for proper technological awareness and skill development (Bakare *et al.,* 2011). The practical aspect of the course that will lead to basic manipulative skills, acquisition of work habit and attitude in hope to be taught as practical topics using equipment and tools. According to Fasikun, (2005) introductory technology is taught in many secondary schools from first year to third year without any

practical or demonstration lesson. He said that this ugly situation has been attributed to many reasons which range from unqualified teachers to lack of equipment. In order to achieve the objectives of National Policy on Education in the area of qualified technical teachers, the National Commission for Colleges of Education Structured a programme that is aimed at producing NCE graduates competent to teach introductory technology at Junior Secondary School level with a view of attaining the following objectives specified by the Federal University of Education Printing Division (1985);

1. To provide the youth in Junior Secondary School a pre – Vocational orientation for further training in technology,
2. To stimulate creativity

Fasikun, (2005) observed that many introductory technology teachers are not performing well. Ojidu, (2007) said that technology was structured to assist learners to develop interest in technology. The aim was that at the end of the Junior Secondary School, technological ignorance is reduced and solid foundation laid for students' entrance into vocation of their Choice. This statement is in consonance with the National Policy on Education, (2004) curriculum for Junior Secondary School, which states, "In order to reduce ignorance about technology and to help lay a solid foundation for national development, introductory technology as a subject is to be offered in Junior Secondary Schools. However, the extent to which technology succeeds in actualizing these objectives is contingent upon adequate supply of professionally qualified and competent basic technology teachers in the secondary schools, availability of instructional materials for both teachers and students and development of favourable attitude on the part of teachers and students (Ojidu, 2007). Introductory technology is a multi-disciplined subject that has a wide curriculum offering in different areas of engineering, food science and applied technology. Concepts are carefully selected and

serve as very useful introduction to technology for the nation's children. This is with the belief that development of technology begins from the society and ends with the society, and in every technology, the overall aim is to exploit the existing scientific and other knowledge for useful ends. Introductory technology involves academic and practical study of materials, source of energy and natural phenomena with the ultimate intention of applying these to the service of humanity (Bakare *et al.,* 2011). The objectives of introductory technology in the school system according to the Comparative Education Studies and Adaptation Centre (C.E.S.A.C, 1989), are to provide prevocational orientation for further training in technology; to provide basic technological literacy for everyday living and to stimulate creativity.

Technology makes the learners get familiar with the environment. The learner is oriented properly into work habits toward technology. So, as the nation enters the 21st century and strives toward technological growth and overall national development, the strategic importance of introductory technology is recognized. It is only when technology is understood that it can be adapted to suit local environment, that the concepts could be applied to problems of society. A technologically literate individual is more advantaged to succeed in personal and community life than one who is not (FGN, 2009). As envisioned in the National policy of Education (2009), a thorough understanding and application of introductory technology principles and concepts right from schools is capable of empowering learners to tackle problems confronted in real life situations. As Bakare *et al.* (2011) explained the study of introductory technology enables one to become more aware of one's changing environment, explore it better and be better adapted to it. Ojidu, (2007) said that introductory technology is expected to equip the learners with the needed skills for laying of solid foundation for lifelong learning. For the learners to acquire the appropriate level of literacy, numeracy,

manipulative, communicative and life skills there is need to expose the child to appropriate instructional materials which will provide an effective communication channel to the learners. The introductory technology curriculum is so planned to enable students acquire the scientific and technological skills to function effectively after 3-tier system of education in the world of work if so desired and for further studies. Despite the government's effort in terms of resource provisions the teaching and learning of introductory is in poor state (Ojidu, 2007). Basic technology according to Ojidu, (2007) is one of the compulsory prevocational courses, which students are supposed to take at the JSS level. It is an integration of a number of subjects and has the following objectives;

1. To provide pre – vocational orientation for further training to technology.
2. To provide basic technological literacy in everyday living.
3. To stimulate creativity.

Miller *et al.* (2010), pointed out that introductory technology was included in the new education system because in this era of globalization and development of information technology, emphasis is on technical education if the nation and her citizens are to benefit from the process and it also facilitates the attainment of the nation's technological goals. It was planned to be only taught at the introductory levels; that is all the Courses incorporated in it. Teaching introductory technology is both teacher and learner focused (Fasikun, 2005). The teacher is expected to be dynamic, resourceful and conscious of the rapid developments in the field of technology. The body of knowledge constantly changes with the development in introductory technology and societal needs. On the learners' side, the magnitude of the theoretical and practical information required by them to attain the expected level of competence is so high, complex and extremely new. The learners are expected to learn at his own pace, conscious of new

information and environment, through unconsciously, should be able to compete with his peer to earn a desirable place. Introductory technology has characteristics of new body of knowledge and features of complex traditional discipline therefore required special treatment for successful teaching and learning. Technology is one of the new subjects brought into Nigerian educational System by the National Policy on Education (2009). It was introduced to satisfy the need to make the educational process and enterprise relevant to the individual and societal needs. Initial effort at the development of similar body of knowledge emanated from the need to enhance the ability of the student to conceptualize geometric solids and understand some basic tools and processes. It has equally been observed that understanding the subject has transfer effects on such subjects as physics, chemistry; biology, business studies and even accounting (Fasikun, 2005).

The rapid development of technology and its attendant effects on individual and the national development have expanded the frontier of the concept of introductory technology. Technology as a subject therefore can simply be described as simplified familiarization to the fundamentals of the technology. It has been seen as foundation to technology and technology education in Nigeria, that is, a means of creating technology literacy and awareness. According to Lenhart *et al.* (2015), technology presented as distinct but related components of technology. Emphasis is on exposition to both theory and workshop practice with a view to acquiring knowledge and skills to a qualified degree of attainment.

Basic technology is apparently and even actually more of workshop subject (Fasikun, 2005). Most of the instructional methods for teaching technology are not tenable for effective teaching of the subject. Therefore, some of these common methods are examined for their appropriateness. However, it should be borne in mind that the most

appropriate method of instruction is that which can motivate the students and sustain their interests in the course of instructions.

Basic Technology helps to develop in pupil's aptitude for technical skills and ability to manipulate some basic tools. It also develops curiosity and creativity in pupils and in fact serves as basis for manpower development in Nigeria. It is also expected that if introductory technology is well implemented in junior secondary schools, it will help to create a new technological culture, a new scientific outlook which will allow young Nigerians to participate actively in the making of history rather than just submit themselves to it. It is also one of the aims of introductory technology to lay the foundation not only for the nation's technological take off but prepare youths for future employment by inculcating specific skills, which will enable them to render certain specialized services of economic value (Fasikun, 2005).

Basic technology is an aspect of vocational education obtainable at junior secondary Schools in Nigeria. It was integrated with Nigerian educational system in 1982 by the Federal Government of Nigeria (Otamba, 2013). Introductory technology was described as one of the core courses, to be learnt at pre – vocational level of the junior Secondary School. Introductory technology has the potential to effect technological enlightenment on all the beneficiaries if the teaching and learning of the course were free from problems. Basic technology the potential to effect technological enlightenment on all the beneficiaries if the teaching and learning of the course were free from problems. Introductory technology also prepares the youths for specific professions in the future, for example, some will go into higher institutions for further study in technological related areas. Some might even join the labour force directly where they will serve as craftsmen in industries. Nigeria as a developing nation cannot afford not to keep pace with the rest of the world in terms of rapid technological development proper

implementation of introductory technology now become necessary for nation's development. We all need food, shelter, clothing good health, transportation, telecommunication and stable power supply. All these can only be achieved if special emphasis is laid on introductory technology at junior secondary Schools.

Basic technology according to Uwameiye & Ogiegbaen (2006) is the only core subject among the prevocational subjects of the Junior Secondary School in Nigeria, involves the academic practical study of materials, and sources of energy with the ultimate intention of applying knowledge from the study to provide a comfortable environment for man. The study of introductory technology helps to reduce ignorance about technology. Among the prevocational subjects in the junior secondary school curriculum, are practical agriculture, home economics, business studies and introductory technology. Basic technology gives opportunities to students to use tools and machines, which are used in the industrial process. This helps to develop good attitudes towards technology and industry. Uwameiye & Ogiegbaen, (2006) explained that introductory technology does not in any way provide training for specific occupations nor aims at developing competencies. The focus of the provocation courses such as Basic technology was to expose students at the junior secondary school level to the world of works through exploration. Such exposure will enable junior secondary school students to make intelligent consumption patterns.

Basic technology came into Nigerian Educational System as Introductory technology in 1982 when the system of education then was changed to 6.3.3.4 system of education. This 6-3-3-4- means six years of primary school, three years of junior secondary school, three years of senior secondary school and four years of university education. At the junior secondary school level, pre-vocational subject such as introductory technology were introduced into the curriculum while vocational subjects were introduced into

senior secondary level. The subject has three main objectives as stated by Federal Republic Nigeria (Federal Ministry of Education, 2009). Towards the realization of objectives of introductory technology in junior secondary schools, adequate teaching methods must be put in place for its teaching so that optimum achievement can be guaranteed (Uwamerye, and Ogiegbaen, 2006). One of the subjects introduced by the National Policy on Education for study at the junior secondary school level is introductory technology (Jokotola, 2003). According to Jokotola (2003) general objectives of teaching introductory technology are: To provide students with the technological literacy required for every day thing; to provide pre-vocational orientation for further development of employable skills and training in technology; to stimulate creativity.

According to Jokotola (2003) introductory technology provides a broad based skills development approach to practice – oriented work where practical application of day needs in the service of man is emphasized. Introductory technology is not peculiar to Nigeria, it is accepted throughout the world under different names. In the USA and Canada, it is called industrial Art; in the United Kingdom, it also known as handicrafts. Some countries also called it different names like elementary technology, basi craft, basic technology education etc. UNESCO (2004) calls it general technical education (Aremu, 2015). It is very clear that introductory technology consists of many components which are made up of separate topics; yet its Philosophy is that it should be taught as one – integrated subject. The purpose of this is that the skills acquired in one of its components could be easily transformed to another. Aremu (2015) stated that the Nigeria government approved the study of introductory technology at the junior secondary school level with the following objectives which includes:

Developing familiarity with the various form of technology available; developing a proper orientation and proper work habits towards technology; developing appreciation for the significant roles played by the various technologies in national development; Acquiring knowledge of how to perform simple faculty diagnosis of basic machines available for developing technology.

The following objectives were formulated for Basic technology by UNESCO (2004):

1. Introductory technology should offer young people the opportunity to learn of the world of technology and its products through exploration of materials tools, techniques and production process as a whole.
2. Introductory technology should lead children to develop interest and understanding of the cultural aspect of technology.
3. Introductory technology should develop certain command of valuable skills such as tool uses repair and maintenance, etc.
4. Introductory technology through an experimental approach should teach children to plans and think rationally, to face problems and makes decision as to the best way of solving problem.

Introductory technology is an integrated subject offered in junior secondary one to three. It is one of the types of vocational courses. Introductory technology curriculum is designed in a way to inculcate basic skills in learners. According to Ihediwah, (2007) technology education is the most effective means of empowering the citizenry to overcome poverty, limit the incidence of social vices due to joblessness and promote a culture of peace, freedom and democracy. Federal Ministry of Education (2004) expressed some concern about correcting the society's attitude to technology as well as providing trained manpower at sub-professional level for the technological development of the country. It stipulates that a prevocational subject introductory technology should

be studied in junior secondary schools that is aimed at instilling appreciation of technology, creation of awareness, acquisition of knowledge, work habits and attitudes, as well as orientation to basic manipulative skills. This is expected to be a foundation on which future technological knowledge and skills can be built either in technical colleges or tertiary institution for those who will proceed to higher levels. The FME (2004), provides that the junior Secondary School was both prevocational and academic, which will expose students to basic ideas and concept of technology and skill development in the various subject area that make up the course. Introductory technology, which is expected to be taught as part of general education is designed as integrated subject which is expected to be taught as part of general education is designed as integrated subject which comprise the following; basic electricity, electronics metalwork, woodwork building construction, food storage and preservation, principle of operations of domestic appliances, agriculture, plastics, ceramics rubber etc. Introductory technology, therefore, is unique because it is a skill oriented subject, which involves practical application of day to day learning for proper technological awareness and skill development (Aremu, 2015).

For children/students to appreciate latest technologies in the present society, introductory technology was replaced by basic technology in secondary school curriculum. Basic technology (BT) is a newly introduced subject in the curriculum of junior secondary schools in Nigeria. It is a subject in the Junior Secondary School which exposes students to basic ideas and concepts of technology and skill development in the various subject areas that make up introductory technology. Basic technology is expected to be a foundation on which future technological development and skills can be built either in technical colleges or secondary schools or tertiary institutions for those who will proceed to higher levels. It is a practice – oriented course where practical

application of day to day learning is enforced for proper technological awareness and skill development.

Basic Technology comprises of technical subjects such as Applied Electricity, Automechanics, Building Construction, Technical Drawing, Electronics, Metal Work and Woodwork. Miller *et al.* (2010) described basic technology as one of the essential pre-vocational and integrated subjects that offered by students in junior secondary schools; It exposes students to basic ideas and concepts of technology and skill development in the various components that make up the subject. It is also a foundation subject on which future technological development of students are built for those interested in advanced technology (Miller *et al.,* 2010).

According to the Report of Federal Ministry of Education (2007), Basic Technology is a compulsory subject in the 9 – basic education programmes. Its purpose according to the report is to contribute to the achievement of the national education goals by inculcation of technology literacy, exposure of students to the world of work to match their talents and interests for wise vocational choice and inculcation of positive attitudes towards work as a source of human identity, livelihood and power. Basic technology according to Report of Nigerian Educational Research and Development Council (NERDC) (2007) became necessary due to technological development and national policy orientation to the teaching of technology as an integral part of world globalization trends in education. Therefore, most of the introductory technology teachers in any particular part of the country should receive a training that would enable them to utilize effectively the local materials available in their areas, to train their students. This would enable the teachers as managers of skill learning to effectively relate learning to the local environment with its resources. Also, towards the realization of these objectives of Basic Technology,

adequate teaching methods must be put in place for its teaching so that optimum achievement can be guaranteed.

2.1.3 The use of teaching methods and techniques

Teachers of basic technology are expected to be competent in applying appropriate teaching methods or techniques. Teaching methods or techniques are important in any educative process. The teacher has to employ very rich methods and select suitable ones among them. The method will not only provide students with knowledge but it also must develop skills of cooperative learning, discussion and social relations of students of the same time (Linda *et al.*, 2020). In research about the perceptions of instructional materials, classroom teachers generally demonstrated little knowledge of technologies (Aremu, 2015). Teaching methods according to Schmidt *et al.* (2011) "is a recurrent pattern of teacher behavior, applicable to various subjects matters, characteristics of more than one teacher and relevant to learning". According to them methods are described as recurrent because they are repeated over interval measured in minutes or weeks that teaching can also been said to be instrumental process such as pattern teacher behavior, for example lecturing, discussion and so on.

Delivery systems for curriculum such as film, games, programmed instruction, printed matter etc are also organizational structures for promoting learning. The instructional processes promoted student learning of different kind of various subject matters. Landøy *et al.* (2020) argued that there exists a vast literature on teaching techniques or methods conceived as classified by different authors, some teaching methods ends up in instruction in instructing in education. Pedagogy requires that teachers avoid confining to one teaching methods, teachers are advised to use various methods. Among the various difficulties experienced by teachers of basic technology is not being able to use adequate teaching methods. Basic elements of several types of teaching methods may

appropriately be combined for best result depending on the age of the students and the type of subject matter being taught. This is where teachers select good but not all can be used at the same depending on the age and level of the students. Dare & Francis (2019) stated that no teaching method is more efficacious than the other. But in a strict sense, some methods are more suitable for teaching certain contents that is skill, knowledge and values and so on.

A good teacher knows the principle guiding the choice of teaching method and stick to them in all situation, the teacher chooses the best suited for the subject matter considering the students ability available materials and the time her own capability. Olaitan *et al.* (2010) also supported the concept that many experts will prefer the instruction separated from the curriculum and call it methodology which will include methods and techniques of teaching or various delivery system. According to Liakopoulou (2011), it is the teachers' personal qualities compiled with his professional competencies and the age of the learners that makes for effective teaching". Any effective teacher is aware that any method of teaching employed without due consideration for the learner will not be successful. Some of the methods found effective in teaching technology-based subjects are demonstration method, discussion methods, the lecture methods, project methods and laboratory methods.

Demonstration method means teaching through displaying something that is audio-visual explanation of an idea process or a product. It involves showing, doing and telling the students the point of emphasis. It is mostly used as a technique within a method of teaching and sometimes used as a method by itself. The method is most effective methods in teaching skill or performance-oriented subjects either in the sciences or art, the method is executed by examples and activities by the teachers while the learner observes and listens, thus the demonstration tasks the learners' sense of sight

and learning. This method could be given to the entire class, small group of students or to an individual. It requires careful planning and skilful execution where the method is used as an adjunct to another method or solely used, the teacher needs to plan well, organize the materials and skillfully present the demonstration exhibition and high degree of craftsmanship. Roediger (2005) also supporting the contribution, Kreiner (2009) said a little practical demonstration can make an incredible increase in speed and efficiency with which information is passed on to the learners.

The lecture method which is also referred to as the talk chalk is the traditional methods of teaching which many modern educators consider as out dated but it is still prevalent in the education system in parts of Nigeria. Large number of materials could be covered to a large class size in single period; it involves verbal presentation of ideas, concepts, generalization and facts. This method is not recommended for those in the primary school and lower secondary school level because of their level of development. Elvis (2013), stated that the art of lecturing is a difficult one which requires that the teacher should undergo some training and continuous practice so as to achieve the required standard of performance. The teacher needs to have at his disposal to a variety of skills that do come as a result of natural endowment of which these skills must be developed except in exceptional case.

Discussion method is when two or more people interact verbally with each other. It could be considered as a technique within a method, it is a method that could be adopted deliberately in a learning situation (Elvis, 2013). Sometimes it occurs spontaneously as a teacher uses one method of teaching or another. It may also occur at brief intervals during informal lecture. It involves talking over subjects from various points of view and the teacher's role is not to dispense or communicate knowledge but to act as a

moderator, she does not dictate or influence the viewpoints of the student as he moderates the discussion.

Project method is learning activities selected, planned, designed and executed by learning collectively or individually clarifying factors, acquired new knowledge skills appreciation and to solve identified problems under teachers' guidance and supervision. Okoro (1993) reported that "in the planning of a project students may have to list the major steps in doing the project, make needed sketches, list the tools, equipment and materials required and state the procedures to be adopted in the assembly of the project. Okoro also remarked that in project methods, students are not usually told exactly what to do but are expected to participate in the planning of the intended project. Another method is the laboratory method; the concept of laboratory work has extended from science affair to almost all other disciplines. Laboratory work is no more restricted to science alone. Laboratory method of teaching involves observation, experimentation or application by individual or small groups dealing with actual materials. This method is not restricted to a classroom called laboratory alone but it cuts across environments outside the classroom that provides practical work to give first hand experiences to the learner. Subjects like English or literature are in modern times taught in specialized laboratories equipped with tape recorders, cassettes and earphones, instead of scientific apparatus to do science experiments (Okoro, 2013). Teachers are therefore expected to be effective in using appropriate methods for teaching contents of basic technology. The choice of any method should however be based on stated objectives and the objectives must be stated in term of anticipated change in student's behaviour (achievement and retention) that can be measured.

2.1.4 Gamification as a method of teaching

The concept of gamification is defined by Zicherman and Cunningham (2011) as "use of gamebased thinking and game-related functions to help users solve problems and to draw their interest". In a broader sense, use of games in an out-of-game activity means making that activity entertaining (Deterding *et al.,* 2011). The concept of gamification is often confused with game-based learning. Gamification refers to application of the game philosophy to an out-of-game area, while game-based learning is a subset of gamification that teaches the outcomes of a course via games (Knutas, 2014; Yıldırım, 2016). Accordingly, it could be stated that gamification allows entertaining while teaching, while game-based learning allows teaching while entertaining (Utomo & Santoso, 2015). The design of gamification is generally made up of three elements: game mechanics, game dynamics and game aesthetics. Game mechanics include various activities and control mechanisms for the gamification of a content to create user experience and interest (scores, levels, difficulties). Game dynamics refer to the outcome of experiences in the game played (reward, statue and success). Also, game aesthetics defines the desirable emotional reactions evoked in the player, when he interacts with the game system. (Hunicke *et al.,* 2004; Utomo & Santoso, 2015).

There are a number of applications for the gamification of a content or activity. One of these applications is "Kahoot". It is a Web 2.0 tool that allows creating online quizzes, surveys or discussions. The questions prepared by the teacher with the help of Kahoot appear on the screen one by one, and students mark their responses and get scores via their mobile phones through the Internet. When they finish the questions, the names of the top-3 students appear on the screen. Students can also provide feedback regarding the application, and the teacher can examine the results and identify the deficiencies (Byrne, 2013; Dellos, 2015). The aim of gamification is to make the learning process more attractive in terms of learners. With a learning environment where more fun

activities are available, learners can be motivated and gain a different learning experience. So, motivation can be an important element in a learning design where gamification is applied unlike game-based learning (Güler & Güler, 2015).

