CHAPTER ONE

INTRODUCTION

Background to the Study

One of the most significant occurrences of the 20th century is the invention of the Internet and World Wide Web in the 1980s. This has remained so through the 1990s when Information and Communication Technology (ICT) took centre stage. These inventions have changed and continued to change people's lives and activities in almost all aspects of life including education and training, transportation, communication, business, banking and leisure. As Mbah (2016) stated, this modern technology has launched the world into a knowledge-based economy in which ideas and technological principles are used for better output. Thus, advancement in technology according to Muhammed, Asua and Munnaza (2015) has compelled teachers and educators to utilize its benefits for the delivery of instruction and promote learning through on-line learning.

An area that has been most affected by this phenomenon is the office. The space, tools and equipment, procedures/processes and personnel (including office managers/secretaries) involved in the generation, maintenance and management of office information have been revolutionized. These changes in the functions of secretaries, office layouts and equipment used in performing office functions have given rise to specific training and retraining needs for the secretaries. This is to ensure that they remain relevant and contribute adequately to the goals of their

employers and the society. The changes also led to the expansion and extension in the curriculum/syllabus of secretarial studies and change of the nomenclature to office technology and management (OTM) and job title from secretary to office manager. Salleh, Musa and Sulaiman (2017) noted that today's secretary has come to assume the rightful position as the chief organizer of the secretariat, its staff and equipment. The nomenclature has changed the job title from 'the secretary' to 'the office manager.'

The introduction of ICTs into education has resulted in changes in the ways everything is done in teaching and learning. Today, ICTs facilitate teaching and learning through on-line learning, e-learning and similar terms and methods which are rapidly taking over the conventional or face-to-face teaching and learning modes. According to Omoniyi and Boluwaji (2014), this development justified the transformation of secretarial studies into OTM and modernization of the curriculum in order to equip students with relevant office and socio-psychological skills and competencies for the current information era.

Despite the above changes, the core competency area on which secretarial duties are anchored is the generation of information by 'note taking'. Before the invention of the typewriter, note-taking was entirely done manually in shorthand and subsequent handwritten transcription. In Office Technology and Management (OTM), the core skills centre on the use of computer to generate and process information with keyboarding speed and accuracy. According to Career and Technical Education Resource Centre (CTERC, 2012), keyboarding

refers to inputting of data using the touch method on a standard alpha-numeric keyboard known as the QWERTY keyboard.

Keyboarding is as old as the history of typewriting itself. Today in the society, keyboarding is evident in almost every aspect of life. One constantly experiences the need of keyboard training in the educational system for its sustainable development. Oyeyiola (2006) and Daudawa (2006) opined that if education is to take a new and dynamic significance, it must be aimed at training the child for some specific skills. The challenge then to business teachers in preparing National Diploma (N.D) students and/or workers for entry into Higher National Diploma and/or work places are to indicate which method of teaching keyboarding is more appropriate for development of work habits and high operative skills.

Career and Technical Education Resource Centre (CTERC, 2012) asserted that the goal of keyboarding instruction is to develop a touch skill that will enable an individual to enter alpha-numeric information at a speed that is faster than writing with hand. The source further observed that once keyboarding skills have been imbibed, students should be able to strike the correct keys without looking at them or the fingers. Whereas a person speaks at an average of 120 words per minute, an expert in keyboarding can reach a speed of 125 words per minute. At graduate of National Diploma (ND) is expected to type a passage of 350 words at 98% rate of accuracy (NBTE, 2014). Perfection in keyboarding depends on sitting position and controls (Schenectady County Public Library, 2010). These

are broken down into seven aspects, namely, (i) correct keyboard height (ii) correct distance from the keyboard (iii) right positioning of the body/person, (iv) wrist position (v) eyes on the copy material (vi) fingers anchored and (vii) relationship of light and the eyes.

Speed and accuracy are important requirements for effective performance, professional growth and upliftment of office technology and management students. However, most OTM students do not seem to acquire high speed and accuracy that will enhance their work performance in employment considering the current mode of teaching keyboarding with manual typewriters. Office Technology and Management curricula are tailored towards the needs of the labour market with conventional method of instruction being used predominantly as against the use of online learning in developed countries of the world (Magaji, 2015). For example, Alsaaty and Cater (2016), reported that as at 2011, over 6.1 million of students in tertiary institutions in the United States of America were taking at least, one online course. According to Allen and Seamans (2013), the number of people engaging in on-line learning grew at about 9 per cent and the trend showed no sign of reversing. Allen and Seamans observed that forces external to the institutions such as finance and demand for schedule flexibility among others are factors driving the change.

Office Technology and Management programme was designed for two major reasons. According to Adelakin (2009), the first was a response to the yearnings of secretarial studies students and practitioners for change of the name

of the programme as it makes their products seem only suitable for the traditional office environment. The second was to integrate ICT, managerial and entrepreneurial competencies in order to enrich the knowledge of students and equip them with skills needed in the modern office environment. Hence, the OTM curriculum of National Diploma in keyboarding at the third semester is to equip students with the ability to type efficiently various office jobs and acquire a copying rate of 35 words a minute on passages not below 1.3 syllabic intensity with 98% accuracy.

Online learning encompasses a face-to-face, mixed and blended delivery model that utilizes electronic means. The electronic devices include e-mail, cell phone, interactive CDs, internet, computers, radio, optical fiber technologies (Ugwoke , 2011). According to Obikeze and Onyechi (2011), online learning means formal and non-formal education that uses electronic delivery method such as internet based learning delivery packages, CD-Rom, online video conferencing or e-mail to manage the relationship between teachers and learners. This study uses the term online instruction to mean teaching keyboarding using computer instructional packages such as Mavis Beacon Teaches Typing. The Mavis Beacon Teaches Typing is an application software which can be installed in a computer for teaching and learning keyboarding. The software rates users at the completion of each task on accuracy, typing speed, errors and words per minute. At the end of the exercise, users can also print their result which comes out in a certificate format.

In Nigeria, based on governments' dwindling resources and load-shedding, increasing rate of unemployment amidst increasing demand for quality education, it is pertinent that the route to effective educational delivery will increase reliance on online instruction. As Micheal and Heather (2014) insinuated, not only is on-line instruction fast becoming an important mode of teaching and learning, it is becoming more and more acceptable, affordable and therefore preferable. According to Michael and Heather, on-line instruction could have positive influence on students' performances and increase their access to wider area of interaction. Moreover, Emeasoba and Nweke (2016) noted that ICT availability and usage has been slow in Nigerian polytechnics particularly with respect to OTM programmes. With increasing demand for Vocational Technical Education (VTE) (especially OTM) amidst declining instructional facilities, the most practical solution will be online instruction. Apart from declines in government funding, availability of teach your-self, easy-to-follow online teaching aids and packages, personal funding, flexibility and increasing desire will tend to bias education in Nigeria towards on-line learning like other countries.

There is a large body of literature and empirical works on on-line instruction versus conventional instructional methods but only few have addressed the effects of on-line learning and conventional learning on keyboarding speed and accuracy which are the foundation blocks of OTM. The FRN (2014) stipulates that teaching should be shifting towards practical activity, experiment and ICT supported. This indicates that government desires to

movetowards on-line instruction in line with global trends. Furthermore, more and more professionalsin other fields who depend on the knowledge, skills and expertise of office managers are themselves becoming highly computer literate and know fairly well about keyboarding. Consequently, the demand for office managers (specialists in the field)will decline unless they continue to maintain an edge in their own profession by out-performing all others in note-taking via keyboarding in order to remain dependable and indispensable.

Gender influence in students' academic achievement is a crucial matter to the educationist. Oluwatulure (2015) asserted that gender refers to the social attributes and opportunities associated with being a male or female, woman or man and being a girl or boy. These attributes, opportunities and relationships are socially constructed and are learnt through socialization processes of which the school is one of the major agents. The gender issue is one of the most divisive classifications in human relationships. According to Bloksgaard (2011), there are so many directions to gendering - biological, psychological, anthropological, sociological and even economic. Dania (2014) and Filgona, Sababa and Filgona (2016) argued that gender cannot be factored in students' performance but Adeyemi and Ajibade (2011) posited that gender could play a significant role in students' achievement. It is not clear if these performance indices would not change if new instructional methods like online teaching are adopted in teaching a skill course such as keyboarding, hence, this study will test gender.

A cursory look at professions and gender seems to show that there are three professions that are gender biased in favour of women – nursing, secretarial duties and teaching to a lesser extent. It can be suggested that the tendency of introducing gender dimension in secretarial profession researches is because the secretarial profession is still considered, rightly or wrongly as women's work. It will, therefore, be necessary to ascertain the extent to which this natural calling contribute to differences (if any) in the keyboarding speed and accuracy achievement of male and female OTM students.

Statement of the Problem

Information and Communication Technology [ICT] has changed almost every facet of life relative to what things are done and how things are done. One area most seriously affected by ICT is the office technology and management (or secretarial) profession. In recognition of this development, the Nigeria government restructured and expanded the curriculum of the former secretarial studies programme in polytechnics and renamed it Office Technology and Management (OTM). The government also recommended that educational deliveries generally (and OTM in particular) should be ICT driven (FRN, 2013).

The integration of ICTs in education has led to significant changes in both the structure and functionality of education in Nigeria and other countries. One of these changes on delivery modes is on-line instruction. Researchers such as Ukonu, Sababa and Filgona (2017) have conducted studies on effective methods of teaching keyboarding other than face-to-face instruction in business education

programme generally but studies on using online instruction in teaching keyboarding seem to be scanty.

Of all the courses taught in a 2-year National Diploma (ND) programme in OTM in Nigerian polytechnics, only keyboarding and shorthand feature in three of the four semesters of the programme. Despite this, there is little or no evidence that the lecturers are adopting on-line method of instruction. According to Ukonu, Sababa and Filgona (2017), keyboarding is a popular business course for many students whose major objectives are to develop touch control of the keyboard and proper typing techniques. It also involves building basic speed and accuracy and provides practice in applying these skills to the formatting of letters, reports, tables, memos and other kinds of personal and business communication. Consequently, OTM students require high speed and accuracy that will enhance their professional growth in employment.

As an OTM lecturer in a polytechnic in Nasarawa State, the OTM NDII students' achievement in keyboarding speed and accuracy is on the decline. The reason for this situation may not be unconnected with the methods of instruction adopted by lecturers which are mostly conventional. It is expected that adoption of on-line instruction which is innovative will stimulate students' interest in keyboarding instruction leading to higher achievement in speed and accuracy. However, this is an assumption that needs to be established with empirical evidence, hence this study on effect of on-line instruction on keyboarding speed

and accuracy achievement among OTM students in polytechnics in Nasarawa State.

Purpose of the Study

The main purpose of the study is to determine the effect of on-line instruction on keyboarding speed and accuracy achievement among office technology and management (OTM) students of polytechnics in Nasarawa State. Specifically, the study determined the:

1.   Effect of on-line instruction on keyboarding speed achievement among OTM students of polytechnics in Nasarawa State when compared with those taught with conventional method.

2.   Effect of on-line instruction on keyboarding accuracy achievement among OTM students of polytechnics in Nasarawa State when compared with those taught with conventional method.

3.   Effect of on-line instruction on keyboarding speed achievement among male and female OTM students of polytechnics in Nasarawa State.

4.   Effect of on-line instruction on keyboarding accuracy achievement among male and female OTM students of polytechnics in Nasarawa State.

5.   Interaction effect of instructional methods and gender on keyboarding speed achievement among OTM students of polytechnics in Nasarawa State.

6.   Interaction effect of instructional methods and gender on keyboarding accuracy achievement among OTM students of polytechnics in Nasarawa State.

Significance of the Study

The findings of this study when published will be of immense benefits to OTM teachers/lecturers, students, education policy makers, curriculum planners and future researchers. Findings of the study when applied by OTM lecturers will enable the lecturers deliver quality teaching and learning of keyboarding and consolidate on hands-on practical strategy which will facilitate students' smooth acquisition of keyboarding skills needed in the business world. The findings of the study will equally stimulate the students' interest in keyboarding instruction leading to higher speed and accuracy achievement. This will lead to their professional growth in employment on graduation as OTM professionals/secretaries.

To the education policy makers, the findings of this study will highlight some of the advantages as well as difficulties in on-line learning. This will help educational policy makers in addressing some of the issues that affect education in general and OTM education in particular as they relate to finance, personnel and facilities. Imbibing on-line learning will enhance improvement in resource utilization to the overall benefit of society and without reducing access to quality education.

Equally, curriculum planners will stand a better chance to benefit from the result of this study which will help them to adequately plan for the training of students at all levels especially the National Diploma students. Future researchers

will find the findings of this study useful as it will identify areas needing further research and provide relevant literature to such researchers.

Scope of the Study

The study focused on comparing the effectiveness of online instruction on keyboarding speed and accuracy achievement among office technology and management students in polytechnics in Nasarawa State. Only ND 2 students was used because it is at the stage that OTM students are expected to type at a speed of 35 words a minute and 95% accuracy. The study focused on polytechnics because it is only in polytechnics that Office Technology and Management (OTM) as a nomenclature is adopted. The study concentrated on three basic areas that are pertinent to keyboarding namely (a) keyboard finger movement co-ordination (b) speed and (c) accuracy. Mavis Beacon Teaches Typing version 12 is used in this study as an online instruction software. The Mavis Beacon Teaches Typing software can be installed in a computer through CD for teaching and learning keyboarding. The software rates users at the completion of each task on accuracy, typing speed, errors and words per minute. Users can also print their result which comes out in a certificate format at the end of every exercise

Research Questions

The following research questions guided the study.

1. What is the effect of on-line instruction on keyboarding speed achievement among OTM students of polytechnics in Nasarawa State when compared with those taught with conventional method.

2. What is the effect of on-line instruction on keyboarding accuracy achievement among OTM students of polytechnics in Nasarawa State when compared with those taught with conventional method.

3. What is the effect of on-line instruction on keyboarding speed achievement among male and female OTM students of polytechnics in Nasarawa State using their pre-test and post-test scores?

4. What is the effect of on-line instruction on keyboarding accuracy achievement among male and female OTM students of polytechnics in Nasarawa State using their pre-test and post-test scores?

5. What is the interaction effect of instructional methods and gender on keyboarding speed achievement among OTM students of polytechnics in Nasarawa State?

6. What is the interaction effect of instructional methods and gender on keyboarding accuracy achievement among OTM students in of polytechnics in NasarawaState.

Hypotheses

The following null hypotheses was tested at 0.05 level of significance.

1. There is no significant difference in the mean keyboarding speed achievement of OTM students in polytechnics in Nasarawa State taught with on-line instruction and their counterpart taught using conventional methods of instruction.

2. There is no significant difference in the mean keyboard accuracy achievement of OTM students in polytechnics in Nasarawa State taught with on-line instruction and their counterpart taught using conventional methods of instruction.

3. There is no significant difference in the mean keyboarding speed achievements of male and female OTM students in polytechnics in Nasarawa state taught with online instruction when compared with those taught with conventional instructional methods.

4. There is no significant difference in the mean keyboarding accuracy achievements of male and female OTM students in polytechnics in Nasarawa state taught with online instruction with those taught with conventional instructional methods.

5. There is no significant interaction effect of instructional methods and gender on the mean keyboarding speed achievement among OTM students in polytechnics in Nasarawa State.

6. There is no significant interaction effect of instructional methods and gender on the mean keyboarding accuracy achievement among OTM students in polytechnics in Nasarawa state.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

This chapter reviewed the literature related to this study under the following sub-headings:

Conceptual Framework

Online Instruction

Keyboarding

Keyboarding Speed

Keyboarding Accuracy

Achievement

Office Technology and Management

Theoretical Framework

Constructivism Theory

Achievement Motivation Theory

Theoretical Studies

Teaching and Learning Principles

Measuring Teaching Effectiveness

Types of Online Instruction

Effects of Online Instruction

Importance/Benefits of Keyboarding Skills

Objectives of keyboarding at ND level

Factors that Affect Keyboarding Speed and Accuracy

Teaching Approaches in Keyboarding

Touch Typing Keyboarding Techniques

Gender Issues in OTM Profession

Empirical Studies

Online and Conventional Instructional Methods

Gender and Students' Academic Achievement

Teaching Methods and Academic Achievement

Achievement

Summary of Review of Related Literature

Conceptual Framework

Key concepts in the title of this study are reviewed in this section as follows:

On-line Instruction

Online instruction is the practice of using information and communication technology to create learning experiences that can be formulated, organized and used with ample freedom without any boundaries (Horton, 2006). It is a process where a set of lessons is provided on digital devices like computers or any mobile devices that supports the learning. Online instruction is interactive learning in which the learning content is available online and provides automatic feedback to the student's learning activities (Paulsen, 2003). Besides acquiring general knowledge, another main goal of online instruction is to develop

professional skills and understanding to help learners achieve their learning objectives (Clarke and Mayer, 2008).

Ezenwafor and Nwaokwa (2017) explained that online refers to an innovative approach to delivering electronically mediated, well-designed, learner-centred and interactive learning environment to anyone, anytime and anyplace by utilizing technology in concert with instructional design principles. The online teaching method emphasizes an interactive learning environment, designed to stimulate dialogue between instructor and students and among students themselves. The online process requires both instructor and students to take active roles. The instructor on the online instructional method acts as a facilitator, organizing activities that engage students directly rather than relying too heavily on lectures and memorization.

