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# Gender Differences in Acceptability and Usability of Computer Based Learning Package in Electrical and Electronics Technology in Nigeria

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**Abstract** Gender differences are one aspect of the overall cultural differences that exist between human beings. National/ethnic and gender differences constitute the socio-cultural factors that influence perceptions and behaviors. Gender differences found across a wide variety of disciplines apply equally well to emerging computer-based technologies. One of the new technological systems is the computer described as a device for the most effective communication and individual education. The success of technology-based instruction usage for learning is primarily due to its potential to integrate various types of media but gender inequality in learners' perception of, attitude towards, and intention to use technology, belief, view, motives and motivation, and behavioural intention has created disparity in their acceptance and use of this new technologies. Therefore, this study investigates gender differences in acceptability and usability of a computer learning package for teaching thermionic emission in electrical and electronics technology. This study adopts a Causal comparative research design with the design and development of the learning package. 80 students in 200 Level and ND1 (First Year Students of National Diploma) of the department of Electrical and Electronics engineering and Technology in a University and Polytechnic in Ogun State formed the respondents for the study. 40 students are randomly selected from each school with the total number of 18 females and 62 males. The developed package and 43 questionnaire items were used as data collection tools. The designed and developed package was presented to each student for interaction and later the structured questionnaire (Cronbach alpha = 0.89) was administered to the respondents for data collection. Two research questions were raised and two hypotheses were tested in the study. Data collected were analysed using T-test at 0.05 level of significance. The research findings revealed a non significant gender difference in both acceptability and usability of the FOSS-based package (df = 78; t = 1.620; P > 0.05 and df = 78; t = 0.668; P > 0.05 respectively). Based on the findings, it is concluded that there most likely will not be gender differences in the achievement of males and females using this computer based package. Consequently reducing the gender gap in science and technology.

***Keywords:*** *gender, FOSS, computer based learning (CBL), science and technology education (STE), ICTs*

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## 1. Background

### 1.1. Introduction

In Nigeria, like most other developing nations of the world, most people tend to accept the fact that science and technology education is required for a meaningful technological development. This acceptance is guided by the fact that growth of any nation depends on, and is generally determined by its advancement in science and technology as in [11]. The advances in science and technology have changed the structure and the education systems of societies [1]. Reference [2] emphasized in their study that technology has become very important in human life at the present time. Reference [2] further stated that technology proves to change the less developed characteristics of any country by changing their cultural and social structures. Therefore, any knowledge that can provide advancement in technology is being given attention for development and improvement.

Moreover, study such as [14] opines that there are important contributions of results and suggestions of scientific researches in physics being integrated into the life of the communities on the basis of technological growth, and that the use of computers provides significant contributions in physics and related courses. Using technological equipments in order to aid learning has become a common method in the educational sectors around the world, including Nigeria. Therefore, the use of equipments and computer in education is quickly replicated because of triggered positive developments in

educational technology. Technological applications in education have improved in various ways. Software programs, animations and experiment simulations for physics concepts are premier examples of using technological equipments in education.

Today many schools in Nigeria are trying to integrate Information and Communications Technologies (ICT) into their teaching and learning processes. Reference [16] stated that one of the aims of any science and technology course is to train individuals capable of keeping up the fast developing and changing science world and capable of utilizing the recent technological discoveries in every field. Also, study of [2] revealed that one of the main aims of the science teaching education is to bring up people who can keep up with the science age which changes and grows up at any moment and can benefit from the latest technological inventions in every fields and to teach the necessity of the science in all technological inventions and developments. Reference [7] established that the use of computers in education due to its positive effect to increase the attention and curiosity of students, and the helps it provides in the conceptual learning, is spreading widely. In addition, most of the knowledge related to natural phenomenon is now available in the computer environment. That is why, when teachers use computers as a teaching tool, this would give them the ability to show the physical phenomenon in a way that students can visualize in a three dimensional form.

