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# FOSTERING FEMALE PARTICIPATION IN SCIENCE AND TECHNOLOGY THROUGH ENHANCED CURRICULUM DELIVERY USING INFORMATION TECHNOLOYGY

**Jumoke Soyemi[1] & Olugbenga B. Soyemi[2]**
[1] Department of Computer Science, Federal Polytechnic, Ilaro
[2] Department of Civil Engineering, Federal Polytechnic, Ilaro
jumoke.soyemi@federalpolyilaro.edu.ng
jidesoyemi@federalpolyilaro.edu.ng

## ABSTRACT

The advancement and sustainability of any nation depends on science and technology. Over the years, women are seen to have improved in their quota of contributing to nation building and development, however, their participation in science and technology is very low compared to their male counterparts. A major cause of this has been traced to mode of curriculum content delivery in science and technology-based courses. This paper, therefore developed a teaching framework that fosters female participation in science and technology through enhanced curriculum delivery using Information Technology. Statistical analysis was further conducted through quantitative research that administered questionnaires to 50 participants each from the 7 departments in the school of Management Studies of the Federal Polytechnic Ilaro, totaling 350 participants, to seek the reason behind the student's choice of courses into management studies and not Science and Technology based courses. Out of the research instruments administered for the research study, 91.1% was returned in which the analysis was based upon. Analysis was done using descriptive statistics. The result from this analysis indicated that 49.2% avoided Science and Technology based courses because of the mode of curriculum content delivery that made the courses look difficult, 23.8% avoided it because of their belief that science based courses are difficult, 16.9% have passion for Management courses while 10% just found themselves studying Management courses because of issues with their WAEC result combination. This research study recommends that the curriculum should be enhanced using Information Technology as the driving tool to increase female participation in STEM courses.
**KEYWORDS**: Science and Technology, Growth and Development, Improved Curriculum Content Delivery, Information Technology

## 1.      INTRODUCTION

Education is central to any nation's growth and development and according to Nyerere (1968), Education is an instrument that prepares an individual for life and must foster social goals as well as encourage the growth of social attitudes and values. Therefore, a country that must develop and be productive must strive to educate its citizens including the female gender. The culture of marginalization and discrimination of female gender in education had persisted until now, determining, the kind of courses to run if eventually given opportunity to attend higher institution and the type of jobs that could be picked up by them. Presently, there have been great improvement leading to many female's admission into higher institutions. However, the percentage of such admission into Science and Technology based courses are quite poor.

Science and Technology are the secret behind economic growth and development through scientific discoveries and technological innovations. Statistics has it that women participation in Science and Technological education is far low compared to their male counterparts (Wang & Degol, 2018). Most of them study courses that tends towards the so-called 'women occupation' such as secretariat jobs, nursing, teaching and social works. Courses in Science and Technology such as Engineering, Medicine, Mathematics, Physics are dreaded by most female gender. According to world population statistics by United Nations (2017), put the estimate of male population as 3,776,294,273 and that of female population as 3,710,295. This high population of women, therefore requires strategies to be developed so as to encourage more participations of the gender in science and technology-based courses for sustainable economic growth and development.

The conventional way of lecture delivery to students of nowadays are no longer interesting and attractive enough to command their interest and attention. The advancement in Technology and the world of Information Technology (IT) has turned the world into a global village and changed several ways of carrying out assignments from the traditional to the modern way. The advent of multimedia devices, smart phones coupled with the internet has widen the scope and imagination and means of getting required information by students. In western world, it is no longer popular to engage students in teaching and learning through the conventional methods alone. Here, in Nigeria, curriculum delivery at all levels in schools have not yet metamorphosized into the present age. There is the need to enhance the present curriculum delivery to attract female gender participation in science and technology-based courses for the future growth and development of the nation having in mind that the female's population far outnumbered those of the male population.

When formal education was introduced initially in the past by religious, missionaries and colonial powers, females were not permitted to attend schools until much later. Despite this, the number attending school were much low compared to their male counterparts (Allison *et al*., 2008; Masanja, 2010). According to Masanja (2010), the culture of marginalization and discrimination of females in education continued until recently and the stereotype knowledge and skills given to females at the introduction of formal education continues to affect the gendered nature of education today and hence determines the courses for females. They continue to be underrepresented in the careers related to Science and Technology (Cheryan, Master & Meltzoff, 2015).