2.1.5 Game-based learning

The use of play in an educational context and for purposes of learning and development is by no means a new phenomenon. However, the growing acceptance of digital games as mainstream entertainment has raised the question of how to take advantage of the promise of digital games for educational purposes. Reports on youth's consumption of digital games are compelling, with studies such as the Pew Internet & American Life Project indicating 99% of boys and 94% of girls playing digital games (Lenhart *et al*., 2008). Equally compelling are reports on how much time youth spend playing digital games, which range from approximately 7 to 10 hours per week (Lenhart *et al*., 2008), with more recent estimates putting this number even higher (Homer *et al.,* 2012). Although there are gender differences in the amount of time boys and girls play digital games (Homer *et al*., 2012), and in the types of games boys and girls prefer to play (Lenhart *et al.,* 2015), studies have not found significant gender differences in learning or motivational outcomes in educational games (e.g., Annetta *et al.,* 2009; Papastergiou, 2009). Given this level of engagement that games generate for a broad range of individuals, and considering the kinds of individual and social activities they afford, advocates have argued that games are an ideal medium for learning (Dellos, 2015; Gee, 2003, 2007; Squire, 2011).

Definitions of game-based learning mostly emphasize that it is a type of game play with defined learning outcomes (Shaffer *et al.,* 2005). Usually, it is assumed that the game is a digital game, but this is not always the case. A corollary to this definition is that the design process of games for learning involves balancing the need to cover the subject

matter with the desire to prioritize game play (Plass *et al.,* 2010). This corollary points to the distinction of game-based learning and gamification. What exactly is meant by gamification varies widely, but one of its defining qualities is that it involves the use of game elements, such as incentive systems, to motivate players to engage in a task they otherwise would not find attractive. Similarly, there is an ongoing debate among scholars as to the exact definition of a game, and especially what is not a game (Salen & Zimmerman, 2004). One definition defines a game as "a system in which players engage in an artificial conflict, defined by rules, that results in a quantifiable outcome" (Salen & Zimmerman, 2004). Consider as an example the gamification of math homework, which may involve giving learners points and stars for the completion of existing activities that they consider boring. Game-based learning of the same math topic, on the other hand, even though it may also include points and stars, would involve redesigning the homework activities, using artificial conflict and rules of play, to make them more interesting and engaging. Even though the debate around how games are defined cannot be resolved here, this may not be a problem, as play—the essential activity in games—has long been thought of as a critical element in human development.

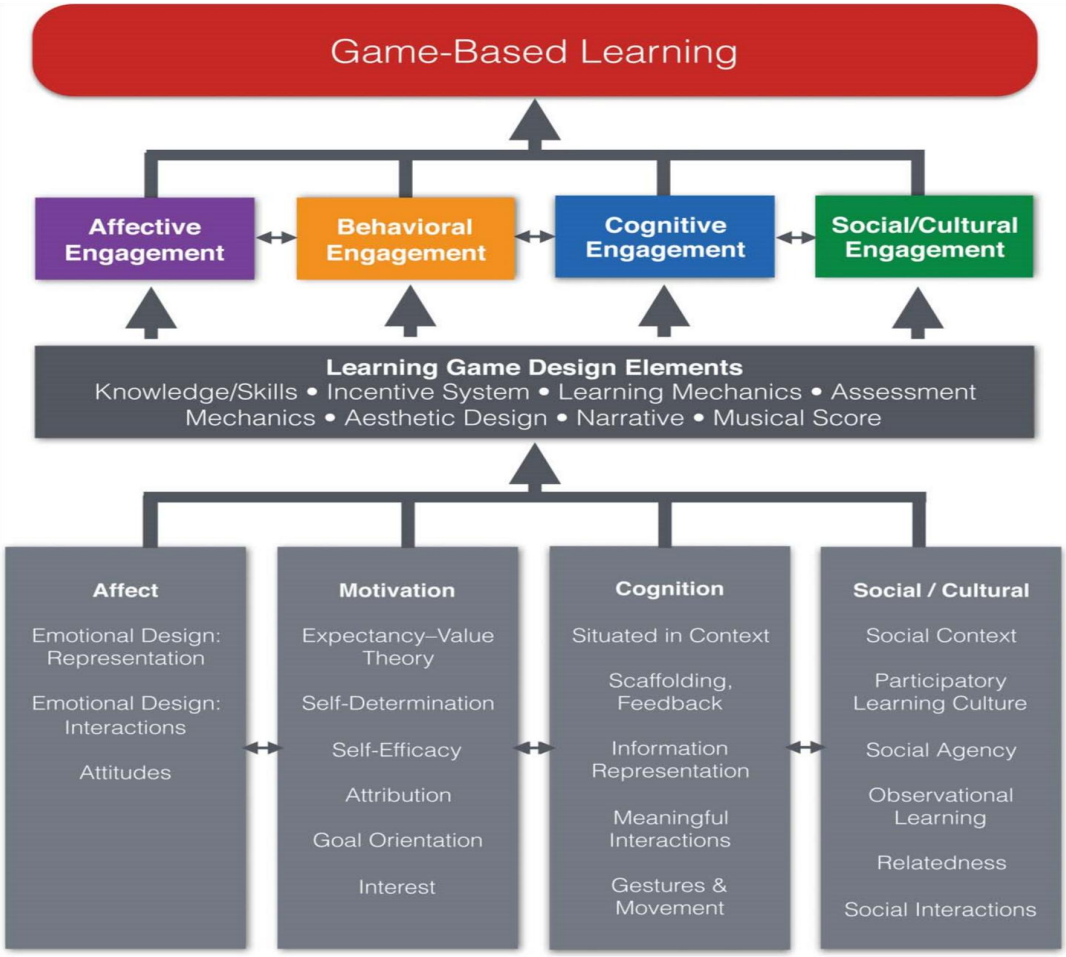

Fig 2.2: Integrated design framework of game-based and playful learning. (Source: Plass *et al*., 2015).

2.1.6 Kahoot

Kapuler (2015) listed Kahoot as one of the top 100 new online apps to use in the classroom. Kahoot came in at number 36 on the list of apps rated for their effectiveness and usefulness for teaching and/or assessing students in the classroom (2015). This information suggests that Kahoot may be an effective tool for teaching Basic Technology. Kahoot is a relatively new online tool and as a result there is limited research on the effect of Kahoot in the classroom, and a lack of evidence for its effectiveness as a tool to measure achievement, retention and interest in Basic Technology.

Kahoot is a free game-based learning tool that makes learning fun (enjoyable). It is an extremely useful educational technology tool that requires minimum technical expertise for creating quiz, surveys and discussions. It can be used for learners of all ages and for all subjects. Currently this platform offers 41 languages to create exciting and engaging learning experiences.

The quiz is usually created by the educator/trainer and the students make use of devices such as computers, laptops, tablets or smartphones, to respond to the quiz. It is a synchronous type of interaction where the questions are displayed on teacher's screen and students have to reply using their devices. Teachers can use readymade Kahoots that have been created by others. Students then have the capability to answer questions through a variety of devices and using colors and shapes to connect to the answer. The website even tracks student achievement by looking at what the student did during the Kahoot, as well as overall achievement while logged in. The goal for the students is to answer the correct answer as fast as possible to get as many points as possible. Figure 2.3 shows how Kahoot! Is played. A question is shown on the large screen along with four or less alternative answers shown in different colors with associated graphical symbols. The students give their answers by choosing the color and symbol she or he believes corresponds to the correct answer. *(Source: www.kahoot.com).*

Fig. 2.3: Kahoot Interface (Playing live host Kahoot!). (Source: www.kahoot.com).

2.1.6.1 History of Kahoot

The idea for Kahoot came from a Norwegian Computer Science and Game Technology professor at the Norwegian University of Technology and Science (NTNU) in Trondheim, Norway named Alf Inge Wang. Professor Wang called this idea Lecture Quiz back in 2006. The technology is based on research conducted by Kahoot Co-founder Morten Versvik for his Master's degree at NTNU, who was a student of Wang's at the time. Later co-founders Jamie Brooker, Johan Brand and Asmund Furuseth joined the company and worked on theUX and design of kahoot. The beta of Kahoot rolled out at SXSWedu in Texas in March 2013 and formally launched in August 2013. In a few months, Oslo, Norway-based Kahoot already has millions of users. Key investors in the company include Microsoft Ventures, Northzone Ventures, Creandum and private investors from Norway. Devised from typical behaviour, gaming and teaching models, the Kahoot! Platform was uniquely designed to ensure that all students can participate in the classroom in a way that they are comfortable with. By having their name listed on

the screen at the front, Kahoot brings the child at the back of the classroom to the front, for all the right reasons.

Moreover, Kahoot game-based pedagogy creates a cycle which empowers learners to present and share their new-found knowledge to their peers, so they can go from *"learner to leader"*. This suits different learning styles - some students are skillful at playing Kahoot, whereas others excel at creating their own quizzes, surveys and discussions. In terms of technology requirements, Kahoot is device agnostic, and doesn't require an account or email address to play, simply an internet connection and any device with a web browser. This device agnostic design means that Kahoot is accessible to varying types of technology environments. Anyone is able to join a Kahoot by entering the unique game-pin into their smartphone, tablet, laptop or desktop, in a matter of seconds. It is perfect for school BYOD (bring your own device) schemes, or if students and schools lack enough devices, can be easily played in teams. Additionally, Kahoot's user interface is in English, but its user-generated content framework means it is accessible to non-English speakers.

An ally of inclusive education, Kahoot is also designed to suit those with learning disabilities and special education needs. Its use of imagery, visual cues (such as different colours and shapes), and its simple Easy Read-friendly question and answer format means it can be used by students with various learning needs, either as a group or in one-to-one sessions.

Fig. 2.4: Getting Started with Kahoot. (Source: www.kahoot.com).

Kahoot is very easy to use to create quizzes and surveys. The website takes you step by step through the creation process. Both quizzes and surveys are created in the same way. You first start by creating a title for your quiz or survey. Then, you are brought to a new screen where you start creating your quiz/survey by typing your first question. Next, you type in at least two answers (no more than four answers) to your question and mark which answers are incorrect or correct by a click of a button. You also have the ability to add images to your question by either dragging the file into the workspace or chose the file from your device. If you do not add an image, Kahoot will add one for you to make the Kahoot more engaging for the students. Kahoot has recently added a video feature to its website, meaning that you can add a YouTube video to the question. All you need is the ID of the YouTube video as well as the time to start and end the video clip. You can add more questions to your quiz by clicking the “add question” button.

You must complete the question before you move on to creating the next question. Kahoot also gives you the choice to duplicate questions if the teacher wants to create a similar question. From experimenting with the website, you can add many questions to your quiz/survey. (I was able to create 40 questions in my Kahoot, which is more than what I would have for my students). After all your questions have been created, you are then brought to a review screen. On this review screen, you are able to reorder the questions that you have created as well as edit your questions if that is needed. When the questions are in the order as desired, you then are able to adjust the settings, such as privacy (if you want to make the Kahoot public or private), difficulty level (easy, intermediate, advanced) , and primary audience (school, university, business, etc.). The last step is to give your quiz a cover image or cover video. This is done in the same way of adding an image or video to a question. Then, your Kahoot is ready to use with your students.

2.1.6.2 Using Kahoot in the classroom

Kahoot is an online game that tests student's knowledge of course content. The game is free for both teachers and students, and simply requires a multimedia tool to participate. A cellphone, laptop, or Chromebook works for running the Kahoot website. Teachers can create quizzes using multiple choice questions presented in a game-based format to students. The quizzes contain questions that have up to four possible choices, and questions can contain various multimedia contents such as pictures or videos. On top of the number of answer choices, Kahoot also provides teachers with the ability to select the amount of time that the students have to respond to each question. The students join the game via a specific generated game code and are able to create their own nicknames to be displayed on the game screen. If a name is inappropriate for school use the teacher can simply click on the name and the student is kicked out of the game.

Furthermore, Kahoot is easy to use in its game-like format and is gaining popularity across the country. Dellos (2015) reports that of the approximate 55 million elementary and middle school students in the United States, about 20 million of them are using Kahoot to some extent. Kahoot uses educational trends to capitalize on their popularity. These educational trends include gamification and student engagement. The makers of the video game rely on student engagement and interest to keep the popularity of the game spreading. Students play the created Kahoot using their own devices. The teacher projects the game on a Smartboard or projector that students can see from a distance. The teacher then begins the Kahoot by clicking "play". This creates a unique game code that students enter on a device of their choice. When students use this code, they were synced into your game. Students then look at the game board, which is projected to get the question-and-answer choices. On their devices, students see the two-by-two grid with different colors and associated shapes. Depending on answer choice and speed, Kahoot will give students a score. After each question a leaderboard was shown to students, as well as overall leader after that round. Students continue to do this throughout the Kahoot to find the overall winner of the game.

Fig. 2.4: Cheering Kahoot. (Source: www.kahoot.com).

2.1.6.3 Advantages and Disadvantages of using Kahoot in the classroom

Advantages

There are many advantages to using Kahoot in the classroom that benefit both teacher and student:

1. It adds fun and excitement to a boring lesson and increase class participation
2. It helps the teachers understand the weak areas of their students and assists in planning reinforcement of those weak areas
3. It is a helpful tool for self-evaluation, as it challenges students in "Ghost Mode" to evaluate their own understanding and reinforce learning.
4. It is an exciting tool for engaging students having short attention span
5. It can be used to collate answers from participants easily and in an organized manner
6. It is an interesting way of giving students a break during a long lecture
7. It is an extremely helpful tool to get a quick survey of students' feedback about issues such as the teacher's pace of the lesson or method of instruction
8. It can be used as an ice breaker in the first lesson
9. It is a great tool for designing instant polls
10. Teachers can use this too as an assessment for student learning by looking at the type of questions the student created, as well as what answer choices were created and visual representations were associated with the different questions.

Disadvantages

1. Cannot put questions in order.
2. Students have to have an internet connection and a smartphone/tablet.
3. The picture comes a bit after the question

Fig. 2.5: Kahoot Infographic. (Source: www.kahoot.com).

2.1.7 Academic achievement in secondary schools

Achievement according to American Heritage Dictionary (2016) is that level accomplishment evaluated by teachers, tests etc, in order words, definition of achievement depends upon value judgment, opinions and standards. Therefore, achievement is basically an act of accomplishing or finishing something, something accomplished successfully especially by means of exertion, skill, practice or perseverance. In the view of New Webster's Dictionary (2013) achievement means to reach a required standard of performance, to carry out successfully. According to Anastasi & Uraina (2009) achievement is the aspect of measuring the effects of relatively standardized sets of experiences. Achievement, simply put, is accomplishing whatever goals one sets for him/herself, not necessarily earning a lot of money.

In the context of this work, academic achievement is the focus. According to Mkpaoro (2006) academic achievement could be seen as the level of proficiency and knowledge demonstrated by an individual after learning has occurred. The parameter for verifying the extent of learning that has occurred or the level of proficiency of an individual is teacher made test, examination or standardized tests. Mkpaoro (2006) stresses that, the yard sticks for measuring one's academic achievement is assessing the academic performance of the individual through tests and systematic observation.

Academic achievement can be described as high or low. When academic achievement is measured, one can observe it as being high when a child excels and performs extraordinarily well in his/her academic activities by scoring high marks. But when a child performs poorly in his/her academic activities by scoring very low marks, academic achievement is said to be low. It is worthy of note that without a strong desire/will, one will not believe, and therefore will not achieve. Mkpaoro (2006) supports the above assertion by identifying "the will to achieve and the ability to achieve as the two major factors that can affect academic achievement. If a person is willing to achieve something, he has to work on his ability and improve on it by dedicating more time and energy to the thing. Buttressing this point, Mkpaoro (2006) asserts that achievement equals aptitude and experience, putting it in an equation; Achievement =Aptitude x Experience. As earlier mentioned, the measurement of academic achievement is focused on the past performance of the pupils/students. Hence the pupils/students' academic achievement level is measured based on the test/examination scores on the particular subject already studied. This score is the product of the students' ability and experiences gained by the students during the processes of teaching by the teacher. The result or outcome of academic achievement

serves a lot of purposes. It is very essential in determining a lot of things that surround the student and even the educational programme.

2.1.8 Modern Retention of Students in Secondary Schools

In the recent years, administrators in high schools, colleges, and universities have been concerned about the retention of students in their programs (Kitto, 2006; Farvardin, 2007; Fowler & Luna, 2009; Powell, 2009; Supiano, 2009; Stuart, 2010; James, 2011). Powell (2009) indicated, "Student retention is one of the most widely studied areas in higher education" (Powell, 2009,). Retention according to Ugwuanyi, (2014) is a direct correlate of positive transfer of learning. This means that a student who has high retention ability should invariably achieve highly when achievement test is given. It is still a factor of many other variables such as interval between learning and retrieval, intervening experiences, specific subject involved, teaching strategies or methods used, environmental situations among others. However, in researcher there is no consistency on the variable that may lead to the students retaining more of what they have learnt. But Ugwuanyi (2009) maintained that the ability of the students to retain and hence remember what they have been taught by the teacher depends heavily on the appropriateness of the method of instruction. The teacher is mainly faced with the task of how to help the students improve on their ability to assimilate information.

The term “retention” sounds negative, but it is important policy makers, educators, and parents spend a great deal of money in education demanding very little if nothing from our students; hence, studies have been organized to measure student success and learning effectiveness (Kim *et al.,* 2010). Akpan & Aminikpo (2017) showed that retention was an act where “some students persist and graduate, and others do not” (Fowler & Luna, 2009; Powell, 2009; James, 2011). By contrast, student success occurs when students enter into high school, college, and university, and are able to complete

the programs through either personal intrinsic motivation, school organized advising interventions, tutoring programs, or counseling (Kim *et al*., 2010).

Retention plays a pertinent role when it comes to the effective or correct application of whatever a pupil or student has learnt. This is because a student retrieves the information, he/she has retained in his/her memory when the need arises (may be during a test or examination). So, what has been learnt and assimilated by the students can be measured by their ability to answer questions given to them in either test or examination. Retention according to Chauham (1998) is a direct correlate of positive transfer of learning. This means that a student who has high retention ability should invariably achieve highly when achievement test is given. It is still a factor of many other variables such as interval between learning and retrieval, intervening experiences, specific subject involved, teaching strategies or methods used, environmental situations among others. However, in researcher there is no consistency on the variable that may lead to the students retaining more of what they have learnt. But Ugwuanyi, (2009) maintained that the ability of the students to retain and hence remember what they have been taught by the teacher depends heavily on the appropriateness of the method of instruction. The teacher is mainly faced with the task of how to help the students improve on their ability to assimilate information. Mathematics concepts we know, cannot be learnt properly by mere memorization through rote learning. It has been noted that man is endowed with limited capacity for memorization (Child, 1981).

Based on this assertion, teachers are challenged to find out ways to help students improve on their ability to assimilate and retain learnt materials. Ugwuanyi (2009) observed that the ability to remember takes place more effectively when experiences are passed to the learner through an appropriate instructional method. For a student to retain or hold back something, the student must have good memory where what he has learnt

can be stored and hence retrieved when the need arises. This process relates to the main stages in information and retrieval of memory from information processing perspective which are: Encoding (processing and combination of retrieved information); Storage (creation of a permanent record of encoded information); Retrieval (calling back the stored information in response to some).

2.1.9 Learners' Interest in Basic Technology

Obviously, interest is a very strong factor in the teaching and learning of basic technology in schools. The degree and direction of attitude towards basic technology are largely determined by the kind of interest developed by students for basic technology. Okigbo & Okeke (2011) added that interest is the determinant of success, second in importance to intelligence. Hence the interest one has in any endeavour definitely lead to success or failure in such endeavour. Some authors and researchers have conceptualized interest in many perspectives. Some perceived it in relations to internal state of mind, some activity that motivates, some feeling of like or dislike (Ugochukwu *et al.,* 2014), emotionally oriented behaviour (Ugochukwu *et al.,* 2014), subjective feeling of concentration (Chima, 2007). Interest is a content-specific motivation of characteristics composed of intrinsic feeling-related and value-related initiatives with an organized force. It could also be regarded as a pre-determinant of one's perceptions that is, what aspect of the world one is mostly likely to see always (Mkpaoro, 2006). It could also be viewed as a condition in which an individual associates the essence of certain things or situation with his needs or wants. Essien *et al.* (2015) maintained that one's interest is enkindled or killed through participation, experience, familiarity, study and work. It is what one perceives in these engagements that shape interest. Interest is a feeling of identification with a person and some conditions, things or other persons. It has been variously defined as a kind of consciousness accompanying and stimulating

attention, a feeling, pleasant or painful directing attention, the pleasurable or painful aspect of a process of attention, and as identical with attention of itself. Thus, it may be said, "I attend to what interests me". The term is also used to indicate a permanent mental disposition (Essien *et al.,* 2015). Therefore, the actions of a person are greatly influenced by the degree of his/her interest.