One of the new technological systems is computer described as a device for the most effective communication and individual education. It is inevitable to use these new technologies such as; the internet, video or teleconferencing, mobile phones, IPADs, IPODs, Interactive TV, satellite broadcast, Audio and Video, Slides, CDs, computers etc to solve problems in education because the development of technology from day to day is providing better alternatives to the ways and means by which teaching and learning was previously carried out which invariably is reducing the problems encountered in education [2]. The success of technology-based instruction usage for learning is primarily due to its potential to integrate various types of media (such as sound, video, graphics, text, etc.) and delivered in various forms (such as collaboration, interactive, simulation, etc.). Majority of this teaching tool possesses the ability to show the physical phenomenon in a way that students can visualize in a three dimensional form.

With these technologies, learning nowadays can be facilitated through different methods other than the traditional teaching and learning method. Such methods include; mobile learning, distant learning, virtual learning, computer-based learning, among others.

## 1.2. Computer-Based Learning (CBL)

Computer-based learning (CBI) has the potential to facilitate development of students' decision-making and problem solving skills, data-processing skills, and communication capabilities [4]. Recent studies have associated learning performance with the use of Computer Assisted systems and that the quality of learning can be significantly enhanced when ICT is integrated with teaching. For instance in his study [4] found that computer assisted instruction has had positive impact on students' perceptions about computer supported instruction as well as on to their academic achievement. Also, based on the result obtained from her study, [19] disclosed that the experimental group's superior performance illustrates the power of the science–technology–society paradigm (STS) curriculum over the traditional science curriculum to which the control group was exposed. Hence, calls for ICT based learning packages because it promotes active participation of learners. It furthermore enhances, hands-on-experience that learners require to construct meaningful learning, promoting active reasoning. By using computers, [4] confirmed that students can gain access to expansive knowledge links and broaden their exposure to diverse people and perspectives.

Reference [16] also established in his study that, educational technologies, especially computers play an important role in concretizing abstract concepts, which are difficult for students to learn, by means of animation. Thermionic emission, the process of driving electrons out of a substance by heating, is the concept under consideration in this research work. This is one of the abstract topics in electrical and electronics engineering field which is usually difficult to teach and learn. The computer-based instruction makes teaching techniques far more effective than those of the traditional teaching methods as it is used for presenting information, testing and evaluation and providing feedback [16]. It contributes greatly to the individualization of education. It motivates students and gets them to take an active part in the learning process. It helps to develop creativity and problem solving skills, identity and self-reliance in learners. CBI provides drawing, graphics, animation, music and plenty materials for students to proceed at their own pace and in line with their individual differences. It serves to control lots of variables having an impact on learning, which cannot be controlled by means of traditional educational techniques [2]. Computers, computer based learning materials, and educational software is widely used in schools and colleges as part of school practice nowadays [3,4].

## 1.3. Free Open Source Software (FOSS)

Free Open Source Software (FOSS) is software that is made available along with source code as a distinctive feature. It is often available at no cost. Users can use and distribute the software. And if they so wish, they can study the source code and modify it to suit their needs. The modified version of the software can also be redistributed [17]. Open Source Software/ Free Software (OSS/FS) programs are "programs whose licenses give users the freedom to run the program for any purpose, to study and modify the program, and to redistribute copies of either the original or modified program without having to pay royalties to previous developers" [22].

The Free Software movement focuses on moral and ethical issues relating to the freedom of users to use, study, modify and redistribute software. There are a lot of Free/Open Source educational software that can be used to package learning materials for teaching specific subjects or courses in schools, colleges and universities. Some of the examples of FOSS are Tux Paint, Drag and Drop games, Kig, Ghemical, Photo Story, QCAD, Scilab and Microsoft Learning Content Development System etc.

