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ANIMATED INFOGRAPHICS AS A POTENTIAL TOOL IN VISUAL ART PEDAGOGY

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ABSTRACT: *The study adopted a qualitative approach with the case study to ascertain the pedagogical environment and infographics format(s) used by Visual Art teachers in the teaching and learning of Visual Art subjects in Senior High Schools. Respondents for the study were sampled purposively and conveniently from KNUST Senior High School, Kumasi, Ghana. Findings from the study indicated the non-availability of animated infographics as an instructional tool in the Visual Art classroom and the inefficiency of instructional delivery with only textbooks. For better comprehension and achievement of instructional objectives, the study recommended animated infographics as an alternative pedagogical strategy to the conventional way of instruction in the Visual Art classroom.*

KEYWORDS: Infographics, Pedagogy, Visual Literacy, Instructional Design & Technology,

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INTRODUCTION

Considering numerous researches (DeGraft-Yankson, 2010; Siaw 2009; Siaw & Nortey, 2011; Evans-Solomon, 2004; Evans-Solomon & Opoku-Asare, 2011; Opoku-Asare, Agbenatoe & deGraft-Johnson, 2014) conducted in Visual Art Education especially in a typical Ghanaian context, it is refreshing to note that none of these studies considers the pedagogical environment that informs how Visual Art subjects are taught. Although DeGraft-Yankson's (2010) study looked at the integration of Information and Communication Technologies (ICTs) into the Ghanaian Senior High School Visual art curriculum, the study was alien to the pedagogical environment and infographics format(s) adopted by Visual Art teachers in the teaching and learning of Visual Art subjects.

Elsewhere, Science, Technology, Engineering and Mathematics (STEM) researchers (Shafer, 1996; Coleman, 2010; Noh and Son, 2015; Hassan, 2016; Shafipoor, Sarayloo & Shafipoor, 2016; Warmann, 2016), have demonstrated that infographics could be an auxiliary tool that supports the cognitive comprehension of instructional content. Despite the fascinating impact and endorsement by these educational researchers in STEM, little is known of the potential and impact of teaching and learning with infographics in the Visual Art classroom.

It is against this background that this study sought to examine the format(s) of infographics used in the teaching and learning of Visual Art subjects and the effectiveness of the available infographic formats adopted in providing instructional content to Visual Art students. The research was undertaken at KNUST Senior High School in the Kumasi Metropolis in the Ashanti region of Ghana considering its proximity to the researchers and because it falls within the category of grade **A** schools in Ghana.

The Purpose of the Study

The purpose of the study was to identify and discuss the effects of available infographic format(s) used in the teaching and learning of Visual Art subjects in Senior High Schools using KNUST Senior High School as the case.

LITERATURE REVIEW

Infographics

As a means of communicating with one another, cavemen and women drew pictures on walls and rocks. This can be traced as far back as 3,500 years. Despite the gradual and periodical shift in the use of pictures to communicate from the Paleolithic period of man's settlement, it would not be out of place to submit that pictures still rule. From pictograms that characterize cave art to Egyptian hieroglyphics to ideograms on modern signs, humans have been drawing to communicate.

A popular visual approach to deliver abstract, complex and dense in technologically advancing global village has seen the use of infographics as a mediating tool (Lamb, Polman, Newman & Smith, 2014; Smiciklas, 2012; Vanichvasin, 2013). Infographics as a concept originate from information literacy, which entails a "set of skills needed to find, decode and use information" (American Library Association 1996–2013). It consists of two words "info" and "graphic".

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Towards A Working Definition

Several theories suggest that early paintings of animals and hunting scenes by the cave artists were not just religious or decorative, but connote a way of communication. This has, however, been the bedrock of infographics: communicating information.

Several professionals and researchers have attempted a definition for the term "*infographics*" (Al-Mohammadi, 2017; Hassan, 2016; Yıldırım, 2016; Smiciklas, 2012; Arum 2012). This study adopts the definition of infographics as the presentation of information within a certain flow by using visuals and texts. Infographics help convey complex or abstract information to the target audience in a more comprehensive manner.

Other terms such as data visualization, information design, or information architecture are associated with the process of infographics creation and publishing.

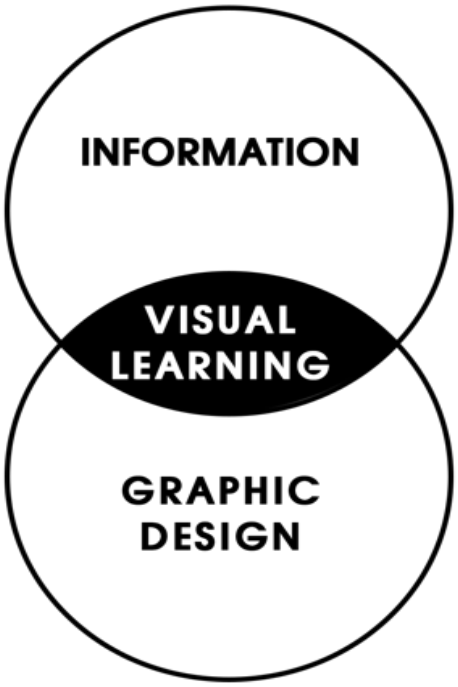

Figure 1. Anatomy of an infographic

Source: Smiciklas (2012)

Infographics is basically composed of three parts: *visual*, *content* and *knowledge* (Roy, 2009). The visual aspect of infographics is related to the design, appeal, comprehension and retention. On the other hand, infographics content can be categorized into three: introduction, main event and conclusion. The introductory aspect seeks to introduce the topic of the infographics to the reader. This includes a couple of data visualization that helps in establishing formidable groundwork.

Arum (2012) underscores the importance of the content of the main event or possibly the body of infographics. The main event or body of infographics is predominated with visuals whereas

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the concluding section drives readers to the end of the entire display by wrapping up the intended message.

The knowledge aspect of infographics entails the display of facts and deduction from the content. It includes emphasizing relevant content in order to initiate easy deduction. As one of the predominantly used contemporary learning approaches, infographics allow information to be presented in different visual forms (Williams, 2002). Their type or format has contributed immensely to their usage over time.

Infographics Formats

In recent times, infographics as a term have become more like articles or speeches than just mere charts. The purpose of these visual images (infographics) can be grouped into three main objectives similar to that of public speaking: to inform, persuade an audience and entertain.

In relation to their formats, Lankow, Ritchie & Crooks (2012) submits that there are three types of infographics: static, motion, and interactive. David and Quinn (2014) on the other hand categorized the formats into static and dynamic. They added that the dynamic format allows for interactivity.

Shafipoor et al. (2016) extend their categorization into four main classes: static, dynamic, interactive and physical. Shafipoor's et al. (2016) physical infographics hinge on three-dimensionality although they agree with Lankow *et al.* (2012) that both *motion* and *dynamic* infographics centre on animation despite their different captions. Yildirim (2016) captures the formats under three main headings: interactive, semi-interactive and non-interactive.

Elsewhere, Al-Mohammadi (2017) simplified the formats into static and motion graphics. Al-Mohammadi maintains that static infographics include visuals that are usually printed or distributed over the internet as explanatory tools. In sampling the views on the usefulness of animated infographics in the teaching and learning of Biology, Teixeira, Paiva, and Moreira (2017), submit that infographics generally fall under two main formats: static and animated; an opinion Hassan (2016) holds.

Considering the generic attempt to categorize the formats of infographics, it appears these formats can be brought under two main headings: static and animated. Also known as non-interactive, information display in static infographics appears fixed and only has one-way interaction. It is characterized by only viewing and reading user activity. The display output for static infographics includes still images, which narrate a story.

Unlike static infographics, their animated counterpart possesses animated or moving text and images, which are occasionally accompanied by sound. These animated infographics may optionally come with some interactivity where users would have options to click, search for specific data, shape displayed content and also choose which information to access and visualize.

Infographics in Teaching and Learning

To improve learning and knowledge retention, the frequent use of information visualization has become a frequently used phenomenon. Data visualization includes the use of graphical

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illustrations to communicate effectively relationships between ideas and facts. A more recent and popular genre of information visualization that supports learning is *infographics*.

These information visualization tools (infographics) are not bound to one particular area but cut across a spectrum of diverse fields such as science, business, education, to mention but few. This research, however, considers their usage in the circles of classroom pedagogy. Coleman (2010) conducted his research to find out the extent to which primary level schoolteachers use charts in their educational practices at Alabama University in the USA. Using descriptive design and questionnaire as his data collection tool to reach desired results. Results showed an increase in teachers' usage of charts, which included most educational practices. Charts, which are typical examples of static infographics proved viable as an instructional tool in their study.

In the fall semester of (2015-2016) at the Near East University, Kocakoyun, Ozdaml, Sahin and Akdag evaluated the views about infographics prepared for anatomy lessons. Per their findings, Kocacoyun and his colleagues recommended that similar studies could be conducted in other courses. Nonetheless, Kocakoyun's *et al* (2016) study failed to clarify the infographics format they adopted for the study. Although a greater percentage of their respondents showed greater interest in infographics their responses only adds to the numerous ones submitted by their colleagues in the Science Technology Engineering and Mathematics STEM fraternity.

Using a randomized controlled study with 27 engineering undergraduate students, Lyra, Isotani, Reis, Marques, Pedro & Jaques (2016) investigated the effectiveness of using infographics in learning vis-à-vis conventional instructional materials (graphics + text). Their research sought to bridge a gap in pedagogical issues with infographics by looking at individual factors that may interfere with how students perceive and retain learning materials. Although their results reveal a considerate satisfaction with students' interaction with infographics than the (graphics + text) at the post-test stage of evaluation, the researchers were quiet on the format of infographics they adopted for the study making it cumbersome to ascertain whether similar results could be realized, should the research be replicated elsewhere with the same variables present.

In 2016, Yildirim, an assistant professor at Ataturk University, sought the views of learners on infographics used for educational purposes and the place of infographics among learning preferences using an instant case study design, of students of the Department of Computer Education and Instructional Technology in the said university. Adapting Likert-type questions, Yildirim (2016) tailored his survey for his topic under the following: Informativeness, Selection Preferences, Sharing, Basic Presentation Structure, and Retention-Memorability. With regards to the order of preference of infographics types, Yildirim's respondents rated interactive (animated) infographics over other available options. This preference rate may be as a result of the background of the learners; an assertion Yildirim (2016) agrees to. Will the same choice be merited with learners who may not have a very high computer literacy background similar to Yildirim's?

To improve the retention and easy assimilation of concepts in Biology, Bellei, Welch, Pryor & Katheesan (2016) employed a collaborative approach by engaging an Immunology and a design lecturer in producing animated infographics for immunology teaching. This Design Thinking approach saw a combination of both static and animated infographics over a period of eight (8) weeks to achieve the intended results: better comprehension. Although learners claimed satisfaction with the visual intervention tool (infographics), the study was aimed at

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finding a cost-effective approach of producing animations for immunology lessons and not necessarily the most effective infographics format that may be the magic wand in achieving similar results.

In teaching complex subjects in science, Hassan (2016) conducted a study for the desired infographics design that would play a supportive role in teaching and learning. He predicts that the creation of an infographic using the *animated format* would be more effective in communicating a complex science subject that involves spatial and temporal data.

Somewhere in the mid of 2017, Lievemaa studied the pros and cons of animated infographics in educational publishing. His *action research* was geared towards the production of three practical animated infographics for e-Oppi Oy, a digital educational publishing company in Finland. One key observation is that Lievemaa's animations on some selected topics for e-Oppi Oy were not tested on learners, thereby creating a gap in ascertaining whether animated infographics alone stand a better chance in enhancing comprehension amongst learners.

In two separate schools in Canada; Queen's and Ryerson University, Matrix and Hodson (2014) reported on two case studies where students from these universities were tasked to produce infographics on various themes. Students posted their work online on Learning Management System (LMS) and public blogs respectively for peer assessment and critique. Their research was subjective to the creation of the information visualization (infographics) proficiency by learners. Their findings revealed that the use of infographics help students to build critical faculties needed to understand complex online communication and commercial systems. Despite this evaluation, the research focused on the creation process and not necessarily the learning outcome. This and many other identified gaps identified in the use of infographics in the circles of academia have informed the need to research on the current infographics format being used in the Visual Art classroom at KNUST SHS as well as discuss its accompanying effects.

METHODOLOGY

This study adopted the case study strategy with interviews as data collection instruments. The study was carried out in the Kumasi Metropolis in the Ashanti region of Ghana. Ghana Education Service (GES) records reveal that among the 89 public Senior High Schools in the Ashanti Region out of which 42 schools offer Visual Art, only 18 are located in the Kumasi Metropolis of which KNUST falls within the bracket of schools that offer Visual Art as a programme of study.

KNUST SHS was conveniently sampled on the premise of proximity and easy accessibility. On the basis of validity and appropriateness, the Visual Art Department became the focal point for the study. The said department had a total population of 160 students and 5 teachers. Out of the 5 teachers, 4 were accessible representing 80% of the total number. The teachers were purposively and conveniently sampled because they match the needed characteristics for the study (Christensen *et al*. 2015).

A pilot test was conducted in order to authenticate the research tool (interview guide), refine and further develop the instrument by examining the degree of observer bias, framing of questions and collection of background data. This enabled the researcher room to restructure

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the questions for easier comprehension and answering by the respondents. All the five ethical considerations proposed by Miles and Huberman (1994) were conscientiously adhered to in order to ensure participants' privacy, confidentiality and anonymity.

PHILOSOPHICAL UNDERPINNINGS AND RESEARCH PARADIGM

The research process has three major dimensions: *ontology*, *epistemology* and *methodology* (TerreBlanche and Durrheim, 1999). Whiles Crotty (1998) explains ontology as the study of being, Scotland (2012) adds that ontological assumptions are mostly hinged on what constitutes *reality*. Epistemology, on the other hand, is associated with the nature and forms of knowledge (Cohen et al., 2007). Epistemological assumptions constitute the creation, acquisition and communication of knowledge. In his view, Creswell (2003) further expanded these philosophical assumptions by adding axiology (the role of values in the research) and rhetoric (the language of research).

Every paradigm finds its grounds on its own ontological and epistemological assumptions (Scotland, 2012). According to Scotland (2012), what accounts for the different assumptions of reality and knowledge underpinning any study is the differences in ontological and epistemological views. These differences, however, reflect on the methodology and methods adapted from that study. Methodological assumptions are concerned with the strategy or plan of actions that informs the choice and use of a particular method (Crotty, 1998). The methodology takes into keen consideration *why*, *what*, *where*, *when* and *how* data is collected and analyzed. How the inquirer goes about finding what is believed is one key feature under *Methodology* as a research paradigm. According to Grix (2004), it is impossible to conduct any form of research without implicitly committing to ontological and epistemological positions.

It is refreshing to state that this study stems from an ontological stance. According to Creswell (2003), as cited in Moustakas (1994), an ontological stance features the presentation of different perspectives from individuals in a study as well as considering evidence of multiple realities from multiple quotes. This study, however, sampled the different views of the respondents (Visual Art Teachers) on the phenomenon understudied (infographics).

In most qualitative studies, four main worldviews are likely to be adopted by the inquirers. These paradigms or worldviews are post-positivism, constructivism, advocacy/participatory, and pragmatism (Creswell, 2003). This study, however, falls within the brackets of advocacy/participatory. The ideology of advocacy/participatory paradigm hinges on an action agenda to effect change in participants' lives, places of work or even in the inquirer's life. Furthermore, it is also concerned with the change in practice and limits the constraints in media, language, work procedures in educational settings (Kemmis and Wilkinson,1998). Juxtaposing this paradigm to the current study, it is obvious that the study sought to examine efficient and effective procedures that involve the delivery of instructional content in the Visual Art classroom.

PRESENTATION AND DISCUSSIONS OF RESULTS

Demographic Characteristics of Respondents (Visual Art Teachers)

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Four male teachers participated in this study. The first teacher **(T1)** has taught in the Visual Art department for a period of 7 years. The second **(T2)** has taught for 13 years, whiles the third **(T3)** and fourth **(T4)** interviewees have taught for 14 and 8 years respectively.

The data gathered from the interview were categorized into analytic codes. These codes were obtained from the qualitative description of responses from the teachers.

After coding the raw data transcribed from the interview, the following themes became prevalent: **teaching and learning materials, perception and inaccessibility.** These themes would form the basis for the discussion of the accrued data from the respondents.

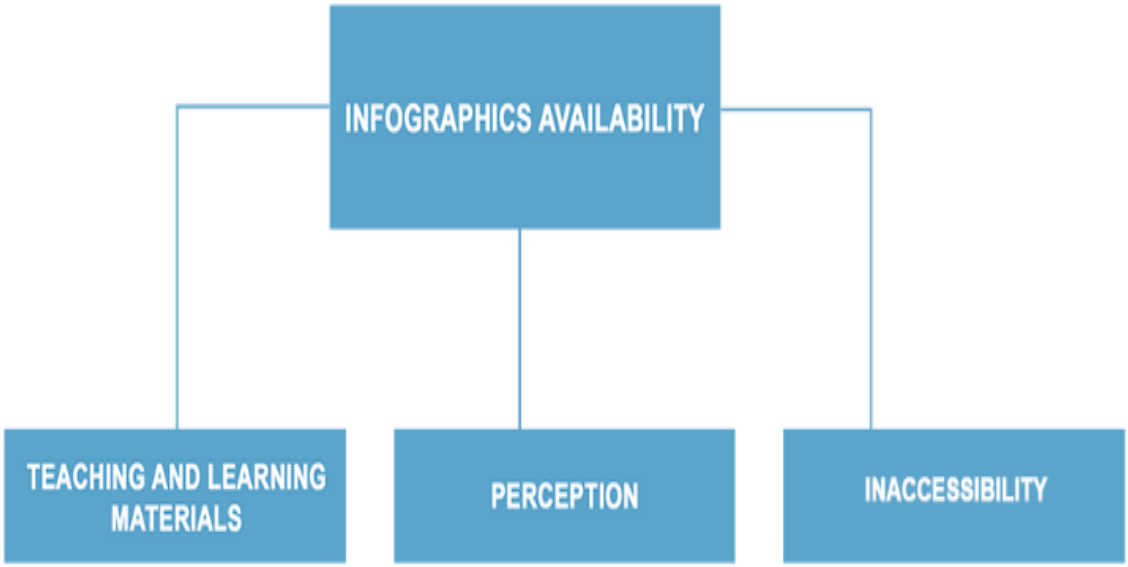

Figure 2: Themes generated from views of the respondents on the availability of infographics

Source: Researchers' construct

INFOGRAPHICS AVAILABILITY

Theme 1: Teaching and Learning materials

Teaching and Learning Materials (TLMs) in this context refers to the instructional materials available for the tuition of Visual Art subjects. Whiles all the teachers would prefer teaching with both text and illustrations, their submissions revealed the absence of animated infographics as a TLM in the Visual Art classroom.

Although several topics in the Visual Art syllabus could better be taught with animated infographics, textbook illustrations were the readily available ones (Opoku-Asare *et al.*, 2014).

- *"…because there are no animations, all static in the book most teachers don't even teach certain topics, so students don't even know that it's part of the syllabus"* (T1 interviewee)

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- *"To get the materials to teach the students is not there so if there is an animated version for them to even watch it will even attract them or encourage them to improve upon their creative skills".* (T2 interviewee)

The statements by (T1 and T2) indicates that the Visual Art classroom lacks animated videos, hence teaching with traditional tools such as textbooks has become the major means through which Visual Art teachers instruct their students. According to Kember (1997), using animations in teaching and learning facilitates Student-Centered Learning (SCL) and the understanding of concepts by learners. In the context of this study, Visual Art students are deprived of the rich experience and advantages that accompany learning with animated videos. Also, if certain areas of the syllabus are left uncovered because of the unavailability of an alternative or supportive instructional aid such as animated infographics then teaching and learning in the Visual Art classroom needs serious attention.

Stemming from literature, Gill (2006) indicates that a technological learning environment rewards learning difficulties. As revealed from the interview, there is no technological environment in the Visual Art classroom of KNUST SHS. Teachers are left to the mercy of conventional instructional aids such as textbooks. T2 and T3 bemoaned the scarce material resource in teaching Visual Arts subjects.

- *"We don't have much teaching aids materials that's why most often we stick to the textbooks"* (T2)

- *"Looking even into Visual Arts subjects themselves, we do have a very big problem. Sometimes the materials are not readily available, as I've already stated, sometimes teachers would have to comb for the material themselves"* (T3).

From the submissions of (**T2, T3**) the unavailability of alternative TLMs is a matter of concern. This implies that teachers would have to improvise to ensure the delivery of instruction and completion of the syllabus. However, such improvisation cannot fully be trusted since certain vital concepts might not be fully attended to.

Although some writers have published a few textbooks and pamphlets to support the teaching and learning of Visual Art, the credibility of these educational materials are questionable. From the interview, it was revealed that the only GES approved textbook for the Visual Arts was written as far back as 1994, hence other Visual Art textbooks on the market cannot be hundred percent trustworthy. T3 brings out this exposé and throws caution to the wind.

- *"Apart from GKA there is no material and I repeat no material for other areas, which has been produced by the government. So teachers have to source for their own information from wherever they can get them and you can't rely on pamphlets".* (T3)

Chepchieng (1995) shares that the availability and quality of textbooks contribute to the relative achievements in senior high schools. In the context of this study, the quality of instruction in the Visual classroom is comprised of teachers who would have to always improvise to ensure the delivery of instruction. This, therefore, calls for the production of alternative teaching and learning material (animated infographics) to augment the available ones. In probing further into the absence of animated infographics in the Visual Art classroom, it was discovered that the

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perception and attitude of the head of the school towards the Visual Art programme contribute to this absence.

Theme 2: Perception

Perception, as a theme in the context of this study, is the way the Visual Art programme is seen, understood and interpreted by senior high schools' administrators. As revealed by DeGraft-Yankson (2010), Evans-Solomon and Opoku-Asare (2011) the general attitude and perception towards Visual Arts education in Ghana is one of greater concern. The teachers interviewed in this study always alluded to greater attention being given to the sciences in terms of teaching and learning materials and any other educational logistics that would ensure the success of the General Science programme. Comments by (T1, T2) reveal this assertion.

- *"Everybody thinks science is driving the world so when they say Science Oh! (Exclaims) they have a science laboratory, they have this, they have that. When it comes to the other areas, we are lacking these things and I think these things are making or giving us lots of problems". (T1 interviewee)*

- "*They give the better one to the Sciences, Look at the nature of the studio let me take you to the science laboratory, and look at the nature of the…. so the perception, right from the top they have neglected us"* (T2)

Despite their willingness to abreast their teaching methodology with other instructional aids such as videos, it appears that the perception and attitude of some heads of second cycle institutions as revealed by DeGraft-Yankson (2010) have played a pivotal role in why the Visual Art programme remains under-resourced with innovative educational technologies.

In a similar study, DeGraft-Yankson (2010) indicated that a comment from one of his interviewees (a headmaster) revealed his unwillingness to support the integration of technology (ICT) and technological tools by Visual Art teachers. The situation is the same as that of KNUST SHS where this study was conducted. What this implies is that the unavailability of animated videos and over-reliance on conventional teaching and learning aids is a result of the zero attention given to the Visual Art programmes by senior high school administrators. So the absence of animated videos has little to do with the Visual Art teachers but an attitudinal problem on the part of school heads towards Visual Art.

There is, therefore, the need to discard the erroneous impression held by some heads of Senior High Schools that aside from General Science other programmes such as the Visual Arts should be relegated to the background. Aside from this erroneous perception, accessibility to facilities that support innovative teaching is one of the reasons why the Visual Art classroom remained technologically bankrupt with animated infographics.