According to Galy, Downey and Johnson (2011), online instruction is mode whereby instructional contents are delivered either online or in campus-based classroom via a computer network technology. The authors explained that, online instruction modes has three levels which are web facilitated computer-network learning, blended or hybrid mode and online mode. The authors further explained that web-facilitated instructions involves about 30% online facilities/learners interaction, while hybrid mode involves from 30% to 79% online learners interaction with computer network instructions. On the other hand, Galy et al stated that a typical online instruction involves from 80%

interaction or above with the possibility of little or no face-to-face contact between learners and teachers.

Ugwoke (2011) opined that online learning encompasses a face-to-face, mixed and blended delivery model that utilizes electronic means. The electronic devices include e-mail, cell phone, interactive CDs, internet, computers, radio, optical fiber technologies and so on. According to Obikaeze and Onyechi (2011), online learning means formal and non-formal education that uses electronic delivery method such as internet based learning delivery packages, CD-Rom, online video conferencing or e-mail to manage the relationship between teachers and learners.

This study uses the term online instruction to mean teaching keyboarding with computer instructional packages such as Mavis Beacon Teaches Typing version 20. In this case, therefore, students are required to upload the instructional package unto their computer systems. As an introductory exercise, the degree of online/offline combination is not specified. However, it is expected that with time teacher's activities will be reduced to near zero, to ensure a high level of online facility interaction.

Keyboarding

According to Olinzock (1998), keyboarding is a complex skill made up of finely discriminated movement patterns that depend upon interrelated sensory, perceptual, mental and motor inputs and outputs which must occur close together in time. In order to maximize the full capabilities and features computers

provide, students and employees must be able to input data using the computer keyboard (Anderson-Yates & Baker, 1996)

Keyboarding is a component of OTM programme aimed at equipping students with skills to use the typewriter or computer to produce official documents in the world of work upon graduation (Onojaife, 2018). Onojaife averred that keyboarding is one of the key activities performed in modern offices today because creating information, searching for information, managing, processing information and communicating information all revolve around keyboarding. Career and Technical Education Resource Centre (CTERC, 2012) posited that keyboarding refers to the input of data using the touch method on a standard alphanumeric keyboard such as the Qwerty keyboard. According to the source, the goal of keyboarding instruction is to develop a touch skill that will enable an individual to enter alphanumeric information at a speed that is faster than handwriting.

According to Okoduwa (2007) keyboarding is the learning of the correct manipulation of keys on the computer or typewriter keyboard and using that keyboard for basic data input. The author submitted that keyboarding included all data entry operation while typing was concerned with hard copy formatting. It is cumulative psychomotor skill involving the touch method of input into the keyboard. Thus keyboarding is a psychomotor skill that develops, as does any other motor skill, through cognitive, associative and autonomous stages. The main objective of keyboarding education is to allow students to become more

proficient in computer or typewriter usage and to avoid lengthy re-teaching of keyboarding skills when students have acquired improper keyboarding techniques. Since keyboarding is a motor skill, it requires the fingers to be trained to respond correctly and quickly. Nwosu (2001) reported that keyboarding skill is one of the occupational survival skills in business education/OTM programme, adding that teaching basic keyboarding to students has the advantage of helping to prepare them to cope with the electronic office of the future. Amoor (2010) opined that keyboarding emphasizes input of information with the use of keyboard.

Ezenwafor (2012) explained that keyboarding instruction aims at the use of the 10 finger-touch method or what is described as touch type skill method rather than 'Hunt and Perk method' in a layman's approach. Keyboarding instruction ranged from the traditional approach in which students were expected to know how to type before they could use the computer to a more expansive view which holds that students do not need typing at all to use a computer. In the context of this study, keyboarding is the art of placing information into various types of equipment through use of typewriter-like keyboard. It is one of the core subjects in OTM education and students are expected to acquire keyboarding speed and accuracy to help them to type and produce mailable documents and satisfy their employers as office workers after graduation.

Keyboarding Speed

Speed can be defined as the rate at which a thing is done, that is, proportion of task achieved per time unit. In keyboarding, speed is determined by number of words typed by a typist per minute usually expressed as (nwpm) that is, number of words per minute. Mackenzie and Zhang (2001) posited that the primary objective of keyboarding instruction is to enable in the typist the capacity and techniques for the two-hands eyes-free touch typing.

In keyboarding, it will appear that speed is the central objective, because as Froiland, Nicolai and Gotteried (2011) opined, "accuracy is king". The authors revealed that a targeted minimum rate of accuracy at the best or most acceptable level of proficiency is 98%. It therefore, means that the primary objective of keyboarding instruction is to increase speed. In keyboarding, speed means the number of words a typist types in a given space of time, usually in minutes. According to Ezenwafor (2012), keyboarding speed is a great asset to a secretary. With the correct techniques, a secretary can attain keyboarding speed of 50 words in one minute and above which will normally fetch a good employment and income. Therefore, a proficiency speed of 35 words per minutes (WMP) is expected of a typist after one month of lesson. On the whole an average speed of 60 (WPM) is accepted of a professional secretary.

Keyboarding Accuracy

Accuracy means how well or correctly a thing is done. In keyboarding, accuracy is determined by how many words out of a typed text a typist spelt correctly. Thus accuracy is measured as a percentage; for instance:

$$A_d = NC/NT \times 100/1$$

Where A_d = Degree (extent) of accuracy

N_c= number of words correctly typed

N_t=Total number of words typed

Statistically speaking, a 99% Ad can be expected from an expert typist; that is, for every one hundred words typed not more than one wrongly entered or omitted character/word. It can, therefore, be concluded that A_d>- 99% is excellent, A_d>-98% is very good in that sequence.

Ezenwafor (2012) averred that accuracy refers to the correctness of the document created which demands using the right fingers to manipulate their allotted keys and the touching of the correct keys for their representative characters by employing correct techniques. With practice, the would-be secretary acquires the skills such that manipulating the keys of keyboard become very easy and smooth. This would lead to greater degree of accuracy of data input by the secretary.

Achievement

For the purpose of this study, achievement and academic achievement are used interchangeably. Achievement is a permanent change in the conceptual

attainment of knowledge, skill and attitude of the learner on the completion of a specified course of study or module. Kpolovie (2014) described academic achievement as the aggregate of each student's demonstrated learning, knowledge, skills, ability and indeed cognitive, effective and psychomotor domains. The author maintained that academic achievement is measured with examination that assesses important procedural knowledge such as skills and declarative knowledge such as facts which students have learnt. This implies that academic achievement is the level of academic attainment of learners after going through the series of organized courses both in the classrooms, laboratory/workshop as well as extra-curricular activities. It is the observed and measured aspects of students' mastery of skills and knowledge acquired.

Alaba (2010) viewed achievement as attitudinal exhibition an individual achieve in class, workshop, laboratory, library of field of work at school, college or university. Emaikwu (2012) posited that academic achievement vary significantly when lecture, discussion and activity-based method were used, it is used to measure students' success in educational institution or how well students meet standard set out by institution or examining bodies. Academic achievement is the outcome of the extent to which a student, teacher or institution has achieved set educational objectives and goals. However, in the context of this study, achievement is the outcome of students' effort in a specified test. Keyboarding as a course needs to be taught practically with modern methods of instructions, where learners would be exposed to online instruction. This would

help to concertized learners' learning experience and enhance achievement especially in speed and accuracy in keyboarding. The implication of all these for the teacher especially the keyboarding teachers is to develop and employ teaching and learning methods which should encourage learners to be active participants in the learning processes.

Office Technology and Management

Office Technology and Management (OTM) programme was designed by the National Board for Technical Education (NBTE) to replace the secretarial studies programme offered in Nigerian polytechnics. This change was approved in 2004 by National Board for Technical Education (NBTE), the supervising body for polytechnics in Nigeria with a new curriculum designed to equip students with vocational and socio-psychological work skills with which to meet the technological and managerial needs of today's modernized and competitive workplace. Office technology and Management equip students with effective work competencies and socio-psychological work skills which are very essential in everyday interactions with others (NBTE, 2004). This course according to Esene (2011) is with the objectives of equipping the students with the knowledge, competencies and specific skills that will enable them to successfully hold position as secretaries, managers and administrative assistance in both public and private sector of the economy.

Udo (2008) opined that OTM is a comprehensive activity-based educational programme that is concerned with the acquisition of office

technology and management skills, understandings, attitudes, work habits and competencies that are requisite to success in secretarial and office management occupations. The courses in OTM as noted by Onojaife (2018) are shorthand, office practice, office application, keyboarding among others. These courses provide the relevant skills and knowledge needed for employment in the ever dynamic office occupation. Office Technology and Management (OTM) programme is designed to equip students with secretarial/office skills for employment in various fields of endeavors (Akwajon and Pwol, 2009). It is a curriculum response to the demands of dynamics and computerized workplace, which is aimed at administrative personnel that coordinate high office information systems, technical skills with core business line functions. Students are expected to achieve a speed and accuracy of 35 words a minute in keyboarding at the end of their National Diploma programme (NBTE, 2004).

Theoretical Framework

Two theories underpinning this study are reviewed as follows:

Constructivism Theory

Constructivist conceptions of learning developed by Piaget (1980) is an approach to teaching and learning based on the premise that cognition (learning) is the result of "mental construction." In other words, students learn by fitting new information together with what they already know. Constructivists believe that learning is affected by the context in which an idea is taught as well as by

students' beliefs and attitudes. Constructivism is a learning theory found in psychology which explains how people might acquire knowledge and learn. It therefore has direct application to education. The theory suggests that humans construct knowledge and meaning from their experiences. Constructivism is not a specific pedagogy. Piaget's theory of Constructivist learning has had wide ranging impact on learning theories and teaching methods in education and is an underlying theme of many education reform movements.

Constructivism is the theory that people construct their own understanding and knowledge of the world, through experiencing things and reflecting on those experiences. When learners encounter something new, they reconcile it with previous knowledge and experience. They may change what they believe, or they may discard the new information as irrelevant. To be active creators of their knowledge however, they must be able to ask questions, explore and assess what they know. In the classroom, the constructivist view of learning means encouraging students to use active techniques such as experiments and real-world problem solving using authentic data if possible, and to create knowledge and reflect on their understanding.

Constructivism modifies the role of the teacher so that teachers help students to construct knowledge rather than reproduce a series of facts. The constructivist teacher provides tools such as problem-solving and inquiry-based learning activities like in on-line setup so that students can formulate and test their ideas, draw conclusions and inferences, and convey their knowledge in a

learning environment. The teacher must understand the students' preexisting conceptions and guide the activities to address this knowledge and then build on it. Constructivist teachers encourage students to assess how the activity is helping them gain understanding. By questioning themselves and their strategies, students become expert learners as they learn how to learn, with the use of computers online and/or offline. The students then have the tools necessary to become life-long learners.

The teaching-learning method in on-line instruction is assumed to be self-directed learning (SDL), which is supported by the educational philosophy of constructivism. Online instruction is an active information process because knowledge generation is accomplished through individual experience, maturity and interaction with one's environment. It follows that in order to promote student learning it is necessary to create learning environments that directly expose the learner to the material being studied because it is only by experiencing the materials that the learner can derive meaning from them. One of the central tenants of all constructivists learning is that it has to be an active process therefore, any constructivist learning environment must provide the opportunity for active learning.

Implication of the Theory

Central to the tenet of constructivism is that learning is an active process. Information may be imposed, but understanding cannot be, for it must come from within. Constructivism requires a teacher to act as a facilitator whose main

function is to help students become active participants in their learning and make meaningful connections between prior knowledge, new knowledge, and the processes involved in learning.

The relevance of this theory to online instruction lies on the theorist's observation that online learners take the lead in self-regulated learning for the development of a total learning process that involves problem perception, adoption, and assessment of alternatives. Learners play the role of organizing or re-organizing knowledge like a consumer, by selecting knowledge and using it practically. Constructivism theory modifies the role of the teacher in order to help students to construct knowledge but does not cover the aspect of motivating students to gain higher achievement. Hence a second theory is required to evaluate the importance of persistence when an individual knows that his performances will be evaluated based on some standards of excellence.

Achievement Motivation Theory

Achievement Motivation Theory was propounded by Atkinson (1958) based on the work of from the preliminary studies of Sears, Allport, and Lewin. Achievement motivation theory refers to behavior that is achievement oriented and is a determinant of aspiration, effort and persistence when an individual knows that his performances will be evaluated based on some standards of excellence. It is an extension of a person's inward motivation and so kindled when an individual knows that he is responsible for the result of some activities which will define his success or failure especially when there is some elements of

risk and uncertainties surrounding the outcome of his effort. Generally, the goal of achievement-oriented efforts is to succeed, to excel in relation to standards and possibly to outperform competitors.

The following assumptions and analysis as made by Atkinson (1958) are critical to the understanding and application of the theory:

(i)   Motives can be easily expressed in imaginations by means of content analysis of fantasy or imaginative behaviours –Thematic Apperception Test (TAT). Different people observe produced different results under standard conditions but individuals with higher achievement imaginery in standard conditions of assessment are assumed to be the more motivated to achieve.

(ii) Achievement-oriented behavior is believed to be unchangeably influenced by the strength of an individual's tendency to achieve success and by his tendency to avoid failure which is also possible in situations involving evaluation of performance; though the other determinative roles of external motivators (motives and incentives apart from achievement itself) like money, compliance with authority and social approval, which may still have some effects, and so should not be ruled out completely.

(iii) The dimensions of achievement motivation are; the need for power (n-pow) which is reflected in a strong desire to alter the course of events in the form of an ego-enhancing drive; the need for Affiliation (n-Aff) characterized by a strong desire to be loved and group approval; the need for achievement (n-Ach), which

is cognitive driven. Those with high need for achievement share the following characteristics:- a constant desire for achievement; they seek assignment which provide challenges without being too difficult and which they see as being within their mastery; they seek tasks in which they can exercise personal control; they like receiving feedback on their social/affiliation needs.

(iv) The interest to succeed in a specific activity is determined by: the strength or motive to succeed; the personality of the individual and combination of the relative attractiveness/incentive value of success. Thus, both continuous success and continuous failure have implications on motivation. Success increases and failure decreases the expectancy of success at the same or similar activity. People with strong achievement motivation always prefer intermediate risks or moderate level of aspiration and are attracted towards careers in business, leadership and management as there are opportunities to take calculated risks with clear knowledge of results (profit or loss). Conversely, the motive to avoid failure is a disposition to be anxious about failure, it is a negative motive and so runs parallel to the positive tendency but the behavioural implications are diametrically opposite in that, the tendency to avoid failure produces a resistance to achievement-oriented activity that must be overcome, if not by a stronger motive to achieve, then some extrinsic motivational interest. This implies that when an individual's motive to achieve exceeds his motive to avoid failure, the tendency to achieve will dominate in the conflict.

(v) An attempt to determine the strength of achievement motivation has not been feasible due to diverse interpretations of how behavior should be expressed so; imaginative projection of behaviorus was adopted since an individual can more freely express his inner interest. The theorist illustrated that the innovative and risk-taking activities of entrepreneurs does not emanate from just profit motive but mostly from a strong motive to achieve.

Educationally, Atkinson (1958) recommended that: child up-bringing and early emphasis on self-reliance encourages the development of n-Ach; for a child to internalize appropriate abilities and good standards, high standard of excellence and independence should not be introduced too early or too late; a child should be given an opportunity to practice self-reliant behavior and mastery without much parental dominations; political, environmental and economic factors influences achievement motivation and so should be monitored carefully and environmental issues should be watched because they affect the learners' chances of success.

The relevance of this theory to speed and accuracy achievement lies on the theorist's observation that everybody faces an intermediate achievement risk such that in the process of learning, interaction with new methods leads to knowledge construction and skill achievement. Therefore it is expected that achievement through online technique which gives the learner step by step assessment and result will then encourage the learner to learn more in accordance with the

theorist assumptions. The theory also emphasized self-confidence and skill building just as online instruction encourages students' centered learning for effective skill mastering.

Theoretical Studies

Teaching and Learning Principles

Teaching is a serious but complex business. It is complex, because we need to change behavior in terms of cognitive, affective and psychomotor domains. (Nyam, 2012). It is the ability of the teacher to prepare and plan adequately which will ensure that there is the process of learning on the part of the learners. Nyam (2012) went further to propose the following principles in our teaching learning effort; Clear objectives; Previous experience; Pupils readiness; Individual difference; Systematic Teaching; well prepared lesson plan; Motivation; Opportunity for active learning and Usage of variety of methods. Each of these principles is further explained in the subsequent paragraphs.

Clear Objectives: In this context it refers to teaching guidelines to the teacher while preparing for the goals and objectives to be achieved at the end of the lesson.

Previous experience:- This is the experience upon which a teacher builds. Every child has some experiences before going to school or undertaking a course of study in a tertiary institution.

Pupils readiness:- This ensures that pupils are physically, mentally and emotionally stable before the teaching and learning process.

Individual Difference:- This shows that individuals are different from one another in many ways. These differences must be realized by the teacher. They should recognize these differences and thus use a variety of methods and materials to teach.