However, interest is defined and whether it be described as a cause of attention, an aspect of attention or as identical with attention, its special significance lies in its intimate connection with the mental activity or attention. Interest is the focusing of the sense organs on or giving attention to some person, activity, situation or object. It is an outcome of experience rather than a gift. It could either result or cause motivation. It could also be regarded as a predeterminant of one's perceptions that is, what aspect of the world one is mostly likely to see always (Mkpaoro, 2006). It could be a temporary or permanent feeling of preference. It could also be viewed as a condition in which an individual associates the essence of certain things or situation with his needs or wants.

Going by this definition, interest thus seems particularly useful as the relationship between identification, absorption and the maintenance of a self-initiated activity which offers a straight forward way to analyze classroom activities. According to Essien *et al.* (2015) interest is a content-specific motivation of characteristics composed of intrinsic feeling-related and value-related initiatives with an organized force. They however distinguished two conceptions of interest: Individual and situations interest. Individual interest is understood as a long-term direction of an individual towards a type of object, activity or area of knowledge. It is defined as a relatively stable evaluative orientation towards certain domains or towards particular classes of objects, event or ideas (Ugochukwu, 2014). Individual interest have personal significance and are usually associated with high levels of significance and value, positive emotions and increased

reference value (Essien *et al.,* 2015). In this framework, individual interest developed and remains a stable and enduring factor in one's learning over an extended period of time. Therefore, when the students are interested in basic technology, they will pay attention to basic technology teaching and learning and enjoy the basic technology contents taught.

2.1.10 Formative Assessment

Formative assessment is a key piece of insight into student understanding. Setting clear learning targets allows a student a means to set goals and to achieve deeper understanding. Assessment is an on-going process, not viewed as a one-time shot. In addition, it is embedded as part of one's instruction (Shephard, 2000; Hosp, 2012; Hosp & Ardoin, 2008). Since assessment should be viewed as an on-going process, students should be given more than one opportunity to show what they know. Assessment should be about collecting and interpreting evidence about student progress to inform decisions about learning (Moss, 2013). In addition, formative assessment should be concerned with "providing teachers and/or students' feedback information, which they need to interpret when answering the three feedback questions:

"Where am I going? How am I going to get there? and Where to next?" (Hattie, 2003). With the appropriate use of assessment, learning becomes a continuous loop of knowledge and processing. Shephard (2000) stated, and was later cited by Hattie (2003), that the successful teacher "is able to ask the right questions at the right time, anticipate conceptual pitfalls, and have at the ready a repertoire of tasks that will help students take the next steps requires deep knowledge of subject matter".

However, little evidence has been collected to prove that the simple use of assessment furthers student learning throughout the overall learning process. Black and William (1998) reviewed 578 publications about the role of assessment in the learning process

and came to the conclusion that teachers do not consistently engage in purposeful discussions regarding assessment questions and further reflect on these results. Simply using assessment does not further learning, but actually taking the results and empowering students to use these results can make all the difference. Looking at the research from Black and William (1998), I could also add that there are more outliers in the assessment process than just the test itself. In addition, teachers must understand formative assessment as part of the instructional process and further buy-in to the formative assessment process for it to be used as an effective instructional tool.

According to Weurlander *et al*. (2012), formative assessment can act as an external motivator for students. He stated that when students felt pressure to study for a quiz or test them often benefited from having a deadline or some other stressor to motivate them to study, especially at the beginning of a course. He also found that when students had several formative assessments during a course, they seemed to study more consistently.

2.2 Theoretical Framework

A theory is an attempt at synthesizing and integrating empirical data for maximum clarification and unification (Osuala, 2005). Theory according to Osuala (2005) is a series of related statements that are arranged so as to give functional meaning to a set or series of events. He further explained that the set of related statements may take the form of description or functional constructs, assumptions, postulations, laws and theories such as theory of instruction and management. The theoretical framework for this study is based on need assessment model.

Becker (2014) defined learning as the lifelong process of transforming information and experiences into knowledge, skills, behaviour and attitude; learning can be seen as the

way in which information is absorbed, processed and retained which results to a change in one's behaviour. Nsofor saw learning as a construct which is not directly observable but only inferred from behaviour or activities of the learner. Learning theories as reiterated by Tharp & Gallimore (1988) have been formulated by a great deal & number of Psychologists with a mission to explain the process of learning in both animals and humans. Three philosophical frameworks under which learning fall include Behaviourist, Constructivist and Cognitivist. The theoretical framework of this research "effect of Game-based Kahoot Application in students' academic achievement and retention in Basic Technology Concepts in Secondary Schools in Niger State, Nigeria." is based on technology acceptance model and Gardner's Theory of Multiple Intelligences.

2.2.1 Constructivism Theory

The basic premise of constructivist theory is that people are said to learn when they have gained experience from what they learn. That is, people create their own meaning through experience. Constructivist thinking is rooted in several aspects of Piaget and Vygotsky's cognitive theories. The most important thing in constructivism theory is that in the learning process; the learner should get the emphasis. Learners must actively develop their knowledge, not others. Learners must be responsible for their learning outcomes. Their creativity and liveliness will help them to stand alone in their cognitive life.

Learning is directed at experimental learning which is a humanitarian adaptation based on concrete experience in the laboratory, discussions with classmates, who then contemplated and made ideas and developing new concepts. Therefore, the accentuation of educating and teaching is not focused on the educators but on the learners. The nature of constructivist learning by Brooks & Brooks (1993) says that knowledge is non-

objective, temporary, constantly changing, and uncertain. Learning is seen as the compilation of knowledge from concrete experiences, collaborative activities, and reflections and interpretations.

In the perspective of constructivism theory, students are motivated and directed to learn the main idea through discovery learning. For example, learning about vocabulary by playing word strips; learning about additions and subtractions through manipulative use; or learning about the effects, impacts, and relationships of subjects with objects through experiments with different sizes and shapes of objects are motivated students in learning. The above statement shows that students' own ideas about how things work play a big part in constructivism because they will try to explain what they encounter and fix it if they find mistakes. This constructivist strategy emphasizes conceptual understanding rather than rote learning. With this kind of activity, we come to the conclusion that Piaget, in his constructivism theory, encourages learners to be active, have schemes, assimilate and ultimately accommodate everything they learn. Meanwhile, Vigotsky advises students to study together in one group and practice their knowledge. This theory is relevant to both group-play, individual play games because it tells teachers to teach students how to find the main idea of what they are learning and then get the details on their own by discussion "top-down" for knowledge to be achieved and retained.

2.2.2 Wedemeyer's Theory of Independent Study

The process of adapting new innovation has been stated for over thirty years, and one of the most popular adoption models is described by Rogers in his book, independent study. Wedemeyer's theory of independent study was propounded by Charles Wedemeyer who was born in Milwaukee, Wisconsin in 1911. Charles Wedemeyer championed the cause of the independent learner and established several theoretical constructs that have

constituted the core of the contemporary theory of distance education. Among these constructs are autonomy or the learner's need for independence to participate in deciding his/her learning objectives, select the strategy and the means to achieve such objectives, and demonstrate his/her mastery of the chosen objectives.

Wedemeyer also realized that ubiquity of instructional telecommunication would lead to learning anytime and anyplace. Today, with the extensive of use of the Internet in education the idea of learning anytime, anyplace is taken for granted. However, in the early days of experimentation with electronic media, Wedemeyer envisioned the role that the telecommunication technology could play in offering non-formal education and thus increasing the freedom of the leaner to learn when and where s/he is ready to learn. Wedemeyer's is reviewed as new ideas inventor of open and distance education, as well as advocate of the application of technology as an instrument that is essential in opening up opportunities and in the promotion of educational democracy (Fluegge, 2010). Wedemeyer made a consideration that the independent of students is the essence of distance learning. According to Wedemeyer, independent study comprised of several methods of arrangements in learning and teaching where the learners and teachers carry out their responsibilities and tasks separate from each other and communication is done in various manners. Wedemeyer diverted from the traditional correspondence study concept and made contributions to the emerging new design of viewing the roles of the student and the teacher (Fluegge, 2010).

The key elements of independent learning are availability of instruction, student greater responsibility, effective mix of methods and media, adapting to differences among individuals, and a wide variety of start, stop, learning times (Runfang, 2010). Wedemeyer made a proposition that the separation of teaching and learning was a manner of breaking space-time barriers in education. He therefore gave six

characteristics of study system that were independent which were; separation of student and the teacher, the convenience of learning in the students own environment and the learner is the one that takes the responsibility of the pace and pace the freedom to start and stop at any. This theory is relevant to individual-play kahoot because in this system of education, learners play and learn on their own and independently guided by the teacher's instructions.

2.2.3 Gardner's Theory of Multiple Intelligences

Gardner's Theory of Multiple Intelligences is one of the most significant developments in learning theories to come out of the last quarter of this 21st century. The foundation of this theory is that we all employ different strategies for learning, and that these strategies relate to internal strengths and capabilities that can be classified into eight categories, which Gardner called "intelligences". Gardner proposes eight primary forms of intelligence: (1) linguistic, (2) musical, (3) logical-mathematical, (4) spatial, (5) body-kinesthetic, (6) intrapersonal (e.g., insight, metacognition), (7) interpersonal (e.g., social skills), and (8) naturalistic (sensitivity to natural phenomena, and classification skills). The implication of this theory is that learning can become more effective if we focus on and develop instruction for these intelligences. Generally speaking, assessment should include more than one 'intelligence', as each is more than simply a content domain; it is also a learning modality. Cultural differences play a key role, as each culture tends to value and emphasize particular intelligences in favour of others. Gardner's Seven Intelligences Connecting Gardner's ideas with the design of games is particularly effortless, as almost everyone is evident in almost every successful game – in fact, it could be argued that one of the features of games that make them so engaging

is that they address each one of these forms, providing game players with a particularly rich experience, where each player has an opportunity to take advantage of her own particular strengths.

Linguistic: Linguistic intelligence coincides nicely with Gagné's Verbal Information category, and thus what was said there also applies here. Games often include written and spoken elements – for game play, as well as for direction and help.

Musical: Virtually all games include sound to enhance play – there are sound-effects, both diegetic and non-diegetic, as well as music to set the mood or provide feedback about game states. In some cases, musical scores for games are as sophisticated as they are for film. Sounds are used as feedback and reinforcement as well as for effect and enjoyment.

Logical-mathematical: Strategy is one of the key elements in play – the extent to which this intelligence is exercised depends heavily on the genre and specific game played. Puzzle games rely heavily on logical and mathematical intelligences to win. The management type games, like Zoo Tycoon also involve reliance on and further development of this intelligence, for it is virtually impossible to manage the zoo well without an ability to plan and manipulate a fairly complex set of resources. Simpler games, such as Pikmin, still requires counting and arithmetic. Moving an object often requires a minimum number of Pikmin, and even very young players quickly learn to do simple calculations in order to get the optimal number of Pikmin into position to complete a task.

Spatial: Games are of course highly visual, providing a rich and colourful 2- or 3-dimensional environment, which is always at least partially under the player's control in terms of what is visible. It is quite common, for example, to be shown multiple

simultaneous first- and thirdperson views – which not only tap into one's spatial intelligence, but at the same time actively help players learn to use these views in their gameplay.

Kinesthetic: Although games cannot yet place their players physically in the game, most games do require players to 'place themselves' virtually in the game in one way or another and all involve movement and action which, at the very least, is realized through physical movements of the players hands (watching players quickly confirms that there is indeed more going on than just hand motions). There are, of course, numerous games that are specifically designed to involve mild to heavy physical activity, such as Dance Revolution, and, to a lesser extent, games like Donkey Konga. In spite of the fact that these games are marketed on their "Kinesthetic Intelligence" attraction, they still provide musical, visual, and linguistic stimulation, as well as requirements for logical thinking and strategizing.

Intrapersonal: Strategy is one of the key elements in play – once again this is a key element in games: they force players to discover and practice what one can do, what one wants to do, how one reacts to things, which things to avoid, and which things to gravitate toward. Many games present scenarios that involve ethical dilemmas, and have moral (or immoral) themes.

Interpersonal: Many of the most popular games include multi-player modes, many online games massively so. Even single player games typically include multiple NPC's (non-playable characters) and often require varying degrees of both competition and cooperation in order to win.

Naturalistic: Games with naturalistic themes are common – whether they include purely realistic flora and fauna, purely fantastical ones or some combination of the two. Clearly,

games like Zoo Tycoon call upon one's natural intelligence in order to be able to identify various animals' requirements for housing and care. Beyond that, any game that creates a world with geography and a variety of inhabitants require classification, as well as naturalistic skills and understandings. Once again, even a game like Pikmin includes several distinct kinds (species?) of Pikmin, each with its own strengths and weaknesses. Although not all games embody every kind of intelligence, most embody most of them, and it is always possible to find a specific game that favours one or another. This theory is relevant to game-based learning and formative assessment.

2.2.4 Retention Theories

Chauhan (1998) discussed some theories associated with retention thus:

Theory of decay: It can also be called theory of disuse. According to this view, impressions created by learning in the cortex fade away as the time passes. So, forgetting is produced by time factor. Our wealth of experience tends to fade away with passage of time.

Theory of interference: This theory explains that certain activities which take place both before and after learning had occurred tend to inhabit retention of such information and is called proactive inhibition and retroactive inhibition respectively.

Theory of Trace-Change: According to the view of this theory, what has been learned tend to change steadily in a specific way. This usually results in the loss of experience of the property of the original learning or information. More perfect trace-change in the trace of original learning causes loss in the retention of the learnt materials.

Theory of forgetting as a retrieved failure. This theory focuses on where one tends to fail to recall some piece of information at times but under a different condition, such information comes back more spontaneously. This is called tip-of-the tongue. It shows

how non-availability of relevant cues hinders retention. This theory regards forgetting as temporary rather them a permanent phenomenon. This is so because, one may forget information now, only to remember it the next day or two.

Theory of motivation: This theory sees the degrees of pleasantness or unpleasantness which the motive causes as a crucial determination of retention of such motive. Unpleasant motives tend to be quickly regressed and eventually lost in the person's memory. It can also be called dynamic theory.

Consolidation theory: The view of this theory is that the undisturbed period of memory tends to become durable and permanent because the memory traces unit remains. But if the newly formed traces are disturbed and no time is given for its consolidation, they were wiped out as the memory traces. When this happens, retention will not take place.

From the above theories one can allude that the ability to retain information depends on many variables such as time interval between when learning occurred and retrieval, intervening experiences, environment, instructional strategies/material used, specific subject involved etc. These variables in one way or the other affect retention adversely.

2.3 Related Empirical Studies

Okigbo & Okeke (2011) investigated the effect of games and analogies on secondary school students' interest in mathematics. Six research hypotheses were formulated to guide the study. A Solomon three-group design was adopted in the research. A total of 246 JS11 mathematics students were involved in the study. The research instrument for data collection was mathematics interest inventory. The research hypotheses were tested using analysis of covariance (ANCOVA). The results of the analysis showed that both games and analogies enhanced learner's interest in mathematics. Games was found to be more effective in improving students' interest in mathematics than analogy but there

was no statistically significant difference in the mean interest scores of students taught mathematics using game approach and those taught using analogies.

In a similar study.

Bahrami *et al.* (2012) carried out a study on a comparison of the effectiveness of game-based and traditional teaching on learning and retention of first grade math concepts in Iran. The population of the study consisted of all the female student of khorramabad province. Experimental group were taught using game-based teaching while the control group were taught using the traditional teaching. Data description was done using mean standard deviation and data comparison was done using independent T-test and Effect Size (ES). The results showed that the experimental group had higher score in learning and retention; this revealed that using educational games in teaching of first grade math can be remarkably helpful and efficient.

Hassan & Poopak (2012) in their study in Iran investigated the effect of teacher-made instructional card games and computer games for learning chemistry concepts on high school students majoring in math and science. The sample consisted of three groups of 35 students. The results indicated that there was a significant difference between teacher – made card games and computer games.

Atsumbe *et al*. (2013), carried out a study that determined effects of animation on students' achievement and retention in Basic Electricity at Technical Colleges in Benue State, Nigeria. The study adopted quasi-experimental research design; specifically, the pre-test post-test non-equivalent control group experimental design. Students' performance was obtained after being treated with animation instructional technique and conventional teaching method. There was no sampling as the population of the study comprised of all 82 Technical college one (TC 1) students offering Basic Electricity.

The instrument used was Basic Electricity Achievement and Retention Test (BEART). Reliability testing of BEART was carried out with the use of test-retest technique and a reliability coefficient of 0.81 was obtained. Data collected were analyzed using mean and ANCOVA at .05 level of significance. The findings of the study revealed that students taught with animation have higher achievement and retention in Basic Electricity than with conventional method. The findings imply that animation had a positive effect on students' understanding of Basic Electricity. It is recommended that technical college teachers be equipped with necessary skills required to employ animation in teaching.

Akinsola (2014), carried out an investigation on relative effectiveness of mastery learning, cooperative learning, combined mastery learning and cooperative learning strategy on student's achievement in integrated science. The subjects consist of 200 JSS students selected from Ibadan Nigeria. The data collected where analyzed using ANCOVA and Duncan post-hoc analysis, result from the study revealed that combined mastery learning and cooperative learning strategy was found to be more suitable in facilitating achievement in integrated science. More also, female students outperform the male students in integrated science.

Enohuean (2015), carried out an investigation on effects of instructional materials on the academic achievement and retention of SS 2 biology students in Delta State. The study sample consisted of 86 SS2 biology students randomly selected from a population of 5,626 students drawn from 18 public schools. An instrument designed and developed from past WAEC questions by the researcher known as Biology Achievement Test (BAT) was validated by some senior lecturers in science, English and statistic from Ahmadu Bello University and senior biology teachers in Delta State. The instrument

used was tested and certified to be reliable at 0.65 coefficient. Quasi-experimental design was adopted which involves two groups: experimental and control groups. The experimental group was subjected to treatment using instructional materials but the control group was taught without any instructional materials. Four null hypotheses were tested using test statistics. The following major findings were made: There is a significant difference between the mean academic achievement scores of students taught using instructional materials (EG) and those taught without the use of instructional materials (CG). There is no significant difference in the mean achievement scores of male and female students taught biology concepts using instructional materials. There is significant difference in the mean retention scores of students taught with instructional materials and those taught without instructional materials. There is significant difference in the interest ability of male and female students exposed to the use of instructional materials. On the basis of these findings some recommendations were made, one of which is teachers should make use of instructional materials to facilitate the teaching of biology at secondary school level.

Fatokun *et al*. (2016), investigated on the effect of games teaching approach on chemistry students' achievement and retention in periodicity. The research designed employed was pretest - posttest control quasi experimental design. Multi-stage random sampling technique was used to select 96 students who participated in the study. Periodicity Achievement Test (PAT), used as Pre-Test (PREPAT), Post-Test (POSTPAT), and Post-Post-Test (PPPAT) was developed by the researcher and validated by experts. The reliability coefficient of the instrument obtained using spearman-brown prophecy formula was 0.77. Five hypotheses were formulated and tested at 0.5 level of significance. The pretest was administered to subjects in both groups to measure their knowledge in periodicity. The control group was taught

periodicity for four weeks using only the conventional method while the experimental group was also taught periodicity for four weeks with games method. POSTPAT was administered to all the subjects at the end of the fourth week. Two weeks after the administration of POSTPAT, the PPPAT was administered to both groups. The results show that the students taught periodicity using game method achieve and retain better than those taught with conventional method. It was also discovered that gender has no influence on the achievement and retention of those exposed to treatment.

Joseph (2017) carried out a study on the effect of the online game Kahoot on science vocabulary acquisition of students with learning disabilities in a middle school inclusion physical science classroom. Specifically, the study investigated student satisfaction using the online game Kahoot. Vocabulary acquisition was measured in terms of weekly vocabulary assessments. Six middle school students, three males and three females, participated in the study. A single subject design with ABAB phases was utilized. Results showed that all students increased their vocabulary assessment scores when Kahoot was played twice weekly. The use of Kahoot also increased student achievement and focus on task behavior. The results of the student satisfaction survey indicated that students enjoyed playing Kahoot and found it easy to use.