Theme 3: Inaccessibility

In this section of the study, inaccessibility translates into the difficulty in getting resources to aid the instruction of Visual Art subjects. The success in the level of knowledge acquired by learners depends largely on certain parameters. These include the learning objectives and activities, opportunity for critical reflection, availability and accessibility of resources (Pelleth 2010). With much advocacy to integrate Information Communication Technology (ICT) and multimedia tools with their traditional ones by DeGraft-Yankson (2010), the KNUST - Visual

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Art story appears out of the picture. Interestingly, the case school is well-resourced with an ICT lab, nonetheless, access to the facility is only permitted to ICT instructors and ICT lessons. T4 reported that the denial and inability to make judicious use of the computers to facilitate teaching and learning of Visual Art subjects contributes to the absence of teaching with videos (animated infographics).

- *"I will talk about facilities. If you come to this school, for instance, we have the ICT lab. That place is being restricted for ICT lessons alone. If you don't teach ICT you can't go there..."*

As revealed by (T4) the ardent use of only textbooks to teach is a result of restrictive measures put in place that denies Visual Art teachers the opportunity of using facilities that support innovative teaching and learning. According to the Cognitive Theory of Multimedia Learning (CTML), students are said to learn better when auditory narration sync with corresponding diagrams. In this study, these restrictive measures of using the ICT lab limits learning to black and white textbook text and illustrations. This may not augur well for students who are auditory learners.

It is worthy of note that these findings from the individualistic opinions expressed by the interviewed teachers on the non-availability of alternative TLMs such as animated infographics in the Visual Art classroom, buttresses the ontological stance adapted in this study where the nature of reality (infographics) was examined by a conscientious procedure of questioning.

EFFECTIVENESS OF AVAILABLE INFOGRAPHICS FORMAT

Having realized the available infographics used in the Visual Art classroom, it became necessary to consider how effective this format has been in providing instruction to learners. This was in consonance with answering the second research question of the study. Two major themes evolved – difficulty and acceptability.

Figure 3: Themes generated from questions asked on the effectiveness of available infographics format

Source: Researchers' construct

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Theme 1: Difficulty

Contextually, *difficulty* as a theme in this study is the challenging nature of providing instruction to Visual Art students without animated infographics. Although the findings reveal the presence of static infographics in the Visual Art classroom, the success story has been a blurred one. Most of the views expressed by the interviewees (teachers) translate into the difficulty that accompanies teaching without animated illustrations.

The 21st-century student lives in an auditory, visual and kinesthetic world, hence, there is a clarion call by researchers such as Shafipoor *et al.* (*2016*) to augment today's teaching with current instructional methods and media. Nonetheless, the Visual Art classroom lacks alternative instructional media such as animated videos making teaching and learning cumbersome and "abstract" especially in topics where the still illustrations have proved ineffective.

For most of the teachers interviewed, their views portrayed dissatisfaction with the over-reliance on only conventional tools for teaching. According to (T1), static illustrations on topics that involve a stepwise procedure of executing a project or design are hurriedly skipped to the finished stage. This he believes deprives students of grasping some technicalities that are difficult to illustrate. He however alludes to animated infographics as providing the alternative solution of in-depth presentation of facts.

This assertion by T1 embraces the advocacy/participatory paradigm which is concerned with a change in practice and limit the constraints in media, language, work procedures in educational settings (Kemmis and Wilkinson,1998)

- *"Well, the STATIC does not normally depict processes. I believe if it is animated definitely whatever that goes into the production you will see it but the static if the person feels that the next process is even difficult to illustrate, he will jump it and all of a sudden that's the finished work". (T1 interviewee)*

On the other hand, students go through the arduous task of memorizing concepts for the sake of passing an exam without necessary understanding these concepts. In his submission, (T2) explained that most of their teaching is done in "abstract". He attributes this abstract teaching to the unavailability of animated infographics.

- *Over here we are not having it (referring to animation) so it becomes something like an abstract thing that we do. They memorize it and at the end of the day they go and meet any application question because they are not introduced to that aspect it becomes difficult for them". (T2 interviewee)*

Interpreting T2's comments, the researcher would say that the absence of animated infographics has resulted in difficulty in teaching and learning by teachers and students respectively. If the overall objective of the Visual Art programme goes beyond passing an exam but engaging students with the holistic acquisition of skills, then teaching students in abstract defeats this objective of the Curriculum Review and Development Division (CRDD) of Ghana. T4 adds that students even find it difficult in grasping simple concepts due to the absence of motion pictures.

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- *"...Sometimes you have to talk and talk and talk, to explain a little thing but when the pictures are there when these things are in motion, the students can just watch and grasp the concept without you talking sometimes". (T4 interviewee)*

Drawing an inference from T4's statement, the researcher can conclude that so much time is consumed during instructional hours to drum home simple concepts. This he (T4) alludes to making teaching and learning in the Visual Art classroom cumbersome.

- *The educational system as we have it now is having a lot of problems in respect to the teaching of Visual Art subjects in general; I'm not limiting any aspect of it and it makes teaching and learning very difficult. (T4 interviewee)*

Theme 2: Acceptability

Acceptability here means the high rate of expectancy and readiness exhibited by the teachers for an alternative or complementary instructional aid. Having stated their difficulty during instructional hours with the static textbook illustrations, they (teachers) embraced the idea of getting a complementary instructional aid (animated infographics) as suggested by the researcher. "It's not about the teachers not ready to use it because if you want the people who have the technical know-how, we have them better in an area but then the administrative misconception about the course and the department makes it difficult to sometimes reach the target that you want to reach", a comment by one of the art teachers (T4). Comments such as the aforementioned (T4) revealed the readiness to use these animations vis-à-vis the traditional teaching and learning materials. The passion and enthusiasm that was demonstrated by the teachers when the research area was introduced to them were indicative of the fact that they had lived in expectancy for long and had anticipated a change in instructional delivery. This is in line with the advocacy/participatory paradigm, which suggests that instructional delivery would experience a facelift when there is a change in practice and constraints in the use of media in educational settings are limited.

The ICT Policy statement by the Ghanaian government on education shows her commitment to promoting technical and vocational training (ICT4AD Policy, 2003). If indeed the Visual Art programme falls within the brackets of technical and vocational training then there is a need for a comprehensive overview, attention and support to the Visual Art programme by the government by putting in place mechanisms and structures that would support innovative teaching in the Visual Art classroom.

CONCLUSIONS

In this technologically advancing age, the teaching and learning process has become interesting, effective, enjoyable and memorable when teaching and learning materials possess some innovative traits. From an educational stance, the prowess of animation as a pedagogical tool cannot be underestimated especially when aligned with the objectives of the educational curriculum.

Citing from the study, animated infographics appear to be a bridge-builder and an alternative instructional tool that could help in addressing the difficulty faced by Visual Art teachers in explaining both complex and simple concepts to their students. Its potential prowess could

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augment instructional delivery, thereby creating a more creative environment and effecting change in the lives of both instructors and recipients, an assertion that answers to the advocacy/participatory paradigm.

SUMMARY OF FINDINGS

- The only available infographics format available to the Visual Art teachers of KNUST SHS is the static version. Textbook and manila card illustrations fall under this category of infographics.
- The negative perception of some heads of Senior High Schools with KNUST SHS with no exception has contributed to the absence of innovative instructional tools such as animated infographics in the Visual Art classroom.
- Teaching and learning especially practical content is said to be an arduous task. Teachers are left with no option but to improvise.
- Some topics of the Visual Art curriculum that could be best taught with interactive instructional teaching such as animated infographics are deliberately skipped by the teachers because static images only force students to think in abstract.

RECOMMENDATIONS

i. It is important to note that curriculum planners, policymakers and other stakeholders in education should consider liaising with instructional designers to produce animations as supplementary instructional aids alongside traditional teaching and learning materials.

ii. The professional development of teachers in technology usage and pedagogical knowledge should be an ongoing process. Teachers should be abreast with new evolving roles and explore pedagogical options in bringing instructions to their students.

iii. This study could be replicated in separate schools to compare results. Using KNUST SHS as a case study limits generalization of the findings, hence a wider population could be considered.

Suggestion for Future Research

Among other measures, a one-year academic Performance Assessment Procedures (PAP) could be conducted on the effectiveness of incorporating animated infographics in the Visual Art classroom.

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SAMPLE SIZE DETERMINATION IN TEST-RETEST AND CRONBACH ALPHA RELIABILITY ESTIMATES

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ABSTRACT: *The estimation of reliability in any research is a very important thing. For us to achieve the goal of the research, we are usually faced with the issue of when the measurements are repeated, are we sure we will get the same result? Reliability is the extent to which an experiment, test, or any measuring procedure yields the same result on repeated trials. If a measure is perfectly reliable, there is no error in measurement, that is, everything we observe is the true score. However, it is the amount/degree of error that indicates how reliable, a measurement is. The issue of sample size determination has been a major problem for researchers and psychometricians in reliability studies. Existing approaches to determining sample size for psychometric studies have been varied and are not straightforward. This has made the psychometric literature contain a wide range of articles that propose a variety of sample sizes. This paper investigated sample sizes in test-retest and Cronbach alpha reliability estimates. The study was specifically concerned with identifying and analyzing differences in test-retest and Cronbach alpha reliability estimate of an instrument using various sample sizes of 20,30,40,50,100,150,200,300, and 400. Four hundred and eight (408) senior secondary school students from thirty-eight (38) public senior secondary schools in Benin metropolis part took in the study. The Open Hemisphere Brain Dominance Scale, by Eric Jorgenson was used for data collection. Data were analyzed using Pearson Product Moment Correlation Coefficient (r) and Cronbach alpha. The findings revealed that the sample sizes of 20 and 30 were not reliable, but the reliability of the instrument became stronger when the sample size was at least 100. The interval estimate (Fisher's confidence interval) gave a better reliability estimate than the point estimate for all samples. Based on the findings, it was, therefore, recommended that for a high-reliability estimate, at least one hundred (100) subjects should be used. Observed or field-tested values should always be used in the estimation of the reliability of any measuring instrument, and reliability should not be reported as a point estimate, but as an interval.*

KEYWORDS: Reliability, Sample size, Test-retest, Cronbach Alpha

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INTRODUCTION

The estimation of reliability and validity in any research is very important. For us to achieve the goal of the research, we are usually faced with two issues; the first is how do we ascertain that we are indeed measuring what we want to measure?", and "if we repeat the measurement, are we sure we will get the same result?" The first question is related to the issues of validity and the second to reliability. These two concepts are referred to as psychometric properties.

The term reliability in psychological research refers to the consistency of a research study or measuring test (McLeod, 2007). If findings from research can be replicated consistently, they are reliable. Most times obtaining the same results may not be feasible as participants and situations vary. However, if a strong positive correlation exists between the results of the same test, this indicates reliability (Balkin, 2017).

Many definitions abound in the literature of psychometrics of reliability. According to Wilkinson and Robertson (2006) reliability with respect to research means "repeatability" or "consistency". Reliability can also be defined as the degree to which an assessment tool produces stable and consistent results (Meyer, 2010). On his part Mellenbergh, (2011) opined that reliability is the consistency of a test or the degree to which the test gives consistent results. It is also seen as a measure of a test's precision. Reliability is the extent to which an experiment, test, or any measuring procedure yields the same result on repeated trials.

According to National Council on Measurement in Education (NCME; 1999), reliability in statistics and psychometrics is the overall consistency of a measure. A measure is said to have high reliability if it produces similar results under consistent conditions. It is the characteristic of a set of test scores that relates to the amount of random error from the measurement process that might be embedded in the scores. Highly reliable scores are accurate, reproducible, and consistent from one testing occasion to another. That is, if the testing process were repeated with a group of test-takers, essentially the same results would be obtained.

According to the standards written by the American Educational Research Association (AERA), American Psychological Association (APA), and the National Council on Measurement in Education (NCME), 2014), reliability refers to the consistency of measurements when a testing process is repeated for an individual or group of individuals.

Reliability is the extent to which a questionnaire, test, observation or any measurement procedure produces the same results on repeated trials (Bolarinwa, 2015). In short, it is the stability or consistency of scores over time or across raters (Miller, 2015). It is worthy to note that lack of reliability may arise from divergences between observers or instruments of measurement or instability of the attribute being measured (Last, 2015). Nunnally, (cited in Bardhoshi, et al 2016) opined that measurements are reliable to the extent that they are repeatable and that any random influence that tends to make measurements different from occasion to occasion or circumstance to circumstance is a source of measurement error.

According to Kline (2000), reliability, as it applies to test, has two distinct meanings. One refers to stability over time, the second to internal consistency. Reliability is the degree to which a test consistently measures whatever it measures. Reliability is an indicator of consistency, that is, an indicator of how stable a test score or data is across applications or time. A measure should produce similar or the same results consistently if it measures the same "thing."

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(Sawilowsky, 2000). A measure can be reliable without being valid but a measure cannot be valid without being reliable (Erford, 2013).

The correlation coefficient plays an important role in the determination of the degree of reliability. A correlation coefficient of + 1.0 is regarded as a perfect positive relationship, - 1.0 as a perfect negative relationship and that of 0.0 indicates no relationship. The nearer a correlation is to +1.0, the more reliable the results. If a measure is perfectly reliable, there is no error in measurement, that is, everything we observe is a true score. Therefore, for a perfectly reliable measure, the reliability = 1. Now, if we have a perfectly unreliable measure, there is no true score, that is, the measure is entirely in error. In this case, the reliability = 0. The value of a reliability estimate tells us the proportion of variability in the measure attributable to the true score. A reliability of 0.5 means that about half of the variance of the observed score is attributable to truth and half is attributable to error. According to American Educational Research Association (AERA), American Psychological Association (APA), and the National Council on Measurement in Education (NCME) (2014) a reliability of 0.8 means the variability is about 80% true ability and 20% error. All measurement procedures involve error. However, it is the amount/degree of error that indicates how reliable measurement is. When the amount of error is low, the reliability of the measurement is high. Conversely, when the amount of error is large, the reliability of the measurement is low, (Elford, 2013; Meyer, 2010).

It is fundamental to note that reliability refers to the result and not the test itself. The samples from which the reliability coefficient are derived must be representative of the population for whom the test is designed and sufficiently large to be statistically reliable (Leann, & Ken, 2012). According to Kline (2000), reliability of 0.7 is a minimum for a good test. This is simply because the standard error of measurement (which is the estimated standard deviation of scores) of scores increases as the reliability decreases.

In general, there are four broad types of reliability: test-retest reliability, parallel forms reliability, internal consistency of reliability, and inter-rater reliability (Kaplan & Saccuzzo, 2005). In this study, we shall examine stability (test-retest) and internal consistency (Cronbach alpha).

Test-retest Reliability (or Stability)

Test-retest reliability (also called Stability) answers the question, “will the scores be stable over time?” Test-retest reliability refers to the temporal stability of a test from one measurement session to another. The procedure is to administer the test to a group of respondents and then administer the same test to the same respondents at a later date. The correlation between scores on the identical tests given at different times operationally defines its test-retest reliability. Two assumptions underlie the use of the test-retest procedure; (Wells, 2003)

- The first required assumption is that the characteristic that is measured does not change over the time period called 'testing effect' (Engel & Schutt, 2013)
- The second assumption is that the time period is long enough yet short in time that the respondents' memories of taking the test, the first time does not influence their scores at the second time and subsequent test administrations called 'memory effect'.

The estimate of test-retest reliability is also known as the coefficient of stability (Cohen et al, 1996). Test-retest correlation provides an indication of stability over time (Wong, Ong & Kuek,

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2012, Pedisic *et al*, 2014; Deniz, & Alsaffar, 2013). In other words, the scores are consistent from the first administration to the second administration. In using this form of reliability, one needs to be careful with questionnaires or scales that measure variables that are likely to change over a short period of time, such as energy, happiness and anxiety because of the maturation effect (Drost, 2011). For well-developed standardized achievement tests administered reasonably close together, test-retest reliability estimates tend to range between 0.70 and 0.90 (Popham, 2000)

Despite its appeal, the test-retest reliability technique has several limitations (Rosenthal & Rosnow, 1991). For instance, when the interval between the first and second test is too short, respondents might remember what was on the first test and their answers on the second test could be affected by memory. Alternatively, when the interval between the two tests is too long, maturation happens. Kaplan and Saccuzzo (2005) noted that test-retest reliability estimates evaluate the reliability of instrument scores when an instrument is given at multiple and subsequent points in time. Joppe, (2000) detects a problem with the test-retest method which can make the instrument, to a certain degree, unreliable. She explains that the test-retest method may sensitize the respondent to the subject matter, and hence influence the responses given. Similarly, Crocker and Algina (1986) noted that when a respondent answers a set of test items, the score obtained represents only a limited sample of behaviour.

Internal Consistency

Internal consistency reliability answers the question, "How well does each item measure the content or construct under consideration?" The appeal of an internal consistency index of reliability is that it is estimated after only one test administration and, therefore, avoids the problems associated with testing over multiple time periods. (Wong, Ong, & Kuek, 2012). The internal consistency reliability estimate refers to the inter-correlations between items on the same instrument (Kaplan & Saccuzzo, 2005). Cronbach's coefficient alpha is one of the most frequently used ways of estimating internal consistency of reliability (Dimitrov, 2002). The α coefficient is the most widely used procedure for estimating reliability in applied research. As stated by Sijtsma (2009), its popularity is such that Cronbach (1951) has been cited as a reference more frequently than the article on the discovery of the DNA double helix. Nevertheless, its limitations are well known (Yang & Green, 2011), some of the most important being the assumptions of uncorrelated errors, tau-equivalence and normality

Sample size determination in reliability

The issue of sample size determination has been a major problem for researchers and psychometricians in the reliability study. Existing approaches to determining sample size for psychometric studies have been varied and are not straightforward. This has made the psychometric literature to contains a wide range of articles that propose a variety of sample sizes (Donner & Eliasziw 1987; Eliasziw et al, 1994; Cocchetti, (1999); Charter, (1999); Mendoza, Stafford, & Stauffer, (2000); Bonett, 2002). These studies are classified into two broad categories: those based on authors' experiences and those on statistical theory.

In the studies based on judgments from authors' experiences (DeVellis, 1991; Rea,& Parker, 1992; Ferguson, & Cox, 1993), the sample size recommendations vary widely. Other authors advocated and suggested that samples should exceed 300 (Ware, et al,(1997), whereas some posited that much smaller samples as little as 30 subjects (Rea,& Parker, 1992; Bonett &

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Wright, 2014) may suffice. The second category of sample size recommendations includes those studies grounded in statistical theory (Feldt, et al, 1987; Donner & Eliasziw, 1987; Eliasziw, et al, 1994; Bonett, (2002). These differ in approaches for reliability testing (Charter, 1999; Mendoza et al, 2000) and recommendations ranging from n = 25 (Cocchetti, 1999) to 400 for reliability testing (Charter, 1999).

Kline, (2000) advised that researchers should use at least 100 participants per item on our scale if the reliability estimate is to be meaningful. A lot of surprising differences of opinion on sample size determination abound in the literature. Some authors are suggesting that samples as small as thirty (30) (Bonett, & Wright, 2014), can measure the reliability, so long as the scale items have strong inter-correlation. Toe-ing the same line, Nunnally & Bernstein (1994) averred that the minimum criteria for reliability coefficients for Cronbach's Alpha are 0.80; 0.30 for item-total correlations, 0.30 for item-item correlations, and 0.80 for intra-class correlation coefficients. Kline (1986) suggested a minimum sample size of 300, as did Nunnally & Bernstein (1994). Segall (1994) called a sample size of 300 "small". Charter (1999) stated that a minimum sample size of 400 was needed for a sufficiently precise estimate of the population coefficient alpha. Charter (2003) opined that with low sample sizes alpha coefficients can be unstable. Walker and Zhang (2004) suggested a minimum sample size of 125 to 150 for calculating reliability, with at least as many people in the sample as items on the test. However, the minimum sample size for the sample coefficient alpha has been frequently debated due to the difficulty of data collection in psychometric research. Although the determination of the sample size needed for reliability studies is somewhat subjective, a minimum of 400 subjects is recommended.

In reliability studies, various sample sizes are used by different authors and researchers. Furthermore, there is no uniformity in the sample sizes been used. Sample size plays an important role in the estimation of the reliability level of the measurement scale.

Correlations, along with most other statistical indices, have standard errors, indicating how trustworthy the results are. However, it can be said that the larger the number of subjects the smaller the standard error of the statistics (Erford, 2013). This means that it is essential that the reliability estimates are derived from a sample sufficiently large to minimize this statistical error (AERA, APA, & NCME, 2014). In reliability testing, determining the right sample size is oftentimes critical (Erford, 2013; Meyer, 2010). If the sample size used is too small, not much information can be obtained from the test, thereby limiting one's ability to draw meaningful conclusions. On the other hand, if it is too large, information obtained through the test may be beyond what is needed (AERA, APA, & NCME, 2014). Thus, incurring unnecessary costs. But most times, the test developers do not have the luxury to request how many samples are needed but has to create a test plan based on the budget or resource constraints that are in place for the project.

Statement of the Problem

There is a surprising difference of opinion in literature as regards the adequate sample size for establishing the reliability of research instruments. For example, Kline (2000) noted that the standard advice is to use at least 100 participants per item on our scale if the reliability estimate is to be meaningful. On the other hand, Bonnet and Wright (2014) asserted that samples must be as small as thirty (30) to establish reliability so long as the scale items have strong inter-correlation. More so, many researchers use different sample sizes for establishing reliability

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estimates when carrying out research studies. Some use 20, 30, 40, 50 or 100 samples as the case may be. But no scientific research has been carried out to justify the usage of these samples sizes. Also, some researchers use different methods to establish the different types of reliability. For example, some use test-retest for questionnaire instrument as against the popular Cronbach alpha (Vacha-Haase & Thompson 2010).

Although the topic reliability has gained much attention in the literature, investigations into sample size requirements remain scarce. It is, therefore, imperative to examine the test-retest and Cronbach alpha (the most used reliability estimates) of an instrument using various sample sizes.

Research Questions

The following research questions were raised to guide the study.

1. Is there a difference in the test-retest reliability estimate of an instrument using various sample sizes of 20, 30, 40, 50, 100, 150, 200, 300, 400?

2. Is there a difference in the Cronbach alpha reliability estimate of an instrument using various sample sizes of 20, 30, 40, 50, 100, 150, 200, 300, 400?

Relevance of the Study

The findings of the study will help psychometricians, educators and researchers to be aware of the minimum sample size in carrying out reliability studies. This will put to an end the problem of choosing the right sample size for acceptable reliability. It will be an eye-opener to psychometricians and researchers on the method and sample size to use when conducting a reliability study. In the same vein, the findings will help psychometricians and researchers to estimate the proportion of variability in their measurement which is attributable to the true score. That is, it will help them to determine the amount /degree of error which indicates how reliable a measure is. When the amount of error is low, the reliability of the measurement is high and conversely, when the amount of error is large, the reliability of the measure is low.

This study will also be beneficial to researchers and other stakeholders who may be having problems with choosing the appropriate methods of estimating reliability estimates. And this study will help all researchers and other stakeholders to report accurately reliability estimates in any manuscripts (test manuals, conference papers and articles)

Methods

The survey research design was adopted for the study. The population of this study comprised of all the students in public Senior Secondary School in Benin metropolis in Edo state. A total of seventy-five (75) senior secondary schools with a total number of 40,815 students is in the Benin metropolis. The breakdown is as follows: Egor Local government area 12 schools with 8,207 students; Oredo local government area have 13 thirteen senior secondary schools with 12,154 students; Ikpoba Okha local government area have 27 senior secondary schools with 15,456 students and Ovia North East with 23 senior secondary school and 4998 students. The statistics of schools and students were collected from the Ministry of Education, Benin City. A sample size of 408 students from senior secondary schools was selected from thirty-eight (38) senior secondary schools in Benin metropolis. The multistage sampling technique which

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involves various sampling stages was used for selecting the samples. The instrument for data collection was the Open Hemisphere Brain Dominance Scale 1.0 (OHBDS), a personality scale designed by Eric Jorgenson (2015). This was adapted by the researcher. It consists of two sections. Section A was used to elicit information from the student biodata, which includes their sex, and class. Section B consists of a twenty (20) items inventory designed to measure the hypothesized left-brain versus right-brain preference among students with a 4 - point Likert scale. The items are under the options of response: SA = Strongly Agree, A = Agree, D = Disagree, SD = Strongly Disagree. SD will be scored 1 point, D was scored 2 points, A was scored 3 points and SA scored 4 points. The instrument has been validated by Eric Jorgenson but was also validated by experts in Measurement and Evaluation, University of Benin, Benin City. The reliability of the instrument was part of the issues raised in the study.