Teaching should be systematic:- This means that teaching should proceed from known to unknown, simple to complex, concrete to abstract and general to specific.

Usage of a well prepared lesson plan:- This is the teachers' personal lesson plan which should take into consideration the knowledge of the pupils, the subject matter and the teaching environment and / or material.

Motivation:- Means teacher's knowledge of the needs and interests of the pupils and the positive encouragement needed to reinforce the efforts.

Opportunity for Active learning:- This is the student active participation during the teaching and learning process.

Usage of variety of Methods:- When planning the lesson the teachers should think of the use of different methods for different parts of it. When these are done, setting standards for teaching effectively becomes easy.

Measuring Teaching Effectiveness

In measuring teaching effectiveness, a standard setting of achievement is the first step. For example in typewriting, how many words per minute is a

student's speed at the beginning of a semester and what is the expected speed / minute by the end of the semester? Nyam (2012) assert that a good teacher is one who prepares lesson notes which contains objectives, contents, methods and activities". For change to occur, therefore, it demands that a teacher exposes the students to content and activities using appropriate methods. Training provides skills, knowledge and attitudes necessary to undertake required job efficiently.

Efficiency is most needed in the teaching of keyboarding in order to have mailable work. Nyam (2012) added that the word "need" implies that something is lacking, while "teaching" implies that needs can be supplied by systematic training method. The author concludes that "teaching need" exists when the application of systematic method will serve to overcome a particular weakness. Daudawa (2006) states that, the justification of teaching method is the first in the educational process. Just like in every systematic process, its success or failure will correspondingly affect subsequent educational developmental stages. It is needful to stress therefore, that the poor performance being experienced in keyboarding presently could be traced back to the method of the initial keyboard training.

With the increased role of keyboarding in business activities and advancement in technology, the need for business education students to become more and more perfect on the keyboard becomes glaring. Speed is needed in almost every business activity today. Unlike in the pre-industrial revolution

period when all records were handwritten and clerks had to put in extra care and time to ensure that such records were preserved in eligible handwriting.

At this age, a typing production that is not mailable is not necessary. This is so because we are at electronic age when we can quickly type and edit our work to be perfect. Similarly, a teaching method that is not able to put students at a level that will be better than the former handwritten work is not required. The quality of the student work is closely related to the quality of the teacher and the quality of the teacher is also connected to the method of teaching. Federal Government of Nigeria (2004), emphasized, "no education system can rise above the quality of its teacher". Again, it was stated in Federal Government of Nigeria (2004) that teacher education should be carried out to:

1. produce highly motivated conscientious and efficient classroom teachers for all levels of our educational system;

2. encourage further spirit of enquiry and creativity in teachers;

3. help teachers to fit into the social life of the community and society at large, and to enhance their commitment to national objectives.

4. provide teachers with intellectual and professional backgrounds adequate for their assignment, and to make them adaptable to any changing situations, not only in the life of their country but in the wider world;

5. enhance teachers' commitment to the teaching profession.

Types of Online Instruction

The learning process achieved by using digitally delivered content or interaction is online instruction. Mainly online instruction focuses on the use of computers whether in distance or in a classroom to deliver content to students. With the advancement in technology and the use of the World Wide Web the learning process is not only limited between a teacher and student. Learning can be achieved through reading blogs, uploading software on CD, participating in online forums, threaded email discussions, social media or through online training platforms such as the code academy. People consult different blogs or online tutorials to learn about products or particular ways of doing tasks. These are all online learning processes. Depending on the use of the source or the delivery medium, online instruction can be of different kinds:

- Purely online: no face-to-face meetings

- Blended learning: distance learning or a combination of online and face-to-face

- Synchronous: instructor led online courses

- Asynchronous: self-placed learning methods placed on the internet, network or storage devices

- Instructor-led group: distance learning where students may be from different

- geographical locations and learn from a single teacher

- Self-study: learning by visiting blogs, tutorials or informative websites

- Self-study with subject matter expert: learning by regularly visiting some experts blogs or up-to-date sites

- Web based: learning purely by looking up on the Internet with the use of search engines or social media groups such as Facebook

- Computer based: learning by accessing study materials from different storage

- devices like CD ROM or USB in the computer

- Video/audio tape: learning by accessing multimedia files through YouTube or any other video/audio sharing websites

Effects of Online Instruction

Studies on the effects of online instruction are many and varied like the concept itself. Studies on effects of online instruction have been confused or conjured with other like e-learning, web-based, internet based learning and so on. Specific studies on the effects of online instruction have investigated four main lines of effects – learning outcomes, speed of spread and rich of educational instructions deliveries and curriculum issues. Other areas that have been investigated are the issue of multi-media integration and cost effects.

Learning outcomes

Comparison of learning outcomes via online instruction as compared to traditional face-to-face have returned three strand of findings. No significance difference, significant difference and indeterminate.

According to Hinggins, Xioa and Kalispataki (2012) research evidence for the last 40 years suggest that learning outcomes from online instruction as compared to face to face is not different, if anything, learning outcomes from online instruction have been reported to be slightly below outcomes from traditional teaching methods. The authors specifically state that no such link has been identified between online instruction and outcomes. They observed that if appears that more effective teachers are more likely to use digital facility to deliver better outcomes than otherwise. According to them, it is not whether or not technology is used but how well. The authors emphatically claimed that online instruction outcomes are slightly lower than most other methods, especially peer teaching. However, it has to be understood that it is also not whether technology is used or not but whether there is a way backward: and there is none, imagine office technology and management programme that insist on manual typewriter today, they may not find enough in number. So also, as digitalization of education continues, so also will old education technological equipment will tend to vanish.

Curriculum enhancement

Another area where the effect of online instruction is most felt is in the area of curriculum expansion and enhancement. The versatility and efficiency of online curriculum expansion, enhancement as well as integration with other multi-media have a near inexhaustible potentialities and capabilities. As of now, it can be argued that almost anything that has been taught with the face-to-face

(traditional instructional method) is being taught and successfully so with the various means and variants of online learning.

Cost effect

One effect that has been reported very frequently but with little or no empirical report is in the area of cost on the part of students as well as on the part of educational institutions. However, as some researchers have revealed there are cost reductions and other cost related benefits in online instruction as against face-tot-face method. On the other hand, however, report a concern that online instruction may be out of the reach of some students due to cost element. The issue of cost in online instruction will naturally suffer from the general nature of cost in economics because from the speed and enthusiasm with which online instruction is being adopted, it can be argued that learners have perceived a net cost advantage over face-to-face method.

Importance/Benefits of Keyboarding Skill

Keyboarding skill, as a motor skill, is defined as the ability to key information into the memory of the computer with the minimum effort and energy use. You can be considered as a skilled keyboard user only when you are able to accurately key in data into the memory of the computer in a minimum time, with minimum use of energy, and with a high degree of consistency and flexibility. Keyboarding skills are a set of skills required to operate a keyboard smoothly while typing. This includes understanding your computer keyboard layout and its functions. It is a skill required whenever you need to type

(Meredith, 2016). Keyboarding is a skill that makes you look professional. It helps you use a computer more effectively and efficiently. Today everyone uses a computer and whether you are typing from the road, on air or the office, it is likely your boss will expect you to send emails, write reports and be self-supporting in secretarial skills.

Research on typing instruction has yielded inconsistent results, however Rogers, Jody, Lang, O'Leary & Sommers (2003) note the following benefits for students who are introduced to the touch method of keyboarding: (i) Improved achievement in language arts and attitude toward writing (ii) Efficiency in using devices with keyboards as a writing, editing, and computing tools (iii) Use of proper keyboarding techniques, eliminating the formation of ineffective keyboarding habits for word processing and other technology applications (iv) Improved motivation, creative thought, and integration of keyboarding with all subject areas.

Keyboarding skills involves speed and accuracy. Speed is essential if one wants to keep up with the thought processes because keyboarding today is used for original composition, whether it is writing a paper, email or instant message, there is a flow of ideas coming from the keyboardist's thoughts that he/she is trying to capture. Poor speed can certainly get in the way of the office manager's work. The office manager should be able to type 60+ words per minute, which means that he/she should be able to strike 5 keys per second. In that case hunt

and   peck   can   limit   the   keyboarder's
speed.(https://keyboarding.wordpress.com/2008/02/21/who-touch-types/).

Another keyboarding skill is accuracy. The need for accuracy goes without discussion. When someone keyboards, they need to be able to type the correct letters to convey the ideas that they want to share. There are primarily two methods of knowing how to press the correct key: (a) the most obvious method is to look at the keyboard, find the desired letter and press the key. This can be accurate but not too efficient. (b) The most productive method of being accurate is to learn touch keyboarding. Here keyboarders memorize which fingers are used to tap each of the keys. After sufficient practice, this connection becomes automatic and the keyboarders can accurately key without even thinking about it

Keyboarding is the penmanship of the computer age and involves building speed and accuracy, and provides practice in applying those skills to the formatting of letters, reports, labels, memos and other kinds of personal and business communication (Ukonu, Sababa & Filgona, 2017) . As a fundamental skill in today's society, keyboarding provides our connection with the rest of the world though electronic communication. Students, who become efficient keyboarders, compose better, are prouder of their work, produce documents with a neater appearance, and have better motivation. Beyond the benefits derived from students being able to enter their thoughts into the dynamic world of word process and communication through the keyboard, there are a variety of other benefits such as improvement in language arts, improved quality of writing,

greater enthusiasm about using the computer for writing, improvement in spelling and improvement in reading comprehension (Zeitz, 2010).

Objectives of Keyboarding at National Diploma Level

The NBTE keyboarding curriculum at the ND level stipulated among other that the students should be equipped with the ability to type efficiency and acquire a copying speed of 35 words a minute with 98% accuracy (NBTE, 2004). Okoduwa (2007) stated that students should be able to:

1. Develop touch keyboarding skills on alpha, numeric and punctuation keys at a keyboard rate of 35 words per minute with error per minute on standard three minutes timings;

2. Demonstrate knowledge of the key locations by correctly entering information from new copy without looking at their hands, screen or the finished copy;

3. Learn the concept of touch method when operating a numeric keypad; Learn proper typing techniques and ergonomic factors that affect comfort and productivity;

4. Produce various jobs such as letters, memos, reports and so on a typewriter

5. Think and keyboard simultaneously

Factors that Affect Keyboarding Speed and Accuracy

Literature and empirical evidence in the factors affecting keyboarding speed and accuracy can be summarized under three sub-headings: Ergonomics factors, technological/instrument factors and human factors

Ergonomics Factors

Ergonomics is the application of science and technology to the design and production of instrument/equipment that are compatible with physical space, environment and that are also conducive to maximal usage. Ergonomics take into account the sizes, shapes, functionalities and so on of equipment in relation to the users as well as space or place of use. In this regard, keyboarding ergonomics relate to keyboard light, typist distance from keyboard, posture among others all of which are the beginners instruction in keyboarding (Schenectady County Library @http://www.scpl.org is what is described as sitting at the controls. According to the source these include keyboard light, distance, posture, finger positions, and eyes on copy among others. The primary instruction in keyboarding is often the inculcation of the sitting at the control principles into novice typist. Once this is done, the question of speed and accuracy can come in. it can therefore, be said that the primary determinant of speed and accuracy is sitting at the control; that is adaptation to the ergonomics of keyboarding.

Technological Factors

Technological factors have to do with the nature of the equipment and instruments. In keyboarding, this relates to whether the keyboard is hard or soft, whether it is a Qwerty or non-Qwerty keyboard, whether it is large or mini keyboard and the specific model of the keyboard. The study of Clarkson, Clawson, Lyons and Starner (2005) among others have shown that there is usually some significant differences in performance whether of novice, or veterans, when hard and soft keyboards are used as well as when large keyboard

is used as against mini and vice versa as well as due to differences in keyboard models. Celik (2013) also found significant difference between the use of hard versus soft keyboard as a result of what the author described as auditory and tactile feedback.

Another technological factor that affects keyboarding speed and accuracy is whether the keyboard is covered or uncovered. An experimental study by Byers, Brovey and Zahner (2004) revealed that covered keyboard did not increase proficiency but it increased students' confidence. Froiland, Nicolai and Gottried (2011) opined that to be efficient when learning to touch type, it is important not to simply try to type as fast as possible but to keep a slow and steady speed. According to them a 98 % degree of accuracy is the default position and therefore, speed that sacrifices accuracy may not be worth it.

Human factors

Human factor that affects keyboarding speed and accuracy is the source of text, that is, whether it is copy text or dictation. According to Celik (2013) this has an effect on speed and accuracy. Yoo (2015) also report that speech speed on the one hand and differences in typewriter on the other affect typing output.

Another factor is the situation that is whether a typist is typing under normal situation or situation of urgency like deadline among others. Celik (2013) asserts that under urgency situation, keyboarding speed is usually higher but at the expense of accuracy.

Gender is already established as a factor that affect speed and accuracy in keyboarding. According to Froiland et al (2012), Heitz (2014) and Leonard (2018), on the average, men's keyboarding speed is 43 wpm and women's 41 wpm giving an average of 42 wpm. The learning curve theory has already been integrated into keyboarding instructions that as one advances in a given task, his/her rate of perfection − in this case, speed and accuracy − increases. Thus, according to NBTE, keyboarding targets are for first semester 25 wpm for second through to the 3rd semester of a normal ND OTM programme. It goes without saying therefore that the stage at which a learner is will determine to a large extent his/her speed and accuracy rate except that generally, it is agreed that, novice or expert, speed and accuracy are inversely correlated.

From the foregoing, it could be said that factors that affect speed and accuracy in keyboarding are basically of the three categories: ergonomics, technology, human/environmental factors.

Teaching Approaches in Keyboarding

Odundo and Gunga (2013) opine that one of the factors that constitutes good teaching and learning of subjects is the use of appropriate methods of teaching. Nwalado (2008) defined teaching method as a systematic process of presenting knowledge, content, concept, skills, attitudes, information, competence and values in any subject to students in a teaching and learning situation with the aim of achieving success. Onabanjo (2000) stated that for teaching to promote learning, the content to be taught has to be worthwhile and

the procedure has to be educationally acceptable for the activity to be classified as teaching.

Teaching keyboarding like any other discipline is based on approaches. The teaching approaches to keyboarding according to Okoduwa (2007) are basically three namely; the teacher directed style, individualized method with a group and the student–centred approach. However, for the purpose of this study, the two approaches to be compared is the traditional, teacher-directed approach and online (computer assisted/electronic assisted) approach. The two approaches to keyboarding instruction is in agreement with the view of National Business Education Association (1999) which indicated that the initial presentation of the alpha-numeric keyboard can be done in one of two ways; traditional teacher-directed instruction or computer-directed instruction.

Teacher-Centred Approach

The teacher–centred approach has its own teaching strategies. The traditional classroom has been dominated by a teacher-centred approach in teaching over the past five decades. The teacher-centred method is referred to as the traditional or conventional method of teaching. Here the teacher takes active part in the selection, organization and presentation of teaching materials. The conventional method of teaching provides for one-way communication. This is in disagreement to the position of Nwachukwu (2001), who stated that good teaching should provide for a two-way communication between the teacher and the students. Learning involves the changing of observable behavior, that is,

knowing how instead of knowing why. Lecturing, demonstration /illustration and coaching are the main teaching strategies of a teacher centred approach. The teacher is also, responsible for adjusting the pace, level and the style of presentation in a way to elicit the most effective learning outcomes.

Muijs and Reynolds (2001) supported and declared that teachers directly instruct students and provide little chance for questioning, independent thought and interaction among learners. The author posits that such method is the best way to teach rules, procedures and basic skills to younger academic achievers. Nevertheless, lecture method of teaching has its advantages which among others include that it is good for large classes. The teacher provides all knowledge related to the topic and it is time saving as the teacher always finishes in time to allow a great deal of information to be passed to the learner.

Student Centred Approach

Group discussion, debates, simulation, games, role playing, case studies, projects, field visits, co-operative learning and problem based learning are all teaching strategies that dominate the student-centred approach. According to Azih and Nwosu (2011) student-centred methods of teaching could be the important factor for improving students' performance in the teaching of core subjects. Students deep understanding suffer if they cannot share their different insights, reasoning processes, discover weak points in reasoning, correct one another and adjust their understandings on the basis of others understanding.

This gives the opportunities for integration and application of knowledge and skills acquired in the subjects taught. The six basic parts of using student-centred activities suggested by Gagnon and Callay (2001) are worthy of noting.

- Situation – framing the learning into a situation or achievable concept

- Groupings – bringing students together as in learning cells

- Bridge – surfacing of students prior knowledge before introducing new contents

- Question – asking questions in the learning process to foster in-depth learning

- Exhibition – presenting the learning publicly, bringing to view the expected end-product.

- Reflections – that is, criticizing individual and collective learning.

Touch Typing Keyboarding Techniques

Touch typingis a method of professional typing where by the typist keys in the information (data) with eyes off the keyboard and fixed on the copy or manuscript. Technically defined, touch keyboarding is the keeping of both hands in the home row position at the keyboard and reaching with proper home row fingers to press all other appropriate keys (Encarta, 2009). The improper techniques are those keyboarding habits that are likely to result in a low typing speed improvement. Such habits are prone to cause physical fatigue over time, repetitive stress syndrome, neck or eye strain (Sholes, 2008). The method of keyboarding which minimizes the risk of physical fatigue to the person keyboarding and open path to lifelong improvement is keying speed and accuracy through practice is the proper keyboarding technique.