This study developed a teaching framework that takes the advantage of Information technology as the enhancement tool to deliver curriculum in an attractive way that makes Science and Technology based courses attractive to the female gender. The study also carried out a survey to understand the perspectives of female students that finds themselves in the non-science and technology-based courses.

## 2.    RELATED STUDIES

The effect of using computer on 6th grade primary school students were considered by Atawaim (2000) to determine the effect of computer use as an educational tool on students' academic performance. This study revealed significance statistical differences in students' average difference in the level of academic performance and the overall test level.

The effect of using computer as an educational tool in teaching the curriculum of statistics on the development of statistical skills among the third-grade secondary school students was investigated by Salem (2000). Here, experimental group were taught using the computer and the control group was taught using the traditional method. The study showed significant statistical differences in the average grades of the experimental and control groups in favour of the experimental group.

Effectiveness of the use of multimedia computer technology in teaching Geometry to the third preparatory grade students on students' academic achievement and the development of innovative thinking was carried out by Nasr (2005). The result obtained from the experimental and control group set up revealed a statistical significance difference in their grades to favour the method of teaching that used interactive multimedia instead of traditional method.

The effect of using Mathematics software produces locally on the second grade intermediate female students' academic achievement in Riydh was conducted by Da'lij (2008) to identify the use of multimedia software produced locally on second grade intermediate female students' academic attainment in mathematics. The statistical result between the experimental and the control shows no significance difference using the traditional method and interactive multimedia technology.

The impact of using multimedia on students' academic achievement in College of Education at King Saud University was conducted by Aloraini (2012) to find out the influence of using multimedia in teaching computer and its uses in education on the female students' academic achievement. The study discovered that more academic successes were recorded using multimedia in presenting computer lessons than the traditional method of teaching.

The study by Soyemi, Ogunyinka and Soyemi (2012) proposed the use of self-paced e-learning with conventional classroom learning since ICT use in the classroom have a way of increasing and motivating student towards learning. The authors believed that taking the advantage of both methods of teaching and learning will impact positively and improve academic performances of the students at large.

Study by Meluso, Zheng, Spires & Lester (2012) carried out a study on 'Enhancing 5th graders science content knowledge and self-efficacy through game-based learning'. Despite the fact that many argued that games can positively impact learning by producing an intrinsically motivating and engaging learning environment for students than traditional means, the investigation from this study indicated that there were no difference between collaborative and single game player conditions on science content learning and science self-efficacy. The study however proposed that future research should focus on the composition of collaboration interaction among game players to assess what types of collaborative tasks may yield positive learning gains.

A game-based learning approach to increase female participation in science, technology, engineering and mathematics fields was carried out by Bonner (2015). This study developed a game that teaches the concept of variables, lists and if-statements and this game was assessed using middle class students. The essence of this assessment was to determine whether the educational game developed is effective and attractive to the female gender in teaching basic computer programming concepts. The outcome of this assessment revealed increase in students' comprehension of programming concept from the pre-experimental assessment. Students indicated increased likelihood to pursue a career in a programming related profession after playing attractive games.

The effects of integrating mobile devices with teaching and learning on students' learning performance: A meta-analysis and research synthesis was implemented by Sung, Chang & Liu (2015). Analysis of the empirical research on the use of mobile devices as tools in educational interventions revealed that the overall effect of using mobile devices in education is better than when using desktop computers or not using mobile devices as an intervention, with a moderate effect size of 0.523.

## 3.    PROPOSED FRAMEWORK

Figure 1 is the proposed framework for teaching and learning in this study. Resources for learning are to be made available in both hard and soft copy. The advantage of e-books should also be engaged having in mind that apart from visiting the institutional e-library, virtually all students have access to internet enabled cell phones. This means that the learning process for the student can be made ubiquitous if proper use of the phones is employed. Next is the content delivery using multimedia, pictures, diagrams, games and many more. Learning has moved beyond the traditional method to more involving and attractive methods that engages the interest of the student throughout the learning process. Beyond just muttering words in the classroom and creating imaginary pictures that may or may not be comprehensible by the students, teachings that get the attention of students is now delivered using real pictures, diagrams, graphs, games to illustrate and drive home the points. This method ensures permanent retentivity on the student's part and makes learning more simplified.