The reliability coefficient was estimated using the Pearson Product Moment Correlation Coefficient (r) for the instrument that was subjected to test re-test, and Cronbach alpha α, for the instrument that was administered once. The Fisher's 95% confidence interval was used to determine which of the sample sizes give a stable result. The width of the interval for the various sample sizes was determined. The sample size(s) with a shorter interval was adjudged as the most stable and consistent

RESULTS

Table 1: Fisher 95% Confidence Interval of Test Retest Reliability Estimates

Sample size	r	Z_r	σ_z	$\sigma_z(1.96)$	Z_rLB	Z_rUB	ρLB	ρUB	Width
20	0.55	0.618	0.243	0.475	0.143	1.093	0.142	0.798	0.66
30	0.56	0.633	0.192	0.376	0.257	1.009	0.251	0.765	0.51
40	0.75	0.973	0.164	0.321	0.652	1.294	0.573	0.860	0.29
50	0.79	1.071	0.146	0.286	0.785	1.357	0.656	0.876	0.22
100	0.81	1.127	0.102	0.199	0.928	1.326	0.730	0.868	0.14
150	0.85	1.256	0.082	0.161	1.095	1.417	0.799	0.889	0.09
200	0.86	1.293	0.071	0.139	1.154	1.432	0.819	0.892	0.07
300	0.88	1.376	0.058	0.114	1.262	1.490	0.852	0.903	0.05
400	0.88	1.376	0.050	0.098	1.278	1.474	0.856	0.900	0.04

Key: r = Pearson r; Z_r = Fisher Z; σ_z = Standard Error of Fisher Z; Z_rLB = Lower bound of Fisher Z; Z_rUB = Upper Bound of Fisher Z; ρLB = Lower bound of Pearson r; ρUB = Upper Bound of Pearson r

The result in Table 1 showed the Fisher 95% confidence interval of test retest reliability estimates for an instrument using various sample sizes of 20,30, 40,50,100,150,200,300, and 400. It further shows that with a sample size of 20, the r value was 0.55, with a 95% confidence interval of (0.14, 0.80) and a width of 0.66. When the sample was increased to 30 the r value became 0.56 with a 95% confidence interval of (0.25, 0.77) and a width of 0.52. A sample size of 40 gave an r value of 0.75 with a 95% confidence interval of (0.57, 0.86) and a width of 0.29. A sample size of 50 gave an r value of 0.79 with a 95% confidence interval of (0.66,

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0.88) and a width of 0.22. When the size became 100, the value of r became 0.81 with a 95% confidence interval of (0.73, 0.87) and a width of 0.14. A sample size of 150 gave an r value of 0.85 with a 95% confidence interval of (0.80, 0.89) and a width of 0.09. The sample size of 200 gave an r value of 0.86 with a 95% confidence interval of (0.82, 0.89) and a width of 0.07. 300 samples gave an r value of 0.88 with a 95% confidence interval of (0.85, 0.90) and a width of 0.05. A sample size of 400 gave an r value of 0.88 with a 95% confidence interval of (0.86, 0.90) and a width of 0.04. This is presented in figure 1

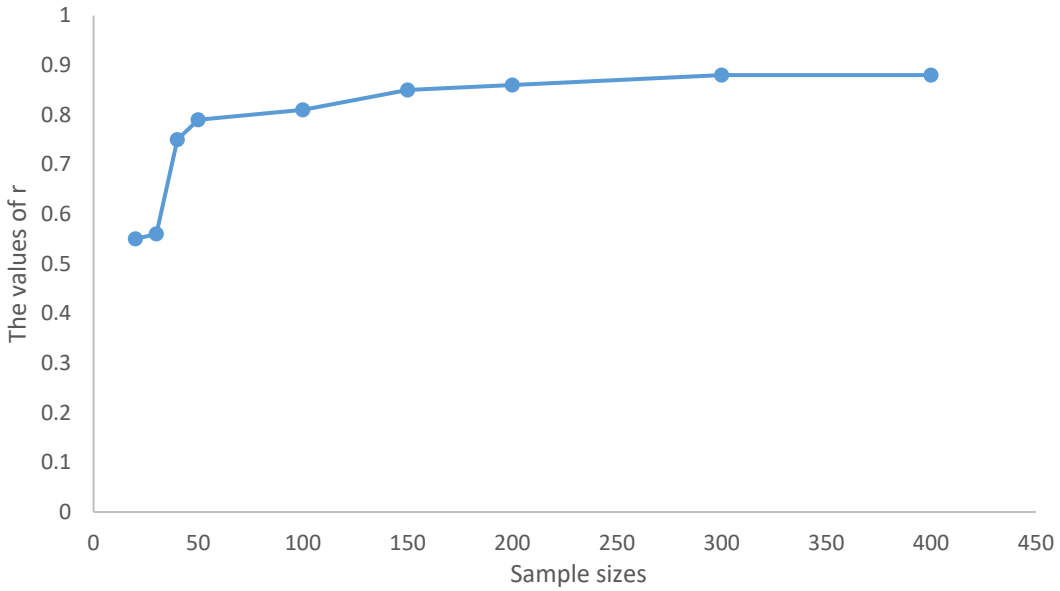

Figure 1: Fisher 95% Confidence Interval of Test – Retest Reliability Estimates

Table 2: Fisher 95% Confidence Interval of Cronbach Alpha Reliability Estimates

Sample sizes	α	Z_α	σ_z	$Z_\alpha(1.96)$	Z_αLB	Z_αUB	ρLB	ρUB	Width
20	0.61	0.709	0.243	0.475	0.234	1.184	0.230	0.829	0.60
30	0.69	0.848	0.192	0.376	0.472	1.224	0.440	0.841	0.40
40	0.78	1.045	0.164	0.321	0.724	1.366	0.619	0.873	0.26
50	0.80	1.099	0.146	0.286	0.813	1.385	0.675	0.885	0.21
100	0.83	1.188	0.102	0.199	0.989	1.387	0.757	0.883	0.10
150	0.84	1.221	0.082	0.161	1.060	1.382	0.786	0.880	0.09
200	0.84	1.221	0.071	0.139	1.082	1.360	0.794	0.876	0.08
300	0.85	1.256	0.058	0.114	1.142	1.370	0.815	0.879	0.06
400	0.87	1.333	0.050	0.098	1.235	1.431	0.844	0.892	0.05

Key: α = Cronbach alpha; Z_α = Fisher Z; σ_z = Standard Error of Fisher Z; Z_αLB = Lower bound of Fisher Z; Z_αUB = Upper Bound of Fisher Z; ρLB = Lower bound of Pearson r; ρUB = Upper Bound of Pearson r

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The result in Table 2 showed the Fisher 95% confidence interval of Cronbach alpha reliability estimates of an instrument using various sample sizes of 20, 30, 40, 50, 100, 150, 200, 300, and 400. It further shows that with a sample size of 20, the α value was 0.61, with a 95% confidence interval of (0.23, 0.83) and a width of 0.60. When the sample was increased to 30 the α value became 0.69 with a 95% confidence interval of (0.44, 0.84) and a width of 0.40. A sample size of 40 gave an α value of 0.78 with a 95% confidence interval of (0.62, 0.87) and a width of 0.26. A sample size of 50 gave an α value of 0.80 with a 95% confidence interval of (0.68, 0.89) and a width of 0.21. When the size became 100, the value of α became 0.83 with a 95% confidence interval of (0.77, 0.89). A sample size of 150 gave an α value of 0.84 with a 95% confidence interval of (0.79, 0.88)and a width of 0.09. The sample size of 200 gave an α value of 0.84 with a 95% confidence interval of (0.80, 0.88) and a width of 0.08. 300 samples gave an α value of 0.85 with a 95% confidence interval of (0.82, 0.88) and a width of 0.06. A sample size of 400 gave an α value of 0.87 with a 95% confidence interval of (0.84, 0.89) and a width of 0.05. This is presented in figure 2

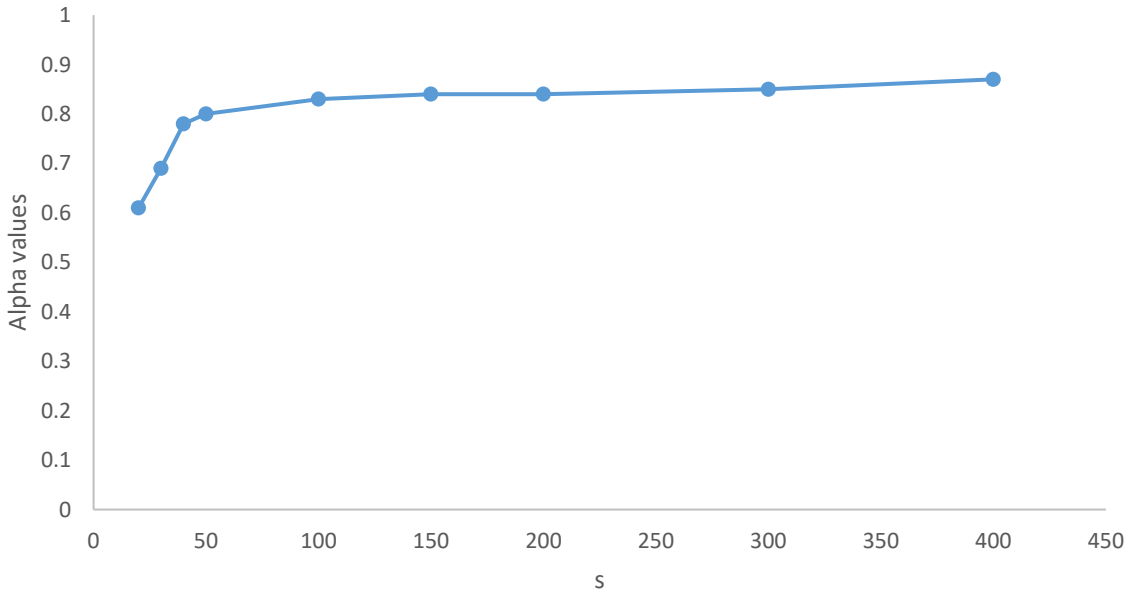

Figure 2: Fisher 95% Confidence Interval of Cronbach Alpha Reliability Estimates

DISCUSSION OF FINDINGS

The study revealed that the sample sizes of 20 and 30 using the test-retest statistics were not reliable. The sample size of 40 and 50, though reliable, the lower bound was outside the acceptable reliability of 0.70 for a test-retest (Kline 2000). The reliability of the instrument became stronger when the sample size was at least 100. This finding is in line with Leann, & Ken, (2012) who affirmed that the samples from which the reliability coefficient are derived must sufficiently be large to be statistically reliable. The finding is also in collaboration with the study of Kline (2000) who noted that the standard advice is to use at least 100 participants per item on our scale if the reliability estimate is to be meaningful. In the same vein, the finding is supported by Ware et al (1997) who asserted that samples should exceed 300. But the finding

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disagreed with Bonnet & Wright (2014) who asserted that samples must be as small as thirty (30) to establish reliability so long as the scale items have strong inter-correlation and Rea, & Parker, (1992) who posited that smaller samples as little as 30 subjects may suffice for test-retest reliability.

The study also revealed that the sample sizes of 20 and 30 using the Cronbach alpha statistics were not reliable. The sample size of 40 and 50, though reliable, the lower bound was outside the 0.80 acceptable reliability coefficients for Cronbach's Alpha (Nunnally & Bernstein (1994). The reliability of the instrument became stronger when the sample size was at least 100. This finding is in line with AERA, APA, & NCME, (2014) and Erford, (2013) who stated that the larger the number of subjects the smaller the standard error of the statistic which means that it is essential that the reliability estimates are derived from a sample sufficiently large to minimize this statistical error. The finding is also in collaboration with the study of Kline (1986) who suggested a minimum sample size of 300, as did Nunnally & Bernstein (1994). Segall (1994) called a sample size of 300 "small". Charter (1999) stated that a minimum sample size of 400 was needed for a sufficiently precise estimate of the population coefficient alpha. Charter (2003) also noted that with low sample sizes alpha coefficients can be unstable. Walker and Zhang (2004) suggested a minimum sample size of 125 to 150 for calculating reliability, with at least as many people in the sample as items on the test. Charter, (1999) suggested a sample size of 400 for reliability testing. But the finding disagreed with Feldt et al, (1987), Donner & Eliasziw (1987), Eliasziw et al, (1994), Bonett, (2002), Charter, (1999), Mendoza et al, (2000) and Cocchetti, (1999) who recommended a sample size ranging from n = 25

The difference in the finding of this study could be as a result of using observed values from the field. Most of the findings in the literature were either from personal experience or statistical theorem. Unfortunately, much of the empirical evidence comes from simulated data. So their recommendations are incomplete because simulated data have important limitations as compared to observed data. They are based on preselected statistical or computer models that can only approximate observed data, have artificially controllable parameters, and are often generated to reflect randomly distributed samples. These limit the inferences that can be drawn from analyzing simulated data and necessitate the collection of observed data to ensure their credibility.

Another revelation from the study is that both the test-retest and Cronbach reliability estimates started converging from the sample size of 100 (see figures 1 and 2). This, therefore, implies that for an acceptable reliability study, at least one hundred subjects should be used.

The result of the study also revealed that the interval estimate gave a better reliability estimate than the point estimate for all the samples. For example, for the test-retest, a sample of 40 gave a reliability index of 0.75 as a point estimate, but the interval estimate gave a reliability estimate of (0.573, 0.860). The lower bound was outside the acceptable reliability index of $\geq = 0.70$. This collaborates with the study of AERA, APA, & NCME, (2014), who advocated reporting reliability estimates as interval estimates against the point estimate previously used.

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CONCLUSION

Based on the finding of this study, the following conclusions emerged. The result demonstrated that a number of differences exist in the sample size determination of a reliability study. The usage of sample sizes of twenty (20) and thirty (30) was not justified. This could be attributed to the fact that other studies that suggested a minimum of 20 and 30 subjects used simulated data as against observed data used in this study.

The larger the number of subjects the smaller the standard error of the statistic. To minimize this statistical error, the reliability estimates must be derived from a sufficiently large sample. The findings of the study have shown that the usage of sample sizes of 20 and 30 for reliability studies is not justifiable. It has also shown that for an acceptable reliability study, the sample size should be at least one hundred (100).

RECOMMENDATIONS

The reliability of any measuring instrument is a task frequently encountered in research. Sample size determination plays a very important role in the estimation of reliability. The higher the sample, the higher the reliability and the lower the error inherent in the instrument. Based on this, the following recommendations were made.

1. Observed or field-tested values should always be used in the estimation of the reliability of any measuring instrument.
2. For a high-reliability estimate, at least one hundred (100) subjects should be used.
3. Reliability should not be reported as a point estimate but as an interval estimate.

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PERSONALITY TRAITS OF SECONDARY SCHOOL GIRLS ASPIRING TO STUDY SCIENCE, TECHNOLOGY, ENGINEERING AND MATHEMATICS (STEM) IN BENIN METROPOLIS OF EDO STATE, NIGERIA

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ABSTRACT: *The study examined some personality traits of secondary school girls aspiring to STEM careers in the Benin metropolis of Edo State in Nigeria. This study is a descriptive survey with a correlational design. The population of the study consisted of senior secondary school girls in sciences selected from federal, state and private schools in Benin metropolis of Edo State, Nigeria. Five hundred (500) female students formed the sample for the study. The data were analyzed using frequency counts, mean, standard deviation and chi-square. The hypotheses were tested using the Analysis of variance (ANOVA) and the multiple regressions. The findings of the study among others were: age and course of interest have a significant influence on girls aspiring to STEM careers; flexibility, self-esteem, enterprising, team spirit, social, and stress tolerance were exhibited by the girls; and that personality trait is a significant predictor of girls aspiring to STEM careers. It was concluded that the personality traits identified affects the single sex and mixed schools in about the same way. This implies that school type does not affect the personality traits of the girls much. Therefore, all secondary school girls have fairly equal chances of excelling in STEM careers. The study therefore recommended among others that: Parents, teachers and all stakeholders in education should be enlightened on participation of girls in STEM. Gender discrimination by employers should be discouraged. Secondary school students especially females should be encouraged to develop STEM competencies and disabuse their minds from the fear of some STEM subjects.*

KEYWORDS: Personality, Traits, STEM,

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INTRODUCTION

The female folks are associated with lots of varieties, creativities, beauties; by this they draw a lot of attention to themselves. The girl child have indeed excelled in different areas of life endeavors; they have distinguished themselves in academics, basically in education and humanities but not so much in Science, Technology, Engineering, and Mathematics (STEM). According to the National Science Foundation (NSF, Science and Engineering Indicators, 2016), women remain underrepresented in the STEM workforce, though with a recent staggering increase in engineering, computer science and physical sciences. But this is not the case with biology, agriculture, social and environmental life science as a reasonable increase of female students are noticeable in this area. STEM covers four specific disciplines – science, technology, engineering and mathematics. Rather than teach the four disciplines as separate and discrete subjects, STEM integrates them into a cohesive learning paradigm based on real-world applications.

According to Midrack (2017), STEM is a global movement in education geared towards increasing students' interest in pursuing higher education and careers in science engineering, computer science and physical science. STEM employs a better model of blended learning and hands- on learning activities, which aims to provide students with the opportunity to experience different ways of learning and problem solving. The generative economic power and social influence of STEM has made the production of a capable science and engineering workforce a priority among business and policy leaders. STEM by principles is meant to be progressive. There has been a relative paradigm shift towards gender equality in STEM. Males have dominated STEM for decades, and for the female to tread in the realm of STEM, they need to brace up, know their abilities and capacities, be in touch with their talents and reach out to break new grounds in STEM fields. Uwaegbulam (2017) perceives STEM as a term utilized to collectively refer to a group of subjects, which has to do with applying logic and theories in innovative and creative ways. The girl child should be given ample opportunities to showcase their abilities and talents, and not restricted to certain roles emulating from traditional, religious and cultural perspectives. Again Uwaegbulam (2017) affirms that before girls attain the point in their life, where they choose to pursue a career in the STEM industry, they must first benefit from the fundamental knowledge acquired during primary and secondary education. Danya (2017) contended that there is no evidence that girls are less capable in STEM rather they often feel incapable partly due to stereotyping form of education in the primary and secondary schools. Danya further asserted that the poor representation of females in STEM may affect female role models for future female students.

According to Atkins (2013), scientific careers are still largely perceived as masculine, and even women who work in the sector believe that engineering is seen as a male career, as it seems more of construction, and heavy machinery. This could be the reason why a large number of females preferred the medical profession to STEM (NGC, 2013), because it is seen as a more caring and nurturing profession (Aspires, 2013). These ideas are working against efforts to achieve gender equality in the sciences. The damaging stereotypes system in the primary and secondary schools have also influenced the subject choice at school, with STEM subjects seen as boys' subjects despite girls' higher attainment in them. Evidence has also shown that female students who are actually doing well in STEM subjects, often feel that the subjects are for the male folks (ASPIRES, 2013). According to Akinsowon and Osisanwo (2014), people have the conception that women in STEM careers are not as good as their male counterparts, except they are extremely and outstandingly good on the jobs. This again puts the female at a cross

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road as her likability tends to diminish because both likability and competence are needed for success in the workplace. They further opined that boys show more interest in sciences than girls, and that the latter are experiencing a sharp decrease in interest in science.

Also Meador (2020) reported that personality traits of an individual have a great impact on the kind of career choice made by that individual. Personality traits are a combination of characteristics that are innate to people as well as characteristics that develop from specific life experiences. The personality traits that make up a person go a long way in determining how successful he/she is. Meador contended that there are certain personality traits that help teachers and students succeed and that success may mean different things to different people. Meador, therefore outlined the following as some of the personalities that help students to succeed in their academic pursuit.

Flexibility: when an individual is able to cope with changes and reflect on situations in a creative way. He or she sees the issue either way**.**

Self esteem: this simply indicates a disposition which a person possesses and which represents his/her judgment of his/her own values.

Enterprising: this personality trait likes to lead and persuade people, but carefully avoid activities that require careful observation and scientific, and analytic thinking.

Team spirit: this type enables that individual to work in one accord with another person. Putting together teams that function well and persistently achieve set goals.

Stress tolerance: a person's ability to provide quick serial answers to continuously challenging issues.

Intuitiveness: This is the ability to understand something without reason simply through instinct. Intuitive students can sense when a friend or a teacher is having a bad day and can try and improve the situation.

Resourcefulness: This is the ability to make the most of what you have available to solve a problem or make it through a situation. Students who have this trait can take the tools they have been given and make the most out of their ability.

Some of these listed personality traits were examined in this study. Also schools around the world are classified based on school ownership (private/ public schools). In Nigeria, public schools are further classified into state government schools and federal government schools. There is also the gender based classification (single sex or gender-segregated schools/co-educational or mixed schools). Independent School Parents (2015) stated that women who were educated at single – sexed schools were compromised at the workplace as their ability to co-operate with men was inhibited and that such girls show less kindness than girls from co-educational schools. Malik (2013), in his study discovered that girls from single – sex school scored higher in personality characteristic "emotional stability". They were less tense/frustrated and were more "socially bold" than those from co-educational schools.

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Meanwhile, STEM education has increased the proficiency of students who pursue a STEM career in advanced studies. This is because STEM occupations remain influential in economic growth and innovation. According to Ndinenchi and Okafor (2016), STEM education in Nigeria will serve as a veritable tool for sustainable national capacity building starting from the elementary to tertiary levels. On his part, Waldren (2017) highlighted the benefit of STEM as follows: helps one stay current; it allows one to be innovative and creative. In spite of these benefits it has been observed that there has been a gap in the male /female workforce in the STEM in many parts of the world including Nigeria due to some identified factors which include lack of genuine interest in engineering by female students, intellectual and physical abilities, parental influence, peer pressure, employers attitude and employment conditions, and government laws, regulations and specific personality type (Matope and Makotose, 2007). This study examined some identified personality traits as it affects secondary school girl aspiration to STEM careers

Rationale for the Study

A lot of studies have shown that women and girls have been sidelined and discouraged both intentionally and unintentionally from the STEM field by teachers, parents, employers and the society at large. This has led to a huge gender gap in some STEM disciplines, such as engineering, mathematics, physics and technological fields. Though lots of studies have been done on the factors influencing female participation in STEM. However, not so much has been done on the personality trait of the female as determinant of female participation in STEM in Benin Metropolis of Edo State Nigeria.

This study highlights some personal characteristics such as age, course of interest as well as some personality traits such as flexibility, self-esteem, enterprising, team spirit, social, stress tolerance, neuroticism and curiosity of secondary school girls aspiring to STEM careers in the Benin metropolis of Edo State. Specifically, the paper seeks to:

1. Find out if age and course of interest influences girls aspiring to STEM careers
2. Examine the personality traits exhibited by girls aspiring to STEM careers
3. Determine if there is a significant difference in personality traits exhibited by girls aspiring to STEM careers based on school ownership
4. Determine if personality traits are good predictors of girls aspiring to STEM careers.

The study will be beneficial to the government, parents and even students as it will reveal the personality types and interest of secondary school girls aspiring to STEM careers. It will also reveal the influence of social background, school type and ownership on secondary school girls aspiring to STEM careers.

Research Questions

1. Does age and course of interest influence girls aspiring to STEM careers?
2. What are the personality traits exhibited by girls aspiring to STEM careers?

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3. Is there a significant difference in personality traits exhibited by girls aspiring to STEM careers based on school ownership?

4. Are personality traits good predictors of girls aspiring to STEM careers?

Research questions 1 and 2 were answered, while 3 and 4 were hypothesized.