Since keyboarding is recognized as a motor skill, training students finger to respond correctly and quickly to press the right key is being regarded more as athletic conditioning, where muscle training uses repetition until habit forms. A best practice for teaching keyboarding is to focus first on technique, which includes building muscle memory to develop automaticity. Once that foundation is built, then comes working on accuracy, and finally, steadily increasing the students' words per minute. Hence, mastering keyboarding involves more than just learning the location of keys.

Gender Issues in the OTM Profession

Gender is qualities or characteristics that society ascribes to men and women because of their biological, physiological and anatomic differences. According to FOA (2016), gender is deeply rooted; vary widely both within and between cultures. It further reveals that in all cultures, gender determines power and resources for female and male. The author maintains that gender system often constrains women to an unequal position in society in comparison to men. As it relates to OTM, it has already been established that men type, on the average about 2 wpm faster than women that is 43 wpm as against 41 wpm (Mackenzie and Zhang, 2001). In this respect there is neither gender inequality nor gender discrimination as there is no evidence or institution that men are better office mangers than women, nor that men must always head an office.

However, Eccles (2001) asserted that boy's interests are professional in nature and technical occupation, whereas girls were interested in office and

entertainment services. Gender has a short history on gender role play. In Nigeria the first commercial school by the missionaries admitted only female who they took for clerical and secretary/typist. The feminine gender hand flexibility and articulation were believed to be best for typewriting and other clerical work (Nyam, 2012). Some determinants that influence gender roles include; parental influence; cultural and environmental influence; media influence and peer group influence (Ibrahim, 2007).

All the above assertions depending on how they are presented can negatively or positively affect both genders (Male and Female). Writing on Colleges of Education and Women enrolment in Nigeria Tertiary Institution, Ibrahim (2007) found that there is a weak presence of women in vocational/technical education in northern Nigeria. Abubakar (2006) opined that there are some remarkable differences in gender enrolment across some Commonwealth countries. In the study conducted by Ibrahim (2007), it was found that most African cultures are known in their traditional separation of one set of task from another according to gender (male and female). Traditionally, males are assigned tasks with physical articulation like warfare, hunting, fishing, wrestling while females are known to be for light and smooth tasks like housekeeping taking care of children, cooking etc.

Empirical Studies

Some studies that are related to the current study are reviewed under relevant subheadings as follows:

Online and conventional instructional methods

Haruna and Ekeh (2011) compared the effectiveness of computer and typewriter on students' skills development in keyboarding in higher institutions in Zaria metropolis. Two research questions and two null hypotheses guided the study. Descriptive survey design was adopted for the study with a population of 537 made up of lecturers and students with a sample size of 150 respondents. A structured 12 item questionnaire was used for data collection. The reliability of the instrument was determined through pilot study. Bar-chart was used in answering the research questions while the t-test was used to test the null hypotheses. The results showed that computer is more effective in the teaching and learning of keyboarding as it helps in improving students' skills and creativity.

The study of Haruna et al (2011) is related to the present study in the sense that both studies are on effectiveness of technology and conventional methods of learning in teaching keyboarding. However, the study was on development of keyboarding skills and was conducted in Kaduna state. The study made use of questionnaire as a method of data collection while the present study will dwell on achievement in speed and accuracy using keyboarding software and will be conducted in Nasarawa State. The present study is a quasi-experimental study.

Okoduwa (2007) conducted a study on the comparison of the performance of Part 1 NCE students taught keyboarding by traditional teacher-directed instruction and those taught by computer assisted instruction. The study was

carried out in Agbor, Delta State and was a quasi-experimental study. Two research questions and two hypotheses guided the study. The population of the study was 210 Part 1 NCE business education students. A sample of two intact classes of 30 students each was used for the study. An Instrument titled Skill Acquisition Test (SAT) was used for data collection. Data collected were analysed using the Analysis of Covariance (ANCOVA) at 0.05 level of significance.

The findings of the study revealed that there was a better learning outcomes with those taught with traditional teacher-directed method than those taught with the computer assisted instruction. There was no significance difference in the performance of male and female students taught keyboarding by traditional teacher-directed method and those taught by computer assisted instruction.

Okoduwa's (2007) study is related to the present study because it is an empirical study using the quasi experimental design. it was also a comparison study of appropriate instructional methods for teaching and learning keyboarding in higher schools in Nigeria. However the study did not assess the effect of the teaching methods on students' mastery of keyboard finger positions and keyboard finger movement. Moreover, Okoduwa's study was conducted in a college of education in Delta State while the present study is will be carried out in Polytechnics in Nasarawa State.

Shen, Chung, Challis and Cheung (2007) conducted a study on a comparative study of students' performance in traditional mode and online mode of learning in Hong Kong. The population and sample size of the study comprised of 2,071 post graduate students. The academic records of students were used to evaluate the performance of students enrolled in the two different modes of learning and measured in terms of their grade points following the schools grading system. To compare the two groups, t-tests was used to investigate the overall performance of traditional and online students on a subject basis and the performance of individual groups of students.

The findings of the study reveals that mode of study was not a key determinant of success; though online learning provided greater flexibility to learners allowing them to study anytime, anywhere and at their own pace. The relevance of Shen et al's (2007) work to the current one is that both studies are on methods of teaching and learning and also both are comparative studies on students' performance. The study is different from the present one in the sense that the former study was on post-graduate students while the current study is polytechnic undergraduates. Again, the former study was carried out in Hong Kong while the current study was carried out in Nasarawa State.

Furthermore, Lin and Wu (2011) conducted a study on factors affecting numerical typing performance of young adults in a hear-and-type task on typing speed and accuracy. The study was carried out in the United State of America with an intact group of 20 participants made up of 13 males and seven females.

The design of the study was experimental. The study used Analysis of Covariance (ANCOVA) to confirm whether the expertise of typing shown in the pretest would have any influence on accuracy in the formal test. The findings revealed that urgency improved typing speed but decreased accuracy showing that urgency affect typing performance. In contrast, the area of study of the former research was New York, USA, while the current study will be carried out in Nasarawa State, Nigeria. However, both studies used the same method of data analysis and both dwell on keyboarding.

Blazek (2015) evaluated two approaches for developing keyboarding skills in children with cognitive disabilities. The study was guided by two quantitative and three qualitative questions. The study was a quasi-experimental comparative design conducted over a fourteen week period. The study was carried in Tennessee with a total population of 44 respondents made up of 23 and 21 respondents for the control and experimental group respectively. The study revealed that the use of technology can enhance the acquisition of skills and knowledge for students when the computer is used to deliver well designed instruction. The study also revealed that children with keyboarding skills are proud of their work and better motivated to learn and work harder.

Blazek's study is related to the current one in that both studies are comparative studies of two approaches to learning keyboarding skills, though the present study is on higher level students. The design and statistical tools are all the same. The difference lies on the fact that the former research was on

keyboarding skills of elementary school pupils in the United States of America with disabilities whereas, the current study is on keyboarding speed and accuracy of Polytechnic students in Nasarawa state. The methods of data analysis also vary.

Byers, Brovey and Zahner (2004) conducted a study on teaching and learning keyboarding. The purpose of the study was to compare the effects of covered keyboarding instruction with uncovered keyboarding instruction on students' typing proficiency and typing techniques. The study was an experimental study of 7th grade students using two intact classes of 24 students. The study revealed that the use of covered keyboarding did not increase keyboarding proficiency but it did increase students' confidence and proper student techniques.

Ekoro, Ofem and Udo (2016) assessed the role of Computer Assisted Instruction (CAI) in enhancing students' mastery of keyboarding in Cross River State College of Education. Three research questions guided the study and three hypotheses were tested at 0.05 level of significance. The study adopted the quasi experimental design. A sample of 60 students was selected using the stratified random sampling technique. The instrument for data collection was the Mavis Beacon Typing Tutor and the ANOVA was used for data analysis. The study showed that computer assisted instructions has a positive impact on keyboard mastery. Furthermore, female students mastered the keyboard faster than their male counterparts.

The study of Ekoro eta al (2016) is similar to this study in terms of study design and some related purposes. The study differs from the present study in that they were conducted in different geo-political zones of Nigeria. Both are

Sale and John (2018) investigated the online study habit and academic performance of business education students in Federal College of Education Kano, Kano State. The purpose of the study was to determine the difference in the academic performance of the online study habit of business education students. The study was a survey design with a population of 320 NCE I and II business education students of FCE, Kano. Random sampling technique was used to determine participation in the study. Research instrument was a structured questionnaire, while t-test statistics was used to analyse data generated in the study and test the null hypotheses. The findings of the study showed that the academic achievement of long study time behaviour of students is significantly different from that of the short study time counterparts.

Sale and John's study differs from the current one in that while Sale et al did a comparative study based on time frame, the current study is on speed and accuracy using two different approaches of learning. The former study was in Kano State while the present will be in Nasarawa State. Also both studies used different research designs. However, both studies are comparative studies.

Wolf (2002) evaluated two teaching methods for teaching keyboarding Skills to Third Grade Students in secondary schools. The objective of the study was to compare two approaches (touch and hunt and peck - Sight) to students in

the third grade of secondary school. The sample size was 100 students from two schools (Westocard 81 and Bellows 19) all in Iona Island of Scotland. Wolf used experimental design with experimental-control groups; pre/post-tests with three research questions. Results indicated that the most efficient method for –teaching keyboarding at the elementary school level was a combination of teacher intensive directed lessons and computer directed practice sessions.

Wolf's study is very much related to the present study because it treated two teaching methods for teaching keyboarding skills. The work compared two approaches for the teaching of keyboarding.

Oyedele (2007) did a comparative analysis of two methods of teaching keyboarding skills in secondary schools in Kwara State. The study had three specific objectives among which included comparing the performance of the students in hunt and peck and teacher demonstration method of teaching keyboarding skills. The researcher raised four research questions and tested four null hypotheses in line with specific objectives. The population comprised 820 students and a sample of 60 students was purposively drawn. The researcher adopted quasi-experimental pre-test post-test control group design. Keyboarding test was used to gather data from pre-test and post-test. The data collected were analyzed using mean and standard deviation for the research questions and t-test statistic was used to test the hypotheses at 0.05 level of significance. Findings revealed among others that students in hunt and peck group performed better than those in teacher demonstration method and that hunt and peck method is the most

effective method of teaching keyboarding. The study recommended that typewriting teachers should give preference to the teaching method that gives better result. The current study is related to the work of Oyedele (2007) because they both studied methods of teaching keyboarding skills.

In a related research conducted by Amadi (2009) on the strategies for effective teaching of typewriting in colleges of education in Enugu State. Four specific objectives were raised among which included determining the strategies for teaching typewriting in colleges of education and finding the effect of the strategies on students' performance in typewriting. Research questions and null hypotheses were formulated in line with the objectives. Descriptive survey design was used for the study. The study involved a population of 2432 students and 12 typewriting teachers. A sample of 132 students and all the 12 teachers were used for the study. Questionnaire was the instrument used to gather data from the respondents. The data collected from the respondents were analyzed using mean and percentages for the research questions and the null hypotheses were tested using chi-square. The null hypotheses were tested at 0.05 level of significance. Based on the data analyzed, it was found that demonstration method, hunt and pick method, touch method, self-directed method are the major strategies for teaching typewriting. It was also found that sight and touch methods are effective methods of teaching typewriting. The researcher recommended, among others, that teachers should use the two most effective methods (sight and touch) in teaching typewriting.

The current research work is related to the study by Amadi (2009) because they both studied the method of teaching keyboarding. It is useful to the current research because it explained the methods of teaching typewriting which the current research used some of them.

Onojaife (2018) conducted a study on strategies considered effective for teaching keyboarding by OTM lecturers in polytechnics in Delta State. The study used three research questions and three hypotheses. A descriptive survey design was adopted. A population of 140 OTM lecturers in polytechnics in Delta State was studied without sampling due to the manageable size. A validated 4-point rating scale questionnaire containing 30 items was used for data collection. Mean and standard deviation were used to answer the research questions while t-test was used to test the hypotheses at 0.05 level of significance.

Findings of the study revealed that OTM lecturers in Delta State considered direct teaching strategies ineffective but rated experimental and independent teaching strategies effective for teaching keyboarding. It was concluded that the utilization of experimental and independent teaching strategies by OTM lecturers will equip students with relevant keyboarding skills with which to produce readable and error free keyboarding presentations. The study recommended among others that, OTM lecturers should be encouraged to use experimental and independent teaching strategies in teaching skill subjects such as keyboarding in educational institutions where keyboarding are offered.

The present study is related to the former in the sense that both looked at appropriate approaches to teaching keyboarding in our institutions where keyboarding is being offered. However the studies differ in the area of design, population of study and the methods of data analysis.

Gender and academic achievement

Kay (2006) conducted a study on gender differences in computer ability, attitudes and use: the laptop effect. The purpose of the study was to explore the effect of ubiquitous computing on gender differences in pre-service teachers with respect to computer attitudes, ability and use. The study was a survey. A structured questionnaire of 215 items was used for collection of data. The sample of the population was 52 pre-service teachers (22 males, 30 females). The t-test was used for the analysis of data. The study showed that there were no significant differences in attitude between males and females after the laptop programme with the exception of programming which continued to favour males.

Olaoye and Adu (2015) investigated the effects of problem-based strategies and gender as determinant of grade nine students' academic achievement in Algebra using two null hypotheses which was tested at 0.05 level of significance. The design of the study was a quasi-experimental factorial design. The population of the study was 1,130 students in the East London district. The sample consisted of 109 grade 9 students from two schools within East London district. The instrument for data collection was achievement test designed by the researcher. The findings from the study revealed that there was

no significant main effect of gender on students' academic achievement. Hence, the study of Olaoye and Adu is related to the present study in that both studies are on effect of instructional methods on achievement of male and female students though on different subjects.

However, the study differs from the present study since Olaoye's study was on algebra and was conducted in London, while the current study is on Keyboarding and is conducted in Nasarawa State.

Another study was conducted by Ukonu, Sababa and Filgona (2017) on effects of hands-on teaching strategy on students achievement and its effect on gender in keyboarding, The researchers adopted the quasi-experimental non-equivalent pre-test, post-test, control group design. The sample comprised of 120 ND1 students purposively selected from the department of office technology and management, Federal Polytechnic, Mubi. A research instrument title Keyboarding Achievement Test (KAT) was constructed by the researcher to obtain data. The instrument was validated and pilot tested. The independent sample t-test statistics and ANCOVA were used in analyzing data obtained from the study. The Scheffes post hoc test was used to establish the magnitude of significance between the experimental and control groups' mean scores. The study revealed that students exposed to keyboarding skills acquisition through hands-on teaching strategy achieved remarkable results than their counterparts taught using the conventional method. There was no significance effect of gender on academic achievement of students exposed to keyboarding skill acquisition

using hands-on teaching with conventional method. It was concluded that hands on teaching strategy was effective in teaching keyboarding skills; hence teachers should be encouraged to use the strategy in teaching keyboarding from the onset of the ND programme.

The study of Ukonu et al (2017) is relevant to the present study for the fact that both studies are on keyboarding and used the quasi-experimental design. Both studies also used the same title for the instrument: Keyboarding Achievement Test. The former study and the present also used the pre-test and post-test control design. The method of data analysis for both studies was the same. In contrast, however, the former study was carried out in polytechnic in Mubi, Adamawa State using the ND1 students as respondent, while the present is in polytechnics in Nasarawa, Nasarawa State using the ND2 students as the respondents.

Eze, Ezenwafor and Obidile (2016) conducted a study on effect of gender on students' academic performance and retention in financial accounting in technical colleges in Anambra State. Four research questions guided the study and two null hypotheses were tested at 0.05 level of significance. The study was a quasi-experimental design and the population of the study was 168 National Business Certificate (NBC) year II students from 11 state owned technical colleges. A sample of 138 was purposively selected to compose the experimental and control groups based on the school offering accounting. The instrument of data collection was Accounting Achievement Test (AAT). Arithmetic mean was

used to analyze data related to research questions while analysis of covariance (ANCOVA) was used to test the null hypotheses. The result of the study showed that male and female students taught financial accounting using PBTM performed better with higher post test scores than those taught with lecture teaching method. Also from the result, there was no significant difference in the post test mean score and also the mean retention scores of male and female students taught financial accounting using problem-based teaching method.

The study of Eze et al (2016) is related to the present study in the sense that both studies are on effects, gender and retention. However Eze et al's study was on financial accounting while the present study deals on effects of online learning instruction on speed and accuracy in keyboarding in Nasarawa State.

Similarly, Ekanem (2008) carried out a study on students' characteristics and academic performance in business studies in Junior Secondary Schools in Akwa-Ibom State. The population was 600 students (300 males and 300 females) selected using proportional random sampling techniques from the public secondary schools in Uyo. Three research questions and three hypotheses guided the study. Business studies achievement Test (BSAT) was used by the researcher to collect data for the study and the data was analyzed using mean and standard deviation. The hypotheses was tested using the t-test at 0.05 significance level. The findings showed a narrow but higher performance in favour of the girls with 25.87 mean scores as against the boys that had 25.07 mean scores. The difference

between males and females group is mostly weaker than the difference within the males and females groups.