Aside from the classroom teaching using Multi-Media Pictures/Diagrams/Games content delivery, self-paced study is very important so as to complement the efforts of conventional classroom learning as proposed by Soyemi, Ogunyinka & Soyemi (2012) in their study 'Integrating self-paced e-learning with conventional classroom learning in Nigeria Educational System'. Therefore, the self-study can be achieved through self-paced e-learning or by taking the advantage of the cell phones using educational resources available, such as educational mobile apps or recordings done during lectures that could be played all over again at the students pace in order to catch up with missing points in the classroom. Although, Soyemi, Oloruntoba, & Okafor (2015) discovered in their study that mobile phone is a source of distraction to students and contributes to poor academic performance in tertiary institutions if not put to properly use. Here, the strength of mobile phone is put to use to enhance the support needed for self-study to complement the content delivery in the classroom using Information Technology (Multi-Media Pictures/Diagrams/Games).

The combination of the above in teaching and learning would lead to the next stage which is more enrolment of females in Science and Technology based courses in addition to better academic performances. The above framework proposed the use of what the students enjoy using most, to pass across the needful. This is taking the advantage of content delivery using Information Technology to foster female participation in science and Technology based courses. Simplicity of delivery, attraction through what they are familiar with to deliver the content, delivery that is pictorial, graphical, multimedia empowered, video and games are therefore the key to improve the participation of the female gender.
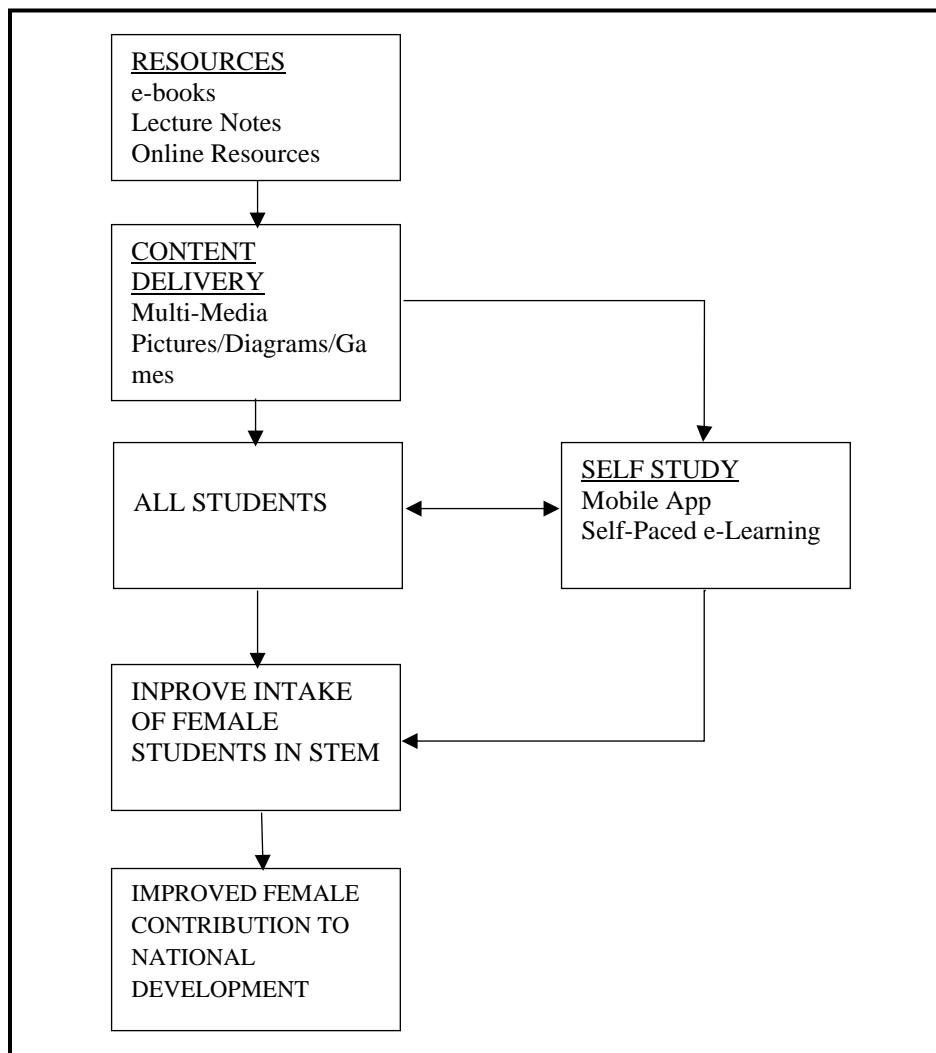
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Figure 1: Proposed Framework for Teaching and Learning