Hypotheses

1. There is no significant difference in personality traits exhibited by girls aspiring to STEM careers based on school ownership

2. Personality traits are significant predictors of girls aspiring to STEM careers.

METHODOLOGY

This study is a descriptive survey with a correlational design. The population of the study consisted of senior secondary school girls in sciences selected from federal, state and private schools in Benin metropolis. Benin comprises five local government areas, which are Oredo, Egor, Ikpoba-Okha, Ovia North-East and Uhunmwonde local government areas. Five hundred (500) female students formed the sample for the study. The population was stratified into Federal, State and private owned schools. This was further stratified into private mixed schools, state mixed schools, private girls and state girls' schools. The simple random sampling (using random numbers) was used to select the females from the sample schools. 55 respondents were selected from the private mixed schools, 126 from the state owned schools, 74 from private girls schools, 113 from state girls schools and 132 from Federal girls schools.

The instrument for the study was a structured questionnaire consisting of two parts: section A consisted of the social demographic data of the respondents such as age, class, STEM courses of interest, academic qualification of parents, etc. Section B consists of 56 items using a four point Likert scale of strongly agree, agree, disagree and strongly disagree. The face and content validity were employed by three experts in the field of science and engineering to validate the instrument. The Cronbach reliability statistics was used to ascertain the reliability of the instrument. It gave a reliability index of 0.87.

The data were analyzed using frequency counts, mean, standard deviation and chi-square for the research questions. A mean criterion value of 2.50 which is the arithmetic mean of the weights assigned to the four point Likert scale was used as acceptance. The hypotheses were tested using the Analysis of variance (ANOVA) and the multiple regression. All the hypotheses were tested at 0.05 level of significance.

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RESULTS

Research question 1: Does age and course of interest influence girls aspiring to STEM careers?

Table 1: Influence of age and course of study on girls aspiring to STEM careers

Personal Characteristics	Responses				χ^2	p-value
Age	**Strongly Agree**	**Agree**	**Disagree**	**Strongly disagree**		
< 15 years	70 (35.5)	70(35.5)	30(15.2)	27(13.7)	14.217	0.027*
15 – 18 years	90(31.7)	113(39.8)	42(14.8)	39(13.7)		
>18 years	02(10.5)	07(36.8)	02(10.5)	08(42.1)		
Total	162(32.4)	190(38.0)	74(14.8)	74(14.8)		
Course of interest						
Biological /environmental sciences	220(41.6)	267(50.5)	18(3.4)	2(5.9)	44.208	0.000*
Physical sciences	07(20.6)	17(50.0)	08(23.5)	02(5.9)		
Engineering	03(18.8)	10(62.5)	02(12.5)	01(6.2)		
Mathematics	00(0.0)	08(72.7)	01(9.1)	02(18.2)		
Total	230(39.0)	302(51.2)	29(4.9)	29(4.9)		

**Significant*

Table 1 shows that the majority of the respondents sampled were between 15 and 18 years of age. It further revealed that 32.4%, 38.0%, 14.4% of those sampled strongly agree, agree, disagree and strongly disagree that age had influence on girls aspiring to STEM careers. The chi-square value of 14.217 and p value of 0.027 indicated that age of girls has a significant influence on their aspiring to STEM careers. Another revelation from table 1 is that, the major course of interest of girls aspiring to STEM careers is biological/environmental sciences. The chi-square value of 44.208 and p value of 0.000 indicated that the course of interest of girls has a significant influence on girls aspiring to STEM careers.

Research question 2: What are the personality traits exhibited by girls aspiring to STEM careers?

Table 2: Descriptive statistics of the personality traits exhibited by girls aspiring to STEM careers

Personality traits	Mean	Standard deviation	Ranking
Flexibility	2.79	0.48	5
Self-esteem	3.32	0.10	1
Enterprising	2.80	0.36	4
Team spirit	3.00	0.32	2
Social	2.54	0.50	7
Stress tolerance	2.68	0.45	6
Neuroticism	2.38	0.58	8
Curiosity	2.86	0.10	3

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Table 2 revealed that personality traits exhibited by girls aspiring to STEM careers are flexibility, self-esteem, enterprising, team spirit, social, stress and tolerance. However, neuroticism was not exhibited by them. Self-esteem was the most highly exhibited trait while sociality was the least.

Hypothesis 1: There is no significant difference in personality traits exhibited by girls aspiring to STEM careers based on school ownership

Table 3: Mean and standard deviation of personality traits exhibited by girls aspiring to STEM careers based on school ownership

Schools	N	Mean	Std. Deviation
Federal girls school	132	141.76	17.215
State girls school	113	143.51	15.110
Private girls school	74	146.94	16.883
State girls mixed school	126	147.82	16.781
Private girls mixed school	55	139.27	16.552
Total	245	143.64	16.516

Table 3 shows the mean and standard deviation of personality traits exhibited by girls aspiring to STEM careers as 141.76 and 17.22; 143 and 15.11; 146.94 and 16.88; 147.82 and 16.78 and 139.27 and 16.52 for Federal girls school, State girls school, Private girls school, State girls mixed school and Private girls mixed school.

Table 4: Analysis of Variance (ANOVA) of the personality traits exhibited by girls aspiring to STEM careers based on school ownership

	Sum of Squares	df	Mean Square	F	Sig.	Remark
Between Groups	1920.140	4	480.035	1.782	.133	Not significant
Within Groups	64636.252	240	269.318			
Total	66556.392	244				

Table 4 shows an F value of 1.782 and a p value of 0.113, this indicates that there is no significant difference in personality traits exhibited by girls aspiring to STEM careers based on school ownership ($p > 0.05$).

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Hypothesis 2: Personality traits is not significant predictor of girls aspiring to STEM careers

Table 5: ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.	Remark
1	Regression	2898.180	8	362.273	48.697	.000	Significant
	Residual	1718.470	231	7.439			
	Total	4616.650	239				

$R = 0.792$; $R^2 = 0.628$; Adjusted $R^2 = 0.615$

Table 5 shows an F value of 48.70 and a p value of 0.000. This implies that personality traits are a significant predictor of girls aspiring to STEM careers. The $R^2 = 0.628$ implies that personality traits accounted for about 62.8% of girls aspiring to STEM careers.

Table 6 shows the Beta and p values as: 0.207 and 0.000; 0.302 and 0.000; -0.221and 0.000; 2.621 and 0.009; and 0.698 and 0.000 for flexibility, self-esteem, enterprising, team spirit, and curiosity. This implies that flexibility, self-esteem, enterprising, team spirit, and curiosity significantly impact on girls aspiring to STEM careers. However, social, stress tolerance and neuroticism did not impact significantly on girls aspiring to STEM careers ($p>0.05$).

The R-partial and part gives us a glimpse of the relative importance of the predictors. Flexibility provided significant part and partial correction (R – part = 0.149; R – partial = 0.237; $p< 0.000$). Self-esteem provided a significant part and partial correction (R – part = 0.195; R – partial = 0.304; $p< 0.000$). Enterprising provided significant part and partial correction (R – part = -0.206; R – partial = -0.320; $p< 0.000$). Team spirit provided significant part and partial correction (R – part = 0.105; R – partial = 0.170; $p< 0.009$). Curiosity provided significant part and partial correction (R – part = 0.618; R – partial = -0.712; $p< 0.000$). However, social media did not provide any significant part and partial correlation as the probability for R – part and R – partial is $p> 0.545$. Also, stress tolerance did not provide any significant part and partial correlation as the probability for R – part and R – partial is $p> 0.769$. And neuroticism did not provide any significant part and partial correlation as the probability for R – part and R – partial is $p> 0.504$.

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Table 6: Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlation			Collinearity statistics	
	B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
(Constant)	2.494	1.875		1.330	0.185					
Flexibility	0.235	0.064	0.207	3.704	0.000	0.331	0.237	0.149	0.516	1.937
Self-esteem	0.260	0.054	0.302	4.849	0.000	0.304	0.304	0.195	0.417	2.400
Enterprise	-0.214	0.042	-0.221	-5.126	0.000	-0.103	-0.320	-0.206	0.868	1.152
Team spirit	0.117	0.044	0.135	2.621	0.009	0.302	0.170	0.105	0.611	1.638
Social	-0.025	0.041	-0.025	-0.607	0.545	0.123	-0.040	-0.024	0.914	1.094
Stress tolerance	0.022	0.074	0.018	0.294	0.769	0.073	0.019	0.012	0.429	2.333
Neuroticism	-0.047	0.070	-0.039	-0.669	0.504	0.101	-0.044	-0.027	0.472	2.117
Curiosity	0.264	0.063	0.698	5.394	0.000	0.587	0.712	0.618	0.784	1.276

DISCUSSION

The study reveals that age and course of interest have a significant influence on girls aspiring to STEM careers. Also, those between 15 and 18 years of age aspire more to STEM than other age levels. This is in collaboration with Archer (2013), who opined that ASPIRES survey of 10- 13 years old found that 80% agreed with the statement "scientists are brains". Also Atkins (2013) asserted that potential students were being put off by the idea that engineering is "too difficult". In the same vein, Atkins (2013), stated that scientific careers are still largely perceived as masculine, and women who work in the sector believe that engineering is seen as a male career, associated with cars, construction, and heavy machinery. The study also revealed that girls who aspire to STEM careers, preferred courses in biological/ environmental sciences to other courses. This is in tandem with NGC (2013) who observed that a far greater number of women have entered the medical profession in the past four decades, to the point where women now outnumber men at medical school. And ASPIRES (2013) contended that though medicine requires science A- levels, medicine is perceived as a normal or desirable choice for women, because it is seen as a caring or nurturing profession consistent with prevailing attitudes about women. This has made more girls tend towards biological/environmental sciences.

With regards to the personality traits exhibited by girls aspiring to STEM, the study revealed that flexibility, self-esteem, enterprising, team spirit, social, and stress tolerance were exhibited by them. However, neuroticism was not exhibited. Self-esteem was the most highly exhibited trait while sociality was the least. This is in tandem with Meador (2020) who stated that personality traits are a combination of characteristics that are innate to people as well as characteristics that develop from specific life experiences. Also, Fairley (2015) Stress tolerance - the ability to feel (or appear) comfortable in a high pressure environment is one key personality trait of high performing women.

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The study also revealed that there is no significant difference in the exhibition of personality traits by girls aspiring to STEM careers based on ownership of school. The study however, disagreed with Malik (2013), who asserted that girls from single – sexed schools scored higher in personality characteristic "emotional stability". They were less tense/frustrated and were more "socially bold" than those from co-educational schools. Also, Independent School Parents (2015) stated that women who were educated at single – sexed schools were compromised at the workplace as their ability to co-operate with men was inhibited and that such girls show less kindness than girls from co-educational schools.

The study further revealed that personality traits (flexibility, self-esteem, enterprising, team spirit, social, stress tolerance, neuroticism and curiosity) is a significant predictor of girls aspiring to STEM careers. flexibility, self-esteem, enterprising, team spirit, and curiosity significantly had an impact on girls aspiring to STEM careers. However, social, stress tolerance and neuroticism did not impact significantly on girls aspiring to STEM.

CONCLUSION

The study revealed that the personality identified affects the single sex and mixed schools in about the same way. This implies that school type does not affect the personality traits of the girls much. Therefore, all secondary school girls have fairly equal chances of excelling in STEM careers. Hence if these characteristics are understood by girls they can pick up interest, pursue and remain in the STEM path.

RECOMMENDATION

Based on the findings of the study, it was recommended that:

1. Parents, teachers and all stakeholders in education should be enlightened on participation of girls in STEM.
2. Students should be properly enlightened on STEM careers and the careers pathway.
3. Gender discrimination by employers should be discouraged
4. Secondary school students especially females should be encouraged to develop STEM competencies and disabuse their minds from the fear of some STEM subjects.

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PUBLIC JUNIOR SECONDARY SCHOOL TEACHERS' PERCEPTION AND APPLICATION OF SCHOOL-BASED ASSESSMENT IN IKPOBA-OKHA LOCAL GOVERNMENT AREA, EDO STATE

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ABSTRACT: *One of the most important and significant developments in the Nigerian educational system was the introduction of school-based Assessment (SBA). School-based assessment is an effective classroom assessment which requires skills and practices as students react to achieve their immediate objectives. Although school-based assessment is relevant and important to both the teachers and the learners, it is still being undermined especially by the teachers. This study, therefore, examined the relevance of schools Based assessment as well as the relevance of using school assessment as a strategy for the evaluation of teaching and learning. Three research questions were raised to guide the study. The study adopted the descriptive survey research design. The population comprised the teachers in the 24 public junior secondary schools in Ikpoba - Okha Local Government area of Edo State. The simple random sampling method was used to select the sample. Sixty questionnaires were administered and the entire questionnaires were returned and analyzed using mean and standard deviation. The results revealed that teachers do apply various assessment techniques in teaching any subjects, the practice of school-based assessment enhances an effective evaluation of learning outcomes by teachers after teaching, and that teachers use varieties of evaluation instruments in the assessment of students Based on the findings, it was recommended that teachers should apply various assessment techniques in teaching of any subjects; school authorities should make it compulsory that all schools must be involved in school-based assessment; teachers should be encouraged to employ varieties of evaluation instruments in the assessments of students and assessment technique employed by teachers should be such that the students can easily cope with and that will not be too rigorous for them so as not lead to their discouragement.*

KEYWORDS: Assessment, school-based assessment, techniques, evaluation, instruments

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INTRODUCTION

One of the most important and significant developments in the Nigerian educational system was the introduction of school-based Assessment (SBA). In Nigeria, educational planners and administrators are now more conscious than ever before of their role in the nationwide scheme of curriculum innovation. Not only have new courses been introduced and new contents injected into existing subjects, a fundamental change in the system of assessment of students' performance has also emerged through the formalization of School-based Assessment as a major component of the evaluation process (Idowu & Esere, 2009).

School-based assessment is an effective classroom assessment which requires skills and practices as students react to achieve their immediate objectives, it is the basic need of the teacher to improve the standard of learning because they have greater responsibility to design quality assessment that aligns with the students learning outcome (Mkpae & Obowu, 2017). Teachers have the opportunity to continuously monitor their students and give constructive feedback to improve students' learning abilities. Based on the assessment outcomes, the teacher can make further decisions whether to continue on the topic or move on to a new topic, give necessary help or send more academically challenged students to remedial classes (Brown, 2001).

By implication, every teacher from primary to secondary level of education should understand and practice School-based Assessment (SBA). The emphasis on school- based assessment is not limited to Nigeria alone; other African countries notably Kenya, Zambia, Ghana, and Liberia have observed that the existing practice (in most institutions of learning) of basing the assessment of students' work on final examination and one-short examination only is no longer tenable. The policy further points out that the first school leaving certificate will ultimately be abolished and primary school leaving certificate will be issued by the headmaster of an individual school and will be based on continuous overall guidance-oriented assessment of students and not based on the results of a single final examination. This policy got entrenched in the earlier versions of the NPE (1981,1983, 1994, and 2004 Eds.). The assessment of learners' progress and achievement academically is an important task for teachers in school. It is an instrument for progressive evaluation of the changes in the behaviour of individual learners and for determining the learner's level of achievement in a particular subject (Ehiametalor,1990); presented to them from time to time, rather than wait till the end of the term or academic year.

School-based assessment has been variously labelled. It is also seen as continuous assessment, course work assessment or internal assessment. According to Vitello and Williamson (2017), an assessment is defined as internal when at least one of the processes of setting, administering and scoring a test are controlled by the student's learning institution. In a school setting, the first form of internal assessment to be introduced is the course work. The course work is to facilitate the assessment of positive achievement (Tatersall et al in Barrance, 2019) and also to test skills which could not be assessed with examination (Elwood, 1999). Bullock, Bishop, Martin and Reid (2002) believed that school-based assessment will also help to engender learning benefits, by enhancing communication skills and encouraging students to take responsibility for their own learning.

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Assessment has been described in several ways by different scholars. Assessment, according to Okoro in Ifeanyieze and Aneke (2013) means an evaluation that uses collected data to estimate the quality of a programme. Ukwujie, cited in Ukwujie and Okpara (2013), opined that when assessment is applied to education, it is an all-embracing term covering the situation in which some aspects of pupil's education are measured by the teacher and the success of their instructional practices. It is the process of identifying, gathering and interpreting information about students' learning achievement. Nitko, cited in Onuka & Adesina (2007), defined assessment as a process of obtaining information that is used for making decisions about students, curriculum, programmes, and educational policies. All the activities which teachers use to help students learn and judge their progress is known as assessment. Assessment of learning occurs at the end of a class, topic or academic year (Earl, 2003). The term assessment in its widest meaning denotes a process of collecting and interpreting information about learning and achievement of students which are used to provide information to students and parents about the progress made in acquiring knowledge, skills and attitudes. It also provides support to teachers to modify their instructions and learning activities of their students.

Osunde and Ethe (2007) defined school-based assessment as an assessment practice that broadens and expands the form, mode, means and scope of assessment in the school in order to facilitate and enhance learning. According to Ahmed and Williams' (1994), school- based assessment contains the following features: a wide range of assessment tasks and skills assessed, flexibility in assessment form (written or oral), and the use of open- ended questions. From these descriptions, it can be seen that views about school-based assessment are different, probably due to the different purposes that school-based assessment is used for in different educational settings. In school-based assessment (SBA), assessment for both formative and summative purposes is integrated into the teaching and learning process with teachers involved at all stages of the assessment cycle, from planning the assessment program, to identifying and/or developing appropriate assessment tasks right through to making the final judgements.

Ukwujie and Opara (2013) defined school-based assessment as a comprehensive, systematic, continuous, diagnostic, and integrative teacher directed assessment procedure. School-based assessment is an assessment procedure for a more responsive and valid assessment of learning. It is part of the teaching process requiring increase in personal contact with and observation of learners. It is a way of obtaining information about learning progress (Obioma, Junaidu, & Ajagun 2013). School-based assessment is a monitoring device which feedback the information collected to teachers to adjust their teaching and improve students' learning skills. It's process contains important features with a wide range of assessment tasks and skills assessed, flexible with open ended questions (Ahmed & William, 1994). These descriptions indicate that school-based assessment is quite different based on its purpose in the educational system.

School-based Assessment is a means whereby the teacher obtains information about knowledge gains, behavioural changes and other aspects of the development of learners. It involves the deliberate effort of the instructional process as well as the overall effort of school learning on the behaviour of students. Assessment covers all aspects of school experience both within and outside the classroom. It covers the cognitive as well as the affective and psychomotor aspects of learning.

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All through school-based assessment, all students must be appraised based on their natural understanding, ability and readiness. According to Davidson (2007), teachers are encouraged to use various methods such as quiz, question and answer sessions, short writing, drama, and role play to assess students' learning outcomes.

In Nigeria, continuous assessment or internal assessment has been included as part of the requirement for any certificate examination in Nigeria. It was introduced to compliment the scores of prospective students for the award of certificates. It is a term which emerged from a change in the conception of assessment as a tool for only identifying students for further education, training and employment, to one geared towards enhancing knowledge. It involves a combination of centralized and school-based assessment. This change of interest is consequent on education not yielding the desired results; products of schools were certified but lacked the wherewithal enhancement of learning for the individual. The introduction of school-based assessment should engender a positive attitude and not a laissez-faire behaviour. School-based assessment was given great impetus by the National Policy on Education (2004) when it was indicated that it will constitute a part of all examinations.

According to Ughamadu (1991), western education came into Nigeria Policy on Education with twin assessment methods in the form of internal and external examinations. Internal examination includes all tests that are conducted from time to time in schools. These tests were conducted firmly at the end of the school year and were used continually for the promotion of students from one class to another or from one level to another. Also, the internal system of assessment is to prepare the student for external examination purposes. External examinations, on the other hand, are those conducted by external bodies and agencies that had no hand in teaching the students. These bodies include the Ministry of Education, West African Examination Council (WAEC), National Examination Council (NECO), National Business and Technical Board (NABTEB) and Joint Admission and Matriculation Board (JAMB). The old system was found to be full of weakness because it concentrated on one aspect of human development which is cognitive domains.

The interest of school-based assessment is a shift from teaching for examination to teaching for acquisition of knowledge and understanding. It is expected to expand the form, the mode and the scope of the assessment in schools to facilitate and enhance learning (Osunde 2008). The implementation calls for the utilization of assignments, projects, practical work, group work, and the conventional assessment techniques, otherwise called authentic techniques. Unfortunately, the implementation has been described as a caricature (Afemikhe 1989, 1990, &2000) because of the shoddy nature in which it has been implemented in Nigeria.

There are a good number of characteristics which distinguish school-based assessment from other forms of assessment. For instance, school-based assessment requires teachers to plan assessment programmes, identify appropriate assessment tests for students and be involved in making judgments. School-based assessment allows for the collection of samples of a student's performance over a period of time. It can also be adopted and modified to match the teaching and learning of a particular class and the students assessed, (Mkpae, &Obowu, 2017).

Other characteristics of School-based Assessment is that it is comprehensive in nature. School-based assessment is also systematic, as well as cumulative and guidance oriented.

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Teachers Perception of School-Based Assessment

In many educational systems around the world, assessment is used for summative, accountability, and evaluation purposes, and it plays an important and indispensable role to cater for the diverse and often competing demands of the various stakeholders and users of assessment information. For example, selecting the best students for the next level of education, monitoring school performance, or allocating limited resources to students (Pongi , 2004).

It has been argued that testing only motivates teachers and students to work towards performance goals rather than learning goals (Adediwura, 2012). Greater value has been placed on testing since the inception of formal education based on the fact that tests are the basic reporting mechanism for the yearly progress of the children. Before the introduction of school-based assessment, the testing of students through a single examination administered at the end of the year had been regular practice throughout our educational system (Mkpae,& Obowu, 2017). According to Yusufu (1994), school-based assessment provides a cumulative teacher's judgment about the performance of an individual student's work based on a collection of grades. The performance of students in recent times have been on the decline, this has brought about the initiation of school-based assessment. Teachers now see the importance of school-based assessment as it helps them to measure the extent to which the subject taught has been comprehended and plan the next step of teaching and learning.

With school-based assessment, significant changes in teachers' perception of teaching and the role they play have been identified. Teachers have started to see teaching as a facilitator of student's learning rather than merely completing the curriculum (Black, 2003). In other development, the perception of teachers on students as having a fixed level of ability have also started to change as they begin to observe that their students are able to own up their works and are free to take more responsibility for their learning and become more independent learners and enjoy the freedom they have in the assessment process (Adediwura, 2012). When students become more independent learners, skills are developed in extreme recognition with reliable confidence in learning outcomes. Therefore, this study examined the perception and application of school based assessment by public junior secondary school teachers in Ikpoba-Okha local government area, Edo state.

Statement of the problem

School-based assessment is relevant and important to both the teachers and the learners but it is still being undermined especially by the teachers. According to Yussufu (1994), school-based assessment provides a cumulative teacher judgment about the performance of an individual student's work based on a systematic collection of grades. The performance of students in recent times have been on the decline, this has brought about the initiation of school-based assessment. Teachers now see the importance of school-based assessment as it helps them to measure the extent to which the subject taught has been comprehended and plan the next step of teaching and learning. With school-based assessment, significant changes in teachers' perception of teaching and the role they play have been identified. Teachers have started to see teaching as a facilitator of students' learning rather than merely completing the curriculum (Black, 2003). In other development, the perception of teachers on students as having a fixed level of ability have also started to change as they begin to observe that their students are able to own up their works and are free to take more responsibility for their

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learning and become more independent learners and enjoy the freedom they have in the assessment process Adediwura (2012). When students become more independent learners, skills are developed in extreme recognition with reliable confidence in learning outcomes. The goal of the teaching-learning activity is to bring about a desirable change or changes in the learners' behaviour. Teachers still fall short in the use of school-based assessment which was carried out at the end of each session still seems valid whereas it is not relevant anymore.

It is on ground that the researcher is carrying out this research to critically investigate the relevance of using school-based assessment as a major strategy for the evaluation of teaching and learning outcomes amongst students.