The difference between Ekanen's study and the current study lie in the area of study, method of instructional delivery and variables. While the former study conducted in Akwa-Ibom State used conventional method and researched on gender differences in achievement, the current one is in Nasarawa State, on online instructional methods on gender. The former study was a survey research while the current one is a quasi-experimental research. The two studies are related since they both centred on teaching methods and its effects on gender.

Udoukpong, Emah and Umoren (2012) conducted a study on Business Studies Academic Performance Differences of secondary School Juniors in Akwa-Ibom State of Nigeria. The purpose was to investigate the effects of gender and self-efficacy on student's academic achievements. The population was 290 junior secondary students (138 male and 152 females) drawn by stratified proportional sampling technique. The data was analysed using mean and standard deviation while two hypotheses were tested at 0.05 level of significance.

The result of the study revealed that females had higher mean scores than males. The researcher attributed the difference in performance by gender to perception by boys that business studies is stereotyped as feminine like secretarial and clerical works.

The study of Udoupkong et al is related to the current study in the sense that both is on effect of gender and performance. The differences between the

former and the current study lies on the methods of teaching, purposes, the areas of study and method of data analyses. The former used discovery method and the area of study was Akwa-Ibom State, whereas the present study is in Nasarawa State and advocates online instructional methods.

Teaching methods and academic achievement

Tumba and Andeyarka (2014) conducted a study to determine the effects of cooperative learning on academic achievement of technical college students in Cross River State in Nigeria. Two research questions and one hypothesis guided the study. The population of the study was 84 technical college students who were grouped into experimental and control groups. The non-equivalent control group, pretest-posttest quasi experimental design was adopted for the study. Four topics from the 2007 National Board for Technical Education (NBTE) approved curriculum were used for the treatment. The pretest and posttest instruments were face and content validated and then trial tested. Reliability indices obtained for pretest and posttest were 0.86 and 0.76 respectively. The research questions were answered using mean and standard deviation while the hypothesis was tested using z-test. The study revealed that cooperative learning enhances academic achievement of radio, television and electronics students hence recommended implementation of cooperative learning in technical colleges. Tumba and Andeyarka's study is related to the present study because both are on teaching methods. However, Tumba and Andeyarkas study was on basic electricity in

technical colleges in Cross River State of Nigeria, while the present study deals on on-line instruction in polytechnics in Nasarawa State.

Isiaka, Moses and Charles (2013), conducted a study to investigate the effects of cooperative and individualistic instructional methods on the achievement of high, medium and low academic achievers using video instructional package in Niger State. A total of 120 senior secondary school mathematics students were randomly assigned into cooperative, competitive and individualized and conventional teaching methods. Students from each group were stratified into high, medium and low achievers. Analysis of Variance and Scheffe test were used for data analysis. Findings indicated that there was significant difference in the achievement of the groups in favour of cooperative learning method. Students' achievement levels had significant influence on their achievement in competitive and individualized instructional settings. It was recommended that mathematics teachers should employ cooperative learning methods to improve students' achievement to bridge the gap among high, medium and low achievers. The study is similar to the present study in that both focused on instructional methodology. But the studies differs as Isiaka, Moses and Charles study was on mathematics in secondary schools, while the present study dwells on keyboarding in polytechnics.

In another study, Ajai, Imoke and Okwu (2013) investigated the effectiveness of problem-based method and conventional method of teaching on students' achievement in Algebra. The study used four hypotheses which were

tested at 0.05 level of significance. The population of the study was 3,460 senior secondary one (SS I) students in the six government owned and grant-aided schools in zone B of Benue State educational zone. Multi-stage sampling was used to select 447 students and quasi-experimental design of pretest – posttest control group was used for the study. The instrument used for data collection was Students' Algebra Achievement Test (SAAT) constructed by the researchers. Data collected were analysed using ANCOVA.

Findings of the study revealed that students taught algebra using problem-based method achieved significantly higher scores in their posttest than those taught using conventional method. Also that there was no significant interaction effect of methods and gender on students' achievement. The study is related to the present study because both studies are on instructional methods. However, Ajai, Imoko and Okwu's study is not on achievement in keyboarding speed and accuracy which the present study addresses.

Summary of Review of Related Literature

Online instruction is a process where a set of lessons is provided on digital devices like computers or any mobile devices that supports the learning. It is an interactive learning in which the learning content is available online and provides automatic feedback to the student's learning activities. In keyboarding, speed is determined by number of words typed by a typist per minute usually expressed as (nwpm) that is, number of words per minute. The primary objective of keyboarding instruction is to enable in the typist the capacity and techniques for

the two-hands eyes-free touch typing. Accuracy is determined by how many words out of a typed text a typist spelt correctly and is measured as a percentage.

Theories of teaching and learning were discussed using the constructivism and achievement motivation theories. The literature review also highlighted the importance of keyboarding skills to OTM students, factors affecting keyboarding speed and accuracy and different teaching approaches in the teaching of keyboarding. Most importantly, empirical studies on the effects of instructional method on keyboarding were reviewed. The review of empirical literature has corroborated three issues already identified with respect to online learning. (i) that there is much of interchangeability in the usage of terms or phrases such as e-learning web-based instruction, computer assisted learning etc. (ii) that online learning in developing countries – Nigeria inclusive is yet to advance appreciably as it relates to adoption, but (iii) that there is great awareness and enthusiasm among students, not only in the OTM field of study but across almost all academic and vocation fields of study.

All the empirical studies focused on different approaches to the teaching of keyboarding but none of the studies compared the effects on speed and accuracy of the students. This has created a gap in the body of knowledge which this study sought to fill.

CHAPTER THREE

METHOD

This chapter presents the method employed in carrying out this study covering research design, area of the study, population of the study, sample and sampling technique, instrument for data collection, validation of the instrument, reliability of the instrument, experimental procedure, method of data collection and method of data analysis

Research Design

The study adopted the quasi-experimental design. According to Uzoagulu (2011) quasi-experimental research is a process where randomization of subjects to experimental and control is not possible. DeRue, Nahrgang, Hollenbeck and Workman (2012) explained that quasi-experimental is a kind of experiment in which an otherwise homogeneous group is split into two, one group called the experimental group receives a form of stimulus (or stimuli) while the second group called the control group does not receive any form of treatment. After treatment by the experimental group, the two groups are compared to know if the difference (if any) between the results of the pre and post-test of the experimental group is attributable to the treatment (stimulus).   In this case, the research was designed to determine if online teaching and learning method engender OTM students' acquisition of speed and accuracy in keyboarding better than face-to-face (conventional) teaching. The experimental group received a treatment -

online teaching, while the control group did not receive this treatment. The experimental design is illustrated below:

Illustration of design of the study

Group	Pre-test	Treatment	Post-test
EG	O_1	E_1	O_2
		E_2	
CG	O_1	C_1	O_2
		C_2	

Source: Author's Creation

Where:

EG = Experimental group

CG = Control group

O_1 = Pre-test for EG and CG

O_2 = Post-test for EG and CG

E_1 = Experimental group observation before the experiment

E_2 = Experimental group observation after teaching with online learning;

C_1 = Control groups observation before teaching with conventional method.

C_2 = Control groups result after teaching with conventional method.

Area of the Study

The study was carried out in Nasarawa State in North Central Nigeria. Nasarawa State (nicknamed Home of Solid Minerals) is bounded in the west by the Abuja Federal Capital Territory in the east by Taraba and Plateau states, in the north by Kaduna State and in the south by Kogi and Benue states. Nasarawa State has 13 local government areas with capital at Lafia. It occupies a total land

space of about 27,117 km2 (10,470 sq mi) and has a population size of about 1,869,377 people (National Population Commission, 2006). There are three polytechnics in the State (one federal, one state and 1 private polytechnic). The State also has a college of education, college of agriculture, a state university and a federal university. The State is known for abundance of natural and mineral resources such as tantalite, salt, barite and bauxite which are mostly mined by artisanal miners.

The northern zones of Nigeria are generally categorized as educationally disadvantaged areas but the north central zone where Nasarawa State is located is an exception considering its passion for education and the number of public and private educational institutions. There are also a lot of government and private establishments which offer hope for OTM graduates' opportunity for employment. The choice of the state as area for this study was informed by the high value placed on education, employment opportunity for well-trained OTM graduates and for the fact that online method of teaching and learning is yet to be popularized in polytechnics and other institutions in Nasarawa State.

Population of the Study

The population of the study consisted of 184 (110 females and 74 males) ND II students in all three polytechnics in Nasarawa State in the 2018/2019 academic session. The ND II students was chosen for this study because it is the level at which students are expected to have mastered finger placements and

movement on the keyboard and ready to take speed and accuracy test at 35 words per minute. The population distribution is shown as Appendix A on page 107.

Sample and Sampling Technique

The sample for the study was 95 ND2 students drawn from one federal and one state polytechnic in the area of study. The sample consisted of two intact classes from the two polytechnics. A simple random sampling technique was used to assign one class to experimental and control groups. The experimental group consisted of 60 students (29 males and 31females) while the control group comprised of 35 students (16 males and 19 females). The sample distribution is presented as Appendix B on page 108.

Instrumentfor Data Collection

Instrument for data collection was a standard test developed by the National Secretarial Examination Board and titled OTM Speed and Accuracy Test (OTMSAT). The instrument consisted of a passage of 350 words produced at a speed of 35 words a minute for 10 minutes. The test was marked over 100% to determine the speed and accuracy level of the subjects after the treatment. A copy of OTMSAT is shown as Appendix C on page 109.

Validation of the Instrument

The OTM Speed and Accuracy Test (OTMSAT) was face validated by three experts. Two of the experts were chosen from the Department of Technology and Vocational Education and one expert in measurement and evaluation from the Department of Educational Foundations, all in the Faculty of

Education, Nnamdi Azikiwe University, Awka. The experts were given the research topic, purpose of the study, research questions, the null hypotheses, the lesson plan and the test instrument and requested to check the test items for clarity, language and syllabic intensity. The validates' reports are attached as Appendix F at pages 121-123.

Reliability of the Instrument

The reliability of the instrument was established using the test-retest method because of the practical nature of the instrument. It was administered on 10 ND II OTM students of the Plateau State Polytechnic, Barkin-Ladi, who are not part of the population of the study. After two weeks, the instrument was re-administered as recommended by Uzoagulu (2011). Using the Spearman's Correlation Co-efficient, a reliability co-efficient of 0.78 was obtained. This was considered high enough to conclude that the instrument was reliable for the study in line with the recommendation of Abonyi (2011) that any reliability index of more than 0.50 is an acceptable reliability value.

Method of Data Collection

The research instrument, the OTM Speed Tests Instrument (OTM/STI) was administered generally on all the students on the first day of contact as pretest. At the end of the 4 weeks experiment where the experimental group was taught by online method and the control group taught by conventional method, both groups took the same final test (post-test) Appendix D. The experimental group used the Mavis Beacon Software as installed in their computers via CD-

ROM while the control group used the manual typewriters. The speed and number of errors was recorded in the chart sheet be provided and test was marked over 100%.

Experimental Procedure

Stage 1: Sensitizing/Training the Research Assistants

(i) The researcher obtained approval from the authorities − Rector, Dean and or Head of the Department to the effect that the school/students are to participate in a four weeks experiment; the nature, importance and purpose − PhD dissertation was made clear to the authorities and would-be teachers.

(ii) Training the Teachers

The researcher met the would-be teachers, those who were currently teaching keyboarding at NDII, two of such teachers from each polytechnic were identified. The researcher explained to the teachers the purpose of the research, the design and their expected roles. A formal coaching session was scheduled for the online teachers.

First Contact

(i) The researcher found out if any of the two teachers is currently using online method.

- If one is, then that person takes the online or experimental group and the other the control group.

- If none or both are currently using/not using online method, a decision is reached between the teachers who takes online and who

goes with conventional. It is assumed that the teachers themselves agreeing on which group to take ensured enthusiasm on their parts, (especially the online teacher) in learning new things that may enhance students understanding.

(ii) The researcher gave out the prepared lesson plans to the online teacher to take home and study

Second Contact

(i) The online teachers reported to the researcher on the interactions with lesson plans and made suggestions, observations among others.

(ii) The researcher listened to the teacher's inputs but did not accept the areas that will materially affect the research design, procedures or any other aspect.

(iii) Find out what students may require in the experimental group that they may have to provide by themselves.

STAGE II: Commencement of Experiment

(i) Both the experimental and control groups were NDII students of OTM. They are therefore not expected to have any knowledge of the experiment. Within this period the control group was taught using the conventional method.

Pre-test

The pre-test of 10 minutes passage at 35 words per minute was administered on both the control and experimental groups before the commencement of the study. The experimental group received eight

contact hours(2 per week) for the duration of the experiment. Within this period, the control group was taught using the conventional method.

Post-Test

Students then took the end of experiment test. The post-test was aimed at finding out the level of speed and accuracy gained during the treatment period for both control and experimental groups. This contained the same passage of 35 words a minute for 10 minutes but this time reshuffled. The print outs was marked adopting the NBTE (2004) marking scheme for keyboarding.

Control of Extraneous Variables

There is usually the problem of extraneous variables in experimental and quasi-experimental researches. These variables occurrences or phenomena can interfere in the experimental process and distort experimental outcomes. There are at least five such phenomena or variables in this research that need to be identified. These are (i) initial group difference, (ii) experimenters' bias (iii) teachers variable (iv) variability in instructional situation and (v) maturation/mutation – pretest, post-test effect.

1.   Initial Groups Differences

Differences in the knowledge, skill or competencies between the experimental and control groups can influence final outcomes without the researcher knowing. To avoid this, three precautions was taken; (a) all

members of both experimental and control groups are on the same pedestals. In this caseall the studentsare ND II OTM students of intact classes. (b) a pre-test was applied to identify if any factor such as exposure to keyboarding is operative in any member of either group and (c) the students were equally randomly assigned to any of the two groups, so that even if the case in (b) applies it was not continued to a single sub-group.

2. **Experimenter's bias**

    The characteristics of the experimenter may influence favourably or unfavourably on the behavior of subjects, which might affect the end result of the study. This was avoided by reducing the researcher's contact with both control as well as the experimental groups. Secondly, the teachers that were engaged in this assignment were the regular teachers who know the importance of neutrality and objectivity in an experiment of this kind.

3. **Teacher's variable**

    This can occur when teachers tend to teach according to their areas of strength or preferences. This was avoided because the researcher designed the lesson plan in such a way that the only variation that teachers are allowed to introduce is the instructional method, that is, online or face-to-face. The teacher handling online method was equally trained and guided by the researcher to forestall any introduction of personal biases.

4. **Pre-test, Post-test bias**

This arises due to maturation or fatigue in the students or the teachers. To reduce the chances of this, the experiment is for four weeks only. This reduced the possibility or loss of interest, fatigue on the part of the teachers as well as on the part of the students. This length of time equally matched the experimental interval.

5. **Variability in instructional situation**

Obviously, differences in research instrument can alter the lecture content or delivery pattern or emphasis all of which can affect teaching and learning and therefore outcomes. Therefore, the research instrument was a perfect replica of each other. Since only one teacher was to teach each of the groups, no instrument differences or bias can be introduced. The only thing that differed was the mode of delivery – online or conventional; which is what the research intends todetermine.

Method of Data Analysis

The arithmetic mean was used to answer the research questions while the Analysis of Covariance (ANCOVA) was used in testing the hypotheses at 0.05 level of significance. ANCOVA is suitable because it helped to take care of the nonequivalence of the subjects in comparing the effects of the experimental treatment on the students speed and accuracy in keyboarding. In using ANCOVA. A null hypothesis was rejected where the f-value is less than the level of significance (0.05) but was accepted where the f- value is greater than 0.05.

CHAPTER FOUR

PRESENTATION AND ANALYSIS OF DATA

This chapter presents analysis of data collected in the study according to the research questions and hypotheses.

Research Question 1

What is the effect of on-line instruction on keyboarding speed achievement among OTM students of polytechnics in Nasarawa State when compared with those taught with conventional method using their pre-test and post-test scores?

Analysis of data for research question 1 is presented in Table 1.

Table 1

Mean keyboarding speed achievement scores of students taught using on-line instruction and those taught using conventional method

Teaching Method	Pre-test			Post-test			Mean Gain Score
	N	Mean	SD	N	Mean	SD	
On-line instruction	60	34.98	1.21	60	37.78	2.25	2.80
Conventional Method	35	34.60	1.31	35	35.09	1.17	0.49

Table 1 shows that students taught using online instruction had pre-test and post-test scores of 34.98 and 37.78 with achievement mean gain of 2.80 while those taught using conventional method had pre-test and post-test scores of 34.60 and 35.09 with achievement mean gain of 0.49. This indicates that whereas the pre-test mean score of the students taught keyboarding speed using online instruction was slightly higher than that of those taught using conventional method, their post-test and achievement mean gain scores were significantly higher than those of the class taught with conventional method. This clearly

shows that on-line instructional method was more effective in enhancing students' achievement in keyboarding speed than the conventional method.