2.4 Summary of Literature Reviewed

The study views three theories of game-based learning; constructivist theory, Wedemeyer's theory of independent study and Gardner's Theory of Multiple Intelligences. More also, eight empirical studies were reviewed; the first being Okigbo & Okeke (2011) investigated the effect of games and analogies on secondary schools students' interest in mathematics. Bahrami *et al.* (2012) carried out a study on a comparison of the effectiveness of game- based and traditional teaching on learning and retention of first grade math concepts in Iran. Then Hassan & Poopak (2012) in their

study in Iran investigated the effect of teacher-made instructional card games and computer games for learning chemistry concepts on high school students majoring in math and science. Also, Atsumbe *et al*. (2013), carried out a study that determined effects of animation on students' achievement and retention in Basic Electricity at Technical Colleges in Benue State, Nigeria. Then Akinsola (2014), carried out an investigation on relative effectiveness of mastery learning, cooperative learning, combined mastery learning and cooperative learning strategy on student's achievement in integrated science. With Enohuean, (2015), carried out an investigation on effects of instructional materials on the academic achievement and retention of SS 2 biology students in Delta State. And Fatokun *et al*. (2016), investigated on the effect of games teaching approach on chemistry students' achievement and retention in periodicity. Finally, Joseph (2017) carried out a study on the effect of the online game Kahoot on science vocabulary acquisition of students with learning disabilities in a middle school inclusion physical science classroom. The study also reviewed concepts of Basic Technology; Kahoot; Teaching methods; ICT in Education; Achievement; Retention; Interest; Gamification; Game-based learning and formative assessment.

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 Research Design

The research design that was adopted for this study is a quasi-experimental pre-test, post-test, control group design. According to Gall *et al.* (2007), quasi-experimental design can be used when it is not possible for the researcher to randomize the subjects and assign them to treatment groups without disrupting the academic programmes of the schools involved in the study. The design was considered suitable to conduct this study because intact classes were used and as such the researcher did not randomize the subjects to groups. The experimental groups were taught with individual-play Kahoot game, group-play Kahoot game while the control group was taught with the usual lecture method. The three groups were pre-tested before the intensive implementation of the three instructional strategies and after a four week of extensive classroom session, the three groups were post-tested at same time to measure their achievement, retention

and interest level. The study consists of three independent variables 'individual-play kahoot, group-play kahoot, and Lecture method; three dependent variables 'achievement, retention and interest' and one moderating variable gender (male and Female). This design allows the two independent variables to determine their impact on the dependent variables. The research design layout is as shown in Table 3.1.

Table 3.1: Research Design Layout

Group	**Pre-test**	**Pre-interest**	**Treatment**	**Post-test**	**Retention Interest**
Experimental Group1	O_1	O_2	X_1	O_3	O_4 O_5
Experimental Group2	O_1	O_2	X_1	O_3	O_4 O_5
Control Group	O_1	O_2	X_0	O_3	O_4 O_5

Key:

O_1: Represent the pre-test of the experimental and control groups

O_2: Represent the pre-interest of the experimental and control groups

O_3: Represent the post-test of the experimental and control groups

O_4: Represent observation on Interest

O_5: Represent observation on Retention

X_1: Represent the treatment of the experimental groups on Kahoo! Application

X_0: Represent the control group that was exposed to lecture method.

3.2 Population of the Study

The population of this study is made up of the entire 35,584 students consisting of 18,548 males and 17,036 females in the 2018/2019 academic session, offering Basic Technology in both private and public secondary schools of the two local government areas in Minna. The target population of this study are the entire 11,870 JSS2 students consisting 6,164 males and 5,706 females of both the public and private schools of the two local government areas in Minna.

Source: Niger State Secondary Education Board (2018/2019 academic session).

3.3 Sample and Sampling Techniques

The sample of this study was made up of 438 students consisting of 224 males and 214 females from one public school and two private schools selected from both Bosso and Chanchaga local government areas in Niger State. Purposive sampling technique was adopted for the study. The reason for using this technique is because of the availability of the use of ICT, internet facilities and mobile technologies. The sample distribution of students in the selected schools is shown in Table 3.2

Table 3.2: Sample Distribution Table of Students in the Selected Schools

Name of school	Number of male students	Number of female students	Total
Day secondary school Chanchaga B	205	179	384
Niger Baptist School Minna	9	16	25

Brighter Nursery & Primary School Minna	10	19	29
Total	224	214	438

Source: Niger State Secondary Education Board (2018/2019 academic session)

3.4 Research Instruments

Two research instruments were used for this study. The instruments included:

1. Test instrument (Basic Technology Achievement Test (BTAT))
2. Students Interest Inventory Scale (SIIS)

3.4.1 Development of Basic Technology Achievement Test (BTAT)

The Basic Technology Achievement Test (BTAT) was adopted by the researcher, based on the past promotion examinations by the Basic Education Certificate Examination from the JSSII curriculum. BTAT consisted of 30 items multiple choice objective test, four options lettered A-D with only one correct answer included. The test will cover wood, ceramics and plastics. The BTAT contains two sections, the first section contained information on the demographic data students while the second section elicit information on the students' cognitive level based on learning materials. The instrument was used for pre-test and post-test respectively. In scoring the multiple-choice questions, each question was awarded one mark for a correct option chosen and later converted to percentage. (See Table of Specification in Appendix E).

3.4.2 Procedure for Development of Kahoot

Step I: Login to www.kahoot.com and sign up for a free account.

Step II: created an account, you will see a screen with three icons for a quiz, discussion item or survey.

Step III: You then create the quiz, survey or discussion item.

Step IV: Make your selection and build your game. Questions have a 95-character limit and have up to four answer options.

Step V: Select the correct answer by pressing the red “Incorrect” button. It will turn green and say “Correct”.

Step VI: Choose a time limit between 5 and 120 seconds. You may embed an image or a YouTube video.

Step VII: Continue to add and edit questions using the toolbar on the bottom of the screen.

Step VIII: To complete the quiz, select “Next” and follow the instructions. You may add a cover image and you select whether you want to make your game public or private. You are now ready to launch your game.

Your Kahoot games are saved in My Kahoots. You then select the game you want to launch (individual player group play) and press the Play button.

Note: I. Students login to the game using their smart phone or computer.

II. Kahoot! displays a game pin to join the quiz (see example below).

III. Students enter the game pin on their device and create a username that will display as the game progresses.

Students get points for correctness and speed. The correct question and a scoreboard display after each question.

Fig. 3.1: Kahoot scoreboard display. (Source: www.kahoot.com).

The results of your quizzes are displayed in My Kahoot section. Click on the purple cloud next to the game plays. If you allowed students to select a user name, you will want them to share that name with you so you can track the results.

3.4.3 Procedure for Administration of Kahoot (individual-play and group-play)

The following are the step-by-step procedures on playing a Kahoot as live host or group-play game:

1. If you are leading a Kahoot for others to play, your device should be connected to something that all of your learners can see, such as a projector screen or large TV for playing locally, or a service like Youtube Live or Skype to stream your screen online.
2. Once you have selected a Kahoot to play, you will need to select a game mode (classic or team) to launch the Kahoot.
3. Play! You should now see a lobby screen, where instructions to go to kahoot.it and enter a game PIN are displayed. Leave this page open and have your learners follow the instructions on their own devices. As they join, you'll see their nicknames appear on your screen. Click 'Start' once everyone's joined.
4. Use the 'Next' button to move through results screens and get to the next question.

   Once all questions have been answered, you'll be able to collect feedback on the kahoot from your learners and download results.

Here are the necessary steps of using Kahoot! as challenge or individual-play (Latham, 2017):

1. Open the Kahoot! quiz intended for play.
2. Click on the Challenge button and follow the instructions to set up a challenge. Choose when the challenge should end.
3. Copy the challenge link, and share it with the participants via email, text messages, etc. or share the PIN of the challenge.
4. Once the participants open the challenge link, it will take them to the app automatically. If they preferred to use the challenge PIN, they will need to enter the code manually when they launch the app. Access and review the

participants' data at any time to see who has completed the challenge and how many questions they have answered.

3.4.4 Student Interest Inventory Scale (SIIS)

The Student Interest Inventory Scale (SIIS) is adapted from the Academic Interest Scale, a self-report 101-item inventory developed by Addison *et al.* (2009) and used by Althoff (2010). The scale consists of four subscales of motivation, organization, responsibility and self-awareness. The items used for the SIIS were generated from the original Academic Interest Scale. The SIIS consists of sections A and B. Section A deals with the biodata of the respondents while section B contains 20 item statements arranged on a five-point adapted Likert scale type of SA, A, UD, D and SD. The instrument was re-validated for local use and then administered to a parallel sample. Data collected were used for the calculation of reliability coefficient using Cronbach Alpha.

3.5 Validation of Research Instrument

3.5.1 Validity of Basic Technology Achievement Test (BTAT)

The Basic Technology Achievement Test (BTAT) contained 30 selected items and was validated by two lecturers from the Department Industrial Technology Education, Federal University of Education Minna, and two teachers teaching Basic Technology in secondary schools selected for the study. The validation entails checking the items against the topic and content of the lesson. However, Basic Technology Achievement Test (BTAT) validation ensured that the content of the test adequately covers the curriculum or syllabus and the experts also suggested modification on the structure of the items, organization, choice of appropriate alternatives for the multiple-choice questions, clarity of the questions, and language level of the items. The report was presented as the appendix in this work. (See Appendix J, pg. 115).

3.5.2 Validity of Treatment Instrument

The Kahoot (KGA) relevant to the concept of Basic Technology was equally validated by two experts in Educational Technology, Federal University of Technology Minna, Niger State. The experts examined the face and the content validity of the instrument using criteria which are: the simplicity of the format and its suitability for the level of students; the appropriateness of the graphics and text; the sharpness, clarity, and easy accessibility of the instrument; the subject matter covered, accuracy and logical presentation; verification of the content to determine the degree and component of the topic to be covered; and then the time provided to answer the kahoot questions.

3.5.3 Validity of Students Interest Inventory Scale

The Interescale relevant to the concept of Basic Technology waas equally validated by psychologist / guardian counselor, from Spring Fountain Basic School Chanchaga-Minna, Niger State. The expert examined the face and the content validity of the instrument using criteria which are: the simplicity of the format and its suitability for the level of students; the appropriateness of the graphics and text; the sharpness, clarity, and easy accessibility of the instrument.

3.6 Reliability of the Research Instruments

Pilot testing was carried out to test the consistency of the BTART and SIIS and to trial run the KGA. The study was carried out at supreme international Schools chanchaga who are part of the population but not part of the sample schools chosen for the study. The administration was done once and the reliability coefficient of 0.87 was obtained using KR-21 formula on BTAT and Cronbach's Alpha to determine SIIS with reliability coefficient of 0.78. The result obtained from the reliability coefficient revealed that the instruments are reliable, (see Appendix H & I).

Control of Extraneous Variables

The researcher attempted to control the extraneous variables that may mar the generation of the findings through the following measures:

1. Teacher variable

The researcher organized a two-day uniform training for the research assistants in order to control teachers' variable. Lesson plans were also prepared by the researcher and made available to the participating teachers. This reduced teachers' effect on lesson preparation and presentation. In order to avoid experimental bias, the researcher involved the services of the same school basic technology teachers in handling the groups. The researcher ensured that the four weeks period for the experiment was followed by the teachers and that the teachers did not deviate from the instrument specifications and instruction. The entire test was under the custody of the researcher until when required.

2. Pre-test sensitization

Since the same instruments were used for both pre-test and post-test for the measurement of basic technology students' cognitive achievement. It was very easy for the students to get familiar with the test instrument and hence bringing error into the study. To control this pre-test sensitization therefore, the researcher:

i. Withdraw all the instrument items from the students and the classroom teachers after the pre-testing.

ii. Restructure or reshuffle the options in each test items in the pre-BTAT before using it as post-BTAT.

3. Initial group difference

The researcher checked the issue of initial group difference through the application of

analysis of variance (ANOVA) since the study was pre-test, post-test, non-equivalent control group design

4. Hawthorne effect

Hawthorne effect is a situation where the performance of research subject is affected due to the fact that the students are conscious of the fact that they are involved in an experiment. In order to reduce this problem, the researcher used the normal classroom teachers in both experimental groups and control group.

3.7 Method of Data Collection

One week before the experiment, the researcher visited the selected schools obtained official permission from the schools' management, cooperation from staff especially those teaching Basic Technology were sought. Two weeks was used for the administration of the pre-test on BTAT and KGA, which was used to determine the entry behaviour, pre-interest, and the equivalent level of both the control and experimental groups. The post-test was taken in the sixth week. The experimental groups were exposed to the thirty-unit contents based on Kahoot while the control group was taught using the lecture method on the same thirty-unit contents. This process lasted for four weeks at constant period of once a week. After the entire process, the post-test on achievement and retention was administered to both the control and the experimental groups using BTAT and KGA respectively.

3.8 Method of Data Analyses

The procedure for data analysis is determined by the type of data and the nature of hypothesis to be tested. The data collected were analyzed using descriptive and inferential statistics respectively. Mean and standard deviation were used to answer the research questions using the Statistical Package for Social Sciences (SPSS) version 20,

the significance of the statistical analyses was ascertained at 0.05 alpha level of significance. The student's achievement test used in this study involved interval data which brought out the differences and the hypotheses stated in Null form. On the basis of these criteria ANOVA was used to analyze the pre-test scores, since significant difference exists between the groups at the initial stage, then ANOVA was used to answer hypotheses 1, 4 & 7, while T-test was used to answer hypotheses 2, 3, 5, 6, 8 & 9, to take care of the initial differences in the pre-test. However, if at the posttest analysis significant difference exist between the three groups, then Sidak post-hock analysis was used to determine the difference and reduces the experimental errors and so increases the probability of rejecting the Null hypothesis when it was false.

3.9 Pre-test

The data collected from the pre-test was analyzed using ANOVA. The purpose of pretest was to establish the equivalence before the commencement of the study. To analyze the pre-test scores, analysis of variance ANOVA was used to determine if there was any existing difference between the variables. Result of pre-test Scores using ANOVA is shown in Table 3.3.

Table 3.3: Summary of ANOVA Result of the pre-test Scores

Source of Variation	Sum of Squares	df	Mean Square	F	P
Between Groups	13.562	2	6.781	0.808	0.446
Within Groups	3649.525	435	8.390		
Total	3663.087	437			

NB: Not significant at 0.05

Table 3.3 revealed that the ($F_{(2,435)} = 0.808$, $P < 0.05$). Since the test statistic is greater than the critical value, it implies and conclude that there is a (statistically) significant difference in the mean pre-test scores of students taught with individual-play kahoot, group-play kahoot and lecture method. Hence, Analysis of Variance (ANOVA) was used to test the null hypotheses.

CHAPTER FOUR

4.0 RESLTS AND DISCUSSION

4.1 The Results

The data collected from the post-test consisting of research questions were analyzed using mean and standard deviation and the hypotheses using ANOVA for hypotheses 1, 4, & 7, T-test for hypotheses 2, 3, 5, 6, 8 & 9 respectively.

4.2 Research Questions

All research questions in this study were answered using descriptive statistics (mean and standard deviation).

4.2.1 Research Question One

What is the difference in the mean achievement score of student's taught Basic Technology using individual-play Kahoot, group-play Kahoot and lecture method?

Mean and Standard Deviation was used and the result is presented in Table 4.1

Table 4.1: Mean and standard deviation of achievement scores of students taught Basic Technology through individual-play Kahoot, group-play Kahoot and lecture method

Groups	N	Pre-test		Post-test		Main Gain	
		Mean	SD	Mean	SD	Mean	SD
Lecture Method	384	13.99	3.04	27.44	1.58	13.45	1.85
Individual-play	25	14.16	1.70	29.44	0.96	15.28	0.74
Group-play Kahoot	29	13.31	1.17	29.07	0.92	15.76	0.25

Source: Field work 2019

Table 4.1 reveals that, the mean and standard deviations of the post-test and that of the pre-test in the three groups under study differ, where the students taught basic technology with lecture method had mean achievement scores of 27.44 with standard deviation of 1.58 while those taught with individual-play kahoot had mean sores of 29.44 with standard deviation of 0.96 and those taught with group-play kahoot had mean scores of 29.07 with standard deviation of 0.92. Table 4.1 further revealed that the group-play kahoot recorded high mean and SD gain score of 15.76 and 0.25 as against 15.28 and 0.74 recorded by individual-play kahoot and 13.45 and 1.85 recorded by lecture method. This implies that there is a statistically significant difference in the mean achievement scores of students taught through the three methods in favour of group-play kahoot.

4.2.2 Research question Two

Is there any gender influence in the mean achievement score of male and female student's taught Basic Technology using individual-play Kahoot?

Mean and Standard Deviation was used and the result is presented in Table 4.2

Table 4.2: Mean and Standard deviation of Male and Female students' achievement score in Basic Technology when taught through individual-play kahoot,

Groups	N	Pre-test		Post-test		Mean Gain	
		Mean	SD	Mean	SD	Mean	SD
Male	9	13.89	1.05	29.22	1.09	15.33	0.04
Female	12	14.31	1.99	29.56	0.89	15.25	1.10

Source: Field work 2019.

Table 4.2 shows that, the mean and standard deviation of the post-test and that of the pre-test of the male and female students taught using individual-play Kahoot differ. Where the male students had mean achievement score of 29.22 with standard deviation of 1.09, their female counterparts had mean achievement score of 29.56 with standard deviation of 0.89. Table 4.2 further revealed that the male students recorded high mean and SD gain of 15.33 and 0.04 as against 15.25 and 1.10 recorded by their female counterparts. This implies therefore that there is a statistically significant difference in the mean achievement scores of male and female students taught basic technology with Individual-play Kahoot.

4.2.3 Research Question Three

Does group-play Kahoot have any influence in the mean achievement score of male and female student's taught Basic Technology?

Mean and Standard Deviation was used and the result is presented in Table 4.3

Table 4.3: Mean and Standard deviation of Male and Female students' achievement score in Basic Technology when taught using group-play kahoot,

Groups	N	Pre-test	Post-test	Mean Gain

		Mean	SD	Mean	SD	Mean	SD
Male	10	13.30	1.06	28.80	0.92	15.50	0.14
Female	19	13.32	1.25	29.21	0.92	15.89	0.00

Source: Field work 2019.

Table 4.3 shows that, the mean and standard deviations of the post-test and that of the pre-test of the male and female students taught using group-play Kahoot differ. Where the male students had mean achievement score of 28.80 with standard deviation of 0.92, while their female counterparts had mean achievement score of 29.21 with standard deviation of 0.92. Table 4.3 further revealed that the female students recorded high mean and SD gain of 15.89 and 0.00 as against 15.50 and 0.14 recorded by their male counterparts. This implies therefore that there is a statistically significant difference in the mean achievement scores of male and female students taught basic technology with group-play Kahoot.

4.2.4 Research Question Four

Is there any difference in the mean retention score of student's taught Basic Technology using individual-play Kahoot, group-play Kahoot and lecture method?

Mean and Standard Deviation was used and the result is presented in Table 4.4

Table 4.4: Mean and standard deviation of retention scores of students taught Basic Technology through individual-play Kahoot, group-play Kahoot and lecture method

Groups	N	Post-test		Retention		Main Gain	
		Mean	SD	Mean	SD	Mean	SD
Lecture Method	384	27.44	1.58	26.60	2.56	0.84	0.98

Individual-play	25	29.44	0.96	27.44	1.87	2.00	0.91
Group-play Kahoot	29	29.07	0.92	27.90	1.65	1.17	0.73

Source: Field work 2019

Table 4.4 reveals that, the mean and standard deviations of the retention and that of the pre-test in the three groups under study differ, where the students taught basic technology with lecture method had mean retention score of 26.60 with standard deviation of 2.56, while those taught with individual-play kahoot had mean sore of 27.44 with standard deviation of 1.87 and those taught with group-play kahoot had mean score of 27.90 with standard deviation of 1.65. Table 4.4 further revealed that the individual-play kahoot recorded high mean gain score of 2.00 as against 1.17 recorded by group-play kahoot and 0.84 recorded by lecture method. This implies that there is a statistically significant difference in the mean retention scores of students taught through the three methods in favour of individual-play kahoot.

4.2.5 Research question Five

Is there any influence of gender in the mean retention score of male and female student's taught Basic Technology using individual-play Kahoot?

Mean and Standard Deviation was used and the result is presented in Table 4.5

Table 4.5: Mean and Standard deviation of Male and Female students' Retention score in Basic Technology when taught through individual-play Kahoot.

Groups	**N**	**Post-test**		**Retention**		**Mean Gain**	
		Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**

Male	9	29.22	1.09	27.33	1.87	1.89	0.78
Female	16	29.56	0.89	27.50	1.93	2.06	1.04

Source: Field work 2019.

Table 4.5 shows that, the mean and standard deviations of the retention and that of the post-test of the male and female students taught using individual-play Kahoot differ. Where the male students had mean retention score of 27.33 with standard deviation of 1.87, while their female counterparts had mean retention score of 27.50 with standard deviation of 1.93. Table 4.5 further reveal that the female students recorded high mean and SD gain of 2.06 and 1.04 as against 1.89 and 0.78 recorded by their male counterparts. This implies therefore that there is a statistically significant difference in the mean achievement scores of male and female students taught basic technology using individual-play Kahoot.