## 4.     METHODS

### 4.1     Data Collection Method

Survey method was adopted in carrying out this research study. The surveyed data used was collected through structured questionnaire. The questionnaire was administered to a sample of 350 female students aged $16 - 27^+$ in the seven(7) departments of the school of management studies, Federal Polytechnic, Ilaro out of which 91.1% of the research instrument was returned. A self-administered process whereby the respondent himself reads the questions and records answer without the assistance of an interviewer. The questionnaire was designed to collect relevant information the questions were numbered for easy references and arranged so that the respondents can understand easily the reason and important attached to each question. The form of questionnaire used provided an easy quick way of collecting objective information from primary sources without necessary allowing the respondents to strain his or her brain for answers.

### 4.2     Method of Data Analysis

Descriptive Statistics method of data analysis was applied to scale and unscaled statements to examine the order of importance. The analysis was done using Statistical Package for Social Sciences (SPSS) Version 20.

## 5.     RESULTS AND DISCUSSION

The figure 2 below is the distribution of the seven Departments in the School of Management studies. Eighty percent of the questionnaires were returned (280). Department of Taxation has the least number of participants (10%) while department of insurance has the majority number (16%) as shown in figure 2. Department of Public Administration, Business Administration, Accounting and Banking & Finance have the same number of participants indicating 15% each, while the Department of Marketing has 14%.
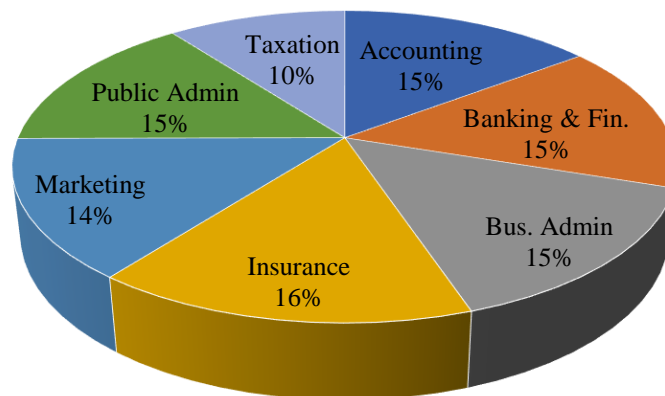


Figure 2: Distribution of Participants Departments in the School of Management Studies

Table 1 depicts the satisfaction of female students in non-STEM courses based on their chosen field of study. However, 50.5% of the participants were not satisfied with their choice of courses irrespective of the departments they found themselves while 49.5% were satisfied. Analysis revealed that responses vary from participants to participants on whether they are satisfied with their chosen course of study taking the departments into consideration as depicted in figure 3.

Table 1: Frequency and Percentage distribution of Participants on satisfactory level of course choice and their chosen course of study

| | | | Are you satisfied with your choice of course | | Total |
|---|---|---|---|---|---|
| | | | No | Yes | |
| Departments | **Accounting** | Count | 20 | 27 | 47 |
| | | % within Department | 42.6% | 57.4% | 100.0% |
| | **Banking and Finance** | Count | 25 | 24 | 49 |
| | | % within Department | 51.0% | 49.0% | 100.0% |
| | **Bus. Admin** | Count | 30 | 17 | 47 |
| | | % within Department | 63.8% | 36.2% | 100.0% |
| | **Insurance** | Count | 27 | 23 | 50 |
| | | % within Department | 54.0% | 46.0% | 100.0% |
| | **Marketing** | Count | 21 | 25 | 46 |
| | | % within Department | 45.7% | 54.3% | 100.0% |
| | **Public Admin** | Count | 26 | 21 | 47 |
| | | % within Department | 55.3% | 44.7% | 100.0% |
| | **Taxation** | Count | 12 | 21 | 33 |
| | | % within Department | 36.4% | 63.6% | 100.0% |
| **Total** | | Count | 161 | 158 | 319 |
| | | % within Department | 50.5% | 49.5% | 100.0% |