Research Question 2

What is the effect of on-line instruction on keyboarding accuracy achievement among OTM students of polytechnics in Nasarawa State when compared with those taught with conventional method using their pre-test and post-test scores?

Analysis of data for research question 2 is presented in Table 2.

Table 2

Mean keyboarding accuracy achievement scores a of students taught using on-line instruction and those taught using conventional method

Teaching Method	Pre-test			Post-test			Mean Gain Score
	N	Mean	SD	N	Mean	SD	
On-line instruction	60	92.45	1.64	60	96.07	1.40	3.62
Conventional Method	35	91.63	.91	35	91.80	.99	0.17

Table 2 shows that students taught using online instruction had pre-test and post-test scores of 92.45, 96.07 with achievement mean gain of 3.62 while those taught using conventional method had pre-test and post-test scores of 91.63 and 91.80 with achievement mean gain of 0.17. This indicates that whereas the pre-test mean score of the students taught keyboarding accuracy using online instruction was slightly higher than that of those taught using conventional method, their post-test and achievement mean gain scores were significantly higher than those of the class taught with conventional method. This clearly shows that on-line instructional method was more effective in enhancing students' achievement in keyboarding accuracy than the conventional method.

Research Question 3

What is the effect of on-line instruction on keyboarding speed achievement among male and female OTM students of polytechnics in Nasarawa State using their pre-test and post-test scores?

Analysis of data for research question 3 is presented in Table 3.

Table 3

Mean scores of male and female students taught keyboarding speed using on-line instruction

Group	Gender	Pre-test			Post-test			Mean Gain Score
		N	Mean	SD	N	Mean	SD	
On-line Instruction	Male	29	34.93	1.41	29	37.55	2.16	2.62
	Female	31	35.03	1.02	31	38.00	2.34	2.97

Table 3 shows that male students taught keyboarding using on-line instruction had pre-test and post-test speed achievement mean scores of 34.93 and 37.55 with a mean gain score of 2.62 while the female students had pre-test and post-test speed achievement mean scores of 35.03 and 38.00 with mean gain score of 2.97. This shows a difference in speed achievement mean gain score of 0.35 (which is not significant) in favour of the female students.

Research Question 4

What is the effect of on-line instruction on keyboarding accuracy achievement among male and female OTM students of polytechnics in Nasarawa State using their pre-test and post-test scores?

Analysis of data for research question 4 is presented in Table 4.

Table 4

Mean scores of male and female students taught keyboarding accuracy using on-line instruction

Group	Gender	Pre-test			Post-test			Mean Gain Score
		N	Mean	SD	N	Mean	SD	
On-line Instruction	Male	29	92.45	1.68	29	96.10	1.23	3.65
	Female	31	92.45	1.63	31	96.03	1.58	3.58

Table 4 shows that male students taught keyboarding using on-line instruction had pre-test and post-test accuracy achievement mean scores of 92.45 and 96.10 with a mean gain score of 3.65 while the female students had pre-test and post-test accuracy achievement mean scores of 92.45 and 96.03 with mean gain score of 3.58. This shows a difference in accuracy achievement mean gain score of 0.35 (which is not significant) in favour of the male students.

Research Question 5

What is the interaction effect of instructional methods and gender on keyboarding speed achievement among OTM students of polytechnics in Nasarawa State?

Analysis of data for research question 5 is presented in Table 5.

Table 5

Mean interaction effect of instructional methods and gender on keyboarding speed achievement

Teaching Method	Gender	Pre-test			Post-test			Mean Gain Score
		N	Mean	SD	N	Mean	SD	
Online Instruction	Male	29	34.93	1.41	29	37.55	2.16	2.62
	Female	31	35.03	1.02	31	38.00	2.34	2.97
Conventional Method	Male	16	34.94	1.18	16	34.94	1.12	0.00
	Female	19	34.32	1.38	19	35.21	1.23	0.89

Table 5 shows the pre-test and post-test keyboarding speed achievement mean gain male and female students taught with online and conventional

instructional methods. In each case, the female students achieved slightly higher speed achievement gain scores (below 1.00) than their male counterparts. These show that there is no significant interaction effect of instructional methods and gender on keyboarding speed achievement among OTM students.

Mean plots of interaction between instructional methods and gender are shown in figure 1.
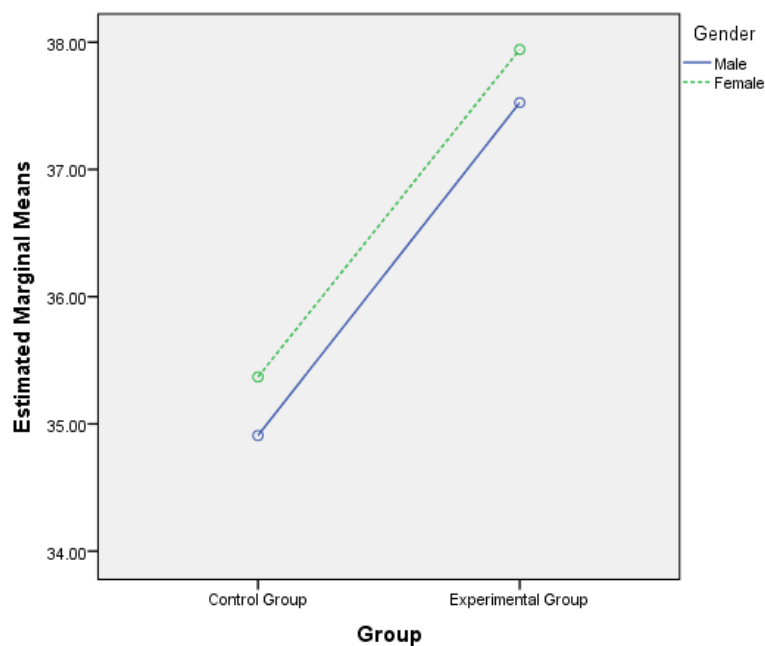
Fig.1: Mean plots of interaction between instructional methods and gender on keyboarding speed achievement

Research Question 6

What is the interaction effect of instructional methods and gender on keyboarding accuracy achievement among OTM students of polytechnics in Nasarawa State? Analysis of data for research question 6 is presented in Table 6.

Table 6

Mean interaction effect of instructional methods and gender on keyboarding accuracy achievement

Teaching Method	Gender	Pre-test			Post-test			Mean Gain Score
		N	Mean	SD	N	Mean	SD	
Online Instruction	Male	29	92.45	1.68	29	96.10	1.23	3.65
	Female	31	92.45	1.63	31	96.03	1.56	3.58
Conventional Method	Male	16	91.69	.87	16	92.00	1.10	0.31
	Female	19	91.58	.96	19	91.63	.90	0.05

Table 6 shows the pre-test and post-test keyboarding accuracy achievement mean gain male and female students taught with online and conventional instructional methods. In this case, the male students achieved slightly higher accuracy achievement gain scores (below 1.00) than their female counterparts. These show that there is no significant interaction effect of instructional methods and gender on keyboarding accuracy achievement among OTM students.

The mean plots for the instructional methods and gender are shown in Figure 2.
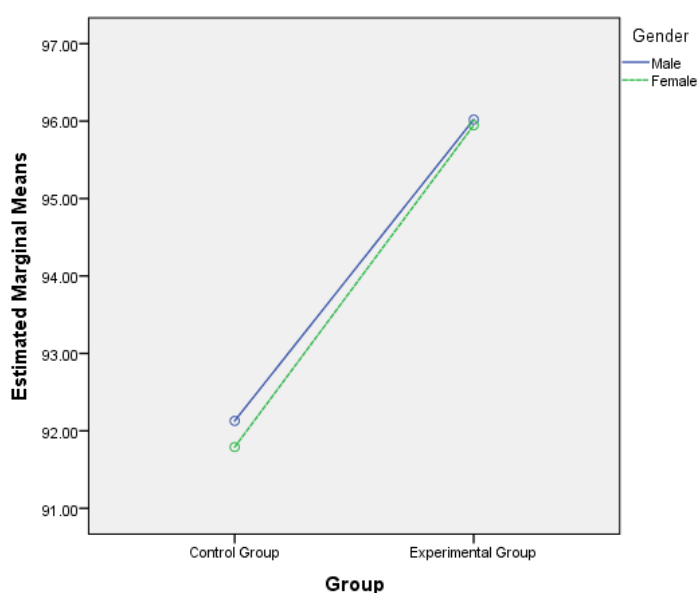
Fig.2: Mean plots of interaction between instructional methods and gender on keyboarding accuracy achievement

Hypothesis 1

There is no significant difference in the mean keyboarding speed achievement of OTM students in polytechnics in Nasarawa State taught with on-line instruction and their counterpart taught using conventional methods of instruction.

Table 7: Summary of Analysis of Covariance of Students' Keyboarding Speed Achievementby Teaching Method

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	172.987[a]	2	86.494	23.910	.000
Intercept	83.516	1	83.516	23.087	.000
Speed Pretest	12.124	1	12.124	3.352	.070
Group	144.699	1	144.699	40.001	.000
Error	332.802	92	3.617		
Total	129085.000	95			
Corrected Total	505.789	94			

Table 7 shows that the calculated F-ratio of 40.00 is greater than the significance level of 0.05 ($P < 0.05$). This means that there is a statistically significant difference in the mean keyboarding speed achievement of OTM students taught with on-line instruction over their counterparts taught using conventional method of instruction. The null hypothesis of no significant difference between the two groups was, therefore, rejected.

Hypothesis 2

There is no significant difference in the mean keyboard accuracy achievement of OTM Students in Polytechnics in Nasarawa State taught with on-line instruction and their counterpart taught using conventional methods of instruction.

Table 8: Summary of Analysis of Covariance of Students' Keyboarding Accuracy Achievementby Teaching Method

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	417.208[a]	2	208.604	142.646	.000
Intercept	102.201	1	102.201	69.887	.000
Accuracy Pretest	14.794	1	14.794	10.116	.002
Group	333.423	1	333.423	228.000	.000
Error	134.540	92	1.462		
Total	848831.000	95			
Corrected Total	551.747	94			

Table 8 shows that the calculated F-ratio of 228.00 is greater than the significance level of 0.05 ($P < 0.05$). This means that there is a statistically significant difference in the mean keyboarding accuracy achievement of OTM students taught with on-line instruction over their counterparts taught using conventional methods of instruction. The null hypothesis of no significant difference between the two groups was, therefore, rejected.

Hypothesis 3

There is no significant difference in the keyboarding speed achievements scores of male and female OTM students in polytechnics in Nasarawa State taught with online instruction when compared with those taught with conventional instructional methods.

Table 9: Summary of Analysis of Covariance of Students' Keyboarding Speed Achievementby Teaching Method

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	31.971[a]	2	15.986	3.104	.050
Intercept	54.671	1	54.671	10.615	.002
Accuracy Pretest	29.579	1	29.599	5.743	.019
Group	3.683	1	3.683	.715	.400
Error	473.818	92	5.150		
Total	129085.000	95			
Corrected Total	505.789	94			

Table 9 shows that the calculated F-ratio of .71 is less than the significance level of 0.05 ($P < 0.05$). This means that there is no statistically significant difference in the mean keyboarding speed achievement of male and female OTM students taught with on-line instruction with their counterparts taught using conventional methods of instruction. The null hypothesis of no significant difference between the two groups was, therefore, not rejected.

Hypothesis 4

There is no significant difference in the keyboarding accuracy achievements scores of male and female OTM students in polytechnics in Nasarawa State taught with online instruction when compared with those taught with conventional instructional methods.

Table 10: Summary of Analysis of Covariance of Students' Keyboarding Accuracy Achievement Scores by Gender

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	85.233[a]	2	42.616	8.404	.000
Intercept	29.616	1	29.616	5.840	.018
Pre-test	83.316	1	83.316	16.431	.000
Gender	1.448	1	1.448	.286	.594
Error	466.515	92	5.071		
Total	848831.000	95			
Corrected Total	551.747	94			

Table 10 shows that the calculated F-ratio of .28 is less than the significance level of 0.05 ($P < 0.05$). This means that there is no statistically significant difference in the mean keyboarding accuracy achievement of male and female OTM Students taught with on-line instruction and their counterparts taught using conventional methods of instruction. The null hypothesis of no significant difference between the two groups was, therefore, not rejected.

Hypothesis 5

There is no significant interaction effect of instructional methods and gender on the mean keyboarding speed achievement among OTM students in Polytechnics in Nasarawa State.

Table 11: Summary of Analysis of Covariance of Students' Mean Scores in keyboarding speed by Gender and Teaching Method

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	177.420[a]	4	44.355	12.157	.000
Intercept	78.648	1	78.648	21.556	.000
Speed Pretest	12.898	1	12.898	3.535	.063
Group	145.245	1	145.245	39.809	.000
Gender	4.197	1	4.197	1.150	.286
Group * Gender	.010	1	.010	.003	.959
Error	328.369	90	3.649		
Total	129085.000	95			
Corrected Total	505.789	94			

Table 11 shows that there is no statistically significant interaction between the mean keyboarding speed achievement of male and female students taught with online instruction and those taught with conventional instructional methods, $F_{(1,95)}= .003$, $P>0.05$.. The null hypothesis was, therefore, not rejected

Hypothesis 6

There is no significant interaction effect of instructional methods and gender on the mean keyboarding accuracy achievement among OTM Students in Polytechnics in Nasarawa State.

Table 12: Summary of Analysis of Covariance of Students' Mean Scores in keyboarding accuracy by Gender and Teaching Method

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	418.278[a]	4	104.569	70.512	.000
Intercept	102.630	1	102.630	69.205	.000
Accuracy Pretest	14.609	1	14.609	9.851	.002
Group	330.170	1	330.170	222.638	.000
Gender	.925	1	.925	.624	.432
Group * Gender	.389	1	.389	.262	.610
Error	133.469	90	1.483		
Total	848831.000	95			
Corrected Total	551.747	94			

Table 12 shows that there is no statistically significant interaction between the mean keyboarding accuracy achievement of male and female students taught with online instruction and those taught with conventional instructional methods, $F(1,95)= .26, P>0.05..$ The null hypothesis was therefore not rejected.

Summary of Findings

Findings of the study are summarized below:

1. Students taught keyboarding speed using on-line instruction had higher post-test mean score and greater mean gain score than those taught using conventional method.

2. Students taught keyboarding accuracy using on-line instruction had higher post-test mean score and greater mean gain score than those taught using conventional method.

3. Female students taught keyboarding speed using on-line instruction had higher post-test mean score and greater mean gain score than their male counterparts.

4. Male Students taught keyboarding accuracy using on-line instruction had higher post-test mean score and greater mean gain score than their female counterparts.

5. Male and female students taught keyboarding speed using on-line instruction had higher post-test mean and greater mean gain score than their counterparts taught using conventional method.

6. Male and female students taught keyboarding accuracy using on-line instruction had higher post-test mean and greater mean gain score than their counterparts taught using conventional method.

7. There is a statistically significant difference in the mean keyboarding speed achievement of students taught with on-line instruction and their counterparts taught using conventional method.

8. There is a statistically significant difference in mean keyboarding accuracy achievement of students taught with on-line instruction when compared with their counterparts taught using conventional method.

9. There is no statistically significant difference in mean keyboarding speed achievement scores of male and female students taught with online instruction when compared with those taught with conventional instructional method.

10. There is no statistically significant difference in mean keyboarding accuracy achievement of male and female students taught with online instruction and those taught with conventional instructional method.

11. There is no statistically significant interaction between the mean keyboarding speed achievement of male and female students taught with online instruction and those taught with conventional instructional method.

12. There is no statistically significant interaction between the mean keyboarding accuracy achievement of male and female students taught with online instruction and those taught with conventional instructional method.

CHAPTER FIVE

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

This chapter focuses on discussion of results of the study, conclusion, implications of the study, recommendations and suggestions for further research.

Discussion of Findings

Findings of this study are discussed under the following headings; Online instruction on speed and accuracy achievement in keyboarding, Gender and academic achievement, Teaching methods and academic achievement .

Online instruction on speed and accuracy achievement in keyboarding

The study revealed that students who were taught keyboarding speed and accuracy using online instruction method achieved higher post-test scores than those taught using conventional teaching method. Similarly the result of the study showed that there is a statistically significant difference in the mean keyboarding speed and accuracy achievement of OTM Students taught with on-line instruction and their counterpart taught with conventional method. This result is in line with the findings of Haruna and Ekeh (2011) which reported that teaching method other than conventional method had a significant effect on post-test achievement scores of students. The results showed that computer (technology) is more effective in the teaching and learning of keyboarding as it helps in improving students' skills and creativity. The findings of the study also agree with Shen, Chung, Challis and Cheung's (2007) findings that online learning provided greater flexibility to learners allowing them to study anytime, anywhere and at

their own pace. This finding is also in line with the findings of Blazek's (2015) which revealed that the use of technology can enhance the acquisition of skills and knowledge for students when the computer is used to deliver well designed instruction.