Research Questions

i. What is the perception of public junior secondary school teachers in Ikpoba-Okha Local Government Area of school-based assessment?

ii. To what extent do teachers apply school-based assessment techniques in teaching subjects?

iii. Do demographic variables of sex, location, experience, age and qualification of teachers predict usage of school-based assessment?

METHODS

The design of the study is a descriptive survey. The population of the study consisted of teachers in the 27 public junior secondary schools in Ikpoba Okha Local Government Area of Edo State. All the teachers in the 150 schools which were 150 were used. A structure questionnaire was used for the study. It has two sections. Section A elicited demographic information of the respondents which includes, sex, age, educational qualification, location of school and years of experience. Section B consisted of 20 items which elicited information that bothers on perception of SBA, and techniques adopted. The face and content validity were used to validate the instrument. This was done by three experts in measurement and evaluation. The reliability of this study was ascertained using the Cronbach Alpha statistics. It gave a reliability index of 0.88. The data collected were analyzed using frequency count, mean and standard deviation. A mean criterion value of 2.50 which was the arithmetic mean of the weight assigned to the 4-point Likert scale was used to make a decision on the items. A mean score of 2.50 and above indicated acceptance, while below 2.50 was regarded as rejection. Also, an interpretative norm of 25.00 which was the mean of the items in the cluster multiplied by the criterion mean, was used to make a decision on the level of perception and application of school-based assessment. A mean score of 25.00 and above indicated high level, while below 25.00 was regarded as low. Ordinal logistic regression was used to answer question three. The choice of ordinal logistic regression was the fact that four of the demographic variables were nominal, (sex, qualification, years of experience and school location), while age was a continuous variable, and the dependent variable perception of teachers was ordinal.

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RESULTS

Table 1: Mean ratings of the teachers' perception of school-based assessment in Ikpoba-Okha local government area

Items	Mean	Standard deviation	Remarks
School - based assessment is systematic	4.18	0.93	Agree
School based assessment is cumulative	4.26	0.94	Agree
School based assessment is guidance oriented	4.17	0.97	Agree
School based assessment is used once a term for examination	2.93	1.05	Disagree
Secondary teachers use school-based assessment always	4.05	0.98	Agree
School-based assessment enhances students' performance	3.96	0.99	Agree
School-based assessment develops cognitive abilities	4.23	0.99	Agree
School-based assessment is meant to enhance psychomotor skills	3.54	1.40	Agree
School-based assessment promotes examination malpractice	2.87	1.15	Disagree
School-based assessment provides spurious results	2.67	1.22	Disagree
Cluster	**30.69**	**5.25**	

Table 1 shows that the teachers agree that school - based assessment is systematic, cumulative, and guidance oriented. They also believed that school-based assessment is used always, as it enhances students' performance, develops cognitive abilities and is meant to enhance psychomotor skills. However, they disagree that school-based assessment is used once a term for examination, promotes examination malpractice and provides spurious results. The cluster mean of 30.69 and standard deviation of 5.25 implied that the public junior secondary school teachers in Ikpoba – Okha local government area have a good perception of school-based assessment.

Table 2: Frequency of teachers use of variety of instruments in the assessment of students

Items	Mean	Standard deviation	Remarks
Testing	4.07	0.98	Frequently
Observation	3.38	1.16	Sometimes
Interviews	3.11	1.46	Sometimes
Socio metric techniques	2.48	1,23	Rarely
Rating scale	3.33	1.34	Sometimes
Projects	3.26	1.38	Sometimes
Anecdotal records	2.14	1.34	Rarely
Checklists	2.07	1.98	Rarely
Personality inventories	2.29	1.01	Rarely
Attitude scales	2.42	1.16	Rarely
Cluster	**20.86**	**3.28**	

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Table 2 shows the teachers' use of a variety of assessment tools in the assessment of students. It further shows that the teachers frequently use tests as assessment techniques. They sometimes use observation, interviews, rating scales, and projects, as assessment techniques. However, the teachers rarely use socio metric techniques, anecdotal records, checklists, personality inventories and attitude scales in the assessment of students. The cluster mean of 20.86 and standard deviation of 3.28 implied that the application of school-based assessment was to a low extent.

Table 3: Demographic variables as predictors of teachers' knowledge and application of school base assessment

		N	Marginal Percentage
Knowledge	Undecided	1	0.7
	Strongly disagree	7	4.7
	Disagree	8	5.4
	Agree	71	47.2
	Strongly agree	63	42.0
Sex	Male	44	29.3
	Female	106	70.7
Location	Urban	17	11.3
	Rural	133	88.7
Qualification	NCE	30	20.0
	Bachelor degree	80	53.3
	Other higher degree	40	26.7
Experience	Below 10 years	63	42.0
	10 years & above	87	58.0

Table 3 shows that 0.7%, 4.7%, 5.4%, 47.2% and 42.0% of the respondents were undecided, strongly disagree, disagree agree and strongly agreed that public junior secondary school teachers apply school-based assessment. Also, 29.3% of the teachers sampled were male while 70.3% were females. 88.7% of the teachers were in rural schools while only 11.3% were in urban schools. 20.0% of the sampled teachers had the highest qualification as NCE, 53.5% had bachelor's degree while 26.7% had higher degrees. With respect to experience, 42.0% of the teachers had below 10 years' experience, while 58.0% had 10 years and above.

Table 4: Test of Parallel Lines

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Null Hypothesis	208.830			
General	172.368[b]	36.462[c]	36	.447

Table 4 shows the test for the suitability of the data for ordinal regression. This was used to test the assumption of proportional odd. Since the p-value of 0.447 was greater than 0.05, the main assumption of ordinal regression was not violated.

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Table 5: Model Fitting Information

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	402.303			
Final	208.830	193.473	6	.000

The model fit table shows a p-value of 0.000 which is less than 0.05. This shows that the model is a very good finding on how well the model fits the data.

Table 6 Goodness-of-Fit

	Chi-Square	df	Sig.
Pearson	750.731	729	.281
Deviance	193.449	729	1.000

Table 6 shows the Pearson and Deviance values greater than 0.05. Hence the null hypothesis is rejected. Thus, the model is a good fit.

Table 7: Parameter Estimates

		Estimate	Std. Error	Wald	df	Sig.
Threshold	[Knowledge = 1]	12.827	2.124	36.478	1	.000
	[Knowledge = 2]	16.785	2.123	62.485	1	.000
	[Knowledge = 3]	17.185	2.150	63.885	1	.000
	[Knowledge = 3]	19.775	2.479	63.649	1	.000
	[Knowledge = 4]	20.850	2.593	64.670	1	.000
	[Knowledge = 4]	27.788	3.313	70.374	1	.000
	[Knowledge = 5]	28.918	3.372	73.543	1	.000
Location	Age	.713	.084	72.430	1	.000
	[Sex=1]	-.099	.426	.054	1	.817
	[Sex=2]	0[a]	.	.	0	.
	[Location=1]	-.122	.641	.036	1	.849
	[Location=2]	0[a]	.	.	0	.
	[qualification=1]	-1.090	.598	3.317	1	.069
	[qualification=2]	-.618	.466	1.761	1	.184
	[qualification=3]	0[a]	.	.	0	.
	[experience=1]	.870	.395	4.848	1	.028
	[experience=2]	0[a]	.	.	0	.

In Table 6, we have that a statistically significant relationship existed between teachers' knowledge and application of school-based assessment and the age of the teacher ($p < 0.05$). This was also the same with the years of experience of the teachers ($p < 0.05$). However, there was no significant relationship between, sex of teacher, location of teachers' school, and teacher's qualification and their knowledge and application of school-based assessment. The estimated value of 0.713 and 0.870 for teachers' age, and years of experience, indicated that

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the age of teachers and experience increases the likelihood of the knowledge and application of the teachers in the art of school-based assessment

DISCUSSION OF FINDINGS

The study assessed public junior secondary school teachers' perception and application of school-based assessment in Ikpoba-Okha local government area, Edo state. The study showed that public junior secondary school teachers in Ikpoba – Okha local government area have a good perception of school-based assessment. This result was in agreement with Black et al (2003) who opined that teachers have started to see teaching as a facilitator of student's learning rather than merely completing the curriculum. It also collaborated with Adediwura (2012), who stated that the perception of teachers on students as having a fixed level of ability have also started to change as they begin to observe that their students are able to own up their works and are free to take more responsibility for their learning and become more independent learners and enjoy the freedom they have in the assessment process.

The result from the finding also showed that the application of school-based assessment by public junior secondary school teachers was to a low degree. This result was in consonance with the work of Adediwura, (2012) who argued that testing only motivates teachers and students to work towards performance goals rather than learning goals and that greater value have been placed on testing since the inception of formal education based on the fact that tests are the basic reporting mechanism for the yearly progress of the children. Before the introduction of school-based assessment, the testing of students through a single examination administered at the end of the year had been a regular practice throughout our educational system (Mkpae, & Obowu, 2017) and this practice had not given effective measurement of the level of students' performance.

The study further revealed that a significant relationship existed between teachers' perception and application of school-based assessment and the age of the teacher ($p<0.05$). This was also the same with the years of experience of the teachers ($p<0.05$). However, there was no significant relationship between, sex of teacher, location of teachers' school, and teacher's qualification and their knowledge and application of school-based assessment. More so, the age of teachers and experience increases the likelihood of the perception and application of the teachers in the art of school-based assessment

CONCLUSION

It is observed that teachers show much interest in the assessment process and better understanding of the characteristics of school-based assessment in secondary schools. This study has shown the importance of School-based Assessment (SBA) based on the immense benefits to the students as well as the teachers in terms of teaching and learning. Students usually like to play, therefore the SBA tools such as drama, group project work, role play, questioning and answering session with immediate feedback procedure and classroom interactions could impress on their interest to practice for maximum skills development among them. However, the challenges of the poor standard of our education need to be examined. Consideration should be focused on the application of SBA to facilitate the teaching and learning processes in the schools.

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RECOMMENDATIONS

Following the findings of the research, the researcher made the following recommendations:

1. Teachers should apply various assessment techniques in teaching of any subject. This enables the students to be able to assimilate the teaching to a very large extent.
2. Knowing the fact that school-based assessment enhances effective evaluation of learning
   outcomes by teachers after teaching, school authorities should therefore make it a compulsory thing that all schools must be involved in school-based assessments.
3. Teachers should be encouraged to employ varieties of evaluation instruments in the assessment of students. In this way, they will be able to boost the interest of the students in their academic works thereby leading to greater academic performances.
4. Assessment technique employed by teachers should be such that the students can easily cope with and that will not be too rigorous for them so as not to lead to their discouragement.

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EFFECTS OF LANGUAGE OF INSTRUCTION ON JUNIOR SECONDARY STUDENTS' PERFORMANCE IN MATHEMATICS

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ABSTRACT: *This study investigated the Effects of Language of Instruction on Junior Secondary Students' Performance and Terminology Achievement in Mathematics. A case study of Adavi Local Government Area of Kogi State, Nigeria. A total of eighty (80) students were drawn from two (2) schools. The study was guided by two (2) research questions and two (2) hypotheses. Mathematics Achievement Test (MAT) and Mathematics Terms Achievement Test (MTAT) were used as instruments for data collection. The students were taught the concepts of Algebra, Word Problem and Fraction for two weeks. The PRE-MAT and POST-MAT were administered to the students. Mathematics Terms Achievement Test (MTAT) was administered one week after the administration of POST-MAT. The students' scripts were scored and the resulting data were subjected to data analysis. Research questions were answered using mean and standard deviation. Hypotheses were tested using Analysis of Variance (ANOVA). Major findings of the study showed that the experimental group achieved higher and retained more mathematical concepts than their counterparts in the control group. It is therefore recommended that teaching mathematics strictly in English should be de-emphasis to enable the mathematics teachers to explain in the mother tongue whenever they are teaching. Also, curriculum developers should take into consideration the language interference between English and the language of the environment in their planning for junior secondary school students.*

KEYWORDS: Mathematics Achievements Test (MAT), Mathematics Term Achievements Test (MTAT), Algebra, Communication, Language.

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INTRODUCTION

In every culture, there has always been the need for mathematics in the aspect of counting and record-keeping which varied from tribe to tribe and country to country. All societies have developed mathematical concepts and practices to serve their needs and interest. Charles, (2012) stated that mathematics could be said to be as old as humankind. Ngoma, (2013) added that proficiency in basic numeracy is essential for everyday functioning and it is a foundation for other aspects of human endeavour.

Research in mathematics education has also focused on the role of language in mathematics because language is the means by which mathematics concepts (as all ideas) are communicated between the teacher and the learner, either through oral or written materials, Kaphesi, (2002) argue that language of is not merely a vehicle of expression, it is also the driver and that what we perceive, and therefore can learn, is a function of our language processes. He also stated that "Communication breaks down when people do not have certain concepts". When pupils do not understand what the teacher is trying to say, then he/she is not communicating. Hence, the language of instruments has a large space in mathematics education and also as a subject in junior secondary school.

Mathematics language or terminology in mathematics is the collection of signs or symbols, abbreviations, axioms, lemma, methods, formulae, and units that are necessary for mathematics teaching and learning (Oginni, 2013). Understanding its usage is imperative and cannot be underestimated. Kolawole, (2013) affirmed that the failure of the learners to master the mathematical language leads to poor performance in the subject. Oginni, (2013) remarked that mathematics has often been described as arithmetic with letters, however, notations used in mathematics such as +, -, x, and ÷ are symbols while other mathematicians believed that mathematics language is a special emblem that guided the learners on the step to take. The uniqueness of mathematics terminology has distinguished mathematics from other subjects. Moreover, proper consideration is not given to this in Nigeria. Mathematics is viewed as every other subject whose terms are not technical. Particularly in Adavi Local Government Area, children who have acquired their mother tongue (Ebira) and even communicate in them before enrolling in schools are then taught mathematics in the language they don't understand. The likelihood of language interference occurring is high when students learn in a language other than their mother tongue.

Communication

Kaphesi, (2002) conceives communication as consisting of the transmission of a message from the source to the receiver through a medium and that the receiver must integrate the message into the mind. Figure 2.1 is the theoretical map showing the relationship between teacher, content, medium and pupils.

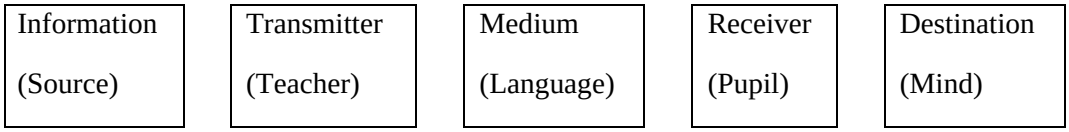

Figure 2.1: The relationship between the teacher, medium, language, content and pupils.

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To use this model in explaining classroom communication implies that in any teaching and learning process, the teacher is one of the many transmitters of the messages (content) which is contained in a medium (language) (figure 2.1). Other transmitters are such materials as printed matter. The model suggests that:

1. The most common source of the content in classroom communication is the teacher (and the target group is the pupils) who initiates, facilitates and organizes the content in a medium that conveys it to the pupils. The teacher has to have the content in the form of mathematical symbols, concepts, principles and relationships. The teacher processes this in an appropriate language that is meaningful to the pupils.

2. The major component of any communication is the medium because it has to allow the content to flow freely from the source to the target group. Naturally, in classroom communication, pupils receive the content through language. For the pupils to be active learners of the content, they must be competent enough to use the medium to share and discuss the content. As a result, teachers must recognize pupils' need for knowledge of, attitude to and practices in the language of instruction. Failure of pupils to comprehend either the language used or the content being taught may lead to ineffective learning of mathematics.

3. The destination of the learning content is the mental (cognitive) domain. A child has to make sense of or process the context in the medium and store it in the memory. This is what constitutes meaningful learning. (Kaphesi, 2002) also argues that children may fail to solve a problem being set by an adult or misunderstand something being taught or explained to them not because they lack certain intellectual abilities but because they don't understand the language being used.

This problem of communication breakdown can be more pronounced where the local language in mathematics involves simply replacing a refined mathematical language, as Kaphesi, (2002) argue, with a crude one without considering that different languages carry to the child different mathematical meanings. The effective use of a language as a medium of instruction in mathematics should take into consideration the differences in knowledge of attitude to and practice of language between teachers and their pupils (see, Kaphesi, 2002). In the case of this study, I am concerned with exploring if either the language of instruction – Ebira/English or English only – will carry the intended message to the learner who will in turn, correctly interpret the message.

Kaphesi, (2002) was a Russian psychologist whose pioneering work focused on child development, and the connections between language development, social learning and cognition. He is one of the prominent proposers of constructivism. According to the Educational Broadcasting Corporation (2004) in Kaphesi, (2002), constructivism is basically a theory – based on observation and scientific study – about how people learn. It says that people construct their own understanding and knowledge of the world through experiences. When we encounter something new, we have to reconcile what we believe, or maybe discard the new information as irrelevant. In any case, we are active creators of our own knowledge. To do this, we ask questions, explore, and assess what we know.

In Baiju, (2010) Piaget emphasized the importance of social interaction to intellectual development. Piaget saw interaction as the key to how we overcome the instability of the

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symbols we individually construct. Piaget tied the role of social interaction to the importance of language. Piaget tied the role of language in the development of conceptual and logical understandings. He made language an integral part of his ideas on intellectual development. Piaget linked the role of social interaction in intellectual development to the role of language.

According to Piaget, language is inherently a social factor partly because of the conventional nature of words and this conventional nature of words is crucial for conceptual development. Piaget offers an avenue for extending Vygotsky's approach to the interplay of conceptual and semiotic aspects in intellectual development. Piaget argued that the formation of mental structures underlying feelings of logical necessity requires social interaction using a conventional sign system.

Piaget theorized that language was simply one of the children's ways of representing their familiar worlds, a reflection of thought, and that language did not contribute to the development of thinking. Cognitive development, he argued, proceeded with that of language.

In view of the above problems, this study is ready to answer the following questions; what are the effects of language of instruction on junior secondary students' performance and terminology achievement in mathematics?

Purpose of the Study

The purpose of this study is to investigate the effect of language of instruction on junior secondary students' performance and terminology achievement in mathematics. To achieve the above purpose, the following objectives are outlined, to:

1. Investigate the effect of English/Ebira as the language of instruction on JSS 2 performance in mathematics;
2. Investigate the effect of English/Ebira as the language of instruction on JSS2 terminology achievement in mathematics;
3. Comparing any significant effect on the mathematical achievement test of the students;
4. Comparing any significant effects on the mathematics terms achievement test of the students.

Significance of the Study

The research will be valuable to scholars, educationists and other researchers who will use it for further studies. Also, provide information for parents, educators and the general public on how effective and efficient Nigeria's native languages can be in the mathematical performance of the students, especially in junior secondary classes. It is crucial for teachers to realize how mathematics learning is linked to language, social interaction and cultural context. Mathematics has been taught using language as if the language itself bore little relation to the acquisition of mathematical concepts. The study will educate the general public on the fact that mathematics can be easier if communicated in a familiar language. The learners will not have to misinterpret the communicated idea, as a result of lexical ambiguity.

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Research Questions

The following research questions guided the study;

1. What is the difference in the mean achievement scores of students taught mathematics in English/Ebira language and those taught in English language only?
2. What is the difference in the mean terminology achievement scores of students taught mathematics in English/Ebira language and those taught in English language only?

Research Hypotheses

The following research hypotheses were tested at a 0.05 level of significance.

1. There is no significant difference between the mean mathematics achievement scores of the students in the experimental group and the control group.
2. There is no significant difference between the mean terminology achievement scores of the students in the experimental group and the control group.

METHODOLOGY

This study adopted a quasi-experimental design. Quasi-experimental design involves the PRE-TEST, POST-TEST non-equivalent control group design. This design was adopted because it was not possible for the researcher to randomly sample the subjects and assign them to groups without disrupting the academic programs of the schools involved in this study. The researcher randomly assigned intact classes of one school to the experimental (E) group and intact classes of one other school to the control (C) group. This did not disrupt the school timetable and lessons. The research design is symbolically represented as shown below;

$$\frac{E:=M_B X_1 X M_A}{C:=M_B X_2 M}$$

Where E -- Experimental group

C -- Control group

M_B ---- Measurement before treatment

M_A ---- Measurement after treatment

X_1---- English/Ebira as the language of instruction

X_2 ---- English only, as the language of instruction

_____ ____ indicates that there are two groups (experimental and control) which are not equivalent before treatment.

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The research instruments for this study were of two types. The first instrument, the mathematics achievement test (MAT), was a twenty (20) multiple-choice objective question on algebra, word problems and fractions. The second instrument, the mathematics terms achievement test (MTAT), was also a twenty (20) multiple-choice test. There are four response options A, B, C, and D in the instruments. The answers were distributed among the alphabets to make sure the answers do not have the same letters. The first instrument was administered to the entire student prior to the treatment (PRE-TEST). Thereafter, the item in the PRE-TEST was reshuffled to make them appear new at a glance. The reshuffled POST-TEST was administered to all the students concerned at the end of the treatment. The second instrument, MTAT, was administered a week after the POST-TEST.

Bamikole, (2019) sees the validity of the research instrument as an evaluative judgment about an assessment and defined the validity of an instrument as the degree to which the measuring instruments used in the data collection actually serve the purpose intended. To ensure the validity of the instruments, a copy of the MAT and also of the MTAT was given to the project supervisor for moderation, correction and validation.

The MAT was first administered to the entire research group prior to the treatment (PRE-TEST). This exercise provided baseline data that was used to compare the subjects in both groups. The experimental group was then taught using both English and Ebira as the language of instruction. Also, the control group was taught using only English as the language of instruction. This treatment lasted for two weeks. Thereafter, the items in the PRE-TEST were reshuffled to make them appear different at a glance. The reshuffled POST-TEST was administered to all the students at the end of the treatment. Two classes (JSS2A and JSS2B) were used in one school as the control group while two classes (JSS2A and JSS2B) were also used in the other school as the experimental group. After the second week, the POST-TEST was administered to the two groups. A week after the treatment, the MTAT was administered to the two groups. The MTAT has different content.

The data generated from the study were analyzed using various statistics such as mean and standard deviation. The research questions were answered using a mean and standard deviation of test scores. The hypotheses were tested at a 0.05% level of significance using ANOVA.

RESULTS AND DISCUSSION

Research Question One. What is the difference in the mean achievement scores of students taught mathematics in English/Ebira language and those taught in English language only?

Table 1: Mean Achievement Scores Of Experimental Group And Control Group In Pre-Test And Post-Test

Group		Pre-Test Scores		Post-Test Scores	
	Number of Students	Mean	Standard Deviation	Mean	Standard Deviation
Experimental	40	8.55	2.28	11.05	2.66
Control	40	8.13	2.38	9.53	2.84

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From Table 1, the PRE-TEST mean score of the experimental group was 8.55 and standard deviation of 2.28, while that of the control group was 8.13 and 2.38 respectively. This implies that both groups were almost of equal ability at the beginning of the experiment. However, in the POST-TEST, the experimental group had a mean of 11.05 and a standard deviation of 2.66 while the control group had a mean of 9.53 and a standard deviation of 2.84. This implies that the language of instruction has an effect on the experimental group.

Hypothesis One. There is no significant difference between the mean mathematics achievement scores of the students in the experimental group and the control group.

Table 2: Anova Analyses Of The Students' Achievement Scores.

Source Of Variance	Sum Of Squares	Df	Mean Square	F	F^{cv}
Between	46.51	1	46.51	6.001	3.962
Within	604.88	78	7.75		
Total	651.39	79			

Table 2 shows that the F-value is 6.001. Since the F-value is greater than the F^{CV}(Critical value) (i.e. F-value $>F^{CV}= 6.001>3.962$), the hypothesis is therefore rejected. This implies that there is statistically significant evidence at 0.05 significant levels that there is a difference between the mean achievement scores of the experimental and control groups. Similarly, the sum of squares from between (46.51) when compared with the sum of squares arising from within (604.88) indicates that the observed difference in the achievement of the experimental and control group is due to the treatment administered in this experiment.

Research Question Two. What is the difference in the terminology achievement scores of students taught mathematics in English/Ebira language and those taught in English language only?