4.2.6 Research Question Six

Does group-play Kahoot have any influence in the mean retention score of male and female students taught Basic Technology?

Mean and Standard Deviation was used and the result is presented in Table 4.6

Table 4.6: Mean and Standard deviation of Male and Female students' Retention score in Basic Technology when taught through group-play Kahoot.

Groups	N	Post-test	Retention	Mean Gain

		Mean	SD	Mean	SD	Mean	SD
Male	10	28.80	0.92	28.60	1.17	0.20	0.25
Female	19	29.21	0.92	27.53	1.78	1.68	0.86

Source: Field work 2019.

Table 4.6 shows that, the mean and standard deviation of the retention and that of the post-test of the male and female students taught basic technology using group-play Kahoot differs. Where the male students had mean retention scores of 28.60 with standard deviation of 1.17, while their female counterparts had mean retention scores of 27.53 with standard deviation of 1.78. Table 4.6 further reveals that the female students recorded high mean and SD gain of 1.68 and 0.86 as against 0.20 and 0.25 recorded by their male counterparts. This implies therefore that there is a statistically significant difference in the mean retention scores of male and female students taught basic technology with group-play Kahoot.

4.2.7 Research Question Seven

Is there any difference in the mean interest responses of student's taught Basic Technology using individual-play Kahoot, group-play Kahoot and lecture method?

Mean and Standard Deviation was used and the result is presented in Table 4.7

Table 4.7: Mean and standard deviation of Interest Responses of student's taught Basic Technology through individual-play Kahoot, group-play Kahoot and lecture method

Groups	N	Pre-interest		Interest		Main Gain	
		Mean	SD	Mean	SD	Mean	SD
Lecture Method	384	4.13	4.45	4.49	0.40	0.36	4.05
Individual-play	25	3.88	0.33	4.51	0.39	0.63	0.06
Group-play Kahoot	29	4.00	0.00	4.60	0.20	0.60	0.20

Source: Field work 2019

Table 4.7 above showed that, the mean and standard deviations of the post-interest responses and that of the pre-interest responses differs in the three groups under study, where the students taught basic technology with lecture method had mean interest responses of 4.49 with standard deviation of 0.40 while those taught with individual-play kahoot had mean interest responses of 4.51 with standard deviation of 0.39 and those taught with group-play kahoot had mean interest responses of 4.60 with standard deviation of 0.20. Table 4.7 further reveal that the individal-play kahoot recorded high (mean and SD) gain responses of 0.63and 0.06 as against 0.60 and 0.20 recorded by group-play kahoot and 0.36 and 4.05 recorded by lecture method. This implies that there is a statistically significant difference in the mean interest responses of students taught through the three methods in favour of individual -play kahoot.

4.2.8 Research Question Eight

Is there any gender influence in the mean interest responses of male and female student's taught Basic Technology using individual-play Kahoot?

Mean and Standard Deviation was used and the result is presented in Table 4.8

Table 4.8: Mean and Standard deviation of Male and Female students' interest responses in Basic Technology when taught using Individual-play Kahoot

Groups	N	Pre-interest	Interest	Mean Gain

		Mean	SD	Mean	SD	Mean	SD
Male	9	3.82	0.40	4.50	0.23	0.68	0.17
Female	16	3.93	0.27	4.53	0.49	0.60	0.22

Source: Field work 2019.

Table 4.8 shows that, the mean and standard deviations of the post-interest and that of the pre-interest differ in the gender groups under study. Where the male students taught basic technology using individual-play Kahoot had mean interest responses of 4.50 with standard deviation of 0.23, while their female counterparts had mean responses of 4.53 with standard deviation of 0.60. Table 4.8 further reveals that the male students recorded high mean and SD gain of 0.68 and 0.17 as against 0.60 and 0.22 recorded by their female counterparts. This implies that there is a statistically significant difference in the mean interest responses of male and female students taught basic technology concepts.

4.2.9 Research Question Nine

Does group-play Kahoot have any influence in the mean interest responses of male and female student's taught Basic Technology?

Mean and Standard Deviation was used and the result is presented in Table 4.9

Table 4.9: Mean and Standard deviation of Male and Female students' interest responses in Basic Technology when taught using group-play Kahoot

Groups	N	Pre-interest		Interest		Mean Gain	
		Mean	SD	Mean	SD	Mean	SD
Male	10	4.00	0.00	4.61	0.13	0.61	0.13
Female	19	4.00	0.00	4.59	0.24	0.59	0.24

Source: Field work 2019.

Table 4.9 shows that, the mean and standard deviation of the post-interest and that of the pre-interest differs in the gender groups under study. Where the male students taught basic technology using group-play Kahoot had mean interest responses of 4.61 with standard deviation of 0.13, while their female counterparts had mean responses of 4.59 with standard deviation of 0.24. Table 4.9 further reveals that the male students recorded high mean and SD gain of 0.61 and 0.13 as against 0.59 and 0.24 recorded by their female counterparts. This implies that there is a statistically significant difference in the mean interest responses of male and female students taught basic technology concepts.

4.3 Testing the Null Hypotheses

4.3.1 Hypothesis One

There is no significant difference in the mean achievement score of student's taught Basic Technology using individual-play Kahoot, group-play Kahoot and lecture method?

The data collected was analyzed using Analysis of Variance (ANOVA) which is reported in Table 4.10a.

Table 4.10a ANOVA comparison of the post-test mean achievement scores of students taught Basic Technology through individual-play Kahoot, group-play Kahoot and lecture method.

Source of Variation	Sum of Squares	df	Mean Square	F	P
Between Groups	155.791	2	77.895	33.799	0.000
Within Groups	1002.522	435	435		
Total	1158.313	437			

Source: Field work 2019. ***Significant @ P<0.05***

Table 4.10a shows the ANOVA comparison of the mean achievement scores of students taught Basic Technology through individual-play Kahoot, group-play Kahoot and lecture method. The result on the table revealed that $F_{(2,435)} = 33.799$, P = 0.00 which implies that the P-value obtained is less than the critical P-value of 0.05, thus, the null hypothesis is rejected. The result therefore revealed that individual-play Kahoot, group-play Kahoot and lecture method produce a significant effect on the student's post-test achievement scores when covariate effect (pre-test) was controlled. The result however, implies that a significant difference exists among the three groups of individual-play Kahoot, group-play Kahoot and lecture method. Since it was established that a significant difference exists in the mean achievement scores of the groups, Sidak Post-hoc analysis was done to identify the direction of the difference among the groups as shown in Table 4.10b.

Table 4.10b: Sidak post-hoc analysis of achievement scores

Group	Lecture method	Individual-play Kahoot	Group-play Kahoot
Lecture Method	-------	-2.00250*	-1. 63147*

Individual-play Kahoot	2.00250*	-------	0.37103
Group-play	1. 63147*	-0.37103	-------

Source: Field work 2019. ***Significant @ P<0.05***

Table 4.10b shows the Sidak Post-hoc analysis of achievement scores of the students taught Basic Technology through individual-play Kahoot, group-play Kahoot and lecture method. The table indicates that significant difference exists between the mean achievement scores of students taught Basic Technology through individual-play Kahoot and group-play Kahoot (mean difference = 0.37103). It also shows that significant difference exists between the mean achievement scores of students taught Basic Technology through individual-play and lecture method (mean difference = 2.00250*), and between group-play kahoot and lecture method (mean difference = 1. 63147*). The implication of this analysis is that individual–play kahoot produced better achievement than group-play and group-play produced better achievement than lecture method in basic technology.

4.3.2: Hypothesis Two

Gender has no significant influence on students', achievement in Basic Technology when taught using individual-play Kahoot.

The data collected was analyzed using t-test which is reported in Table 4.11

Table 4.11: T-Test comparison of the post-test mean achievement scores of male and female students taught Basic Technology using individual-play kahoot.

Group	N	Df	Mean	SD	t-value	P-value
Male	9	23	29.22	1.09	0.727	0.403
Female	16		29.56	0.89		

Source: Field work 2019. ***Significant @ P<0.05***

Table 4.11 shows the T-Test comparison of achievement scores of male and female students taught Basic Technology using individual-play kahoot. The result on the table revealed that the male students had the mean achievement score of 29.22 with the SD of 1.09 while the female students had the mean achievement score of 29.56 with the SD of 0.89, the t-value = 0.727, P = 0.403 which implies that the P-value obtained is greater than the critical P-value of 0.05, thus, the null hypothesis is rejects. The result however, implies that a significant difference exists in the mean achievement scores of male and female students taught basic technology. The result therefore revealed that the female students produce greater achievement than their male counterparts in basic technology when taught with individual play kahoot.

4.3.3 Hypothesis Three

Gender has no significant influence on student's achievements in Basic Technology when taught using group-play Kahoot.

The data collected was analyzed using t-test which is reported in Table 4.12

Table 4.12: T-Test comparison of the post-test mean achievement scores of male and female students taught Basic Technology using group-play kahoot.

Group	N	Df	Mean	SD	t-value	P-value
Male	10	27	28.80	0.92	0.820	0.053
Female	17		29.21	0.92		

Source: Field work 2019. ***Significant @ P<0.05***

Table 4.12 shows the T-Test comparison of the mean achievement score of male and female students taught Basic Technology using group-play Kahoot. The result on the table revealed that the male students had the mean achievement score of 28.80 with the SD of 0.92 while the female students had the mean achievement score of 29.21 with the SD of 0.92, the t-value = 0.820, P = 0.053 which implies that the P-value obtained is greater than the critical P-value of 0.05, thus, the null hypothesis is rejected. The result however, implies that a significant difference exists in the mean achievement scores of male and female students taught basic technology. The result therefore reveals that the female students produce greater achievement than their male counterparts in basic technology when taught with individual play kahoot.

4.3.4: Hypothesis Four

There is no significant difference in the mean retention score of student's taught Basic Technology through individual-play Kahoot, group-play Kahoot and lecture method.

The data collected was analyzed using Analysis of Variance (ANOVA) which is reported in Table 4.13

Table 4.13: ANOVA comparison of the post-test mean retention scores of students taught Basic Technology through individual-play Kahoot, group-play Kahoot and lecture method.

Source of Variation	Sum of Squares	Df	Mean Square	F	P
Between Groups	58.657	2	29.329	4.766	0.009
Within Groups	2677.089	435	6.154		
Total	2735.747	437			

Source: Field work 2019. ***Significant @ P<0.05***

Table 4.13 shows the ANOVA comparison of the mean retention scores of students taught Basic Technology through individual-play Kahoot, group-play Kahoot and lecture method. The result on the table revealed that $F_{(2,435)} = 4.766$, $P = 0.009$ which implies that the P-value obtained is less than the critical P-value of 0.05, thus, the null hypothesis is accepted. The result therefore reveals that individual-play Kahoot, group-play Kahoot and lecture method produce no significant effect on the student's retention scores. The result however, implies that there is no significant difference existing among the three groups of individual-play Kahoot, group-play Kahoot and lecture method.

4.3.5: Hypothesis Five

Gender has no significant influence on student's retention in Basic Technology when taught using individual-play Kahoot.

The data collected was analyzed using t-test which is reported in Table 4.14

Table 4.14: T-Test comparison of the post-test mean retention scores of male and female students taught Basic Technology using individual-play kahoot.

Group	N	Df	Mean	SD	t-value	P-value
Male	9	23	27.33	1.87	0.728	0.124
Female	16		27.50	1.93		

Source: Field work 2019. ***Significant @ P<0.05***

Table 4.14 shows the T-Test comparison of retention scores of male and female students taught Basic Technology using individual-play kahoot. The result on the table revealed that the male students had the mean retention of 27.33 with the SD of 1.87 while the female students had the mean retention of 27.50 with the SD of 1.93, the t-value = 0.728, P = 0.124 which means that the P-value obtained is higher than the critical P-value of 0.05, thus, the null hypothesis is rejected. The result however, implies that a significant difference does exist in the mean retention scores of male and female students taught basic technology. The result therefore reveals that the male and female students does not have the same retention in basic technology when taught using individual-play kahoot.

4.3.6 Hypothesis Six

Gender has no significant influence on student's retention in Basic Technology when taught using group-play Kahoot.

The data collected was analyzed using t-test which is reported in Table 4.15

Table 4.15: T-Test comparison of the post-test mean retention scores of male and female students taught Basic Technology using group-play kahoot.

Group	N	Df	Mean	SD	t-value	P-value
Male	10	27	28.60	1.17	0.189	1.813
Female	19		27.52	1.78		

Source: Field work 2019. ***Significant @ P<0.05***

Table 4.15 shows the T-Test comparison of mean retention score of male and female students taught Basic Technology using group-play kahoot. The result on the table reveals that the male students had the mean retention of 28.60 with the SD of 1.17 while the female students had the mean retention of 27.52 with the SD of 1.78, the t-value = 0.189, P = 11.813 which means that the P-value obtained is greater than the critical P-value of 0.05, therefore, the null hypothesis is rejected. The result however, implies that a significant difference exist in the mean retention scores of male and female students taught basic technology using group-play kahoot. The result therefore reveals that the male and female students does not have the same retention in basic technology when taught using group-play kahoot.

4.16: Hypothesis Seven

There is no significant difference in the mean interest responses of student's taught Basic Technology through individual-play Kahoot, group-play Kahoot and lecture method.

The data collected was analyzed using Analysis of Variance (ANOVA) which is reported in Table 4.16a

Table 4.16a: ANOVA comparison of the mean interest responses of students taught Basic Technology through individual-play Kahoot, group-play Kahoot and lecture method.

Source of Variation	Sum of Squares	df	Mean Square	F	P
Between Groups	0.301	2	0.150	0.988	0.373
Within Groups	66.169	435	0.152		
Total	66.470	437			

Source: Field work 2019. ***Significant @ P<0.05***

Table 4.16a above shows the ANOVA comparison of the mean interest responses of students taught Basic Technology through individual-play Kahoot, group-play Kahoot and lecture method. The result on the table revealed that $F_{(2,435)}=0.88$, $P = 0.373$ which implies that the P-value obtained is greater than the critical P-value of 0.05, thus, the null hypothesis is rejected. The result therefore reveals that a significant difference exists in the mean interest responses between individual-play Kahoot, group-play Kahoot and lecture method. Since it was established that a significant difference exists in the mean interest responses of the groups, Sidak Post-hoc analysis was done to identify the direction of the difference among the groups as shown in Table 4.16b.

Table 4.16b: Sidak post-hoc analysis of achievement scores

Group	Lecture method	Individual-play Kahoot	Group-play Kahoot
Lecture Method	-------	-0.02033*	-0.10489*
Individual-play Kahoot	0.02033	-------	-0.08455
Group-play	0.10489	0.08455	-------

Source: Field work 2019. ***Significant @ P<0.05***

Table 4.16b shows the Sidak Post-hoc analysis of mean interest responses of the students taught Basic Technology through individual-play Kahoot, group-play Kahoot and lecture method. The table indicates that significant difference exists between the mean interest responses of students taught Basic Technology through individual-play Kahoot and group-play Kahoot (mean difference = 0.08455). It also shows that significant difference exists between the mean interest responses of students taught Basic Technology through individual-play and lecture method (mean difference = 0.02033) and between group-play kahoot and lecture method (mean difference = 0.10489). The implication of this analysis is that mean interest responses on group-play is more than others.

4.3.8: Hypothesis Eight

Gender has no significant influence on student's interest in Basic Technology when taught using individual-play Kahoot.

The data collected was analyzed using t-test which is reported in Table 4.17

Table 4.17: T-Test comparison of male and female student's interest taught Basic Technology using individual-play kahoot.

Group	N	Df	Mean	SD	t-value	P-value
Male	11	23	4.50	0.23	1.834	0.189
Female	14		4.53	0.49		

Source: Field work 2019. ***Significant @ P<0.05***

Table 4.17 shows the T-Test comparison of the mean interest responses of male and female students taught Basic Technology using individual-play kahoot. The result on the table revealed that the male students had the mean interest of 4.50 with the SD of 0.23 while the female students had the mean retention of 4.53 with the SD of 0.49, the t-value = 1.834, P = 0.189 which means that the P-value obtained is higher than the critical P-value of 0.05, thus, the null hypothesis is therefore rejected. The result however, implies that a significant difference does exist in the mean interest responses of male and female students taught basic technology through individual-play kahoot. The result therefore revealed that the male and female students have no the same interest in basic technology when taught using individual-play kahoot.

4.3.9 Hypothesis Nine

Gender has no significant influence on student's interest in Basic Technology when taught using group-play Kahoot.

The data collected was analyzed using t-test which is reported in Table 4.18

Table 4.18: T-Test comparison of male and female student's interest taught Basic Technology using group-play kahoot.

Group	N	Df	Mean	SD	t-value	P-value
Male	13	27	4.61	0.13	3.435	0.075
Female	16		4.59	0.24		

Source: Field work 2019. ***Significant @ P<0.05***

Table 4.18 above shows the T-Test comparison of mean interest responses of male and female students taught Basic Technology using group-play kahoot. The result on the table reveals that the male students had the mean interest of 4.61 with the SD of 0.13 while the female students had the mean interest of 4.59 with the SD of 0.24, the t-value

= 3.435, P = 0.075 which means that the P-value obtained is greater than the critical P-value of 0.05, therefore, the null hypothesis is rejected. The result however, implies that a significant difference exist in the mean interest responses of male and female students taught basic technology using group-play kahoot. The result therefore reveals that the male students have more interest than their female counterpart in basic technology when taught using group-play kahoot.

4.4 Summary of Findings

1. There exists a significant difference in the mean achievement score of student's taught Basic Technology through individual-play Kahoot, group-play Kahoot and lecture method.
2. There is a significant difference in the mean achievement scores of male and female students taught basic technology through individual-play Kahoot.
3. There is a significant difference in the mean achievement scores of male and female students taught basic technology through group-play Kahoot.
4. A significant difference does not exist in the mean retention scores of students taught Basic Technology through individual-play Kahoot, group-play Kahoot and lecture method.
5. There is a significant difference in the mean retention scores of male and female students taught basic technology through individual-play Kahoot.
6. There is a significant difference in the mean retention scores of male and female students taught basic technology through group-play Kahoot.
7. There is a significant difference existing in the mean interest responses of student's taught Basic Technology through individual-play Kahoot, group-play Kahoot and lecture method.

8. A significant difference does exist in the mean interest responses of male and female students taught basic technology through individual-play Kahoot.
9. A significant difference does exist in the mean interest responses of male and female students taught basic technology through group-play Kahoot

4.5 Discussion of Findings

The result of this finding revealed that there exists a significant difference in the mean achievement score of student's taught Basic Technology through individual-play Kahoot, group-play Kahoot and lecture method. The finding is synonymous to that of Joseph (2017), who carried out a study on the effect of the online game Kahoot on science vocabulary acquisition of students with learning disabilities in a middle school including physical science classroom. The results of the study indicated that students enjoyed playing Kahoot and found it easy to use, thereby increasing their achievements and retention. The findings are also in agreement with the findings of Atsumbe *et al.* (2013), who carried out a study that determined effects of animation on students' achievement and retention in Basic Electricity at Technical Colleges in Benue State, Nigeria. The findings of the study revealed that students taught with animation have higher achievement and retention in Basic Electricity than with conventional method.

There was a significant difference in the mean achievement scores of male and female students taught basic technology using both individual-play and group-play kahoot. The findings of the study is synonymous to Akinsola (2014), carried out an investigation on relative effectiveness of mastery learning, cooperative learning, combined mastery learning and cooperative learning strategy on students achievement in integrated science. Result from the study revealed that combined mastery learning and cooperative learning strategy was found to be more suitable in facilitating achievement in integrated science. More also, female students outperform the male students in integrated science.

A significant difference does not exist in the mean retention scores of students taught Basic Technology through individual-play Kahoot, group-play Kahoot and lecture method. This finding is in disagreement with the findings of Bahrami *et al.* (2012) who carried out a study on a comparison of the effectiveness of game- based and traditional teaching on learning and retention of first grade math concepts in Iran. The results showed that the experimental group had higher score in learning and retention; this revealed that using educational games in teaching of first grade math can be remarkably helpful and efficient. The finding is also in disagreement with the study of Landøy *et al.* (2020), who investigated the comparative effects of concept mapping, guided discovery and activity-based strategies on secondary school biology student's achievement and retention in Minna metropolis. The findings of the study revealed that there was significant difference in the achievement and retention of students taught biology using concept mapping, guided discovery and activity-based strategies.

A significant difference does not exist in the mean retention scores of male and female students taught basic technology using both individual-play and group-play kahoot. This finding is in connection with the findings of Landøy (2020), investigated the comparative effects of concept mapping, guided discovery and activity-based strategies on secondary school biology student's achievement and retention in Minna metropolis. it was revealed that there was no significant difference in the gender and retention of biology students taught concept mapping, guided discovery and activity-based strategies.