Similarly, Eze (2014) concluded that learning outcome (achievement) of every student depends greatly on the type of teaching strategy employed by the teacher(s) during instructions. Ekoro, Ofem and Udo's (2016) study showed that computer assisted instructions has a positive impact on keyboard mastery and speed achievement which is also in line with the result of this present study. This could be why Oyedele (2007) recommended that keyboarding teachers should give preference to the teaching method that gives better result.

Gender and Academic Achievement

Findings of the study revealed that male and female students taught keyboarding using online instruction method differ significantly in post-test scores. The study revealed that male and female students taught keyboarding using online instruction method achieved better in accuracy and speed respectively in their post-test mean scores. This indicated that the online instruction was effective and has the potential of improving students' achievement in speed and accuracy in keyboarding. This result is line with the findings of Ukonu, Sababa and Filgona (2017) which revealed that students exposed to keyboarding skills acquisition through hands-on strategy achieved remarkable results than their counterparts taught using the conventional method.

There was no significant effect of gender on achievement of students exposed to keyboarding skill acquisition using hands-on teaching with conventional method. It was concluded that hands on teaching strategy was effective in teaching keyboarding skills; hence teachers should be encouraged to use the strategy in teaching keyboarding from the onset of the National Diploma programme. Ekanem (2008) findings showed a narrow but higher performance in favour of the girls in speed achievement as against the boys. The study also revealed that students taught with online instruction performed better and that gender was in significant in speed and accuracy achievement of students taught using online instruction.

The findings from the study of Kay (2006) also showed that there were no significant differences in achievement between males and females after a computer laptop programme with the exception of programming which continued to favour males. The result and findings of this study is also in line with the study of Udoukpong, Emah and Umoren (2012) which reported that students taught with online instruction performed better and that gender was not significant in speed and accuracy achievement of students taught using online instruction.

Teaching Methods and Academic Achievement

The results of the study show that there is no interaction effect between the methods of instructional delivery and gender on students mean scores in keyboarding speed and accuracy achievement. This result is in consonance with the observations of Zeeb in Ganyaupfu (2013) that an alignment of teaching

methods with students' preferred learning influences students achievement. Ajai, Imoke and Okwu's (2013) findings is also in line with this study as the researchers' study revealed that students achieved significantly higher scores in their post-test than those taught using conventional method and there was no significant interaction effect of methods and gender on students' achievement.

Conclusion

Based on the findings of the study, it was concluded that online instruction has proved to be an effective method for improving students' speed and accuracy achievement in keyboarding.

Implications of the Study

The study has educational implications for educational stakeholders, teachers and students alike. The study indicated that:

1. Online instruction using Mavis Beacon Teaches Typing increases students speed and accuracy in keyboarding. This implies that if teachers of keyboarding involve their students actively in the teaching and learning process through the use of online instruction, they will acquire speed and accuracy which will help them to perform better in their jobs after graduation.

2. The result of the study also indicated that there was significant effect of instructional methods and gender on students' speed and accuracy achievement in keyboarding. Thus, the online instruction method favoured both male and female students' equally, showing that the method is

effective in instructional delivery in keyboarding for both male and female students. As a result, keyboarding lecturers in polytechnics should introduce the use of online instruction in their teaching of keyboarding.

Recommendations

Based on the findings of this study, the following recommendations are made:

1. Keyboarding lecturers should use online instruction through Mavis Beacon Teaches Typing in teaching to enhance students' achievement in keyboarding speed and accuracy.

2. National Board for Technical Education (NBTE) should restructure the keyboarding curriculum at the ND level to eliminate the use of manual typewriters as instructional equipment.

3. Management of polytechnics should provide adequate computers to enhance the use of computer keyboard for keyboarding instructions.

4. For maximum benefit, lecturers should ensure that computer touch keyboarding instructions should be carried out on computer keyboard rather than on the typewriter keyboard.

Limitation of the Study

The study has limitations that are associated with quasi-experimental studies. The sample size involved only National Diploma II Office Technology and Management (OTM) students in polytechnics in Nasarawa State. This may affect the generalization of the findings among all OTM students.

Suggestion for Further Studies

It is suggested that further studies be carried out in the following areas.

1. The effect of computer-assisted instruction on the speed and accuracy achievement of Office Technology and Management Students in Colleges of Education in Nigeria

2. As assessment of the factors affecting the adoption of online instruction in the teaching and learning of keyboarding in polytechnics and/or colleges of education.

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APPENDIX A

Population Distribution by Institution and gender

S/N	Institution	No of students	Gender	
			Male	**Female**
1	Federal Polytechnic Nasarawa	120	54	66
2	Nasarawa State Polytechnic, Lafia	35	16	19
3	Hikima Polytechnic Mararaba	29	4	25
	Total	**184**	**74**	**110**

APPENDIX B

Sample Distribution by Institution and Gender

GENDER	SAMPLE		TOTAL
	Experimental	Control	
Males	29	16	46
Females	31	19	49
Total	60	35	95

APPENDIX C

OTM Speed and Accuracy Test: 35 words a minutes for 10 minutes   Pre-test

Proofreading is a skill and like any skill it must be practiced. If you are to become   17

efficient at spotting errors of all kinds, it is necessary to undergo training in the art   35

of proofreading. To be effective a proofreader needs to be able to spell and   50

punctuate correctly, and to know the basic rules of grammar, as well as acceptable   66

typewriting display and layout.   72

It is not a question of just reading though a completed piece of typescript in case a   89

typing error may have been overlooked; it is often necessary to ask the help of a   106

colleague to read through the copy to make certain that figures are correct, that   122

nothing has been omitted, or that unreadable handwriting has been deciphered   137

correctly.   139

It may be that you are an audio typist and that you have to listen to a recording on a 156

transcribing machine. You will need to take great care when proofreading, and, in   172

order to check certain details, it may be necessary for you to play part of the   188

recording again.   191

If the transcription is from shorthand notes, it is a good plan to check the transcript 209

very closely with the notes to make certain that nothing has been omitted. Keep   224

one finger following the shorthand notes with a finger of the other hand following   241

each word on the typed copy. Take particular care with words that sound alike but   257

are spelt differently – homophones, eg, check and cheque; aloud and allowed. If   273

you have any doubt as to which spelling is required, check the meaning of the   288

word in a dictionary.   292

If you are proofreading from a VDU, it may be helpful to use the cursor to guided   308

the eye across the screen, and to vary the density of the brightness on the screen.   325

Make sure that you have used the correct stationery, typed accurately any labels or   342

envelopes required, and attach enclosures.   350

S.I. 1.41

Speed and Accuracy Test: 35 words a minutes for 10 minutes – Post Test

It is not a question of just reading though a completed piece of typescript in case a   17

typing error may have been overlooked; it is often necessary to ask the help of a   33

colleague to read through the copy to make certain that figures are correct, that   50

nothing has been omitted, or that unreadable handwriting has been deciphered   65

correctly.   68

Proofreading is a skill and like any skill it must be practiced. If you are to become   85

efficient at spotting errors of all kinds, it is necessary to undergo training in the art 104

of proofreading. To be effective a proofreader needs to be able to spell and   117

punctuate correctly, and to know the basic rules of grammar, as well as acceptable 131

typewriting display and layout   138

It may be that you are an audio typist and that you have to listen to a recording on a 152

transcribing machine. You will need to take great care when proofreading, and, in   168

order to check certain details, it may be necessary for you to play part of the   184

recording again.   192

If you are proofreading from a VDU, it may be helpful to use the cursor to guide the208

eye across the screen, and to vary the density of the brightness on the screen. Make sure 227

that you have used the correct stationery, typed accurately any labels or envelopes 240

required, and attach enclosures. If the transcription is from shorthand notes, it is a good 258

plan to check the transcript very closely with the notes to make certain that nothing has 272

been omitted.Keep one finger following the shorthand notes with a finger of the other   287

hand following each word on the typed copy. Take particular care with words that 302

sound alike but are spelt differently – homophones, eg, check and cheque; aloud and 318

allowed. If you have any doubt as to which spelling is required, check the meaning of 334

the word in a dictionary.   350

APPENDIX D

LESSON PLAN

WEEK I

A lesson plan on keyboarding for Online Instruction

Subject: Keyboarding

Class: ND 2 OTM

Date: XYZ

Duration: 2 periods (1 hour each)

Topic: Introduction to Keyboarding III

Specific Objectives: By the end of this lesson, Students should be able to:

    i. Define keyboard and keyboarding

    ii. Explain the concepts of posture and position

    iii. Explain the effect/role of proper posture/position in
         keyboarding

    vi. Explain home keys and finger positions

    v. Explain striking

Content Outlines:

    i. Definition of a keyboard and keyboarding

    ii. Explanation of posture and position in keyboarding

    iii. Explanation of the effect of proper posture/position in
         keyboarding

    vi. Home keys and finger positions

    v. Key striking

Instructional Materials: Computer, Projector Screen, writing material/pad or note.

Instructional Method: On-line Method (OLM)

Entry Behaviour: Students are familiar with the keyboards

Instructional Procedure:

Content Development	Teacher's Activities	Students' Activities	Instructional Strategy
Introduction	The teacher arouses students' interest and attention by asking a rather funny question: why is the machine used in typing called a typewriter and the user called a typist.		Set Induction
Definition of keyboard and keyboarding	The teacher defines the keyboard and keyboarding	The students listen to the explanations	Listening
Posture and Positioning	The teacher commences the lesson by uploading a typist sitting at her desk. Uploads definitions of positions and lists elements that constitute correct sitting position.	The students observe read comments and listen to explanations.	Analyzing
Effects of proper posture	The teacher explains the importance of proper posture/sitting position in keyboarding	Students watch the different postures/position and take notes	Observations
Home keys and finger positioning	Teacher uploads picture/video of typist keyboarding and asks students to place their fingers appropriately on their keyboard and key-in some words e.g. their names, school, etc.	Students demonstrate on the keyboard as they can see on screen for 2-3 minutes	Demonstration, typing
Key striking	Teacher goes round, to rate students on posture and finger positions	Students type for 5-10 minutes with eyes on the copy	Typing, demonstration
Evaluation	The teacher asks students to explain posture and position. Repeats the importance of mastering finger position	Students update notes and ask questions	Questioning
Summary	Teacher summarizes the lesson and gives assignment and topic of next lesson	Students copy topic of next lesson	Note copying

WEEK II

A lesson plan on keyboarding based on Online

Subject: Keyboarding

Class: ND 2 OTM

Date: XYZ

Duration: 2 periods (1 hour each)

Topic: Keyboarding Speed and Accuracy Development

Specific Objectives: At the end of this lesson, students should be able to:

        i.   Assume a proper keyboarding posture

        ii.   Strike the home keys with the right fingers without looking at them

        iii.   Type and average of 30 words per minute

Content Outlines: i.   Assuming proper position

        ii.   Placing fingers on home keys

        iii.   Striking randomly dictated letters

        iv.   Practical hands-on of a 2 paragraph document

Instructional Materials: Computer, Projector Screen, writing material/pad or note.

Instructional Method: On-line Learning Method (OLM)

Entry Behaviour: Students have learnt the keyboard architecture, home keys and finger positions.

Instructional Procedure:

Content Development	Teacher's Activities	Students' Activities	Instructional Strategy
Introduction	The teacher arouses students' interest and attention by uploading a video of a very fast keyboarder at work.		Set Induction
	The teacher commences the lesson by uploading Mavis beacon package on the screen	The students study the instructions/activities being displayed in the package	Observation
Dictation Passage	The teacher dictates a passage and instructs students to type dictated passage.	Students listen to instructions and type from dictation	Listening and typing
Practical	The teacher uploads the speed and accuracy passage and request students to type using teacher recommended font size and spacing.	Students start typing as instructed while the teacher walks round for observation.	Hands-on experience
Practical	The teacher stops the students after two minutes, highlights observations made, gives advice and asks students to resume typing.	Students listen, take the instructions and resume typing.	Demonstration Hands-on
Practical	Teacher asks students to stop, discontinue the first script and start all over again. The teacher reminds students that speed and accuracy are of essence	Students resume typing for 10 minutes without interruption from the teacher.	Demonstration Hand-on
Printing	Teacher instruct students to send their work to printer	Students upload their work to the printer	Printing
Evaluation	Teacher gives highlights of the day's activities. Mentions commendable habits and those to avoid. Reruns the day's Mavis Beacon activities.	Students listen, ask questions	Listening and Questioning
Summary	Teacher reviews the exercises with students	The students listen and note points for improvement.	Listening

WEEK III

A lesson plan on keyboarding based on Online Instruction

Subject: Keyboarding III

Class: ND 2 OTM

Date: XYZ

Duration: 2 periods (1 hour each)

Topic: Keyboarding Speed and Accuracy Drill

Specific Objectives: By the end of this lesson, the students should be able to:

        i.   Describe the concept of corrective drill

        ii.   Explain the role of corrective drill in mastery of keyboard.

        iii.   Explain the relationship between speed, accuracy and keyboarding proficiency

        iv.   Practice Keyboarding at a speed of 35 words per minute with 98% level of accuracy.

        v.   Identify drill deficiencies and practice corrective drill on their own

Content Outlines: i.   Concept clarification

        ii.   Inter-relationship between speed, accuracy and corrective drill

        iii.   Corrective drilling

        vi.   Keyboarding speed and accuracy target; hands on

        vii.   Drill deficiencies and corrections

Instructional Materials: Computer, CD-Rom, writing material/pad or note.

Instructional Method: Online

Entry Behaviour: Students have learnt the keyboard architecture, home keys, finger positions with practical keyboarding speed and accuracy exercises

Instructional Procedure:

Content Development	Teacher's Activities	Students' Activities	Instructional Strategy
Introduction	The teacher arouses students' interest asking questions on activities of the previous week.		Set Induction
Introduction	The teacher commences the lesson by asking students to re-load their Mavis Beacon software and get set for work	Students re-load the software and get ready to type	Demonstration
Practice	The teacher instructs the students to locate the speed passage on the software ready to type.	Students locate passage and await further instructions.	Demonstration
Speed and Accuracy	The teacher instructs students to type for 10 minutes.	Students start typing while the teacher walks round to observe and note level of progress.	Hands-on
Practical	The teacher directs the students to stops after ten minutes and highlights observations in their practice.	Students check their speed and accuracy development.	Demonstration
Speed and Accuracy Drill	Teacher asks students to resume typing for another 10 minutes. The teacher reminds students that speed and accuracy are of essence	Students resume typing for 10 minutes without interruption from the teacher while the teacher continues with observations.	Hand-on
Drilling	Teacher explains non-mastery of a particular finger or fingers as source of inaccuracy. The teacher asks students to check for wrong spellings in the last two typing exercises.	Students check spelling errors as directed using the software check list.	Demonstration
Corrective Drill	Teacher asks students to do corrective drill on fingers identified in the last step for 2 minutes.	Students listen and perform corrective drill of the fingers as directed.	Listening and Hands-on
Drilling	The teacher reechoes the importance of corrective drill and how it is done and asks students to resume typing for 10 minutes.	Students resume typing for another 10 minutes	Hand-on
Drilling	Teacher directs students to discontinue typing after 10 minutes	Students stop typing.	Demonstration
Evaluation	The teacher recasts concept, of corrective drill and reaffirm its importance. Asks students questions.	Students listen, answer teacher's questions and ask their own.	Listening, Questioning
Summary	The teacher reviews the exercises so far taken. Restate some key points, commend and correct observed errors and shortcomings of students regarding posture and eye control.	Students listen, and seek for clarifications.	Reviewing, questioning, note taking

WEEK IV

A lesson plan on keyboarding based on Online Instruction

Subject: Keyboarding III

Class: ND 2 OTM

Date: XYZ

Duration: 2 periods (1 hour each)

Topic: Keyboarding Speed and Accuracy Drill

Specific Objectives: By the end of this lesson, the students should be able to:

      i.   Describe the concept of corrective drill

      ii.   Explain the role of corrective drill in mastery of keyboard.

      iii.   Explain the relationship between speed, accuracy and keyboarding proficiency

      iv.   Practice Keyboarding at a speed of 35 words per minute with 98% level of accuracy.

      v.   Identify drill deficiencies and practice corrective drill on their own

Content Outlines: i.   Concept clarification

      ii.   Inter-relationship between speed, accuracy and corrective drill

      iii.   Corrective drilling

      vi.   Keyboarding speed and accuracy target; hands on

      vii.   Drill deficiencies and corrections

Instructional Materials: Computer, CD-Rom, writing material/pad or note.