Table 3: Students' Mean Terminology Achievement Scores And Standard Deviation Scores In Mathematics Of Experimental And Control Groups

Group		Pre-Test Scores		Post-Test Scores	
	Number of Students	Mean	Standard Deviation	Mean	Standard Deviation
Experimental	40	8.55	2.28	12.1	2.79
Control	40	8.13	2.38	10.33	4.15

Table 3, shows that the experimental group had a mean score of 8.55 and a standard deviation of 2.28 in the PRE-TEST while the control group had a mean score of 8.13 and standard deviation of 2.38. The experimental group had a mean score of 12.1 and a standard deviation of 2.79, while the group had a mean score of 10.33 and a standard deviation of 4.15 in the mathematical terms achievement test. This implies that the experimental group gained higher than the control group in the MTAT. It is, therefore, profitable that students taught using both English and Ebira language achieve more terms in mathematics than those taught using the

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English language only. A higher MTAT score and a low standard deviation by the experimental group show that most members of the experimental group gain more mastery in mathematical terms by the use of both English and Ebira as the language of instruction.

Hypothesis Two. There is no significant difference between the mean terminology achievement scores of the students in the experimental group and the control group.

Table 4: Anova Analysis Of Students' Terminology Achievement Scores

Source of Variance	Sum of squares	Df	Mean square	F	F^{cv}
Between	63.01	1	63.01	4.91	3.962
Within	1001.38	78	12.84		
Total	1064.39	79			

From table 4, the ANOVA analyses terminology achievement score shows that the F-value is 4.91. Since the F-value is greater than the F^{CV}(Critical value) (i.e. F-value $>F^{CV} = 4.91 > 3.962$), the hypothesis is, therefore, rejected. This implies that there is statistically significant evidence of 0.05 significant levels to show that there is a difference between the mean terminology achievement scores of the experimental and control groups. Similarly, the sum of squares arising from between (63.01) when compared with the sum of squares arising from within (1001.38) indicates that the observed difference in the terminology achievement of the experimental and control groups is due to the treatment administered in the experiment.

DISCUSSION

The Analysis of Variance (ANOVA) presented in Table 1, confirmed that there is a significant difference between the mean achievement scores of students taught using both English and Ebira language and those taught using the English language only. The significant difference is attributed to the treatment. This finding indicates that using both English and Ebira as the language of instruction has positive effects on students' performance in mathematics. Both groups (control and experimental) were taught the same concepts and tested with the same test items but the experimental group significantly performed better than the control group. This result is in conformity with the findings of Dauda, (2015). They found that language is crucial not only for the purpose of communication but for the role it plays in the thinking process. Table 2 showed that the experimental group had higher mean scores than the control group. Table 3, confirms that there are significant differences in the terminology achievement scores of students taught mathematics using both English and Ebira language and those taught using English language only. This indicates that English/Ebira as a language of instruction is more effective than using English only as a language of instruction. This result shows that the students in the experimental group performed better in MAT due to their understanding of mathematics terminology.

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CONCLUSION

Students understand better if teachers teach mathematical concepts in both the English language and the language of the environment. Presently, the Nigerian policy is in line with the finding of this study. However, from our experience in the school system, most of the teachers are still complying with the old policy which states that the language of the environment should be used only for the first three years of primary, after which English should be used. It is most probable that some of the teachers are not aware of the change in policy, which now allows the use of both English and the language of the environment for teaching right from the fourth year of primary school.

RECOMMENDATIONS

1. Teachers should be encouraged to teach in both English and the language of the environment as it facilitates understanding of mathematical concepts and hence improve students' performance. The implication of this is that teachers should be able to teach mathematics in the language of the environment better.

2. Curriculum developers should take into consideration the language interference between English and the language of the environment in their planning for junior secondary school students.

3. Textbook writers should include materials in Mother Tongue or both mother tongue and English in texts since the policy says the language of the environment should be used in teaching mathematical concepts at the JSS level. Terms used in mathematics should be explained as much as possible to help students understand the concept better.

4. Indigenous language should be taught properly at all levels of the educational ladder both by utilizing the outcome of research with these languages and by ensuring adequate and suitable training for the teachers concerned.

5. Teaching mathematics strictly in English should be de-emphasis to enable the mathematics teachers to explain in the mother tongue whenever they are teaching.

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ASSESSING SCORE DEPENDABILITY OF WEST AFRICA EXAMINATION COUNCIL (WAEC) 2019 MATHEMATICS OBJECTIVE TEST USING GENERALISABILITY THEORY

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ABSTRACT: *This study investigated score dependability in the 2019 West Africa Examination Council (WAEC) Senior Secondary School examination using the generalisability theory. The study was specifically concerned with identifying and analysing the score dependability of the Senior Secondary School 2019 WAEC mathematics objective examination using generalisability theory, and determining the highest contribution of facets: students, items and teachers to score dependability. Two research questions were raised to guide the study. The study was a survey which adopted a random effect two-facet fully crossed* $s \times r \times i$ *design for generalisability (G) and decision (D) studies. The population consisted of fifty-six thousand, seven hundred and ninety-seven (5697) Senior Secondary three (SS3) students in the seventy-five (75) public secondary schools in Benin Metropolis for the 2019/2020 academic session. The instrument for data collection was a fifty (50) multiple choice WAEC, Mathematics 2019 examination. The instrument had been validated by the West African Examination Council (WAEC). The reliability of the items was ascertained using the Kuder – Richardson 20 (KR 20) to obtain internal consistency. It gave a value of 0.92. Data collected were analysed using the software EduG version 6.0-e based on analysis of variance (ANOVA) and generalisability. The findings which emerged from the study were the highest effects to score dependability in examination came from the interaction of students and teachers, an index of dependability (∅)of 0.92 high enough to maximise reliability was observed only when the teachers were increased to 78. Based on the findings, it was recommended that generalisability analysis should be carried out by researchers, test developers and examination bodies so as to reduce or eliminate measurement error and hence maximise reliability, and there should be enough invigilators when conducting examinations, thereby minimising error and maximising reliability (dependability) of examination scores.*

KEYWORDS: Reliability, Mathematics, Generalisability, Dependability, Facets.

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INTRODUCTION

Reliability as a psychometric property of any measuring instrument deals with stability and constituency of scores when the instrument is used over time. Several authors defined reliability in various ways. For example, Kline (2000) opined that reliability with respect to tests has two distinct meanings. One refers to stability over time and the second is an internal constituency. Mcleod (2007), stated that reliability in psychological research refers to the constituency of a study or measuring test. On their part, Wilkinson and Robertson (2006), posited that reliability with respect to research means repeatability or constituency. Meyer (2010) opined that reliability is the degree to which an assessment tool produces stable and consistent results. According to the National Council in Measurement in Education (1999), reliability in statistics and psychometrics is the overall consistency of a measure. It further stated that a measure is said to have high reliability if it produces similar results under consistent conditions. On his part, Bolarinwa (2015) averred that reliability is the extent to which a questionnaire, test, observation or any measuring procedure produces the same result on repeated trials. It is also seen as the stability or consistency of scores over time (Miller, 2015). From the foregoing, it is clear that reliability means stability and consistency of scores obtained from measuring instruments over a period of time.

Kaplan and Saccuzzo (2005) stated that there are four broad types of reliability: test-retest, alternate form, internal consistency and interrater. Test-retest reliability is also known as 'test me, come again to test me'. It involves two separate administrations, usually within a space of two weeks and the two scores from the two administration is correlated using the Pearson Product Moment Correlation Coefficient. The alternate or parallel reliability is a measure of the similarity of two forms of a test. For forms to be considered parallel, they must have exactly the same difficulty level. One drawback of this type of reliability is that it is usually not achievable. Internal consistency deals with the relationship between the items, that is, if the items are related. This involves a single administration of the instrument. For interrater reliability, Sattler in Sandilos and DiParna (2011) stated that it is concerned with the constituency across different raters when assessing a behaviour, trait or construct.Reliability is a term that is frequently used in psychology, but one that differs slightly depending on the definition. Two reliability models in the literature on psychometrics are the true score model of the classical test theory (CTT) developed by Spearman in the early 1900s and the generalisability theory (GT) by Cronbach and associates in 1972. Both emphasise stability; while CTT assesses the repeatability and constituency of measures, GT focuses on the dependability or accuracy of the generalisation of the test score based on the purpose and components of the testing situation. Generalisability analysis estimates the dependability (reliability) of measures. Classical test theory is the foundation of reliability theory and stated that an individual's observed score is equal to his/her true score plus random or unsystematic error (Sattler, 2001). According to Shavelson and Webb (1991), CTT is mainly concerned with the relative standing of individuals; it assumes that a hypothetical true score exists and that the forms of an assessment were parallel.

Generalisability theory, on the other hand, is a statistical theory about the dependability of behavioural measurement (Cronbach et al in Ogunka & Orluwene (2020). It liberalises classical test theory by using analysis of variance (ANOVA) methods to untangle multiple sources of error, by the researcher that contributed to the undifferentiated error (E) in CTT. It is also a statistical theory for estimating the reliability of behavioural measurement which gives researchers ample opportunity to comprehensively assess numerous sources of measurement

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error (variance components). GT concern itself with the relative and absolute dependability of behavioural measures. GT is a framework for analysing how well-observed scores allow users to make generalisations about a person's behaviour (Shavelson & Webb, 1999). Instead of partitioning and observing scores into two as in the case of CTT, a true score and error score without differentiating the various sources that contributed to the error is seen as a major limitation of CTT (Baykul, 2000; Guller, 2009). However, generalisability theory on its parts partitions the error variance into multiple components representing several different sources of error simultaneously and shows the contribution and influence of each. Hence, several authors such as Brennan (2001), Shavelson and Webb (1999) see generalisability theory as an extension of CTT with the addition of separating the various sources of error and estimating the contribution of each to measurement error and score dependability. Another advantage of generalisability theory as stated by Brennan (2001) is that it can estimate the reliability of mean ratings for each examinee, while simultaneously accounting for both interrater and intra-rater in consequence as well as discrepancies due to various possible interactions which are impossible in CTT.

In a generalisability theory, each source of variation, such as the items, raters, or different measurement situations available in the measurement process is called a facet. Brennan (2001) opined that facets can be interpreted as the measurement situations having similarities. Each level on the facet is called a condition, while the source revealing the variability of concern (student, items etc.) is called the object of measurement. In this study, the object of measurement is students (s), and the two facets are items (i) and teachers/raters (r). Two studies are usually conducted in a generalisability theory. They are the generalisability study (G-study) and the decision study (D-study). A G-study is carried out to ascertain how well the scores can be used for multiple situations. It involves estimating variance components that might in turn be used in a D-study for computing the generalisability coefficient. On the other hand, D-study is conducted for the purpose of optimisation. There are also two types of decisions to be made in generalisability theory; relative and absolute decisions. The relative error is analogue to the error variance in CTT (Lee & Frisbie, 1999). There are also, two reliability coefficients, the generalisability coefficient (G coefficient) and dependability index (Phi).

Generalisability theory is not based on the traditional assumption that reliability and validity are separated but assumes that reliability and validity both fall on the same continuum of dependability (Silva, in Poncy, 2006). What teachers are interested in when they administer a test is to see if that score is dependable. Inherent in this view, is that scores will differ from one administration to another due to a lot of factors which include test administration, occasion, test forms, rates and so on. It is only generalisability theory that can pinpoint and estimate these sources of errors that causes inconsistency in the generalisation of test scores.

Kin and Wilson (2009) defined dependability of behavioural measures as the accuracy of generalising from a person's observed score on a measure or a test to the score that the person who has received averaged over all possible conditions. This type of variation that is mainly due to the measuring instrument rather than factors which are directly controlled by the examinee denotes uncertainty in the quantitative description of the individual on the basis of the test.

According to Shavelson and Webb in Ogunka and Orluwene (2020), dependability refers to the accuracy of generalising from a person's observed score on a test or rather other measures (behaviour observation, opinion survey) to the average score that person would have received

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under all the possible conditions that the test user would equally willing to accept. This notion of dependability is the assumption that the person's knowledge, attitude, skills, or other measured attribute are in a steady state; it is assumed that any differences among scores earned by the individual on different occasions of measurement are due to one or more sources of error, and not to systematic changes in the individual due to maturation or learning.

Orluwene (2020) indicated that in the measurement of complex traits imperfect instruments are used so that the score observed for each person almost always differs from the person's true ability or characteristics; she further affirmed that the discrepancies between the true ability and the observed ability results from measurement error, which implies some inaccuracy in the measurement exist because measurement error may inflate or depress any subject's score in an unpredictable or predictable manner.

The comparison of dependability of reliability in generalisability theory and classical test theory to determine standard error measurement varies. Atilla (2012) asserted that the use of classical test theory approaches to determining score reliability, however, is not capable of identifying and untangling this profusion of error which classical reliability was not conceptualized to do since it accounts for only one source of error at a time. Similarly, Ikeh and Madu cited by Tavakol and Brennan (2013) state that Classical Test Theory (CTT), assume that the student's true score is the sum of the student's observed score and a single undifferentiated error term. Kpolovie (2010) asserted that classical test theory has reliability embedded in the true score and the error score model defines reliability as the coefficient of the predictable proportion of variance in observed scores from the true scores.

Esomonu and Okeaba (2021) estimated measurement error and score dependability of the inventory for students' integration into the University Academic Culture using generalisability Theory. The results show that the highest contribution to measurement error in ISIUAC scores was the residual which accounted for 85.6% of the total variance. The analysis produced a relative standard error variance of 0.22189 which resulted in a generalisability coefficient of 0.55 and an absolute error variance of 0.23510 which resulted in a dependability coefficient (ϕ) of 0.52. The result of the D-study revealed that a minimum of 100 question items were needed to produce generalisability and dependability indices of 0.82 and 0.80 which both attained the benchmark. The variance components of the facets: students, questions, and their interactions overlapped, indicating that the variance components were not significantly different in their contributions to measurement error in ISIUAC scores.

McLaughlin, et al (2017) examined the dependability of the Learning Target Rating Scale (LTRS) using generalisability theory. The result of the study showed that the percentage of the variance of total LTRS scores accounted for by the different sources of variance in the model was similar across the three occasions, with learning targets and teachers accounting for the largest percentage of variance while raters and children accounted for a small percentage of variance. Ogidi (2021) utilised generalisability theory in the estimation of variance components in National Examination Council Essay Questions in Christian Religious Studies. Results of the study showed the index of dependability of 0.938 was obtained which indicated that the instrument was adequate for the certification examination.

Bamidele, et al (2021) carried out a study in estimating generalisability and dependability indices of students' scores in teaching practice assessment in a Nigerian College of Education. It was observed from the result obtained that the dependability coefficient/index of the

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2016/2017 teaching practice scores; the obtained D study or dependability index was high (0.74) considering the 0.70 level of acceptability value, therefore, the dependability index of the 2016/2017 teaching practice was high. The high dependability index level of the 2016/2017 teaching practice scores may be due to the contribution of four sources of measurement errors and to the difference in the persons' performance and high level of commitment of students during the 2016/2017 teaching practice programme.

Statement of the Problem

A student's performance in a given examination is usually gauged by several characteristics other than the student's factor. These characteristics are also known as sources of error and they include test questions, invigilators, and so on and affect the score dependability of these measurements. The impact of these factors leads to questions about the accuracy, precision, and ultimately, the fairness of the scores obtained by students in any given examination. More so, scores obtained by the objects of measurement, (students) in the examination are affected by multiple sources of error and scores from the examinations are used in making relative and absolute decisions concerning students, there is the need to estimate score dependability of examinations using generalisability theory, so as to determine the contributions of each of these facets in measurement situations in examinations with a view to minimising and maximising the reliability of their scores. Estimating the score dependability of any given task involves a multifaceted approach which the classical test theory cannot address as it addresses only one source of measurement error. In the light of this, the present paper seeks to assess the score dependability of the WAEC 2019 Mathematics objective test using generalisability theory.

Research Questions

The following questions were raised to guide the study

1. What is the contribution of the facets: students(s), items (i), and raters (t) to score dependability in the WAEC 2019 Mathematics objective test?
2. To what extent do the dependability coefficients show the degree to which students maintain their rank order across facets: item (i), and raters (t) in WAEC 2019 Mathematics objective test scores?

METHODS

The study was a survey which adopted a random effect two-facet fully crossed $s \times r \times i$ design for generalisability (G) and decision (D) studies. The fully crossed design in the G – study was used to estimate all the possible variance components in the measurement situation. The D – study used the information provided by the G – study to design the best measurement procedures minimising undesirable sources of measurement error and maximising reliability. The population of the study was all the senior secondary three (SS3) students of public secondary schools in the Benin metropolis for the 2019/2020 academic session. They were considered appropriate for the study because they should have almost covered the syllabus for mathematics in any of the external examinations, have stayed six years in school and are fully prepared for any form of examination. There are four local government areas in Benin metropolis and they are Egor, Oredo, Ikpoba-Okha and Ovia North–East. There are seventy-

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five (75) public senior secondary schools in these four local government areas with a student population of 5697 students. 570 students which represent 10% of the total population of SS3 students in the four local government areas constituted the sample. They were selected from thirty-eight (38) schools in the locality. The multi-stage sampling technique was adopted for the study.

The instrument used for data collection was a fifty (50) multiple choice of the 2019 WAEC mathematics objective questions for the 2019 examination year. The objective items were constructed by WAEC and are assumed to have been validated and standardised before it was administered to the students. The items covered a range of topics in Mathematics showing that it is also content valid and considered appropriate for utilization in the study. The reliability of the instrument was established using a sample of 50 students and five teachers from public senior secondary (SS 3) who were not used in the main study. The reliability of the instrument was determined using the Kuder – Richardson 20 (KR 20) to obtain internal consistency. It gave a value of 0.92.

Data collected were analysed using computer software, EduG version 6.0-e based on analysis of variance (ANOVA) and generalisability theory.

RESULTS

Table 1: A generalisability study showing the effects of students, teachers, items and their interactions to score dependability in 2019 WAEC examination

Sources	Variance component estimates	Relative error variance	% Relative variance	Absolute error variance	% absolute error variance
Students (s)	22.70349 ….				
Teachers (t)	0.000	.....		.....	
Items (i)	0.000	.....		(0.00000)	0.0
s × t	0.000	.....		.....	
s × i	0.000	(0.00000)	0.0	(0.00000)	0.0
t ×i	0.000	0.00166	100.0	0.00166	100.0
s × t × i	0.000	.....		(0.00000)	0.0
Total		0.00166	100%	0.00166	100%

Error Variances

$\sigma^2 \delta = 0.00166$

$\sigma^2 \Delta = 0.00166$

Coefficients

$E\rho^2 = 0.91$

$\emptyset = 0.82$

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Table 1 showed that the absolute error variance for items, teachers, the interaction of items and students, teachers and items were set to zero. Conversely, the absolute error variance estimate for the interaction of teachers and students was 0.00166 accounting for 100% of the absolute percentage. The dependability index (∅) of 0.82, showed that 38 teachers supervising 570 students yielded a high dependability index.

Table 2: Estimated dependability coefficient (∅) for a fully crossed s × t × i D-study Design with a different number of teachers

Number of teachers	∅
38	0.74
48	0.83
58	0.86
68	0.91
78	0.92

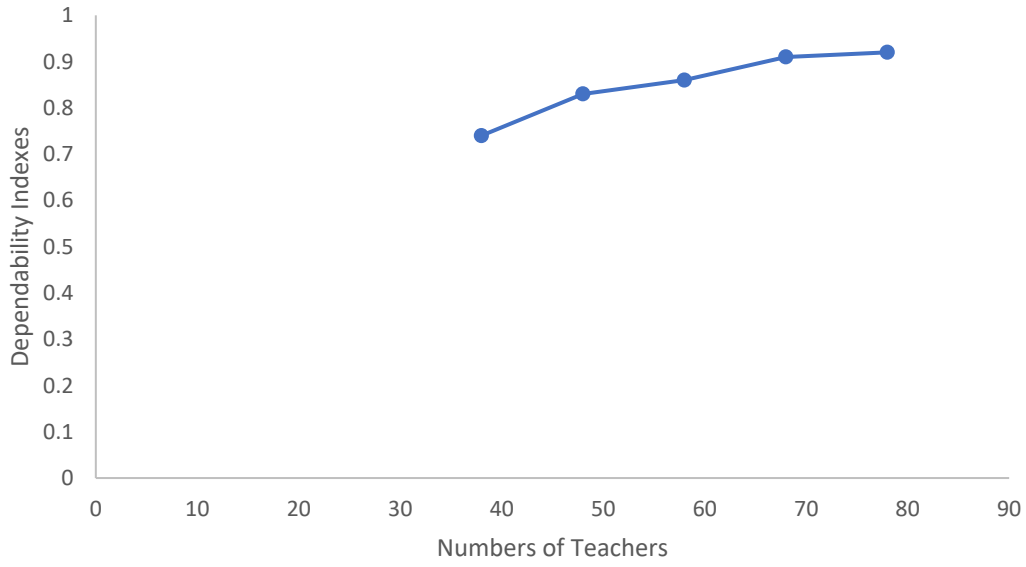

Figure 1: Dependability indices resulting from relative decisions for different teachers.

Table 2 and figure 1 showed that with 38 teachers the dependability index (∅) was 0.74. When the number of teachers was increased to 58, the dependability index (∅) was 0.86, an increase of 0.10. An increase in the number of teachers to 78 produced an increase of 0.16 in the dependability index (∅). This showed that the performance of an individual student does not affect the performance of another student.

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DISCUSSION OF FINDINGS

The findings from the study revealed that the highest effects to score dependability in examination came from the interaction of students and teachers. Items and the interaction of students and items did not have any effect on score dependability in examination scores. This implied that the strictness of the teachers in terms of invigilation on the students maximized their observed scores in the examination. Also, it can be observed that more of the absolute error variability in the examination came from teachers (invigilators), changing the level (numbers) of teachers will have a large effect on the score dependability than changing the number of items. Therefore, there will be the need to bring in more teachers to bring about dependable scores in examinations. These findings in the study were consistent with the earlier findings of Lee et al (2001), Fulcher (2003), Ogidi (2010) and Bamidele et al (2021).

Another revelation from the study was that with a dependability index of 0.92, students that passed were comfortably separated from those that failed. Students who had attained the predefined score and above were separated from those students who did not perform well. The level of invigilators at 38 was not quite satisfactory to produce an absolute scale of measurement. There should be at least 78 teachers so as to attain a dependability index (Ø) of 0.92 that will help to successfully separate students in terms of their performance irrespective of the performance of other students. The result was consistent with the study of Brennan (2001) who found that more raters were needed for a high dependability index. The findings of the study were also supported by Lee (2006) who opined that an increase in the number of raters yielded a higher dependability index than when the raters were small in a study on the dependability of scores for a New ESL Speaking Test. It was also corroborated by Esomonu and Okeaba(2020) who revealed that a minimum of 100 question items were needed to produce dependability indices of 0.80 to attain the benchmark.

CONCLUSIONS

Generalisability theory provides an integrated framework for evaluating multiple sources of variability in examination scores and for deriving implications for test development and test scores interpretation. Apart from the student factor, other sources (facets) affect the scores students obtain in examinations. In this study, the interaction of students and teachers contributed had a large effect on score dependability in the examination. Above all, an increase in the number of the facet -teachers (invigilators) showed that a high index of dependability (Ø), was high enough to rank order student relatively.

Recommendations

Based on the findings of this study, the following recommendations were made.

- Generalisability analysis should be carried out by test developers and examination bodies in the estimation of reliability so as to estimate multiple sources of error and reduce or eliminate measurement error and hence maximise reliability.
- In generating items, item writers should endeavour to develop items that will discriminate among students of different achievement levels. This will in no small way reduce error in measurement and ensure score dependability.

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- There should be enough invigilators when conducting examinations. This will help in reducing cheating among the object of measurement (students), thereby minimising error and maximising the reliability of examination scores.