There is no significant difference existing in the mean interest responses of student's taught Basic Technology through individual-play Kahoot, group-play Kahoot and lecture method. This finding is in relation with the findings of Okigbo & Okeke (2011) investigated the effect of games and analogies on secondary school students' interest in mathematics. The results of the analysis showed that both games and analogies

enhanced learner's interest in mathematics. Games was found to be more effective in improving students' interest in mathematics than analogy but there was no statistically significant difference in the mean interest scores of students taught mathematics using game approach and those taught using analogies.

A significant difference does exist in the mean interest responses of male and female students taught basic technology using both individual-play and group-play kahoot. The result therefore revealed that the female students had higher interest than their male counterparts in basic technology. The finding agrees with that of Enohuean, (2015), carried out an investigation on effects of instructional materials on the academic achievement and retention of SS 2 biology students in Delta State. There is significant difference in the interest ability of male and female students exposed to the use of instructional materials.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

From the literature reviewed and findings of this study, it can be concluded that group-play kahoot produce greater achievement in Basic Technology while individual-play kahoot produce greater retention in Basic Technology and the two methods were gender friendly as well as motivate the interest of both genders significantly in favour both male and female students in the experimental group. The higher the interest level, the more the academic achievement and retention of the students. Therefore, kahoot game is a better method to use in teaching Basic Technology, either it is played individually by students or played in group.

5.2 Recommendations of the study

Based on the findings, the following recommendations where made:

1. I recommend that application of kahoot should be incorporated in teaching Basic Technology in secondary schools.
2. Serving teachers should be trained on the use of Kahoot in teaching Basic Technology to enhance students' interest, improve their achievement and retention.
3. The use of Kahoot should be introduced in teachers training, workshops, seminars and other forms of training programmes.

4. Technological and non-technological teacher training institutions should adopt kahoot as an instructional technique to enhance effective classroom interaction and presentation of Basic Technology.

5.3 Contributions to Knowledge

This study has contributed to the pool of knowledge in the following areas:

1. The use of ICT and formative assessment in teaching of basic technology.
2. The study can help to improve classroom management and interactive session during teaching and learning process.
3. The study has contributed immensely to literature on gamification and interactive learning.

5.4 Suggestions for Further Studies.

The following suggestions are presented for further research:

1. Study should be carried on lecturers' awareness, attitude and self-efficacy on Kahoot support instruction
2. Researches should be carried out on Kahoot game supported instruction students' achievement, interest and retention in Basic Science.
3. The replication of this study could be done in other specific subject areas to add to the generalizability of the research findings.

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APPENDICES

APPENDIX A

Table 3.2 Population distribution table of students in the selected schools

Name of school	Number of male students	Number of female students	Total
Day secondary school Chanchaga B	205	179	384
Niger Baptist School Minna	9	16	25
Brighter Nursery and Primary School Minna	10	19	29
Total	224	214	438

APPENDIX B

Week 1: Lesson Plan for Control Group

Name of School:

Class: JSS3

Subject: Basic Technology

Topic: Materials and their Properties

Sub-topic: Metals and processes of metals

Method of teaching: Lecture method

Date: Time

Duration: 40 minutes

Entry Behaviour: learners are familiar with the types of materials used in technology and engineering.

Behavioral Objectives: At the end of the lesson, the learners should be able to:

1. Mention two types of metals
2. Classify at least 5 different mechanical properties of metals
3. Explain three uses of ferrous and non-ferrous metals
4. Describe different methods of processing metals such as smelting and casting process.

Step	Item	Skills	Teacher Activities	Learners Activities
1	Introduction	Questioning reinforcement	The teacher introduces the lesson by asking the students to mention and explain any two types of materials used in the kitchen.	The students would answer by mentioning: pots, plates, buckets, tables etc.
2	Presentation	Communication	The teacher present the lesson by writing the topic on the chalk board as thus, metals and processes of metals and explain	The learners would listen attentively.
3	Presentation	Communication	The teacher further presents by explaining to the learners how the can identify metals as thus, metals can be identified by their mechanical properties such as: Elasticity, Plasticity, Ductility, Density,	Learners would listen and participate

			Fusibility, Brittleness, Hardness, etc. Metals can be classified into two broad groups namely: ferrous and non-ferrous metals. Examples of Ferrous metals are cast iron, wrought iron and steel alloys. Examples of non-ferrous metals in common use are: aluminum, copper, zinc, among others	
4	Presentation	Communication	The following are some of the applications and uses of ferrous metals: (1) Grey cast iron is used for clutches, pistons etc. (2) white cast iron used for making chains, hooks, gears etc. (3) wrought cast iron is used for making train coupling, gear, boiling plates etc. and more.	Learners would listen and contribute.
5	Evaluation	Questioning	The teacher evaluates the lesson by asking the learners to: (1) Mention two types of metals. (2) Classify at least 5 different mechanical properties of metals. (3) Explain three uses of ferrous and non-ferrous metals. (4) Describe different methods of processing metals such as smelting and casting process.	Learners would respond
6	Summary	Communication and reinforcement	The teacher summarises by re-explaining more to the students for better understanding	Learners would listen and contribute
7	Conclusion	Closure	The teacher concludes by giving the learners note to copy	Learners would write the blackboard summary in their note.

Week 2: Lesson Plan for Control Group

Name of School:

Class: JSS3

Subject: Basic Technology

Topic: Materials and their Properties

Sub-topic: Wood and processes of wood

Method of teaching: Lecture method

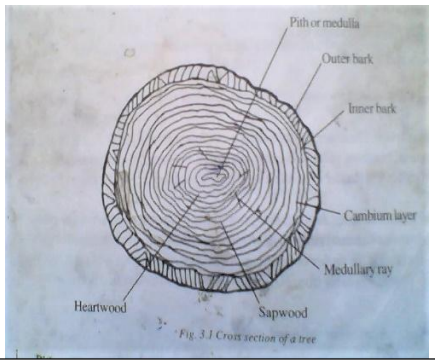
Date:

Duration: 40 minutes

Entry Behaviour: learners are familiar with the types of materials used in technology and engineering.

Behavioral Objectives: At the end of the lesson, the learners should be able to:

1. Mention any 2 properties of wood,
2. State the common uses of wood,
3. Describe 2 key terms in timber processing
4. List any three types of defects in timber

Step	Item	Skills	Teacher Activities	Learners Activities
1	Introduction	Questioning reinforcement	The teacher introduces the lesson by asking the students to mention and explain what they understand by wood	The students would answer with different kinds of explanations.
2	Presentation	Communication	The teacher present the lesson by writing the topic on the chalk board and explaining what wood is, its classification and how it translates to timber as well as the structure of a wood as shown below:  Fig. 3.1 Cross section of a tree	The learners would listen attentively.
3	Presentation	Communication	The teacher further presents by explaining to the learners how	Learners would listen and participate

			the can identify timber as thus, timber can be identified based on the following properties: cut surface observation, hardness, moisture content and density. The following are some of the uses of wood: (1) housing: used for roofing, windows and doors (2) packaging: packaging industrial products eg. Pallets. (3) furniture: eg. Chairs, tables, shelves etc. (4) bridges and polls etc.	
4	Presentation	Communication	The teacher further presents by explaining the conversion of timber, seasoning, wood preservation, defects in timber and laminated boards	Learners would listen and contribute.
5	Evaluation	Questioning	The teacher evaluates the lesson by asking the learners to: 1. Mention any 2 properties of wood. 2. State the common uses of wood. 3. Describe 2 key terms in timber processing. 4. List any three types of defects in timber	Learners would respond
6	Summary	Communication and reinforcement	The teacher summarises by re-explaining more to the students for better understanding.	Learners would contribute
7	Conclusion	Closure	The teacher concludes by giving the learners note to copy	Learners would write the blackboard summary in their note.

Week 3: Lesson Plan for Control Group

Name of School:

Class: JSS3

Subject: Basic Technology

Topic: Materials and their Properties

Sub-topic: Ceramics and processes of Ceramics

Method of teaching: Lecture method

Date:

Duration: 40 minutes

Entry Behaviour: learners are familiar with the types of materials used in technology and engineering.

Behavioral Objectives: At the end of the lesson, the learners should be able to:

1. Describe 3 properties of ceramics,
2. State any 4 common uses of ceramics,
3. Describe the steps in processing ceramics.

Step	Item	Skills	Teacher Activities	Learners Activities
1	Introduction	Questioning reinforcement	The teacher introduces the lesson by asking the students if they know the natural resources used for making ceramics	The students would answer with chorus answer.
2	Presentation	Communication	The teacher presents the lesson by writing the topic on the chalk board and explaining what clay is and how it transform to ceramics.	The learners would listen attentively.
3	Presentation	Communication	The teacher further present the lesson by teaching the learners the properties of clay which includes: plasticity, workability, brittleness, ability towithstand high temperature, etc	Learners would listen and participate
4	Presentation	Communication	The teacher further presents by explaining the uses of ceramics as thus, burnt bricks are used for building purposes and also for the construction of furnace because of its high temperature resistance, its used for electrical insulations and storage of chemicals etc.	Learners would listen and contribute.
5	Evaluation	Questioning	The teacher evaluates the lesson by asking the learners to: 1. Describe 3 properties of ceramics. 2. State any 4 common uses of ceramics.	Learners would respond
6	Summary	Communication and	The teacher summarises by re-explaining more to	Learners would contribute

		reinforcement	the students for better understanding.	
7	Conclusion	Closure	The teacher concludes by giving the learners note to copy	Learners would write the blackboard summary in their note.

Week 4: Lesson Plan for Control Group

Name of School:

Class: JSS3

Subject: Basic Technology

Topic: Materials and their Properties

Sub-topic: Plastic and Rubber

Method of teaching: Lecture method

Date:

Duration: 40 minutes

Entry Behaviour: learners are familiar with the types of materials used in technology and engineering.

Behavioral Objectives: At the end of the lesson, the learners should be able to:

1. Mention 2 properties each of plastic and rubber
2. State 5 common uses of plastic and rubber
3. Describe the steps in processing plastic and rubber.

Step	Item	Skills	Teacher Activities	Learners Activities
1	Introduction	Questioning Reinforcement	The teacher introduces the lesson by asking the students state any uses of plastic and rubber they know	The students would answer one after the other.
2	Presentation	Communication	The teacher presents the lesson by writing the topic on the chalk board and explaining what plastic and rubber are as well as their types and properties of identification	The learners would listen attentively.
3	Presentation	Communication	The teacher further present the lesson by teaching the learners the uses of plastic and rubber	Learners would listen and participate

			which includes bucket and dampers amongs others	
4	Presentation	Communication	The teacher further presents by explaining the steps and techniques in production of plastics and rubber.	Learners would listen and contribute.
5	Evaluation	Questioning	The teacher evaluates the lesson by asking the learners to: 1. Mention 2 properties each of plastic and rubber. 2. State 5 common uses of plastic and rubber. 3. Describe the steps in processing plastic and rubber.	Learners would respond
6	Summary	Communication and reinforcement	The teacher summarises by re-explaining more to the students for better understanding.	Learners would contribute
7	Conclusion	Closure	The teacher concludes by giving the learners note to copy	Learners would write the blackboard summary in their note.

APPENDIX C

EFFECTS OF KAHOOT GAME SUPPORT INSTRUCTION ON ACHIEVEMENT, RETENTION AND INTEREST IN BASIC TECHNOLOGY AMONG SECONDARY SCHOOLS IN NIGER STATE

BASIC TECHNOLOGY ACHIEVEMENT AND RETENTION TEST (BTAT)

INSTRUCTIONS: Answer all the questions. Choose the correct answer of the options lettered A-D.

Time: 30 Minutes

1. Our textbooks are made from …….

   a. Ceramics b. Plastic c. Rubber d. Wood

2. The grade of steel is determined by its …… content

   a. Air b. Carbon c. Hydrogen d. Iron

3. Which of the following is not a property of material?

   a. Brittleness b. Elasticity c. Fusibility d. Hydroxide

4. The following are ferrous metals except ……

   a. Alloy steel b. Cartridge brass c. Grey cast iron d. Malleable cast iron

5. The property of material which enable it to liquidify easily and join with other materials is…..

   a. Cellulose b. Density c. Fusibility d. Tenacity

6. Metals are basically classified into…… and ……..

   a. Ductile, hard b. Ferrous, non-ferrous c. Lustrous, non-lustrous d. Malleable, ferrous

7. Horizontal radial cells scattered though out the trees are called……..

   a. Annual growth ring b. Cambium layers c. Heartwood d. Medullary rays

8. ……. is the amount of growth that takes place at the cambium layer in one year.

a. Annual ring b. Bark c. Heartwood d. Medullary ray

9. Which of these materials is used for making gloves and sandals?

a. Aluminum b. Plastic c. Rubber d. Wood

10. The innermost part of a tree is called……..

a. Annual ring b. Cambium layer c. Pith d. Sapwood

11. Plastic materials which cannot be melted into liquid by heating are known as ……

a. Thermionies b. Thermocouple c. Thermoplastics d. Thermosets

12. Elasticity is a characteristic of …….

a. Cement b. Ceramics c. Mud d. Rubber

13. Bungalow house can be classified under …….

a. Commercial building b. Industrial building c. public building d. Residential building

14. Supermarket house can be regarded as a …… building.

a. Commercial b. Light c. Public d. Residential

15. the mixture of cement, water, gravel and ……. Forms a concrete

a. Clay b. Mud c. Silica (sand) d. Stone

16. The blast furnace is used for manufacturing ……..

a. Aluminum b. Lead c. Metal sheet d. Pig iron

17. Which of the following materials is needed in the production of iron?

a. Cast iron b. Iron ore c. Pig iron d. Wrought iron

18. The following are artificial wood defects except ……

a. Check b. Cup c. Dry rot d. Knot

19. A thin sheet of wood 1mm thick cut from a log is called ……. Sheet.

a. Batten b. Laminate c. Plywood d. Veneer

20. The type of chemicals used to protect wood against termites/insects attack and decay is called …….

a. Polishes b. Preservatives c. Protectors d. Treatments

21. The kiln method of drying wood is …… than the air method.

a. Better b. Faster c. Slower d. Superior

22. The process of reducing the moisture content in wood is known as ……..

a. Conversion b. Felling c. Preservatives d. Seasoning

23. In woodwork, …… is the process of splitting logs with saw machine into commercial purposes

a. Conversion b. Felling c. Preservation d. Seasoning

24. There are ……. methods of cutting veneers.

a. 1 b. 2 c. 3 d. 4

25. Which of the following is not a method of processing plastics?

a. Compression moulding b. Extrusion forming c. Injection moulding d. Vacuum forming.

26. The metal used in making cooking utensils, electrical cables and aircraft bodies is ……

a. Aluminium b. Bronze c. Steel d. Tin

27. Battery terminals and elements are made from ……..

a. Copper b. Lead c. Tin d. Zinc

28. …… are used where high temperature are operating

a. Ceramics b. Plastic c. Rubber d. Wood

29. These elements are constituents of alloy steels except ……

a. Brass b. Cobalt c. Manganese d. Tungsten

30. The non-ferrous metal used for galvanizing, making iron sheets and pipes is …

a. Brass b. Lead c. Steel D. Zinc

APPENDIX D

KEY TO THE TEST INSTRUMENT

1.	D	27.	B
2.	B	28.	A
3.	D	29.	A
4.	B	30.	D
5.	C		
6.	B		
7.	D		
8.	A		
9.	C		
10.	C		
11.	D		
12.	D		
13.	D		
14.	A		
15.	C		
16.	D		
17.	B		
18.	D		
19.	D		
20.	B		
21.	B		
22.	D		
23.	A		
24.	C		
25.	D		
26.	A		

APPENDIX E

Table of Specifications for the Materials and their Properties Cognitive Achievement Test

S/N	Topic	Knowl - edge 50%	Comprehe- nsion 5%	Applica - tion 27%	Analysis 3%	Synthesis 5%	Evaluation 10%	Total 100 %
1	Metals and processes of metals	2	1	1	1	1	1	7
2	Wood and wood processes	1	2	2	1	1	1	8
3	Ceramics and ceramics processes	1	1	1	1	2	1	7
4	Plastics and rbber	2	1	1	2	1	1	8
	Total	**6**	**5**	**5**	**5**	**5**	**4**	**30**

APPENDIX F

QUESTIONNAIRE ON EFFECTS OF KAHOOT GAME SUPPORT INSTRUCTION ON ACHIEVEMENT, RETENTION AND INTEREST IN BASIC TECHNOLOGY AMONG SECONDARY SCHOOLS IN NIGER STATE

Dear Respondent,

This questionnaire is designed to obtain data from your responses on the above subject matter. Any information given will be used purposely for research and will be treated with utmost confidentiality.

Section A: Respondent data

You are expected to tick (√) the appropriate option

Gender: Male ☐ Female ☐

Instruction: carefully choose the option that suits your opinion.

SA ..... Strongly Agreed

A ..... Agreed

UD …… Undecided

D ..... Disagreed

S D..... Strongly Disagreed

Section B: Students Interest Inventory in Basic Technology (SIIBT) for Lecture Method

S/N	Items	SA	A	UD	D	SD
1	I join group discussion on basic technology concepts when taught with lecture method.					
2	I ask questions during basic technology class when taught with lecture method.					
3	I pay attention to the teachings on basic technology					

	when taught with lecture method.					
4	I attend basic technology extra morals classes after being taught with lecture method.					
5	I do self-study of basic technology concepts when taught with lecture method.					
6	I prefer basic science to basic technology because of the method of teaching.					
7	I pay more attention in manipulation and identification of material technology when taught with lecture method.					
8	I don't need to think critically before participating in basic technology class when taught with lecture method.					
9	I explore information on basic technology concepts when taught with lecture method.					
10	I have improved in basic technology since the arrival of our new teacher started using lecture method.					

QUESTIONNAIRE ON EFFECTS OF KAHOOT GAME SUPPORT INSTRUCTION ON ACHIEVEMENT, RETENTION AND INTEREST IN BASIC TECHNOLOGY AMONG SECONDARY SCHOOLS IN NIGER STATE

Dear Respondent,

This questionnaire is designed to obtain data from your responses on the above subject matter. Any information given will be used purposely for research and will be treated with utmost confidentiality.

Section A: Respondent data

You are expected to tick (√) the appropriate option

Gender: Male ☐ Female ☐

Instruction: carefully choose the option that suits your opinion.

SA ..... Strongly Agreed

A ..... Agreed

UD …… Undecided

D ..... Disagreed

S D..... Strongly Disagreed

Section B: Students Interest Inventory in Basic Technology (SIIBT) for Individual-play Kahoot.

S/N	Items	SA	A	UD	D	SD
1	I join group discussion on basic technology concepts when taught with individual-play kahoot.					
2	I ask questions during basic technology class when taught with individual-play kahoot.					
3	I pay attention to the teachings on basic technology when taught with individual-play kahoot.					
4	I attend basic technology extra morals classes after					

	being taught with individual-play kahoot.					
5	I do self-study of basic technology concepts when taught with individual-play kahoot.					
6	I prefer basic science to basic technology because of the method of teaching.					
7	I pay more attention in manipulation and identification of material technology when taught with individual-play kahoot.					
8	I don't need to think critically before participating in basic technology class when taught with individual-play kahoot.					
9	I explore information on basic technology concepts when taught with individual-play kahoot.					
10	I have improve in basic technology since the arrival of our new teacher started using individual-play kahoot.					

QUESTIONNAIRE ON EFFECTS OF KAHOOT GAME SUPPORT INSTRUCTION ON ACHIEVEMENT, RETENTION AND INTEREST IN BASIC TECHNOLOGY AMONG SECONDARY SCHOOLS IN NIGER STATE

Dear Respondent,

This questionnaire is designed to obtain data from your responses on the above subject matter. Any information given will be used purposely for research and will be treated with utmost confidentiality.

Section A: Respondent data

You are expected to tick (√) the appropriate option

Gender: Male ☐ Female ☐

Instruction: carefully choose the option that suits your opinion.

SA ..... Strongly Agreed

A ..... Agreed

UD …… Undecided

D ..... Disagreed

S D..... Strongly Disagreed

Section B: Students Interest Inventory in Basic Technology (SIIBT) for Individual-play Kahoot.

S/N	Items	SA	A	UD	D	SD
1	I join group discussion on basic technology concepts when taught with group-play kahoot.					
2	I ask questions during basic technology class when taught with group-play kahoot.					
3	I pay attention to the teachings on basic technology when taught with group-play kahoot.					
4	I attend basic technology extra morals classes after being taught with group-play kahoot.					

5	I do self-study of basic technology concepts when taught with group-play kahoot.					
6	I prefer basic science to basic technology because of the method of teaching.					
7	I pay more attention in manipulation and identification of material technology when taught with group-play kahoot.					
8	I don't need to think critically before participating in basic technology class when taught with group-play kahoot.					
9	I explore information on basic technology concepts when taught with group-play kahoot.					
10	I have improve in basic technology since the arrival of our new teacher started using group-play kahoot.					