The research reports of [10] and [5] suggested that these software packages can be used to encourage

discovery and experimentation in classrooms and their visualization features can be effectively employed in teaching to generate conjectures. Different packages support teaching at a variety of curriculum levels and they require different amounts of classroom time for students to become proficient with the software. Reference [18] disclose that it is widely recognized that Free and Open Source Software (FOSS) can efficiently address many educational challenges, and provide higher quality, reduced costs and increased availability of different platforms and other educational applications available. For these reasons, FOSS will be used in developing the learning package for this study and the learner's acceptability and usability of the package would be investigated based on gender. Technology acceptance and use in different sectors including teaching and learning has been a debated topic as being influenced by different variables among which gender is germane.

### 1.4. Technology and Gender Disparity

Gender differences are one aspect of the overall cultural differences that exist between human beings. Gender differences found across a wide variety of disciplines apply equally well to emerging computer-based technologies. Socio-linguistic literature on gender differences show that, to some extent, women and men mean and understand similar messages quite differently [6]. Their research has shown that men tend to focus discourse on hierarchy and independence while women focus on intimacy and solidarity. This provides a solid grounding for conceptual extensions to the Information Technology (IT) diffusion research and the Technology Acceptance Model.

Testing gender differences that might relate to beliefs, acceptance and use of computer-based media, the study of [6] indicated that women and men differ in their perceptions but not use of technology. The ways in which men and women respond during the Information Technology (IT) diffusion process could be essential for competitiveness in the emerging organizational environment. It can be established that women and men respond in different ways to Information and Communication Technology (ICT).

In their findings on individual variables, the study of [24] regarding the attitudes towards commonly used technology, disclosed that a highly significant gender effect was found which reveals that men show distinctly more positive biases towards technology than women. In a study of Masters' students, approximately half women and half men, while examining gender differences, [6] found that female college students had significantly higher computer anxiety than male students. These results suggest that differences between the sexes occur in computer-related circumstances which, by logical extension, could affect the diffusion of IT use in the workplace and learning environment. These research reports are supported by the findings of [25] who identify in an empirical study conducted that the prevalence of computer anxiety is higher among women than men due to women's exclusion from the work-place in the past. Computer anxiety was defined as an individuals' apprehension (or fear), when they are faced with the possibility of using computers [20,25]. If this is so this may affect not only the usage but acceptance of technology by either men or women.

Reference [8] disclosed in his study that men and boys, compared with girls and women, consider that computers are more appropriate for them, and believe themselves more competent when performing computer-related tasks. [25] also explained that male college students rated computers as more useful than female students.

Gender differences in technology acceptance may be an important factor affecting perceived usefulness [25]. Similarly, [20] propose that women are more motivated by process (PEU) and social (subjective norm) factors than men. Reference [20] therefore expect that a low evaluation of computer self-efficacy will cause an increase in the salience of perceptions of usefulness and ease of use in an e-learning context. Reference [20] indicated that men consider perceived usefulness to a greater extent than women in making their decisions considering usefulness or productivity-related factors of a new technology and that men are more driven by instrumental factors than women.

A few more empirical studies showed that gender differences in information technology do exist: [26] found significant gender differences in beliefs while applying the technology acceptance model to a group of pre-service teachers; [9] found that males generally are more interested in information technology; this research reports suggested that there is an association between gender and attitudes of information technology [23].

Research reported by [15] has shown that men's ratings of self-efficacy and/or computer self-efficacy is higher than that of women. Reference [13] and [15] pointed out that information technology systems that are easier to use will be less threatening to the individual. In their studies they found that men are more experienced in terms of working with computers and exhibit more positive attitudes than females. Furthermore, they investigated gender-based attitudes towards using computer-assisted learning (CAL) amongst university students; results revealed that male students preferred using CAL in contrast to female students.

A persistent gender imbalance in the African work-place has been noted to exist chiefly in the Science, Engineering and Technology (SET) sectors, areas that have an important bearing on global competitiveness and, more specifically, in the quest for continued growth in sustaining the knowledge economy [12]. Women employed in the SET sectors face a myriad of challenges in their work-life in stark contrast to their male counterparts.