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POST ABORTION COUNSELLING METHOD AND EMOTIONAL COUNSELLING METHOD

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ABSTRACT: *This study was designed to investigate Post Abortion Counselling Method and Emotional Counselling among Mothers in Cross River State, Nigeria. The selection was done through the sampling and purposive sampling technique. The questionnaire (called SMCQ) was the instrument used for data collection. The instrument was subjected to face validity by one expert in guidance and counselling and two experts in measurement and evaluation in the Faculty of Education, University of Calabar. The reliability estimate of the instrument was established through the Cronbach Alfa reliability method. One-way analysis of variance (ANOVA) was the statistical analysis technique adopted to test the hypotheses under study. All hypotheses were subjected to testing at .05 level of significance. From the data analysis, the researcher found that post abortion counselling and emotional counselling methods significantly influence safe motherhood practices among women of reproductive age. Based on the findings of the study, the researcher recommended among others that women considered health facilities as not fully prepared to provide respectful maternal care. The researcher noted that when women are treated disrespectfully, these poor treatment discourages them from taking counselling and practising safe motherhood.*

KEYWORDS: Post abortion counselling method and emotional counselling, counselling method, prevention of mother to child transmission (PMTCT).

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INTRODUCTION

Post Abortion Counselling Method and Safe Motherhood Practices

Counselling after an abortion requires that most women will have a follow-up appointment in which they talk to a counsellor or health professional. They will normally discuss their physical and emotional recovery and go over options for contraception. The World Health Organization (WHO) estimated that 10-50 percent of women who undergo unsafe abortions require medical care (WHO, 2009). Post abortion counselling is needed to enable mothers know that help is available when they visit the health facilities. Unsafe abortion, however, is 'any procedure used for terminating an unwanted pregnancy either by persons lacking the necessary skills or in an environment lacking the minimum medical standards, or both" (WHO, 2008; Sedgh, Bearak & Bankole, 2016). In investigations conducted by Sedgh (2016), Levels (2014), Boland (2008) and Faundes (2008), they stated in previous works that unsafe abortion can lead to the termination of a woman's life, infertility and fatality.

The researcher communicated that death toll among mothers will also increase over decades due to abortion sepsis (Lancet, 2016). Okonofua, Onwudiehwu and Odunsi (2002) conducted a study in Ile Ife, Nigeria on induced illegal cases of abortion based on 74 studies. Seventy-four women with complications of induced abortion were studied prospectively at the Obafemi Awolowo University, Nigeria. Twenty of the women were interviewed privately to elicit confidential information and also to determine their attitudes to contraception counselling and usage and their response to the Nigerian national abortion law.

Interviews with the women revealed that most of them had knowledge of contraception counselling and services but were unwilling to use it because of wrong information. However, when women refuse to make use of contraception, the likelihood of abortion sepsis would increase and thereby increase the likelihood of maternal death toll. Bonet, Nogueira and Pleggi (2017) posited that there is a need for a clear and actionable definition of maternal sepsis, in order to better assess the burden of this condition. Bonet, Nogueira and Pleggi (2017) reiterated that maternal sepsis occurs when the body's response to infection damages its own organs and tissues, and if not recognized and treated, early sepsis can progress to shock and death.

Peach, Christopher Morgan and Michelle (2021) admitted that the global pregnancy rate decreased only slightly from 2008 to 2012, after declining substantially between 1995 and 2008, and eighty-five million pregnancies, representing 40 percent of all pregnancies, were unintended in 2012. Of these, 50 percent ended in abortion, 13 percent ended in miscarriage, and 38 percent resulted in an unplanned birth. For intended and unintended pregnancies worldwide in 2012 in a survey of 213 million pregnancies, the global pregnancy rate decreased only slightly from 2008 to 2012, after declining substantially between 1995 and 2008 (Peach, Christopher Morgan & Michelle, 2021).

Mellerup, Sorensen and Kuriigamba (2015) posited that unsafe abortions are estimated to account for 13% of maternal deaths globally. Mellerup, Sorensen and Kuriigamba (2015) brought forward that a large number of short- and long-term complications are as a result of improperly carried out abortion. An estimated 21.9 million unsafe abortions are performed in the world annually and 97 percent of these occur in low-income countries. Africa is responsible for the second largest proportion of unsafe abortions (44 percent), and the highest rates globally (18–39 per 1,000 women). Ansari, Zainullahi and Kim et al. (2015) posited that complications

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of abortion are one of the leading causes of maternal mortality worldwide. Abortion laws of many countries are restrictive, leaving women no choice other than to procure unsafe abortion (Grimes, Benson, Singh, Romero, Ganatra, Okonofua & Shah, 2006) and (World Health Organizaton, 2008–2011, Raseh, 2011).

The main independent variables for this study were:

Post abortion counselling method

Emotional counselling method.

Summary data and one-way ANOVA of the influence of post abortion counselling method on safe motherhood practices among women of reproductive age (N=586)

Table 1

Post abortion counselling method	N	$\bar{x}$	SD		
Low – 1	176	35.1818	3.06891		
Moderate – 2	236	36.6144	3.19169		
High – 3	174	36.4195	2.87542		
Total	586	36.1263	3.12165		
Source of variance	SS	df	Ms	F	Sig of F
Between group	228.189	2	114.094	12.155	.000
Within group	5472.466	583	9.387		
Total	5700.655	585			

* Significant at .05 level, p-value = .000, df = 2, 586.

The result in Table 1 revealed that the calculated F-value of 12.155 is higher than the p-value of .000 at .05 level of significance with 2 and 586 degrees of freedom. With this result, the null hypothesis was rejected. This result therefore implied that, post abortion counselling method significantly influenced safe motherhood practices among women of reproductive age. Since post abortion counselling method had a significant influence on safe motherhood practices among women of reproductive age, a post hoc analysis was employed using Fishers' Least Significant Difference (LSD) multiple comparison analysis.

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Table 2: Fishers' Least Significant Difference (LSD) multiple comparison analysis of the influence of post abortion counselling method on safe motherhood practices among women of reproductive age

LSD

(I) Post abortion counselling method	(J) Post abortion counselling method	Mean Difference (I-J)	Std. Error	Sig.
Low	Moderate	-1.43259(*)	.30514	.000
	High	-1.23772(*)	.32754	.000
Moderate	Low	1.43259(*)	.30514	.000
	High	.19487	.30614	.525
High	Low	1.23772(*)	.32754	.000
	Moderate	-.19487	.30614	.525

* The mean difference is significant at the .05 level

The result of the analysis in Table 2 showed that women whose post abortion counselling method was low were significantly different in their safe motherhood practices among women of reproductive age from those whose post abortion counselling method was either moderate or high. Also, women whose post abortion counselling method was moderate were significantly different from those who were high in safe motherhood practices among women of reproductive age.

Post abortion counselling, emotional counselling methods: referral counselling methods and financial counselling methods.

Emotional Counselling and Safe Motherhood Practices

Emotional counselling and disclosure (ED) is a term used to describe the therapeutic expression of emotional counselling (ED). It underlies a variety of therapies aimed at improving well-being for various populations, including people with palliative-stage disease and their family cares. McGowan (2018) stipulated that to optimize maternal health, all women must have access to high quality counselling and care before, during and after childbirth. To complement the 2016 antenatal care (WHO, 2016) recommendations, the World Health Organization (WHO, 2016) has published new recommendations on intrapartum care for a positive childbirth experience.

In a quantitative interpretative study conducted by Mills and others (2021) (in Wood & Lavender, 2020) in Nairobi, Western Kenya, the study investigated mother's life experience of facility counselling usage and support following stillbirth in an urban and rural facility. A purposive sample of 75 women and 59 men, who had experienced the stillbirth of their baby (≤1 year previously) and received care in the included facilities, was taken. In an in-depth interview, the study was analyzed using Van Manen's reflexive approach findings; it revealed that parents in Kenya and Uganda were not always treated with compassion and lacked the care or support they needed after the death of their baby. The researcher noted that there is an urgent

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need to institute care and compassion in supporting bereaved parents, with appropriate interventions provided alongside community support for African parents.

Asefa, Bekele, Morgan and Kermode (2013) noted a service providers' experiences of disrespectful and abusive behavior towards women during facility based childbirth in Addis Ababa, Ethiopia**.** A facility based cross-sectional study was conducted in August 2013. The result showed that **t**he majority (83.7 percent) of the female participants were aged <30 years (mean = 27.25 ± 5.45). The majority of the participants (79.6 percent) believed that lack of respectful care discouraged pregnant women from coming to health facilities for delivery. The findings of the study provided that most service providers from these facilities had witnessed disrespectful treatment during childbirth, and recognized that such practices have negative consequences for mothers using health facilities.

In a study conducted by Gebremichael, Worku, Medhanyie, Edin and Berhane (2018), women suffer more from disrespectful and abusive care than from the labour pain itself, in a qualitative study from women's perspective. Biomed Central (BMC) pregnancy and childbirth (2021). Findings showed that counselling of institutional delivery services could be hampered by women's experiences of disrespectful and abusive care during childbirth. A qualitative phenomenological study was conducted in Tigray, Ethiopia. A semi-structured discussion guide was used to elicit the discussion. The study participants described disrespect and abuse as serious obstacles to counselling and maternal health services. Women considered health facilities as not fully prepared to provide respectful maternal care. Positive birth means a birth in which a woman feels she has freedom of choice, access to accurate information, and that she is in control, powerful and respected.

Positive birth according to Rosand, Slinning and Eberhard-Gran (2011) is about approaching birth realistically, having genuine choice, and feeling empowered by your experience. Røsand, Slinning and Eberhard-Gran (2011) carried out a study in Norway, a research on partner relationship satisfaction and maternal emotional distress in early pregnancy. Pregnant women enrolled in the Norwegian mother and child cohort study, and emotional distress was estimated by multiple linear regression analysis. Findings revealed that relationship dissatisfaction was the strongest predictor of maternal emotional distress (β = 0.25). To further buttress the emotional distress mothers encounter when pregnant, Taheri, Takian and Taghizadeh (2018) carried out a study on creating a positive perception of childbirth experience in a systematic review and meta-analysis of prenatal and intrapartum interventions. In a randomized controlled trial of interventions in pregnancy or labour result after screening of 7832 titles/abstracts, 20 trials including 22,800 participants from 12 countries were included. Findings divulged that the most effective strategies for creating a positive birth experience are supporting women during childbirth.

In support of the previous study Nilsson, Thorsell, Hertfelt Wahn and Ekströ (2013) in "Factors Influencing Positive Birth Experiences of First-Time Mothers" reported on the description of first-time mothers' experiences and reflections of their first birth. This study was part of a larger study which was carried out in South Western Sweden in 2008. A qualitative method with content analysis was chosen for this study. The unit of data was 14 written narratives from the first-time mothers according to Gebremichael, Worku, Medhanyie, Edin and Berhane (2018), a study in Tigray, Ethiopia. The study pointed out that women suffer more from disrespectful and abusive care than from the labour pain itself, in a qualitative study from women's perspective. The research circulated that counselling on institutional delivery services

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could be hampered by women's experience of disrespectful and abusive care during childbirth, in a qualitative phenomenological study. A semi-structured discussion guide was used to elicit the discussion. Data were analyzed using thematic analysis approach assisted by the open code qualitative data management software. The investigation revealed described participants disrespect and abuse as serious obstacles to accessing maternal counselling and health services.

Moreso, women considered health facilities as not fully prepared to provide respectful maternal care. Shimoda, Horiuchi, Leshabari and Shimpuku (2018) conducted a research study on midwives' respect and disrespect of women during facility-based childbirth in urban Tanzania, a qualitative descriptive study. The result revealed that all the 14 midwives showed both respectful and disrespectful care and some practices that have not been explicated in previous reports of women's experiences. Findings showed that both respectful care and disrespectful care of midwives were observed in the two health facilities in urban Tanzania. The researcher explained that to promote respectful care of women, pre-service and in-service training, improvement of working conditions and environment, empowering pregnant women, and strengthening health policies are crucial.

In Sando, Ratcliffe and McDonald (2016), in a research conducted on the prevalence of disrespect and abuse during facility-based childbirth in urban Tanzania, the method adopted was postpartum interviews immediately before discharge from the facility with 1914 systematically sampled women with follow-up interviews of 64 women four to six weeks post-delivery. During postpartum interviews, 15% of women reported experiencing at least one instance of depression and anxiety. The prevalence of disrespect and abuse during facility-based childbirth in health facilities has deterred mothers from using the system. Fair brother, Young and Janseen (2015) disclosed that mood and anxiety and related disorders (AD) account for a significant proportion of mental health conditions. Ishola, Owolabi and Filippi (2017) reported that disrespect and abuse of women during childbirth in Nigeria is at an "epidemic" level.

A systematic review was conducted in a qualitative synthesis using the Bowser and Hill landscape analytical framework on disrespect and abuse of women during childbirth. Fourteen studies were included in this review, a qualitative study with a mixed method approach. Findings showed that this systematic review documented a broad range of disrespectful and abusive behavior experienced by women during childbirth in Nigeria, their contributing factors and consequences to negative birth outcomes, and how this menace should be seriously looked into and remedied. Maternal emotional counselling serves as a needed skill employed to ensure that mothers do not fall into postpartum depression during the postpartum period or slip into anxiety at the facility during or after delivery. In the face of this acute challenge, numerous research studies have been conducted which include a similar study by Bohren, Vogel, Hunter and Lutsiv (2015) conducted on the mistreatment of women during childbirth in health facilities globally. A mixed-methods systematic review was carried out finding which showed that this systematic review presented a comprehensive, evidence-based typology of the mistreatment of women during childbirth in health facilities globally, and demonstrated that mistreatment can occur at the level of interaction between the woman and provider, as well as through systemic failures at the health facility and health system levels.

Wikipedia (2021) declared that giving birth and bringing a baby into the world is generally considered a time of happiness. As a new parent, however, not all mothers might experience this straight away. Often, parents go through a period of exhaustion, shock and stress following

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the birth of their baby, and may initially feel emotional and tearful as they come to terms with such a life-changing experience. This period of 'baby blues' is very common among new parents and usually only lasts for a few weeks. For some though, baby blues develop into a much deeper and longer-term form of depression known as postnatal depression (PND) (Bohren, Vogel & Hunter, 2015). In Meghan and Bohren (2015), the global mistreatment of pregnant women and women that are at the verge of delivery is heartbreaking and at the global level, there is no consensus on how this mistreatment is defined and measured.

Due to this global problem that drastically affects mothers and their usage of the health facility, counselling as a helping service will encourage and foster mothers into forging ahead to still have their babies in the facility and have positive outcomes. Counselling falls under the umbrella term 'talking therapies' and allows people to discuss their problems and any difficult feelings they encounter, in a safe, confidential environment. The term can mean different things to different people, but in general, it is a process people seek when they want to change something in their lives or simply explore their thoughts and feelings in more depth.

What is postnatal depression? Medical dictionary (2021) defined postnatal depression as a condition that usually develops within the first year following the birth of a baby, either gradually or suddenly. It affects one in 10 women and one in 10 men. Postnatal depression tends to be triggered (Basto, Furuta, Small, McKenzie-McHarg & Bick, 2015). A meta-analysis was conducted; the population of women contributing data to each outcome varied from 102 to 1745. The result was based on two trials, respectively. Findings unveiled that among women who experienced a distressing or traumatic birth, there was no evidence of an effect of psychological debriefing on the prevention of PTSD (measured by the MINI-PTSD) at four to six weeks postpartum (RR 1.15; 95 percent CI 0.66 to 2.01; n = 102) or at six months (RR 0.35; 95 percent CI 0.10 to 1.23; n = 103). Despite growing recognition of neglectful, abusive and disrespectful treatment of women during childbirth in health facilities, there is no consensus at the global level on how these occurrences are defined and measured (Meghan, Bohren & Joshua, 2015).

Bohren, Hofmeyr, Sakala, Fukuzawa and Cuthbert (2019), in a qualitative research, maintained in continuous counselling and support for women during childbirth (2017) that historically, women have generally been attended and supported by other women during labour in cluster-randomised trials comparing continuous support during labour with usual care. The findings from the study included a total of 27 trials, and 26 trials involving 15,858 women provided usable outcome data for analysis. Kobayashi, Hanada, Matsuzaki, Takehara, Ota, Sasaki, Nagata and Mori (2017) in Tanzania conducted an investigation on the assessment and counselling support received by mothers during early labour for improving birth outcomes in a cochrane database system review. In the progress of labour, the early or latent phase is usually slow and may include painful uterine contractions.

Women may feel distressed and lose their confidence during this phase. For randomised controlled trials of any assessment or support intervention in the latent phase of labour, cluster-randomised trials were used. Findings revealed that the study included five trials with a total of 10,421 pregnant women in this review update (Apgar scored less than seven at five minutes: RR 1.07, 95 percent CI 0.64 to 1.79; 4989 infants, moderate-quality evidence). Findings revealed that emotional counselling interventions will increase maternal satisfaction with giving birth.

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Research Question

1. To what extent does post-abortion counselling method influence safe motherhood practices among women of reproductive age?

2. To what extent does emotional counselling method influence safe motherhood practices among women of reproductive age?

Hypotheses

1. Post-abortion counselling method does not significantly influence safe motherhood practices among women of reproductive age.

2. Emotional counselling method does not significantly influence safe motherhood practices among women of reproductive age.

The main independent variables for this study were:

Post abortion counselling method

Emotional counselling method.

METHOD

Summary data and one-way ANOVA of the influence of post abortion counselling method on safe motherhood practices among women of reproductive age (N=586)

Table 1

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Within group	5472.466	583	9.387		
Total	5700.655	585			

* Significant at .05 level, p-value = .000, df = 2, 586

The result on Table 18 revealed that the calculated F-value of 12.155 is higher than the p-value of .000 at .05 level of significance with 2 and 586 degrees of freedom. With this result, the null hypothesis was rejected. This result therefore implied that, post abortion counselling method significantly influenced safe motherhood practices among women of reproductive age. Since post abortion counselling method had a significant influence on safe motherhood practices

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among women of reproductive age, a post hoc analysis was employed using Fishers' Least Significant Difference (LSD) multiple comparison analysis.

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LSD

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	High	.19487	.30614	.525
High	Low	1.23772(*)	.32754	.000
	Moderate	-.19487	.30614	.525

* The mean difference is significant at the .05 level

The result of the analysis in Table 5 showed that women whose post abortion counselling method was low were significantly different in their safe motherhood practices among women of reproductive age from those whose post abortion counselling method was either moderate or high. Also, women whose post abortion counselling method was moderate were significantly different from those who were high in safe motherhood practices among women of reproductive age.

Table 3: Summary data and one-way ANOVA of the influence of emotional counselling method on safe motherhood practices among women of reproductive age (N=586)

Emotional counselling method	N	$\bar{x}$	SD
Low – 1	74	35.5000	2.51707
Moderate – 2	329	35.7903	3.36523
High – 3	183	36.9836	2.69610
Total	586	36.1263	3.12165

Source of variance	SS	df	Ms	F	Sig of F
Between group	200.676	2	100.338	10.636	.000
Within group	5499.980	583	9.434		
Total	5700.655	585			

* Significant at .05 level, p-value = .000, df = 2, 586

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The result on Table 3 revealed that the calculated F-value of 10.636 is higher than the p-value of .000 at .05 level of significance with 2 and 586 degrees of freedom. With this result, the null hypothesis was rejected. This result therefore implied that, emotional counselling method has a significant influence on safe motherhood practices among women of reproductive age. Since the emotional counselling method had a significant influence on safe motherhood practices among women of reproductive age, a post hoc analysis was employed using Fishers' Least Significant Difference (LSD) multiple comparison analysis.

Table 4: Fishers' Least Significant Difference (LSD) multiple comparison analysis of the influence of post abortion counselling method on safe motherhood practices among women of reproductive age

LSD

(I) Post abortion counselling method	(J) Post abortion counselling method	Mean Difference (I-J)	Std. Error	Sig.
Low	Moderate	-1.43259(*)	.30514	.000
	High	-1.23772(*)	.32754	.000
Moderate	Low	1.43259(*)	.30514	.000
	High	.19487	.30614	.525
High	Low	1.23772(*)	.32754	.000
	Moderate	-.19487	.30614	.525

* The mean difference is significant at the .05 level

DISCUSSION OF FINDINGS

Post abortion counselling method and safe motherhood practices among women of reproductive age

The result of the seventh hypothesis revealed that there is a significant influence of post abortion counselling method on safe motherhood practices among women of reproductive age.

The finding of this hypothesis is in line with the view of WHO (2009) that post abortion counselling is needed to enable mothers know that help is available when they visit the health facilities. Unsafe abortion, however, is 'any procedure used for terminating an unwanted pregnancy either by persons lacking the necessary skills or in an environment lacking the minimum medical standards, or both. The researcher in consonance with Faundes (2008) also stated in previous works that unsafe abortion can lead to the termination of a woman's life, infertility and fatality. In support of Angèle, Abel and Jacques (2021), the researcher agreed in accordance to the finding of the study that in improving the physical, mental and social health of mothers, their babies and their households would be placed at an advantage.

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Emotional counselling method and safe motherhood practices among women of reproductive age

The result of the eighth hypothesis indicated that there is a significant influence of emotional counselling methods on safe motherhood practices among women of reproductive age. The findings of this hypothesis are in agreement with the view of Asefa, Bekele, Morgan and Kermode (2013). The researcher noted from the findings that women who had experienced disrespectful practices during childbirth perhaps may not return to use the facilities. As epitomized by Gebremichael, Worku, Medhanyie, Edin and Berhane (2018), the study indicated that counselling on institutional delivery could be hampered by women's experience of disrespectful and abusive care during childbirth. The researcher pointed out that women considered health facilities as not fully prepared to provide respectful maternal care. Gebremichael, Worku, Medhanyie, Edin,l and Berhane (2018) they evinced that positive birth means a birth in which a woman feels that she has freedom of choice, access to accurate information, and that she is in control, powerful and respected. The disrespectful treatment the researcher observed would discourage women from taking counselling and practicing safe motherhood.

The main independent variables for this study were:

Post abortion counselling method

Emotional counselling method.

METHOD

Table 3: Summary data and one-way ANOVA of the influence of Emotional counselling method on safe motherhood practices among women of reproductive age (N=586)

Emotional counselling method	N	$\bar{x}$	SD
Low – 1	74	35.5000	2.51707
Moderate – 2	329	35.7903	3.36523
High – 3	183	36.9836	2.69610
Total	586	36.1263	3.12165

Source of variance	SS	df	Ms	F	Sig of F
Between group	200.676	2	100.338	10.636	.000
Within group	5499.980	583	9.434		
Total	5700.655	585			

* Significant at .05 level, p-value = .000, df= 2, 586

The result on Table 3 revealed that the calculated F-value of 10.636 is higher than the p-value of .000 at .05 level of significance with 2 and 586 degrees of freedom. With this result, the null hypothesis was rejected. This result therefore implied that, emotional counselling method has a significant influence on safe motherhood practices among women of reproductive age. Since the emotional counselling method had a significant influence on safe motherhood practices

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among women of reproductive age, a post hoc analysis was employed using Fishers' Least Significant Difference (LSD) multiple comparison analysis.

Table 4

Fishers' Least Significant Difference (LSD) multiple comparison analysis of the influence of emotional counselling method on safe motherhood practices among women of reproductive age

LSD

(I) Emotional counselling method	(J) Emotional counselling method	Mean Difference (I-J)	Std. Error	Sig.
Low	Moderate	-.29027	.39517	.463
	High	-1.48361(*)	.42313	.000
Moderate	Low	.29027	.39517	.463
	High	-1.19333(*)	.28324	.000
High	Low	1.48361(*)	.42313	.000
	Moderate	1.19333(*)	.28324	.000

* The mean difference is significant at the .05 level

The result of the analysis in Table 21 showed that women whose emotional counselling method was low were significantly different in their safe motherhood practices among women of reproductive age from those whose emotional counselling method was either moderate or high. Also, women whose emotional counselling method was moderate were significantly different from those who were high in safe motherhood practices among women of reproductive age.