*Source: Field Survey, 2019*
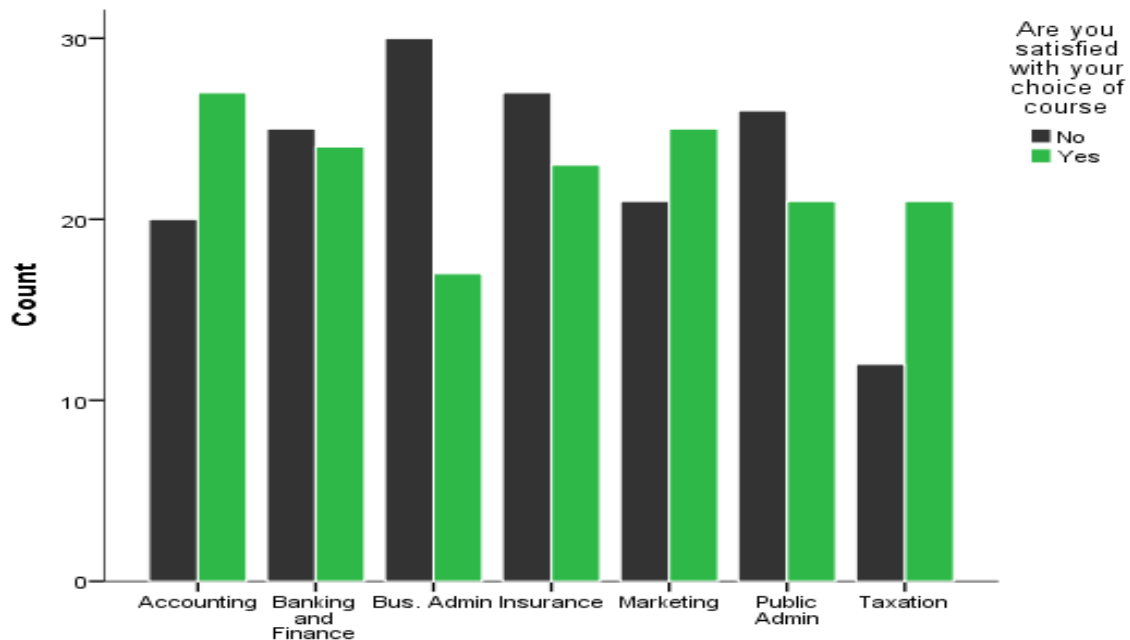


Figure 3: Distribution of Participants on satisfactory level on the choice of courses

It can be evidenced from figure 4 that majority of the female students representing 157(49.2%) said that mode of curriculum content delivery resulted in their avoidance of science based courses, 23.8% attributed the reason to the difficulty associated with science-based courses, 16.9% said management courses were their preference from onset and never STEM related courses while 10% of them attributed the reason to their O'level combinations that made it impossible to opt for STEM courses.