Based on gender disparities in the diffusion and use of technology in various spheres of human life most especially in teaching and learning activities, it is important to investigate the effect of gender on the acceptance and usability of a Free Open Source Software learning package for teaching and learning in electrical and electronic engineering and technology. Therefore, it is necessary to conduct research that deals more intensively with learners' perception of, attitude towards, and intention to use technology based on gender.

## 2. Purpose of the Study

The aim of this study was to determine whether there are any gender differences in the acceptability and

usability of computer based learning package (FOSS/LCDS type) for teaching and learning in tertiary institutions in Nigeria. In the direction of the aim stated above the following research questions and hypotheses were raised and tested at 0.05 Level of significance:

1. Is there gender differences in acceptability of a FOSS-based learning package for teaching and learning in electrical and electronic technology.
2. Is there gender differences in usability of a FOSS-based learning package for teaching and learning in electrical and electronic technology.

**$H_{O1}$**: There is no significant gender difference in acceptability of a FOSS-based learning package for teaching and learning in electrical and electronic technology.

**$Ho_2$:** There is no significant gender difference in usability of a FOSS-based learning package for teaching and learning in electrical and electronic technology.

# 3. Method

## 3.1. Research Design

There were two phases in this study, the first is the design and development of a computer based learning package using FOSS based on Govindasamy model (2002). The second is a causal comparative research design which guided the investigation on acceptability and usability.

## 3.2. Sample

The study was conducted on 40 second year (200L) students of a state university and 40 first year (ND1) students of a Polytechnic in Ogun state. 18 females and 62 males students studying electrical and electronics engineering in total were used for the study. The total sample for the study are 80 electrical and electronics engineering students.

## 3.3. Data Collection Instruments

For data collection, a structured questionnaire consisting of 43 item questions and the developed package were used. Each item in the acceptability testing section were rated between extremely likely and extremely unlikely, a six point likert scale labeled 1-6; the usability testing section were rated between strongly agree and strongly disagree, a four point likert scale labeled 1-4. Thus, a likert 6 level acceptability and 4 level usability scale were used.

The questions in the acceptability and usability questionnaire were selected following expert's advice and validation on the basis of level of defined differences. 43 questions included in the questionnaire were grouped into acceptability and usability testing sections. In the research questionnaire, 7 questions are of the perceived ease of use, 7 are of perceived usefulness, 5 0f actual use, 8 of perceived enjoyment, 2 of self-efficacy, 4 of behavioural intentions and the remaining 10 are of the interface satisfaction. The reliability constant of the questionnaire has been determined according to Cronbach alpha method of reliability coefficient ($\alpha$=0.89). To determine the gender differences in the acceptability and usability of the package by the respondents, the developed learning package for teaching and learning thermionic emission was given out to each respondent for personal interaction and learning.

When the instructions have been completed, the research questionnaire was administered to each respondent. A SPSS package program has been utilized in the investigation to determine any significant differences between the genders.

# 4. Results

## 4.1. Hypotheses 1

The first research question of the study was "Is there gender differences in acceptability of a FOSS-based learning package for teaching and learning in electrical and electronic technology".

**$H_{O1}$**: There is no significant gender difference in acceptability of a FOSS-based learning package for teaching in electrical and electronic technology. Findings obtained from this sub problem are presented in Table 1.

**Table 1. T-test showing Difference between Male and Female Acceptability of a FOSS-based Learning Package**

| Variable | N | Mean | St. Dev | df | t | Sig. | Remark |
|---|---|---|---|---|---|---|---|
| ACCEPTABILITY | | | | | | | |
| Male | 62 | 72.50 | 5.98 | 78 | 1.620 | .109 | NS |
| Female | 18 | 69.83 | 6.72 | | | | |

Table 1 shows the difference between male and female acceptability of the FOSS-based learning package. The table reveals that there is no significant difference in the acceptability of the male and female respondents (df = 78; t=1.620; P>0.05). Hence, hypothesis one was not rejected.