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ANTENATAL CARE COUNSELLING AND HYGIENE COUNSELLING METHOD AMONG MOTHERS IN CROSS RIVER STATE, NIGERIA

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ABSTRACT: *This article provides information on antenatal counselling and hygiene counselling methods among mothers in Cross River State, Nigeria. Two research questions were drawn and two null hypotheses on the variables to direct the variables under investigation. The population was 3,006 women of reproductive age. Relevant literature was reviewed in line with the research objective. The literature employed supports the theoretical framework. Ex post facto design was implemented in the study. The selection was done through the sampling and purposive sampling technique. The reliability estimate of the instrument was established through the Cronbach Alpha reliability method. One way analysis of variance (ANOVA) was the statistical analysis technique adopted to test the hypotheses under study. All hypotheses under study were subjected to testing at .05 level of significance. From the data analysis, the researcher's findings was in consonance with that of Goodburn and Campbell (2001) that antenatal counselling and hygiene are organised services provided to cater for the health needs of prenatal and postnatal women, newly delivered mothers, during labour, delivery, puerperal periods so as to reduce morbidity and mortality. On hygiene counselling, the researcher admitted that hygiene is the practice of keeping oneself and one's living and working environment clean in order to prevent illness and diseases (Centre for Diseases Control, 2009).*

KEYWORDS: Antenatal, Hygiene, Counselling, Variables, Mortality, Fatality, Sampling technique.

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INTRODUCTION

Around the world, people celebrate the birth of a new baby. Mothers are celebrated at the successful delivery of their babies and honoured for their role as mothers. Yet in most parts of the world, pregnancy and childbirth remain a precarious journey (White Ribbon Alliance, 2000). In developing countries, more than half a million women die each year from causes related to these life threatening events, such as morbidity, mortality, obstetric fistula, and other allied diseases such as high blood pressure and gestational diabetes (World Health Organisation, 2004). Shiffman (2000) stated that ninety-nine percent of these deaths occur in less developed regions, and most are due to inadequate medical care at the time of prenatal care and childbirth. Shiffman (2000) further opined that women's lives can be saved and their suffering reduced if health systems could address these preventable life threatening conditions.

Goodburn and Campbell (2001) revealed that antenatal counselling are organised services provided to cater for the health needs of women during pregnancy, labour, delivery and puerperal periods so as to reduce morbidity and mortality. In Nigeria, the use of antenatal counselling, during pregnancy and delivery by pregnant women, is still very low and maternal morbidity and mortality remains a public health challenge (Khalid, 2006). Antenatal Care (ANC) is the care a pregnant woman receives during her pregnancy through a series of consultations with trained health care workers such as midwives, nurses and sometimes a doctor who is a gynaecologist. (National HIV/AIDS and Reproductive Health Survey, 2013; Lincetto, Mothebesoane-anons, Gomez & Minyanja, 2010; Bustre et al., 2013). The poor outcome in Nigeria could be the result of poor ANC utilisation (Barigagi, Findley & Helleningers, 2011; Ajayi & Osakine, 2013).

Fagbamigbe and Idemudia (2015) carried out a study in the north-eastern part of Nigeria. Records of 2,199 respondents who did not use ANC among the 6,229 women of childbearing age who had at least one child within five years preceding the National HIV/AIDS and Reproductive Health Survey in 2012 were used for the analysis. The barriers reported for not visiting any ANC provider were assessed vis-à-vis respondents' social demographic characteristics. Using multiple response data analysis techniques and Pearson chi square test at 5% significance level, rural dwellers constituted the majority of the mothers who did not use ANC during the five years preceding the survey. North-east was the geographical zone with the highest number of non-users compared with the few non-users from the south-east. Some respondents with higher education and also in the wealthiest quintiles did not use antenatal care. The reason given for non-usage of ANC varied significantly with respondents' wealth status, educational attainment, residence geographical location, age, and marital status. Over half of the non-users reported having problems getting money, while 44.1% claimed they did not attend ANC due to unavailability of transport services. The three leading problems: "getting money to go"; "fairness of ANC service providers"; and the "unavailability of transport" constituted 44.3% of all barriers. The study revealed that the elimination of these three problems could increase ANC coverage in Nigeria by 15%.

However, Dada (2008) in a cross sectional descriptive study in Atwina, Ashanti, Ghana studied a population consisting of 28,255 women. This represented the total number of women in the reproductive age group at the time of the study. A total sample size of 222 women was selected through the simple random sampling technique. The instrument was both a close and open ended questionnaire. The average age of the respondents was 28.0 years and a deviation of 6.51. The minimum age among the respondents was 15 and the maximum 47 years. Over fifty

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percent (52.2%) of the respondents were between the ages of 20-29 years. Their occupations were farming, trading, and artisanry.

Also, a study carried out by Ojong et al. (2015) at the University of Calabar Teaching Hospital, Cross River state on 174 pregnant women who attended antenatal care clinics revealed that the majority of the respondents had good perceptions toward antenatal care. The instrument for data collection was a three-section questionnaire. The instrument which had a correlation coefficient of 0.79 questionnaire was administered through face-to-face interaction and on-site collection of completed questionnaires. The data were analysed using frequencies and percentages, while chi-square test analysis was used to test the hypotheses. In testing the hypothesis using chi-square analysis, it showed a statistical association between perception and attitude towards focused antenatal care. Based on the above, intensive awareness creation on focused antenatal care for pregnant women was recommended. Retraining of health workers and the supervision of health workers to improve on the hindrances identified as barriers were also recommended.

Ikechuku (2010) in a descriptive, cross sectional study of 204 eligible and consenting women who participated in this study. These women were of child bearing age (reproductive age group therefore 15-49 years) who attended antenatal, maternal and child health clinics at the General Hospital Onitsha.

Semi-structured interviews were administered using pre-tested questionnaires. Data were collected on the respondent's biodata, antenatal care attendance and content of antenatal care at the last continent and factors influencing antenatal care utilisation. The research assistants were trained on vernacular translation and questionnaire administration. The questionnaire was pre-tested in a private health facility in Idemili North Local Government Area to ascertain the reliability and validity of the instrument and a time duration for completing questionnaires was given. Data collected were analysed using a statistical package for social science (SPSS) and presented using tables and charts. Relevant means were calculated and tests of association carried out using t-test and chi-square (X2). Statistical significance was established at $P<0.05$. A total of 204 respondents were interviewed and the findings are as presented below. The age range of respondents was 15-44 years and mean age was 28.3±4.7 years. Most of the respondents were married (97/1%) about 93% and 88% of them were Christians and Igbos respectively.

WHO (2008) averred that antenatal counselling promotes the health of the mother and newborn during and after delivery. Lawn (2006) maintains that in several developing countries, information is lacking on the intrinsic quality of communication limiting one's ability to assess intervention effects. However, several studies, as posited by Harting (2004), have examined the quality of antenatal counselling suggesting that adequacy of information provided is low (Teifer, 2002; Rowley, 2002; Walreven, 2002). Available data suggested that mothers often perceive counselling to be poor. Beck (2002) further stated that low maternal knowledge following counselling has been attributed to insufficient communication (Rea, 2007; Delva, 2006).

Hygiene Counselling

Hygiene is the practice of keeping oneself and one's living and working environments clean in order to prevent illness and disease (CDC, 2009). Centre for Diseases Control (2009) defined

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handwashing as the act of cleaning the hands with water or another liquid with or without soap or other detergent, for sanitary purposes. Therefore, the fundamental principle of handwashing is removal and not killing (CDC, 2009). Goodburn (2001) opined that the prevention of infection is by ensuring that the women give birth in a clean environment by maintaining the highest possible standards of hygiene and infection control, and using clean or sterile equipment, including gloves.

Fetuga (2007) and Bang (2001) stated that infection accounts for up to 40% of neonatal deaths in Nigeria and India. Hence, the World Health Organisation emphasises on the "five cleans" during the delivery. The "five cleans" are a clean place, a clean surface, clean hands, clean cord and dressing and a clean tie. Curtis (2005) and Fewtrell (2005) stated that the hygiene practices have proven to reduce diarrhoea rates by 30 – 40 percent. Furthermore, they posited that the level of reduction is achieved through a comprehensive approach by promoting improvements in key hygiene practices; such as hand washing, treatment and safe storage of drinking water, safe disposal of faeces and food hygiene. The practice of hand washing is about as old as man; it is a very important practice held by the Jews in high esteem who ensured that hand washing preceded eating. Good handwashing involves the brief rubbing together of all surfaces of the lathered hand, followed by rinsing under a stream of water (CDC, 2009).

People are particularly guided by their culture in Nigeria and other African countries. The African culture assigns mothers the dual role of being the children's nurse (who handles their faeces, blows their nostrils, bathes and feeds among other things as well as the household) and chef (who prepares the family meals and feeds the children). This coupled with poor knowledge and practice of simple hygiene increases the risk of spreading disease to the underage children who by reason of their poorly developed immune system are particularly vulnerable to these diseases (CDC, 2009). Some critical times at which hand-washing must be employed include: after using the toilet; changing diapers; attending to a sick person; handling raw meat, fish or poultry; after handling garbage treating a wound or cut; contact with domestic animals; before food preparation; and before eating (Centre for Disease Control, 2009). Equally, Black, Morris and Bryce (2003) stated that a great number of diseases can be transmitted from lack of or ineffective hand washing, particularly faeco-orally transmitted diseases, ranging from self-limiting infections like diarrhoea. Hygiene measures, including hand washing with soap before meals and after use of restrooms, have been found to prevent Hepatitis A viral infection (WHO, 2012). Water and sanitation projects are strongly linked, introducing multiple health effects. The improvements in the quantity and quality of water were singularly able to reduce the morbidity due to diarrheal diseases by just 17%; combinations of water and sanitation projects were further able to reduce the morbidity rate by as much as 30%.

The World Health Organization (2012) estimated that 5.5% of the global disease burden is due to inadequate water and sanitation, while the duo is believed to be responsible for 88% of the 4 billion diarrheal cases, and the resultant 1.8 million deaths that occur in the world annually. Furthermore, WHO (2005) stated that 94% of the diarrheal cases are preventable through increased availability of clean water and improved sanitation and hygiene. UN (2008) stated that the importance of safe water and improved sanitation is further reflected in their inclusion as one of the Millennium Development Goals, a framework that was widely accepted for the worldwide improvement of health and welfare. National Population Committee/Owners Risk of Chafing (2003) stated that there has been a lot of investments on improving water supply; however, efforts in improving access to sanitation facilities in Nigeria have been restricted to the building of a few public toilets. According to the survey by the National Demography and

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Health in 2003, 29.8% of rural households in Nigeria had access to potable water compared to 6.7% with flush toilets. This lack of emphasis is said to be responsible for 5-20% of all deaths in Nigeria (Water Aid Nigeria, 2004).

In another study, Curtis and Caincross (2003) observed that improving access to safe water, sanitation technologies, products and facilities or an enabling environment improves hygiene. In a community based descriptive cross sectional study carried out by Asekun-Olarinmoye, Olubukola and Wasiu (2014) in Igbonna, located in Olorunda local Government area of Osun State, Nigeria, the sample size was determined by using Leshie Fisher's formula which yielded approximately 270 respondents. Assuming a 10% non-response rate, 300 respondents were recruited for the study. Multi-stage sampling technique which involved four stages was utilised in recruiting respondents as follows:

Stage 1: Two-thirds of all streets in Igbonna were selected (i.e. 10 out of 15 existing streets) by simple random sampling (balloting).

Stage 2: Systematic sampling method was used to select houses in each street. This was based on the total number of houses in each street.

Stage 3: All eligible households in each house were selected.

Stage 4: All consenting mothers of under–five in each eligible household were recruited into the study.

A pre-tested semi-structured questionnaire comprising questions on respondents' socio-demographic characteristics, knowledge, attitude and practice of hand washing was utilised for data collection, using the interviewer administered questionnaires. Three hundred mothers of under five children, most of which belonged to the age group of 21-30years (71.7%) participated in the study. Nearly one-half (48.3%) of them were traders, while about a third (30.0%) were artisans. More than one-half (56.7%) of them had secondary education as their highest educational qualification. A few respondents (2.0%) had no formal education while about one-fifth (18.6%) of them had post secondary education. Majority of the respondents (98.3%) were married and there were nearly as many Muslims as Christians (48.7% and 51.3% respectively). The respondents mostly had 1 or 2 under five children each (97%).

Uneke et al. (2013) carried out a cross sectional intervention study. The study was divided into two phases: the intervention phase and evaluation phase. A total of 202 health workers (39 doctors and 103 nurses) were selected, and the WHO direct observation method was used. In the study, the overall hand hygiene compliance rate was 65.3%. This outcome was comparatively higher than the compliance rates reported by a number of recent similar studies from various developing countries including Saudi Arabia (50.3%), Brazil (46.7%), Kuwait (33.4%) and Indonesia (20%). In the present study, the post-intervention hand hygiene compliance rate was related to professional category and findings indicated that hand hygiene compliance rate was significantly higher among the nurses (72.9%) and the midwives (65%) compared to the doctors (59.7%) (X^2=23.48, P<0.05). Evidence emerging from the same recent studies in Saudi Arabia, United Kingdom and Italy showed that hand hygiene compliance rate is consistently higher among the nurses than the doctors.

Evidence by Clasen (2006) stated that counselling on the treatment and safe storage of water has reduced diarrhoea. Clasen (2007), in a systematic study using randomised and quasi-

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randomised trials of interventions to improve the microbial quality of drinking water for the prevention of diarrhoea in adults and in children in settings with endemic disease. Data analysis with 33 reports from 21 countries documenting 42 comparisons were included. Variation in design, setting, and type at point of intervention and variation in the defining assessing, calculating and reporting outcomes limited the comparability of the study results and pooling of results by metal analysis.

Effectiveness was not conditioned in the presence of improved water supplies or sanitation in the study setting and was not enhanced by combining the intervention with instructions on basic hygiene, a water storage vessel, or improved sanitation or water supplies. Other common environmental interventions intended to improve water quality are generally effective for preventing diarrhoea in all ages and in under fives.

The intervention to improve drinking water quality was undertaken at the level of either the water source or the household. Water source interventions included protected bore holes, wells, distribution to public tap stands. Household interventions comprised improved water storage, approaches to treating water in the home (chlorination), water purifying products, filtration interventions, Improvement in water quality were often accompanied by other environmental interventions intended to prevent faecal-oral transmission, including improved sanitation and water supplies, improved water storage in the home, instruction on basic hygiene regarding contaminated water and diarrheal disease.

Ordimoha and Owhondah (2008) carried out in a descriptive cross-sectional study in Ogboru, Ndomi local government area of Rivers State, 194 was the sample size but made up to 220 to take care of non-responses. The 220 copies of the questionnaire were administered and retrieved. Most of the respondent were engaged in agriculture (31.30%) had secondary school education, (46.82%) and had spouses with mostly secondary school education (53.18%) who were mostly engaged in agriculture (25%) or self employed (28.84%). Only 149 (67.73%) of the households had access to a sanitation facility. The instrument was administered using a structured interviewer-administered questionnaire, field observations and focus group discussion. The reason given by the respondents for not having a sanitation facility include lack of space 61 (85.92%) and cost 9(21.68%). Most of the facilities were flush toilets 91(61.07%) and they formed 87.95% of the 83 facilities found to be in good hygienic condition of the respondents with sanitation facility, 43 (28.86%) would not allow young children to use the facility for the fear that they might fall into the latrine pit. Children were mostly allowed to defecate wherever is convenient for them, and only 47(21.36%) of the respondent routinely disposed the stool of their children into the sanitation facility.

About 88 (40%) of the respondents were found to have found human faeces in their compound, and only 48(21.82%) were found to have the appropriate handwashing behaviour. 31(14.09%) of the households reported at least an episode of diarrhoea in a children less than 36 month. The access to sanitation facilities in the study community was comparable to those of urban communities in Nigeria. However, hand washing behaviour remains poor such that the prevalence of diarrhoea is still high in the commonly.

The study was designed to detect a 5% difference in access to sanitation facility with an alpha error of 5%, acceptable beta error of 20%, and a power of 80%, and using the national average of household access to sanitation facility of 74.3%. Using the usual formula for sample size

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determination descriptive studies, the minimum required sample size was determined to be 194, but made up to 220 to take care of non-responses.

A broad range of research by World Health Organisation (2012) and United Nations Children Emergency Fund (2010) added that safe disposal of faeces reduces the risk of diarrhoea by 30 percent or more. The World Health Organisation (2015) published a document called five keys to safer foods that describes actions that families should take in the kitchen to maintain food safety. These actions include not mixing raw meat with cooked food, cooking food thoroughly, keeping food at safe temperature, and using safe water and raw materials (WHO, 2015).

Research Questions

1. To what extent does mothers' perception of ante-natal counselling influences safe motherhood practices?

2. To what extent does mothers' perception of hygiene counselling influences safe motherhood practices?

Hypotheses

1 Mothers' perception of ante-natal counselling does not significantly influence safe motherhood practices.

2 Mothers' perception of hygiene counselling does not significantly influence safe motherhood practices.

DATA PRESENTATION AND ANALYSIS

Summary of Independent t-test for the Influence of Mothers' Perception of Ante-natal Counselling on Safe Motherhood Practices

S/No	Safe Motherhood Practice	Perception of Ante-Natal Counselling	N	X	SD	T
1	Drug Intake Habit	Positive	22	16.00	0.02	3.57
		Negative	289	13.85	2.82	*
2	Food Consumption Pattern	Positive	22	7.68	2.03	5.23
		Negative	289	9.97	1.97	*
3	Rest Pattern	Positive	22	7.95	2.50	6.15
		Negative	289	10.98	2.21	*
4	Exercise Routine	Positive	22	9.59	3.02	5.67
		Negative	289	12.20	2.00	*
5.	Overall Safe motherhood practice	Positive	22	41.23	5.40	5.37
		Negative	289	47.00	4.82	*

P<.05 level of significance; df = 309; critical t = 1.96

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Results of data analysis showed that the calculated t-values for mothers' perception of antenatal counselling and safe motherhood practices in terms of drug intake habit (3.57), food consumption pattern (5.23), rest pattern (6.15), exercise routine (5.67), and in terms of overall safe motherhood practices (5.37) were each greater than the critical t-value of 1.96 at .05 level of significance using 309 degrees of freedom. These results mean that mothers' perception of antenatal counselling significantly influences safe motherhood practices in terms of the sub-variables and in terms of overall practices. Results of mean values revealed that, it was mothers with positive perception toward ante-natal counselling ($\underline{X}$=47.00) that exhibited better safe motherhood practices than their counterparts with negative perceptions ($\underline{X}$=41.23). Since the result on overall safe motherhood practices was significant, the null hypothesis is rejected.

Summary of Independent t-test for the Influence of Mothers' Perception of Hygiene Counselling on Safe Motherhood Practices

S/No	Safe Motherhood Practice	Perception of Hygiene Counselling	N	X	SD	T	P
1	Drug Intake Habit	Positive	27	15.78	0.42	3.54*	.000
		Negative	284	13.83	2.85		
2	Food Consumption Pattern	Positive	27	8.70	2.30	2.95*	.003
		Negative	284	9.91	2.00		
3	Rest Pattern	Positive	27	8.04	3.40	6.74*	.000
		Negative	284	11.03	2.06		
4	Exercise Routine	Positive	27	9.04	1.99	8.16*	.000
		Negative	284	12.30	1.98		
5.	Overall Safe motherhood practice	Positive	27	41.56	6.06	5.66*	.000
		Negative	284	47.07	4.71		

P<.05 level of significance; df = 309; critical t = 1.96

The independent variable in this hypothesis is the mothers' perception of hygiene counselling (classified into positive and negative perceptions), while the dependent variable is safe motherhood practices among women. The classification of the women into groups of positive and negative perceptions was done using the score range of 18 (24-6=18). Scorers between 6-15 points were considered as having negative perceptions, while scorers within 16-24 points were considered as having positive perceptions towards hygiene counselling. Independent t-test statistical technique was employed in testing the hypothesis.

Results of data analysis showed that the calculated t-values for mothers' perception of hygiene counselling and safe motherhood practices in terms of drug intake habit (3.54), food consumption pattern (2.95), rest pattern (6.74), exercise routine (8.16), and in terms of overall safe motherhood practices (5.66) were each greater than the critical t-value of 1.96 at .05 level of significance using 309 degrees of freedom. These results mean that mothers' perception of hygiene counselling significantly influences safe motherhood practices in terms of the sub-variables and in terms of overall practices. Results of mean values revealed that, it was mothers with positive perceptions toward hygiene counselling ($\underline{X}$=47.07) that exhibited better safe motherhood practices than their counterparts with negative perceptions ($\underline{X}$=41.56). Since the result on overall safe motherhood practices was significant, the null hypothesis is rejected.

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DISCUSSION OF FINDINGS

Mother's Perception of Ante-natal Counselling Significantly Influence their safe Motherhood Practices

The result of the data analysis in respect of hypothesis one showed that mother's perception of antenatal counselling significantly influenced their safe motherhood practices, in terms of drug intake habit (3.57), routine exercise pattern (5.67), food consumption pattern (5.23), rest and recreation pattern (6.15) and safe motherhood practices (5.37) were each greater than the critical value of (1.96) at 0.05 level of significance using 3.09 degrees of freedom. Mothers with positive perception towards antenatal counselling exhibited better safer motherhood practices than their counterparts with negative perceptions. This result corroborated with WHO (2000) reports on the antenatal services on reducing maternal mortality rate. The study of Oman, Sharbarki and Rhandeka (2008) also supported the findings that registered women who visited the antenatal clinics were happy with the services at the antenatal clinic mainly because of the attitude of the doctors and nursing staff and it affords the opportunity for socialisation.

Also, WHO (2008), in further agreement with this finding of the study, stated that antenatal counselling promotes the health of the mother and newborn during and after delivery. The practice of antenatal counselling provides an important opportunity to improve maternal understanding about pregnancy, childbirth and the care of the newborn (Teifer, 2002). This finding corroborated with the earlier research work of Goodburn and Campbell (2001) that antenatal counselling are organised services, provided for, to cater for the health needs of women during pregnancy, labour, delivery, and puerperal periods so as to reduce morbidity and mortality in Nigeria. This researcher noted that mothers with negative perception were dissatisfied with the laboratory services, inadequate learning during visits, inadequate familiarisation with care providers and overcrowding at the ante-natal clinic during morning hours. The researcher also observed that mothers in the study with positive outcome are happier and willing to take to the counsel of the researcher. Mothers who had counselling sessions with the health counsellor were ready to make referrals to other mothers based on their positive outcome and experiences. In line with this result, Igbokwe (2008) indicated that urban and rural locations have great impact on the utilisation of antenatal services, that is, mothers living in rural areas are hindered by access to the health facility due to the distance and cost of transportation. Rowley and Walreven (2002) suggested that mothers with negative perceptions often perceive counselling to be poor. Beck (2002) equally stated that low maternal knowledge following counselling has been attributed to insufficient communication.

Mother's perception of hygiene counselling significantly influences their safe motherhood practices

The result of this component of the study showed that mother's perception of hygiene counselling does not significantly influence safe motherhood practices. In line with Curtis and Fewttrell (2005), this result observed that hygiene practices have proven to reduce diarrhoea rates by 30-40 percent. Furthermore, mothers with positive hygiene practices exhibited better safer motherhood practices such as the "five clean practices" which the World Health Organisation emphasises during delivery. The guidance counsellor positively impacted her counselees by informing them of the need to embark on the five safety keys such as clean food, clean surface, clean water, clean storage and clean hands. This researcher also emphasised the

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need for mothers to engage in the three cleans, such as clean cord, clean tie, clean surface to ensure safety for child.

The implication of the study would mean that mothers who do not practice safe motherhood might have children who are not educationally competent, which might perhaps lead to educational backwardness.

CONCLUSION

The study revealed that there are various factors that mitigate against a mother's safe delivery and influences her well being and her foetus. The study implies that if a mother practises safe motherhood, that is, antenatal counselling and hygiene counselling, she perhaps might fare better in comparison to women who do not practise antenatal counselling.

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