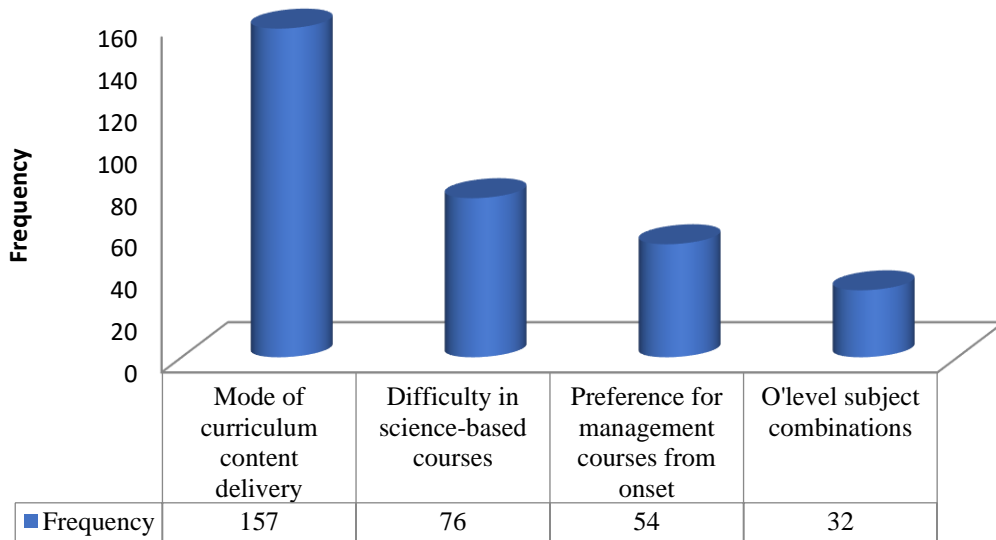| Frequency | Mode of curriculum content delivery | Difficulty in science-based courses | Preference for management courses from onset | O'level subject combinations |
|---|---|---|---|---|
| Frequency | 157 | 76 | 54 | 32 |

Figure 4: Bar Chart showing female students' distribution on avoidance of science-based courses.

Table 2 is the weighted score of respondents that depicts that the participants agreed on a weighted average of 4.14 that the choice of course is influenced by the mode of curriculum content delivery which made the foundation courses look difficult; they also agreed that multimedia and interactive lecture delivery is the required IT means to make science and technology based courses attractive to them as analyzed on the weighted average of 4.21. In addition, the participants agreed on the fact that poor foundation and dislikes for Mathematics is the root cause of their challenges in science and technology-based courses but were neutral on whether female students choice of course is influenced by cultural beliefs. Participants also opined that enhancing curriculum content delivery by making it attractive and interesting using IT will increase female participation in science and technology-based courses.

**Table 2: Weighted Average on Perception and Remedial measures of female participation in STEM courses.**

| | SD | D | U | A | SA | WF | WA | Decision |
|---|---|---|---|---|---|---|---|---|
| Choice of course is influenced by the mode of curriculum content delivery that made the foundation courses look difficult | 5 | 8 | 42 | 147 | 117 | 1320 | 4.14 | A |
| Multimedia and Interactive lecture delivery is the required IT means to make Science and Technology based courses attractive to Female students | 5 | 0 | 16 | 199 | 99 | 1344 | 4.21 | A |
| Poor foundation and dislikes in Mathematics is the root cause of Female students having challenges in Science and Technology based courses. | 4 | 12 | 34 | 139 | 130 | 1336 | 4.19 | A |
| Female students' choice of course is influenced by cultural beliefs that they should be limited to certain courses | 55 | 149 | 8 | 8 | 99 | 904 | 2.8 | U |
| Enhancing curriculum mode of delivery by making it attractive and interesting using Information Technology will increase Female | 29 | 39 | 54 | 91 | 106 | 1163 | 3.65 | A |

| participation in Science and Technology based courses |
|---|

*Source: Author's Computation*
*Results presented as number of participants. Perception and remedial measures was scored by giving 1 to SD, 2 to D, 3 to U, 4 to A, and 5 to SD. Reversed questions were coded otherwise.*

Weighted Mean intervals and decision rules on Likert Scale
Strongly Agree (SA) = 4.5 - 5.0;     Agree (A) = 3.5 - 4.4;     Undecided (U) = 2.5 - 3.4
Disagree (D) = 1.5 - 2.4;     Strongly Disagree (SD) = <1.5
WF = Weighted Frequency;   WM = Weighted Mean

## 6.     CONCLUSION

This paper has clearly shown that there is the need to change the mode of curriculum delivery using Information Technology to foster female participation in Science and Technology based courses. Teaching and Learning has moved beyond the traditional method to more involving and attractive methods that engages the interest of the student throughout the learning process. The statistical analysis from this study also supports the fact that female participation will be better improved in science and technology-based courses if the various mode of curriculum content delivery is revamped. The framework proposed in this study used multimedia, pictures, diagrams, games and many more for content delivery.

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