APPENDIX G

Week 1: Lesson Plan for Control Group

Name of School:

Class: JSS3

Subject: Basic Technology

Topic: Materials and their Properties

Sub-topic: Metals and processes of metals

Method of teaching: Group-play Kahoot Application

Date: Time

Duration: 40 minutes

Entry Behaviour: learners are familiar with the types of materials used in technology and engineering.

Behavioral Objectives: At the end of the lesson, the learners should be able to:

5. Mention two types of metals
6. Classify at least 5 different mechanical properties of metals
7. Explain three uses of ferrous and non-ferrous metals
8. Describe different methods of processing metals such as smelting and casting process.

Step	Item	Skills	Teacher Activities	Learners Activities
1	Introduction	Questioning reinforcement	The teacher introduces the lesson by asking the students to mention and explain any two types of materials used in the kitchen.	The students would answer by mentioning: pots, plates, buckets, tables etc.
2	Presentation	Communication	The teacher present the lesson by projecting the topic as thus, metals and processes of metals. Give learners the pin to connect.	The learners would connect with their devices.
3	Presentation	Communication	The teacher further presents by projecting the questions on web for learners to answer and discuss	Learners would play to answer and discuss
4	Evaluation	Questioning	The teacher evaluates the lesson by asking the learners to: (1) Mention two types of metals. (2) Classify at least 5 different mechanical	Learners would respond

			properties of metals. (3) Explain three uses of ferrous and non-ferrous metals. (4) Describe different methods of processing metals such as smelting and casting process.	
5	Summary	Communication and reinforcement	The teacher summarises by re-explaining more to the students for better understanding	Learners would listen and contribute
6	Conclusion	Closure	The teacher concludes by giving the learners note to copy	Learners would write.

Week 2: Lesson Plan for Control Group

Name of School:

Class: JSS3

Subject: Basic Technology

Topic: Materials and their Properties

Sub-topic: Wood and processes of wood

Method of teaching: Group-play Kahoot Application

Date:

Duration: 40 minutes

Entry Behaviour: learners are familiar with the types of materials used in technology and engineering.

Behavioral Objectives: At the end of the lesson, the learners should be able to:

5. Mention any 2 properties of wood,
6. State the common uses of wood,
7. Describe 2 key terms in timber processing
8. List any three types of defects in timber

Step	Item	Skills	Teacher Activities	Learners Activities

1	Introduction	Questioning reinforcement	The teacher introduces the lesson by asking the students to mention and explain what they understand by wood	The students would answer with different kinds of explanations.
2	Presentation	Communication	The teacher present the lesson by projecting the topic as thus, wood and processes of wood. Give learners the pin to connect.	The learners would connect with their devices.
3	Presentation	Communication	The teacher further presents by projecting the questions on web for learners to answer and discuss	Learners would play to answer and discuss
4	Evaluation	Questioning	The teacher evaluates the lesson by asking the learners to: 1. Mention any 2 properties of wood. 2. State the common uses of wood. 3. Describe 2 key terms in timber processing. 4. List any three types of defects in timber	Learners would play
5	Summary	Communication and reinforcement	The teacher summarises by re-explaining more to the students for better understanding.	Learners would contribute
6	Conclusion	Closure	The teacher concludes by giving the learners note to copy	Learners would write.

Week 3: Lesson Plan for Control Group

Name of School:

Class: JSS3

Subject: Basic Technology

Topic: Materials and their Properties

Sub-topic: Ceramics and processes of Ceramics

Method of teaching: Group-play Kahoot Application

Date:

Duration: 40 minutes

Entry Behaviour: learners are familiar with the types of materials used in technology and engineering.

Behavioral Objectives: At the end of the lesson, the learners should be able to:

4. Describe 3 properties of ceramics,
5. State any 4 common uses of ceramics,
6. Describe the steps in processing ceramics.

Step	Item	Skills	Teacher Activities	Learners Activities
1	Introduction	Questioning reinforcement	The teacher introduces the lesson by asking the students if they know the natural resources used for making ceramics	The students would answer with chorus answer.
2	Presentation	Communication	The teacher present the lesson by projecting the topic as thus, Ceramics and processes of Ceramics. Give learners the pin to connect.	The learners would connect with their devices.
3	Presentation	Communication	The teacher further presents by projecting the questions on web for learners to answer and discuss	Learners would play to answer and discuss
4	Evaluation	Questioning	The teacher evaluates the lesson by asking the learners to: 1. Describe 3 properties of ceramics. 2. State any 4 common uses of ceramics.	Learners would respond

5	Summary	Communication and reinforcement	The teacher summarises by re-explaining more to the students for better understanding.	Learners would contribute
6	Conclusion	Closure	The teacher concludes by giving the learners note to copy	Learners would write.

Week 4: Lesson Plan for Control Group

Name of School:

Class: JSS3

Subject: Basic Technology

Topic: Materials and their Properties

Sub-topic: Plastic and Rubber

Method of teaching: Group-play Kahoot Application

Date:

Duration: 40 minutes

Entry Behaviour: learners are familiar with the types of materials used in technology and engineering.

Behavioral Objectives: At the end of the lesson, the learners should be able to:

4. Mention 2 properties each of plastic and rubber
5. State 5 common uses of plastic and rubber
6. Describe the steps in processing plastic and rubber.

Step	Item	Skills	Teacher Activities	Learners Activities
1	Introduction	Questioning Reinforcement	The teacher introduces the lesson by asking the students state any uses of plastic and rubber they know	The students would answer one after the other.
2	Presentation	Communication	The teacher present the lesson by projecting the topic as thus, Plastic and Rubber. Give learners the pin to connect.	The learners would connect with their devices.
3	Presentation	Communication	The teacher further presents by projecting the questions on web for learners to answer and discuss	Learners would play to answer and discuss

4	Evaluation	Questioning	The teacher evaluates the lesson by asking the learners to: 1. Mention 2 properties each of plastic and rubber. 2. State 5 common uses of plastic and rubber. 3. Describe the steps in processing plastic and rubber.	Learners would respond
5	Summary	Communication and reinforcement	The teacher summarises by re-explaining more to the students for better understanding.	Learners would contribute
6	Conclusion	Closure	The teacher concludes by giving the learners note to copy	Learners would write.

APPENDIX H

```
NPAR TESTS
  /CHISQUARE=posttest GENDER pretest
  /EXPECTED=EQUAL
  /MISSING ANALYSIS.
```

NPar Tests

Chi-Square Test

Frequencies

posttest

	Observed N	Expected N	Residual
25.00	2	3.3	-1.3
26.00	5	3.3	1.7
27.00	4	3.3	.7
28.00	3	3.3	-.3
29.00	3	3.3	-.3
30.00	3	3.3	-.3
Total	20		

GENDER

	Observed N	Expected N	Residual
MALE	12	10.0	2.0
FEMALE	8	10.0	-2.0
Total	20		

Test Statistics

	posttest	GENDER	pretest
Chi-Square	1.600 [a]	.800 [b]	3.400 [c]
df	5	1	8
Asymp. Sig.	.901	.371	.907

a. 6 cells (100.0%) have expected frequencies less than 5. The minimum expected cell frequency is 3.3.

b. 0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 10.0.

c. 9 cells (100.0%) have expected frequencies less than 5. The minimum expected cell frequency is 2.2.

pretest

	Observed N	Expected N	Residual
10.00	2	2.2	-.2
11.00	2	2.2	-.2
12.00	3	2.2	.8
13.00	2	2.2	-.2
14.00	4	2.2	1.8
15.00	2	2.2	-.2
16.00	1	2.2	-1.2
17.00	3	2.2	.8
24.00	1	2.2	-1.2
Total	20		

APPENDIX I

```
RELIABILITY
  /VARIABLES=GENDER SIIBT1 SIIBT2 SIIBT3 SIIBT4 SIIBT5 SIIBT6 SIIBT7 SIIBT8 S IIBT9
SIIBT10 SIIBT11 SIIBT12 SIIBT13 SIIBT14 SIIBT15 SIIBT16 SIIBT17 SIIBT18
 SIIBT19 SIIBT20
  /SCALE('ALL VARIABLES') ALL
/MODEL=ALPHA.
```

Reliability

[DataSet1] C:\Users\UncuulPEE\Documents\DATA FOR ANALYSIS.sav

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	20	100.0
	Excluded [a]	0	.0
	Total	20	100.0

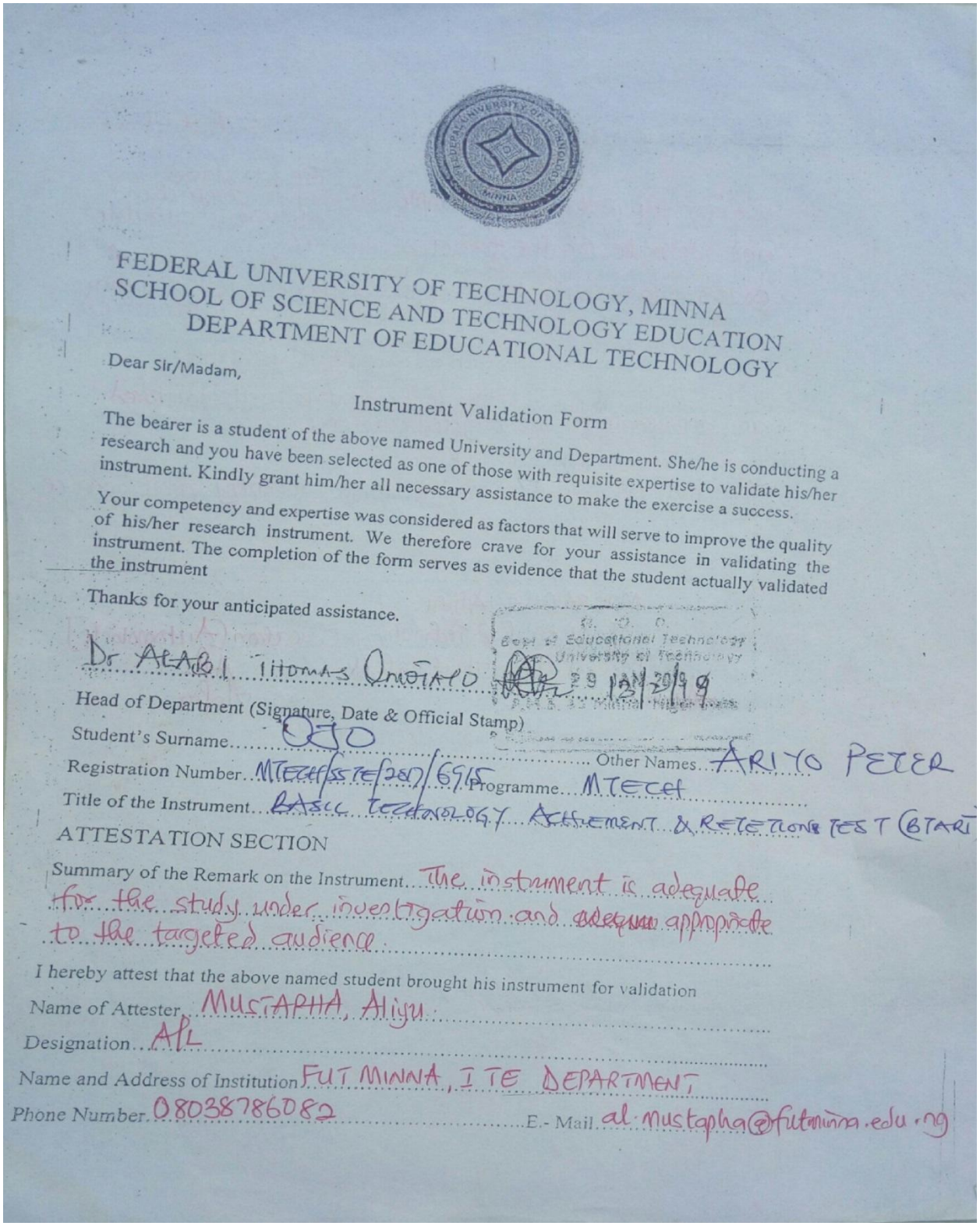
a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.782	21

APPENDIX J

VALIDATION FORM



FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA
SCHOOL OF SCIENCE AND TECHNOLOGY EDUCATION
DEPARTMENT OF EDUCATIONAL TECHNOLOGY

Dear Sir/Madam,

Instrument Validation Form

The bearer is a student of the above named University and Department. She/he is conducting a research and you have been selected as one of those with requisite expertise to validate his/her instrument. Kindly grant him/her all necessary assistance to make the exercise a success.

Your competency and expertise was considered as factors that will serve to improve the quality of his/her research instrument. We therefore crave for your assistance in validating the instrument. The completion of the form serves as evidence that the student actually validated the instrument

Thanks for your anticipated assistance.

Dr ALABI THOMAS OMOTAYO 29/8/2019

Head of Department (Signature, Date & Official Stamp)

Student's Surname OJO Other Names ARIYO PETER

Registration Number MTECH/SSTE/20/6915 Programme MTECH

Title of the Instrument BASIC TECHNOLOGY ACHIEVEMENT & RETENTION TEST (BTART

ATTESTATION SECTION

Summary of the Remark on the Instrument The instrument is adequate for the study under investigation and appropriate to the targeted audience

I hereby attest that the above named student brought his instrument for validation

Name of Attester MUSTAPHA, Aliyu

Designation APL

Name and Address of Institution FUT MINNA, ITE DEPARTMENT

Phone Number 08038786082 E.- Mail al-mustapha@futminna.edu.ng

Please comment on the following

1. Appropriateness of the instrument for the purpose it's design for. Satisfactory
2. Clarity and simplicity for the level of the language used. The language used for the instument is simple and easy to comprehend
3. Suability for the level of the targeted audience. The instrument is suitable and adequate for the targeted audience.
4. The extent in which the items cover the topic it meant to cover. The instrument covers a large extent on the topics under investigation
5. The structuring of the Questionnaire. The instrument is well structured
6. Others (grammatical errors, spelling errors and others. Satisfactory
7. General overview of the Instrument. The instrument is well structured and appropriate to the targeted audience.

Suggestions for improving the quality of the Instrument

1. You can add more items in the interent inventory questionnaire.
2. .....
3. .....
4. .....
5. .....

Name of Validator. MUSTAPHA Aliyu

Area of Specialization. Industrial & Technology Education (Automobile)

Name of Institution. Federal University of Tech. Mx Designation. AP

Signature. ..... Date. 7/8/19

Thank You

FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA
SCHOOL OF SCIENCE AND TECHNOLOGY EDUCATION
DEPARTMENT OF EDUCATIONAL TECHNOLOGY

Dear Sir/Madam,

Instrument Validation Form

The bearer is a student of the above named University and Department. She/he is conducting a research and you have been selected as one of those with requisite expertise to validate his/her instrument. Kindly grant him/her all necessary assistance to make the exercise a success.

Your competency and expertise was considered as factors that will serve to improve the quality of his/her research instrument. We therefore crave for your assistance in validating the instrument. The completion of the form serves as evidence that the student actually validated the instrument

Thanks for your anticipated assistance.

Dr. ALABI Titomas Omoniyo 29/01/2019

Head of Department (Signature, Date & Official Stamp)

Student's Surname..... OJO ..... Other Names..... ARIYO PETER

Registration Number..... MTECH/SSTE/2017/6915 ..... Programme..... M.TECH

Title of the Instrument..... BASIC TECHNOLOGY ACHIEVEMENT AND RETENTION TEST (BTART)

ATTESTATION SECTION

Summary of the Remark on the Instrument..... The instrument is adequately composed and relevant for the research work

I hereby attest that the above named student brought his instrument for validation

Name of Attester..... Dr. A.B. Kaigama

Designation..... Senior Lecturer

Name and Address of Institution..... Dept. of ITE, FUT Minna

Phone Number..... 08130714376 ..... E.- Mail..... abdulkaigama@futminna.edu.ng

Please comment on the following

1. Appropriateness of the instrument for the purpose it's design for..... Appropriate
2. Clarity and simplicity for the level of the language used..... Clear and Simple for the level
3. Suability for the level of the targeted audience ..... Adequate
4. The extent in which the items cover the topic it meant to cover..... Adequate
5. The structuring of the Questionnaire..... Satisfactory
6. Others (grammatical errors, spelling errors and others..... Minimal
7. General overview of the Instrument..... Satisfactory

Suggestions for improving the quality of the Instrument

1. ..... See Comments on the instrument
2. ..... and effect Corrections
3. .....
4. .....
5. .....

Name of Validator..... Dr. A.B. Kagaru

Area of Specialization..... I.T.E. (Building Tech. Educ. Opt.)

Name of Institution..... F.U.T. Minna Designation..... SL

Signature..... Date..... 9/8/13

Thank You

FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA
SCHOOL OF SCIENCE AND TECHNOLOGY EDUCATION
DEPARTMENT OF EDUCATIONAL TECHNOLOGY

Dear Sir/Madam,

Instrument Validation Form

The bearer is a student of the above named University and Department. She/he is conducting a research and you have been selected as one of those with requisite expertise to validate his/her instrument. Kindly grant him/her all necessary assistance to make the exercise a success.

Your competency and expertise was considered as factors that will serve to improve the quality of his/her research instrument. We therefore crave for your assistance in validating the instrument. The completion of the form serves as evidence that the student actually validated the instrument

Thanks for your anticipated assistance.

Dept of Educational Technology
University of Technology
29/01/2019

Dr ALABI THOMAS OMOTAYO
Head of Department (Signature, Date & Official Stamp)

Student's Surname OJO Other Names ARITO PETER

Registration Number MTECH/SSTE/2017/6915 Programme M.TECH

Title of the Instrument STUDENT INTEREST INVENTORY IN BASIC TECHNOLOGY

ATTESTATION SECTION

Summary of the Remark on the Instrument The instrument is appropriate to the targeted students/Pupils and commeasurate for the study.

I hereby attest that the above named student brought his instrument for validation

Name of Attester DADA, DUPE ESTHER

Designation GUIDANCE AND COUNSELLING

Name and Address of Institution SPRING FOUNTAIN BASIC SCHOOL

Phone Number 08062899650 E.- Mail SPYprecious@Gmail.com

Please comment on the following

1. Appropriateness of the instrument for the purpose it's design for.....
   .....Appropriate.....
2. Clarity and simplicity for the level of the language used.....
   .....Clear and simply for the Level.....
3. Suability for the level of the targeted audience .....
   .....Suitable and Adequate.....
4. The extent in which the items cover the topic it meant to cover.....
   .....Adequate.....
5. The structuring of the Questionnaire.....Well Structured.....
   .....
6. Others (grammatical errors, spelling errors and others.....
   .....Satisfactory.....
7. General overview of the Instrument.....
   .....Satisfactory.....

Suggestions for improving the quality of the Instrument

1. .....effect the Correction.....
2. .....
3. .....
4. .....
5. .....

Name of Validator.....DADA, DUPE ESTHER.....

Area of Specialization.....GUIDANCE AND COUNSELLING.....

Name of Institution.....SPRING FOUNTAIN BASIC SCH Designation.....G/C.....

Signature.....Date.....15/8/19.....

Thank You

APPENDIX K

T-TEST

GROUPS=GENDER(1 2)

/MISSING=ANALYSIS

/VARIABLES=filter_$ retention /CRITERIA=CI(.95).

T-Test

[DataSet1] C:\Users\UncuulPEE\Documents\MY DISSERTATION\Ojo achievement relia bility. real. sav.sav

Group Statistics

	GENDER	N	Mean	Std. Deviation	Std. Error Mean
GROUP = 2 (FILTER)	MALE	9	1.00	.000 [a]	.000
	FEMALE	16	1.00	.000 [a]	.000
retention	MALE	9	27.3333	1.87083	.62361
	FEMALE	16	27.5000	1.93218	.48305

a. t cannot be computed because the standard deviations of both groups are 0.

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means	
		F	Sig.	t	df
retention	Equal variances assumed	.124	.728	-.209	23
	Equal variances not assumed			-.211	17.181

Independent Samples Test

		t-test for Equality of Means			
		Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence ... Lower
retention	Equal variances assumed	.836	-.16667	.79628	-1.81389
	Equal variances not assumed	.835	-.16667	.78881	-1.82958

Independent Samples Test

		t-test for Equality of ...
		95% Confidence ...
		Upper
retention	Equal variances assumed	1.48056
	Equal variances not assumed	1.49624

T-TEST

GROUPS=GENDER(1 2)

/MISSING=ANALYSIS

/VARIABLES=retention filter_$ /CRITERIA=CI(.95).

T-Test

[DataSet1] C:\Users\UncuulPEE\Documents\MY DISSERTATION\Ojo achievement relia bility. real. sav.sav

Group Statistics

	GENDER	N	Mean	Std. Deviation	Std. Error Mean
retention	MALE	10	28.6000	1.17379	.37118
	FEMALE	19	27.5263	1.77540	.40730
GROUP = 3 (FILTER)	MALE	10	1.00	.000 [a]	.000
	FEMALE	19	1.00	.000 [a]	.000

a. t cannot be computed because the standard deviations of both groups are 0.