## 4.2. Hypotheses 2

The second research question of the study was "Is there gender differences in usability of a FOSS-based learning package for teaching and learning in electrical and electronic technology".

**$Ho_2$:** There is no significant gender difference in usability of a FOSS-based learning package for teaching in electrical and electronic technology. Findings obtained from this problem are presented in Table 2.

**Table 2. T-test showing Difference between Male and Female Usability of a FOSS-based Learning Package**

| Variable | N | Mean | St. Dev | df | t | Sig. | Remark |
|---|---|---|---|---|---|---|---|
| USABILITY | | | | | | | |
| Male | 62 | 16.82 | 1.84 | 78 | .668 | .506 | NS |
| Female | 18 | 16.50 | 1.65 | | | | |

Table 2 shows the difference between male and female usability of the FOSS-based learning package. The table reveals that there is no significant difference in the usability of the male and female respondents (df=78; t=0.668; P>0.05). Hence, hypotheses two was not rejected.

## 5. Discussion

The results obtained from the statistical analyses on the research hypotheses indicated that there was no significant gender difference in acceptability of the FOSS-based learning package for teaching electrical and electronic technology (df = 78; t = 1.620; P > 0.05). Furthermore, a no significant gender difference was obtained in usability of the FOSS-based learning package for teaching electrical and electronic technology (df = 78; t = 0.668; P > 0.05).

There was no gender difference found in the acceptability and usability of computer-based learning package. These findings agrees with [6] whose report indicated that women and men differ in their perceptions but not use of technology while testing gender differences that might relate to beliefs, acceptance and use of computer-based media. The findings also is supported by [8] that men and boys, compared with girls and women, consider that computers are more appropriate for them, and believe themselves more competent when performing computer-related tasks. Also, [20] found that though men consider perceived usefulness to a greater extent than women in making their decisions considering usefulness or productivity-related factors of a new technology and that men are more driven by instrumental factors than women, there is no gender difference in technology acceptance and use. Reference [20] also found in support of these findings that, compared to women, men placed a greater emphasis on perceived usefulness in determining behavioral intention while women weighted perceived ease of use more strongly in determining behavioral intention than men did, yet no gender difference was found in technology use.

Contrary to findings by [26] who found significant gender differences in beliefs while applying the technology acceptance model to a group of pre-service teachers; [9] also found that males generally are more interested in information technology; this study has found no gender difference in both acceptability and usability of the FOSS-based learning package. Also, [6] found contrary to this study that female college students had significantly higher computer anxiety than male students while [24], regarding the attitudes towards commonly used technology, found a highly significant gender effect which reveals that men show distinctly more positive biases towards technology than women. Whereas, [20] found that women are more motivated by process (Perceived Ease of Use) and social (subjective satisfaction) factors than men. Individual variables (gender, age, experience, and voluntariness of use) were found by [25] to mediate the impact of those constructs on technology usage intention and behavior.

The implication of this study is that the usual gap existing between men and women on the issue of acceptance and use of technology may gradually be reducing as women are also appreciating in the use of technology for their daily activities.

## 6. Conclusion

Based on the findings of this study, it can be concluded that there is no significant gender difference in acceptability and usability of a FOSS-based learning package for teaching and learning in electrical and electronic technology in Nigeria. It is concluded that there most likely will not be gender differences in the achievement of males and females using this computer based package. Consequently reducing the gender gap in science and technology.

## 7. Recommendation

It is recommended that researchers should include gender in ICT diffusion models along with other cultural effects. It is recommended that more researches be carried out on gender disparity based on technology use now that women are more involved in the use of technology than ever before. It is also recommended that science and engineering courses involving more females should be used in replicating this study to further ascertain gender differences on technology acceptance and use.

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