Instructional Method: Online

Entry Behaviour: Students have learnt the keyboard architecture, home keys, finger positions with practical keyboarding speed and accuracy exercises

Instructional Procedure:

Content Development	Teacher's Activities	Students' Activities	Instructional Strategy
Introduction	The teacher arouses students' interest asking questions on activities of the previous week.		Set Induction
Practical	The teacher commences the lesson by asking students to re-load their Mavis Beacon software and get set for work	Students re-load the software and get ready to type	Demonstration
Drilling	The teacher instructs the students to locate the speed passage on the software ready to type.	Students locate passage and await further instructions.	Demonstration
Speed and Accuracy Drill	The teacher instructs students to type for 10 minutes.	Students start typing while the teacher walks round to observe and note level of progress.	Hands-on
Drilling	The teacher directs the students to stops after ten minutes and highlights observations in their practice.	Students check their speed and accuracy development.	Demonstration
Speed and Accuracy Drill	Teacher asks students to resume typing for another 10 minutes. The teacher reminds students that speed and accuracy are of essence	Students resume typing for 10 minutes without interruption from the teacher while the teacher continues with observations.	Hands-on
	Teacher explains non-mastery of a particular finger or fingers as source of inaccuracy. The teacher asks students to check for wrong spellings in the last two typing exercises.	Students check spelling errors as directed using the software check list.	Demonstration
Corrective Drilling	Teacher asks students to do corrective drill on fingers identified in the last step for 2 minutes.	Students listen and perform corrective drill of the fingers as directed.	Listening and Hands-on
	The teacher reechoes the importance of corrective drill and how it is done and asks students to resume typing for 10 minutes.	Students resume typing for another 10 minutes	Hands-on
Speed and Accuracy	Teacher directs students to discontinue typing after 10 minutes	Students stop typing.	Demonstration
Evaluation	The teacher recasts concept, of corrective drill and reaffirm its importance. Asks students questions.	Students listen, answer teacher's questions and ask their own.	Listening, Questioning
Summary	The teacher reviews the exercises so far taken. Restate some key points, commend and correct observed errors and shortcomings of students regarding posture and eye control.	Students listen, and seek for clarifications.	Reviewing, questioning, note taking

APPENDIX E

Determination of the degree of reliability of keyboarding test (KBT) instrument using the Spearman's correlation coefficient (rs)

S/N	X	Y	D	D^2
1	62	62	0	0
2	65	66	-1	1
3	58	60	-2	4
4	72	72	0	0
5	57	57	0	0
6	63	63	0	0
7	58	57	1	1
8	61	61	0	0
9	70	70	0	0
10	64	64	0	0
			$\sum =$	6

Key:

X= First test

Y= Re-test

D= Difference in respondents scores

r_s = Spearman's Order Correlation Coefficient

$$r_p = r \frac{6\sum(d^2)}{n(n^2-1)}$$

$$= 1 - \frac{6(6^2)}{10(10^2 - 1)}$$

$$= 1 - \frac{216}{990}$$

$$= 0.78$$

APPENDIX F

VALIDATES REPORTS

VALIDATES REPORTS

VALIDATES REPORTS

APPENDIX G

SPEED DATA

S/N	GENDER	CONTROL GROUP		EXPERIMENTAL GROUP	
		PRE-TEST	POST-TEST	PRE-TEST	POST-TEST
1	M	33	34	33	35
2	F	32	32	34	35
3	M	33	34	34	34
4	F	34	34	35	34
5	F	34	32	33	35
6	M	33	33	32	34
7	M	30	33	32	35
8	M	28	29	30	34
9	F	33	34	33	35
10	F	34	33	33	34
11	M	35	35	32	34
12	M	34	33	35	35
13	F	33	35	35	35
14	M	34	34	34	33
15	F	35	35	33	35
16	F	33	34	34	34
17	M	34	35	35	35
18	F	30	33	30	34
19	M	32	35	33	34
20	M	29	28	32	35

21	M	34	34	30	34
22	M	35	34	33	35
23	M	28	35	30	34
24	F	30	32	28	32
25	F	28	30	30	34
26	F	28	32	32	35
27	M	32	33	30	34
28	F	35	33	33	35
29	F	32	35	30	34
30	F	33	34	32	35
31	M	34	35	28	33
32	F	33	34	34	35
33	F	24	30	30	34
34	F	31	32	31	35
35	F	33	34	32	35
36	M			30	32
37	F			33	35
38	M			33	35
39	F			30	32
40	F			32	34
41	M			28	33
42	F			32	32
43	F			32	34
44	M			32	35

45	F		30	33
46	M		28	34
47	M		32	35
48	F		32	35
49	M		33	34
50	M		30	35
51	M		29	33
52	F		30	34
53	F		32	33
54	M		32	34
55	M		32	30
56	F		30	32
57	M		33	35
58	M		33	34
59	F		27	29
60	F		32	33

APPENDIX H

ACCURACY DATA

S/N	GENDER	CONTROL GROUP		EXPERIMENTAL GROUP	
		PRE-TEST	POST-TEST	PRE-TEST	POST-TEST
1	M	92	93	92	95
2	F	91	92	92	97
3	M	92	91	93	96
4	F	90	91	93	97
5	F	91	90	92	96
6	M	92	91	92	95
7	M	93	92	91	96
8	M	91	91	90	96
9	F	94	93	92	93
10	F	92	91	92	94
11	M	93	93	91	95
12	M	92	92	92	99
13	F	91	91	92	96
14	M	92	90	91	95
15	F	92	91	92	96
16	F	93	92	91	97
17	M	94	93	91	94
18	F	92	93	91	93
19	M	93	92	92	95
20	M	93	94	93	94

21	M	92	92	92	96
22	M	91	91	91	95
23	M	93	93	93	95
24	F	91	91	91	96
25	F	93	92	92	97
26	F	92	93	93	94
27	M	91	91	91	97
28	F	92	91	93	95
29	F	93	91	92	96
30	F	91	92	90	94
31	M	91	93	91	99
32	F	91	91	92	95
33	F	92	92	93	96
34	F	92	91	91	93
35	F	93	93	92	96
36	M			92	97
37	F			91	99
38	M			92	96
39	F			94	98
40	F			90	97
41	M			94	96
42	F			96	97
43	F			91	97
44	M			94	96

45	F		93	96
46	M		96	96
47	M		92	97
48	F		94	96
49	M		93	98
50	M		91	96
51	M		97	97
52	F		93	98
53	F		94	96
54	M		96	97
55	M		92	96
56	F		93	98
57	M		94	96
58	M		92	97
59	F		93	96
60	F		98	98

APPENDIX I

SPSS Output of Analysis

Case Processing Summary

	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
Speed Pretest * Group	95	100.0%	0	0.0%	95	100.0%
Speed Posttest * Group	95	100.0%	0	0.0%	95	100.0%

Report

Group		Speed Pretest	Speed Posttest
	Mean	34.60	35.09
Control Group	N	35.00	35.00
	Std. Deviation	1.31	1.17
	Mean	34.98	37.78
Experimental Group	N	60.00	60.00
	Std. Deviation	1.21	2.25
	Mean	34.84	36.79
Total	N	95.00	95.00
	Std. Deviation	1.26	2.32

Case Processing Summary

	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
Accuracy Pretest * Group	95	100.0%	0	0.0%	95	100.0%
Accuracy Posttest * Group	95	100.0%	0	0.0%	95	100.0%

Report

Group		Accuracy Pretest	Accuracy Posttest
Control Group	Mean	91.63	91.80
	N	35.00	35.00
	Std. Deviation	.91	.99
Experimental Group	Mean	92.45	96.07
	N	60.00	60.00
	Std. Deviation	1.64	1.40
Total	Mean	92.15	94.49
	N	95.00	95.00
	Std. Deviation	1.47	2.42

Case Processing Summary

Group		Cases					
		Included		Excluded		Total	
		N	Percent	N	Percent	N	Percent
Control Group	Speed Pretest * Gender	35	100.0%	0	0.0%	35	100.0%
	Speed Posttest * Gender	35	100.0%	0	0.0%	35	100.0%
Experimental Group	Speed Pretest * Gender	60	100.0%	0	0.0%	60	100.0%
	Speed Posttest * Gender	60	100.0%	0	0.0%	60	100.0%

Report

Group	Gender		Speed Pretest	Speed Posttest
Control Group	Male	Mean	34.94	34.94
		N	16.00	16.00
		Std. Deviation	1.18	1.12
	Female	Mean	34.32	35.21
		N	19.00	19.00
		Std. Deviation	1.38	1.23
	Total	Mean	34.60	35.09
		N	35.00	35.00
		Std. Deviation	1.31	1.17
Experimental Group	Male	Mean	34.93	37.55
		N	29.00	29.00
		Std. Deviation	1.41	2.16
	Female	Mean	35.03	38.00
		N	31.00	31.00
		Std. Deviation	1.02	2.34
	Total	Mean	34.98	37.78
		N	60.00	60.00
		Std. Deviation	1.21	2.25

Case Processing Summary

Group		Cases					
		Included		Excluded		Total	
		N	Percent	N	Percent	N	Percent
Control Group	Accuracy Pretest * Gender	35	100.0%	0	0.0%	35	100.0%
	Accuracy Posttest * Gender	35	100.0%	0	0.0%	35	100.0%
Experimental Group	Accuracy Pretest * Gender	60	100.0%	0	0.0%	60	100.0%
	Accuracy Posttest * Gender	60	100.0%	0	0.0%	60	100.0%

Report

Group	Gender			Accuracy Pretest	Accuracy Posttest
Control Group	Male	Mean		91.69	92.00
		N		16.00	16.00
		Std. Deviation		.87	1.10
	Female	Mean		91.58	91.63
		N		19.00	19.00
		Std. Deviation		.96	.90
	Total	Mean		91.63	91.80
		N		35.00	35.00
		Std. Deviation		.91	.99
Experimental Group	Male	Mean		92.45	96.10
		N		29.00	29.00
		Std. Deviation		1.68	1.23
	Female	Mean		92.45	96.03
		N		31.00	31.00
		Std. Deviation		1.63	1.56
	Total	Mean		92.45	96.07
		N		60.00	60.00
		Std. Deviation		1.64	1.40

Between-Subjects Factors

		Value Label	N
Group	1.00	Control Group	35
	2.00	Experimental Group	60

Tests of Between-Subjects Effects

Dependent Variable: Speed Posttest

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	172.987[a]	2	86.494	23.910	.000
Intercept	83.516	1	83.516	23.087	.000
Speed Pretest	12.124	1	12.124	3.352	.070
Group	144.699	1	144.699	40.001	.000
Error	332.802	92	3.617		
Total	129085.000	95			
Corrected Total	505.789	94			

a. R Squared = .342 (Adjusted R Squared = .328)

Estimated Marginal Means

Group

Dependent Variable: Speed Posttest

Group	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Control Group	35.156[a]	.324	34.513	35.799
Experimental Group	37.743[a]	.247	37.253	38.232

a. Covariates appearing in the model are evaluated at the following values: Speed Pretest = 34.8421.

Between-Subjects Factors

		Value Label	N
Group	1.00	Control Group	35
	2.00	Experimental Group	60

Tests of Between-Subjects Effects

Dependent Variable: Accuracy Posttest

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	417.208[a]	2	208.604	142.646	.000
Intercept	102.201	1	102.201	69.887	.000
Accuracy Pretest	14.794	1	14.794	10.116	.002
Group	333.423	1	333.423	228.000	.000
Error	134.540	92	1.462		
Total	848831.000	95			
Corrected Total	551.747	94			

a. R Squared = .756 (Adjusted R Squared = .751)

Estimated Marginal Means

Group

Dependent Variable: Accuracy Posttest

Group	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Control Group	91.946[a]	.209	91.530	92.362
Experimental Group	95.982[a]	.158	95.667	96.296

a. Covariates appearing in the model are evaluated at the following values: Accuracy Pretest = 92.1474.

Between-Subjects Factors

		Value Label	N
Gender	1.00	Male	45
	2.00	Female	50

Tests of Between-Subjects Effects

Dependent Variable: Speed_Posttest

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	31.971[a]	2	15.986	3.104	.050
Intercept	54.671	1	54.671	10.615	.002
Pre-test	29.579	1	29.579	5.743	.019
Gender	3.683	1	3.683	.715	.400
Error	473.818	92	5.150		
Total	129085.000	95			
Corrected Total	505.789	94			

a. R Squared = .063 (Adjusted R Squared = .043)

Estimated Marginal Means

Gender

Dependent Variable: Speed_Posttest

Gender	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Male	36.581[a]	.339	35.909	37.254
Female	36.977[a]	.321	36.339	37.615

a. Covariates appearing in the model are evaluated at the following values:

Speed_Pretest = 34.8421.

Between-Subjects Factors

		Value Label	N
Gender	1.00	Male	45
	2.00	Female	50

Tests of Between-Subjects Effects

Dependent Variable: Accuracy Posttest

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	85.233[a]	2	42.616	8.404	.000
Intercept	29.616	1	29.616	5.840	.018
Pre-test	83.316	1	83.316	16.431	.000
Gender	1.448	1	1.448	.286	.594
Error	466.515	92	5.071		
Total	848831.000	95			
Corrected Total	551.747	94			

a. R Squared = .154 (Adjusted R Squared = .136)

Estimated Marginal Means

Gender

Dependent Variable: Accuracy_Posttest

Gender	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Male	94.625[a]	.336	93.958	95.292
Female	94.378[a]	.318	93.745	95.010

a. Covariates appearing in the model are evaluated at the following values:

Accuracy_Pretest = 92.1474.

Group	Gender	Speed_Pretest			Speed_Posttest		
		Mean	N	Std. Deviation	Mean	N	Std. Deviation
Control Group	Male	34.94	16.00	1.18	34.94	16.00	1.12
	Female	34.32	19.00	1.38	35.21	19.00	1.23
Experimental Group	Male	34.93	29.00	1.41	37.55	29.00	2.16
	Female	35.03	31.00	1.02	38.00	31.00	2.34
Total	Male	34.93	45.00	1.32	36.62	45.00	2.24
	Female	34.76	50.00	1.20	36.94	50.00	2.40

Report

Group	Gender	Accuracy_Pretest			Accuracy_Posttest		
		Mean	N	Std. Deviation	Mean	N	Std. Deviation
Control Group	Male	91.69	16	.87	92.00	16	1.10
	Female	91.58	19	.96	91.63	19	.90
Experimental Group	Male	92.45	29	1.68	96.10	29	1.23
	Female	92.45	31	1.63	96.03	31	1.56
Total	Male	92.18	45	1.48	94.64	45	2.31
	Female	92.12	50	1.47	94.36	50	2.54

Between-Subjects Factors

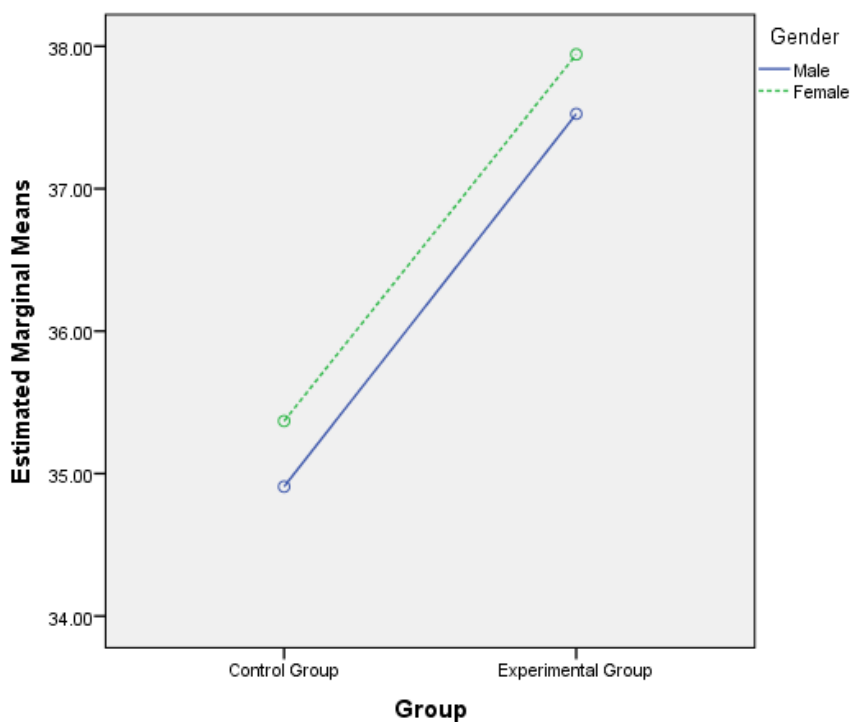|		Value Label	N
Group	1.00	Control Group	35
	2.00	Experimental Group	60
Gender	1.00	Male	45
	2.00	Female	50

Tests of Between-Subjects Effects

Dependent Variable: Speed Posttest

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	177.420[a]	4	44.355	12.157	.000
Intercept	78.648	1	78.648	21.556	.000
Speed Pretest	12.898	1	12.898	3.535	.063
Group	145.245	1	145.245	39.809	.000
Gender	4.197	1	4.197	1.150	.286
Group * Gender	.010	1	.010	.003	.959
Error	328.369	90	3.649		
Total	129085.000	95			
Corrected Total	505.789	94			

a. R Squared = .351 (Adjusted R Squared = .322)

Profile Plots

Between-Subjects Factors

		Value Label	N
Group	1.00	Control Group	35
	2.00	Experimental Group	60
Gender	1.00	Male	45
	2.00	Female	50

Tests of Between-Subjects Effects

Dependent Variable: Accuracy Posttest

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	418.278[a]	4	104.569	70.512	.000
Intercept	102.630	1	102.630	69.205	.000
Accuracy Pretest	14.609	1	14.609	9.851	.002
Group	330.170	1	330.170	222.638	.000
Gender	.925	1	.925	.624	.432
Group * Gender	.389	1	.389	.262	.610
Error	133.469	90	1.483		
Total	848831.000	95			
Corrected Total	551.747	94			

a. R Squared = .758 (Adjusted R Squared = .747)

Profile Plots