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means	
		F	Sig.	t	df
retention	Equal variances assumed	1.813	.189	1.717	27
	Equal variances not assumed			1.948	25.347

Independent Samples Test

		t-test for Equality of Means			
		Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence ... Lower
retention	Equal variances assumed	.097	1.07368	.62517	-.20905
	Equal variances not assumed	.063	1.07368	.55107	-.06047

Report

GROUP		posttest	pretest
LECTURE METHOD	Mean	27.4375	13.9896
	N	384	384
	Std. Deviation	1.58031	3.04104
INDIVIDUAL-PLAY KAHOOT	Mean	29.4400	14.1600
	N	25	25
	Std. Deviation	.96090	1.70000
GROUP-PLAY KAHOOT	Mean	29.0690	13.3103
	N	29	29
	Std. Deviation	.92316	1.16813
Total	Mean	27.6598	13.9543
	N	438	438
	Std. Deviation	1.62807	2.89523

Independent Samples Test

		t-test for Eq	
retention	Equal variances assumed	Co	
	Equal variances not assumed		

M

EANS TABLES=posttest pretest BY GENDER filter_$ /CELLS
MEAN COUNT STDDEV.

Means

[DataSet2] C:\Users\UncuulPEE\Documents\MY DISSERTATION\Ojo achievement relia bility.sav

Case Processing Summary

	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
posttest * GENDER	25	100.0%	0	0.0%	25	100.0%
pretest * GENDER	25	100.0%	0	0.0%	25	100.0%
posttest * GROUP=2 (FILTER)	25	100.0%	0	0.0%	25	100.0%
pretest * GROUP=2 (FILTER)	25	100.0%	0	0.0%	25	100.0%

posttest pretest * GENDER

GENDER		posttest	pretest
MALE	Mean	29.2222	13.8889
	N	9	9
	Std. Deviation	1.09291	1.05409
FEMALE	Mean	29.5625	14.3125
	N	16	16
	Std. Deviation	.89209	1.99060
Total	Mean	29.4400	14.1600
	N	25	25
	Std. Deviation	.96090	1.70000

posttest pretest * GROUP=2 (FILTER)

GROUP=2 (FILTER)		posttest	pretest
Selected	Mean	29.4400	14.1600
	N	25	25
	Std. Deviation	.96090	1.70000
Total	Mean	29.4400	14.1600
	N	25	25
	Std. Deviation	.96090	1.70000

MEANS TABLES=posttest pretest BY filter_$ GENDER /CELLS
MEAN COUNT STDDEV.

Means

[DataSet2] C:\Users\UncuulPEE\Documents\MY DISSERTATION\Ojo achievement relia bility.sav

Case Processing Summary

	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
posttest * GROUP=3 (FILTER)	29	100.0%	0	0.0%	29	100.0%
pretest * GROUP=3 (FILTER)	29	100.0%	0	0.0%	29	100.0%
posttest * GENDER	29	100.0%	0	0.0%	29	100.0%
pretest * GENDER	29	100.0%	0	0.0%	29	100.0%

posttest pretest * GROUP=3 (FILTER)

GROUP=3 (FILTER)		posttest	pretest
Selected	Mean	29.0690	13.3103
	N	29	29
	Std. Deviation	.92316	1.16813
Total	Mean	29.0690	13.3103
	N	29	29
	Std. Deviation	.92316	1.16813

posttest pretest * GENDER

GENDER		posttest	pretest
MALE	Mean	28.8000	13.3000
	N	10	10
	Std. Deviation	.91894	1.05935
FEMALE	Mean	29.2105	13.3158
	N	19	19
	Std. Deviation	.91766	1.24956
Total	Mean	29.0690	13.3103
	N	29	29
	Std. Deviation	.92316	1.16813

```
DATASET ACTIVATE DataSet1.

DATASET CLOSE DataSet2.

MEANS TABLES=retention posttest BY GROUP
/CELLS MEAN COUNT STDDEV.
```

Means

[DataSet1] C:\Users\UncuulPEE\Documents\MY DISSERTATION\Ojo achievement relia bility. real. sav.sav

Case Processing Summary

	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
retention * GROUP	438	68.4%	202	31.6%	640	100.0%
posttest * GROUP	438	68.4%	202	31.6%	640	100.0%

Report

GROUP		retention	posttest
LECTURE METHOD	Mean	26.5990	27.4375
	N	384	384
	Std. Deviation	2.56317	1.58031
INDIVIDUAL-PLAY KAHOOT	Mean	27.4400	29.4400
	N	25	25
	Std. Deviation	1.87261	.96090
GROUP-PLAY KAHOOT	Mean	27.8966	29.0690
	N	29	29
	Std. Deviation	1.65497	.92316
Total	Mean	26.7329	27.6598
	N	438	438
	Std. Deviation	2.50206	1.62807

MEANS TABLES=posttest retention BY GENDER filter_$ /CELLS
MEAN COUNT STDDEV.

Means

[DataSet2] C:\Users\UncuulPEE\Documents\MY DISSERTATION\Ojo achievement relia bility.sav

Case Processing Summary

	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
posttest * GENDER	25	100.0%	0	0.0%	25	100.0%
retention * GENDER	25	100.0%	0	0.0%	25	100.0%
posttest * GROUP=2 (FILTER)	25	100.0%	0	0.0%	25	100.0%
retention * GROUP=2 (FILTER)	25	100.0%	0	0.0%	25	100.0%

posttest retention * GENDER

GENDER		posttest	retention
MALE	Mean	29.2222	27.3333
	N	9	9
	Std. Deviation	1.09291	1.87083
FEMALE	Mean	29.5625	27.5000
	N	16	16
	Std. Deviation	.89209	1.93218
Total	Mean	29.4400	27.4400
	N	25	25
	Std. Deviation	.96090	1.87261

posttest retention * GROUP=2 (FILTER)

GROUP=2 (FILTER)		posttest	retention
Selected	Mean	29.4400	27.4400
	N	25	25
	Std. Deviation	.96090	1.87261
Total	Mean	29.4400	27.4400
	N	25	25
	Std. Deviation	.96090	1.87261

MEANS TABLES=posttest retention BY GENDER filter_$ /CELLS
MEAN COUNT STDDEV.

Means

[DataSet2] C:\Users\UncuulPEE\Documents\MY DISSERTATION\Ojo achievement relia bility.sav

Case Processing Summary

	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
posttest * GENDER	29	100.0%	0	0.0%	29	100.0%
retention * GENDER	29	100.0%	0	0.0%	29	100.0%
posttest * GROUP=3 (FILTER)	29	100.0%	0	0.0%	29	100.0%
retention * GROUP=3 (FILTER)	29	100.0%	0	0.0%	29	100.0%

posttest retention * GENDER

GENDER		posttest	retention
MALE	Mean	28.8000	28.6000
	N	10	10
	Std. Deviation	.91894	1.17379
FEMALE	Mean	29.2105	27.5263
	N	19	19
	Std. Deviation	.91766	1.77540
Total	Mean	29.0690	27.8966
	N	29	29
	Std. Deviation	.92316	1.65497

posttest retention * GROUP=3 (FILTER)

GROUP=3 (FILTER)		posttest	retention
Selected	Mean	29.0690	27.8966
	N	29	29
	Std. Deviation	.92316	1.65497
Total	Mean	29.0690	27.8966
	N	29	29
	Std. Deviation	.92316	1.65497

> Warning # 849 in column 23. Text: en_NG

> The LOCALE subcommand of the SET command has an invalid parameter. It could > not be mapped to a valid backend locale.

GET

FILE='C:\Users\UncuulPEE\Documents\MY DISSERTATION\interest DATA FOR ANALYS IS.sav'.

DATASET NAME DataSet1 WINDOW=FRONT.

MEANS TABLES=invetory preinvetory BY GROUP
/CELLS MEAN COUNT STDDEV.

Means

[DataSet1] C:\Users\UncuulPEE\Documents\MY DISSERTATION\interest DATA FOR ANA LYSIS.sav

Case Processing Summary

	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
invetory * GROUP	438	97.3%	12	2.7%	450	100.0%
preinvetory * GROUP	438	97.3%	12	2.7%	450	100.0%

Report

GROUP		invetory	preinvetory
LECTURE METHOD	Mean	4.4917	4.1299
	N	384	384
	Std. Deviation	.40063	4.45269
INDIVIDUAL-PLAY KAHOOT	Mean	4.5120	3.8800
	N	25	25
	Std. Deviation	.38764	.33166
GROUP-PLAY KAHOOT	Mean	4.5966	4.0000
	N	29	29
	Std. Deviation	.19727	.00000
Total	Mean	4.4998	4.1071
	N	438	438
	Std. Deviation	.39001	4.16974

Multiple Comparisons

Dependent Variable: posttest

Sidak

(I) GROUP	(J) GROUP	Mean Difference (I J)	Std. Error	Sig.
LECTURE METHOD	INDIVIDUAL-PLAY KAHOOT	-2.00250 *	.31335	.000
	GROUP-PLAY KAHOOT	-1.63147 *	.29236	.000
INDIVIDUAL-PLAY KAHOOT	LECTURE METHOD	2.00250 *	.31335	.000
	GROUP-PLAY KAHOOT	.37103	.41431	.751
GROUP-PLAY KAHOOT	LECTURE METHOD	1.63147 *	.29236	.000
	INDIVIDUAL-PLAY KAHOOT	-.37103	.41431	.751

Sidak

(I) GROUP	(J) GROUP	95% Confidence Interval	
		Lower Bound	Upper Bound
LECTURE METHOD	INDIVIDUAL-PLAY KAHOOT	-2.7536	-1.2514
	GROUP-PLAY KAHOOT	-2.3322	-.9307
INDIVIDUAL-PLAY KAHOOT	LECTURE METHOD	1.2514	2.7536
	GROUP-PLAY KAHOOT	-.6221	1.3641
GROUP-PLAY KAHOOT	LECTURE METHOD	.9307	2.3322
	INDIVIDUAL-PLAY KAHOOT	-1.3641	.6221

Multiple Comparisons

Dependent Variable: posttest

*. The mean difference is significant at the 0.05 level.

```
USE ALL.
COMPUTE filter_$=(GROUP = 1).
VARIABLE LABELS filter_$ 'GROUP = 1 (FILTER)'.
VALUE LABELS filter_$ 0 'Not Selected' 1 'Selected'.
FORMATS filter_$ (f1.0).
FILTER BY filter_$.
EXECUTE.
USE ALL.
COMPUTE filter_$=(GROUP = 1).
VARIABLE LABELS filter_$ 'GROUP = 1 (FILTER)'.
VALUE LABELS filter_$ 0 'Not Selected' 1 'Selected'.
FORMATS filter_$ (f1.0).
FILTER BY filter_$.
```

```
EXECUTE.
USE ALL.
COMPUTE filter_$=(GROUP = 2).
VARIABLE LABELS filter_$ 'GROUP = 2 (FILTER)'.
VALUE LABELS filter_$ 0 'Not Selected' 1 'Selected'.
FORMATS filter_$ (f1.0).
FILTER BY filter_$.
EXECUTE.
T-TEST GROUPS=GENDER(1 2)
  /MISSING=ANALYSIS
  /VARIABLES=posttest
/CRITERIA=CI(.95).
```

T-Test

[DataSet1] C:\Users\UncuulPEE\Documents\MY DISSERTATION\Ojo achievement relia bility. real. sav.sav

Group Statistics

	GENDER	N	Mean	Std. Deviation	Std. Error Mean
posttest	MALE	9	29.2222	1.09291	.36430
	FEMALE	16	29.5625	.89209	.22302

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means	
		F	Sig.	t	df
posttest	Equal variances assumed	.727	.403	-.845	23
	Equal variances not assumed			-.797	14.066

Independent Samples Test

		t-test for Equality of Means			
		Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence ... Lower
posttest	Equal variances assumed	.407	-.34028	.40279	-1.17350
	Equal variances not assumed	.439	-.34028	.42715	-1.25601

Independent Samples Test

		t-test for Equality of ... 95% Confidence ... Upper
posttest	Equal variances assumed	.49295
	Equal variances not assumed	.57546

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means	
		F	Sig.	t	df
posttest	Equal variances assumed	.053	.820	-1.145	27
	Equal variances not assumed			-1.144	18.393

Independent Samples Test

		t-test for Equality of Means			
		Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence ... Lower
posttest	Equal variances assumed	.262	-.41053	.35868	-1.14648
	Equal variances not assumed	.267	-.41053	.35884	-1.16327

Independent Samples Test

		t-test for Equality of ... 95% Confidence ... Upper
posttest	Equal variances assumed	.32542
	Equal variances not assumed	.34221

ONEWAY retention BY GROUP

/MISSING ANALYSIS

/POSTHOC=SIDAK ALPHA(0.05).

Oneway

[DataSet1] C:\Users\UncuulPEE\Documents\MY DISSERTATION\Ojo achievement relia bility.sav

ANOVA

retention

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	58.657	2	29.329	4.766	.009
Within Groups	2677.089	435	6.154		
Total	2735.747	437			

Post Hoc Tests

Multiple Comparisons

Dependent Variable: retention

Sidak

(I) GROUP	(J) GROUP	Mean Difference (I J)	Std. Error	Sig.
LECTURE METHOD	INDIVIDUAL-PLAY KAHOOT	-.84104	.51205	.274
	GROUP-PLAY KAHOOT	-1.29759 *	.47775	.020
INDIVIDUAL-PLAY KAHOOT	LECTURE METHOD	.84104	.51205	.274
	GROUP-PLAY KAHOOT	-.45655	.67704	.875
GROUP-PLAY KAHOOT	LECTURE METHOD	1.29759 *	.47775	.020
	INDIVIDUAL-PLAY KAHOOT	.45655	.67704	.875

Multiple

Comparisons Dependent Variable: retention

Sidak

		95% Confidence Interval	
(I) GROUP	(J) GROUP	Lower Bound	Upper Bound
LECTURE METHOD	INDIVIDUAL-PLAY KAHOOT	-2.0684	.3863
	GROUP-PLAY KAHOOT	-2.4427	-.1525
INDIVIDUAL-PLAY KAHOOT	LECTURE METHOD	-.3863	2.0684
	GROUP-PLAY KAHOOT	-2.0794	1.1663
GROUP-PLAY KAHOOT	LECTURE METHOD	.1525	2.4427
	INDIVIDUAL-PLAY KAHOOT	-1.1663	2.0794

*. The mean difference is significant at the 0.05 level.

ONEWAY retention BY GROUP

/MISSING ANALYSIS

/POSTHOC=SIDAK ALPHA(0.05).

Oneway

[DataSet1] C:\Users\UncuulPEE\Documents\MY DISSERTATION\Ojo achievement relia bility.sav

ANOVA

retention

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	58.657	2	29.329	4.766	.009
Within Groups	2677.089	435	6.154		
Total	2735.747	437			

Post Hoc Tests

Multiple Comparisons

Dependent Variable: retention

Sidak

(I) GROUP	(J) GROUP	Mean Difference (I J)	Std. Error	Sig.
LECTURE METHOD	INDIVIDUAL-PLAY KAHOOT	-.84104	.51205	.274
	GROUP-PLAY KAHOOT	-1.29759 *	.47775	.020
INDIVIDUAL-PLAY KAHOOT	LECTURE METHOD	.84104	.51205	.274
	GROUP-PLAY KAHOOT	-.45655	.67704	.875
GROUP-PLAY KAHOOT	LECTURE METHOD	1.29759 *	.47775	.020
	INDIVIDUAL-PLAY KAHOOT	.45655	.67704	.875

Multiple Comparisons

Dependent Variable: retention

Sidak

		95% Confidence Interval	
(I) GROUP	(J) GROUP	Lower Bound	Upper Bound
LECTURE METHOD	INDIVIDUAL-PLAY KAHOOT	-2.0684	.3863
	GROUP-PLAY KAHOOT	-2.4427	-.1525
INDIVIDUAL-PLAY KAHOOT	LECTURE METHOD	-.3863	2.0684
	GROUP-PLAY KAHOOT	-2.0794	1.1663
GROUP-PLAY KAHOOT	LECTURE METHOD	.1525	2.4427
	INDIVIDUAL-PLAY KAHOOT	-1.1663	2.0794

*. The mean difference is significant at the 0.05 level.

> Warning # 849 in column 23. Text: en_NG

> The LOCALE subcommand of the SET command has an invalid parameter. It could > not be mapped to a valid backend locale.

```
GET
  FILE='C:\Users\UncuulPEE\Documents\MY DISSERTATION\interest DATA FOR ANALYS IS.sav'.
DATASET NAME DataSet1 WINDOW=FRONT.
ONEWAY invetory BY GROUP
/MISSING ANALYSIS.
```

Oneway

[DataSet1] C:\Users\UncuulPEE\Documents\MY DISSERTATION\interest DATA FOR ANA LYSIS.sav

ANOVA

invetory

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.301	2	.150	.988	.373
Within Groups	66.169	435	.152		
Total	66.470	437			

```
ONEWAY invetory BY GROUP
  /MISSING ANALYSIS
  /POSTHOC=SIDAK ALPHA(0.05).
```

Oneway

[DataSet1] C:\Users\UncuulPEE\Documents\MY DISSERTATION\interest DATA FOR ANA LYSIS.sav

ANOVA

invetory

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.301	2	.150	.988	.373
Within Groups	66.169	435	.152		
Total	66.470	437			

Post Hoc Tests

Multiple Comparisons

Dependent Variable: invetory

Sidak

(I) GROUP	(J) GROUP	Mean Difference (I J)	Std. Error	Sig.
LECTURE METHOD	INDIVIDUAL-PLAY KAHOOT	-.02033	.08050	.992
	GROUP-PLAY KAHOOT	-.10489	.07511	.414
INDIVIDUAL-PLAY KAHOOT	LECTURE METHOD	.02033	.08050	.992
	GROUP-PLAY KAHOOT	-.08455	.10644	.812
GROUP-PLAY KAHOOT	LECTURE METHOD	.10489	.07511	.414
	INDIVIDUAL-PLAY KAHOOT	.08455	.10644	.812

Multiple Comparisons

Dependent Variable: invetory

Sidak

(I) GROUP	(J) GROUP	95% Confidence Interval	
		Lower Bound	Upper Bound
LECTURE METHOD	INDIVIDUAL-PLAY KAHOOT	-.2133	.1726
	GROUP-PLAY KAHOOT	-.2849	.0751
INDIVIDUAL-PLAY KAHOOT	LECTURE METHOD	-.1726	.2133
	GROUP-PLAY KAHOOT	-.3397	.1706
GROUP-PLAY KAHOOT	LECTURE METHOD	-.0751	.2849
	INDIVIDUAL-PLAY KAHOOT	-.1706	.3397

T-TEST GROUPS=GENDER(1 2)

/MISSING=ANALYSIS

/VARIABLES=invetory
/CRITERIA=CI(.95).

T-Test

[DataSet1] C:\Users\UncuulPEE\Documents\MY DISSERTATION\interest DATA FOR ANA LYSIS.sav

Group Statistics

	GENDER	N	Mean	Std. Deviation	Std. Error Mean
invetory	MALE	11	4.4909	.22563	.06803
	FEMALE	14	4.5286	.48742	.13027

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means	
		F	Sig.	t	df
invetory	Equal variances assumed	1.834	.189	-.236	23
	Equal variances not assumed			-.256	19.201

Independent Samples Test

		t-test for Equality of Means			
		Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence ... Lower
invetory	Equal variances assumed	.815	-.03766	.15935	-.36731
	Equal variances not assumed	.800	-.03766	.14696	-.34504

Independent Samples Test

		t-test for Equality of ...
		95% Confidence ...
		Upper
invetory	Equal variances assumed	.29198
	Equal variances not assumed	.26972

T-TEST GROUPS=GENDER(1 2)

/MISSING=ANALYSIS

/VARIABLES=invetory
/CRITERIA=CI(.95).

T-Test

[DataSet1] C:\Users\UncuulPEE\Documents\MY DISSERTATION\interest DATA FOR ANALYSIS.sav

Group Statistics

	GENDER	N	Mean	Std. Deviation	Std. Error Mean
invetory	MALE	13	4.6077	.13205	.03662
	FEMALE	16	4.5875	.24187	.06047

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means	
		F	Sig.	t	df
invetory	Equal variances assumed	3.435	.075	.270	27
	Equal variances not assumed			.286	23.988

Independent Samples Test

		t-test for Equality of Means			
		Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence ... Lower
invetory	Equal variances assumed	.790	.02019	.07491	-.13351
	Equal variances not assumed	.778	.02019	.07069	-.12571

Independent Samples Test

		t-test for Equality of ...
		95% Confidence ...
		Upper
invetory	Equal variances assumed	.17390
	Equal variances not assumed	.16610