Gender and Academic Performance in Engineering: An Empirical Study in a Leading Nigerian University

Abioye A. A. 1, Ishola F. A. 1, Abioye O. P. 1*, Odunlami O. A. 2, Alayande T. A. 3, Bolu C. A. 1
1Department of Mechanical Engineering, Covenant University, Ota, Ogun State, Nigeria
2Department of Chemical Engineering, Covenant University, Ota, Ogun State, Nigeria
3Department of Civil Engineering, Covenant University, Ota, Ogun State, Nigeria
Corresponding Author: oluwabunmi.abioye@covenantuniversity.edu.ng

Abstract-
Engineering is increasingly becoming a more popular career for women globally. This study aims at examining the performances of female students in comparison to their male counterparts. This is then used to determine if there is any correlation in their performances. The sample population for this research is the engineering students of a leading University in Nigeria. The performance of the graduating students in this school over 11 years, from 2006 to 2017, was analysed and studied. The research suggests that more percentage of female students now graduate with first class and the percentage of female students graduating with third class between these periods has reduced to almost nothing over years. Thus, it is recommended that more women should be encouraged to enrol in engineering courses, as they tend to thrive in courses such as Electrical and Electronics Engineering and Mechanical Engineering.

Keywords: Engineering, Female, Male, Gender, Performance

1. Introduction
Education has greatly affected people’s well-being in positive ways; in fact, education has played an essential role for human capital’s development. Apparently, advances in technology in the modern day, which are enabled through education, are remarkable feats leading to unprecedented effectiveness in most areas of life [1, 2].

Through breakthrough solutions, engineers have indeed brought light into most aspects of human endeavours ranging from domestic use, communication through industrial applications. The very fabric of modern society has been influenced by science and engineering in a significant and ever-increasing manner, ranging from health, energy, environmental controls, transportation, to communication. Therefore, engineers and scientists play prominent roles in the overall workforce, talent, composition, size, and competitiveness of the developments, which have been considered “national priorities” [3-4].

Careers in engineering are known to have a high level of gender disparities in rewards, performance, and participation [4, 5]. That is, men do not only tend to be more employed, have high-ranking positions and earn more than women do, but they are likely to be located in prestigious locations such as research universities [5].

These disparities in gender have caused some apprehensions. This is because the philosophy of science stressed that scientific and engineering careers are expected to be “open to talent”, without any constraint by personal characteristics like gender. Also, the prospective contributions of women to the size, creativity, and diversity of the scientific and engineering workforce are enormous [6].
In order to understand these gender disparities in engineering and science, it is paramount to have a good understanding of university’s undergraduate education. This is because the composition of the future engineering workforce is strongly affected by the mix in gender at undergraduate level, careers are being shaped at this level [7] and the standard entry point into engineering is recognised to be the undergraduate level.

In the past decade, the number of females enrolled in engineering undergraduate studies has increased [8]. However, these females are under-represented in engineering careers. Thus, there is a need to study the performances of engineering female students in a tertiary institution in order to understand if gender disparities affect academic performances, which tend to affect women’s rate in pursue careers in engineering.

Under-representation of female engineers is a common problem in Nigeria and many factors has contributed to this situation, which has the potential of hampering the performance of females studying engineering in tertiary institutions. A significant factor is that some women do not get any form of encouragement from their communities for studying engineering courses [9]. In addition, patterns of socialization in most African countries place huge restriction on girls and women, which has a risk of affecting their academic performances in most science subjects that require practical ability as it is in engineering [10].

Moreover, in Nigeria overall, there are more males in school than females; this brings about some variation in the courses each gender may typically want to opt for. Females prefer courses, which are more affordable, and the leave the courses with more economical commitment such as medicine and engineering to men [11]. Cost aside, most undergraduate girls underrate their ability academically and think that boys are more capable of succeeding in challenging subjects such as mathematics, which is a prerequisite in engineering [12-15].

These problems can easily affect how female engineering students perform. Therefore, this study specifically emphases on the crucial effect of gender on performances of women in engineering compared with that of the men in the field. The University, being one of the leading universities has been chosen for this study. Thus, using this institution will minimize other external societal factors, such as academic session instability, cultism, harassment, substandard laboratories, poor funding, and many others, which can affect students’ performances to an insignificant level. Consequently, allowing us to narrow the variables to course of study, gender and performance.

2. Methodology

2.1 Research context

The sampled population for this research are the Engineering students of the leading University in Nigeria. This is an analytical quantitative research where students’ graduating class in 7 major engineering programmes at the time of graduation over 11 years were collected and collated for analysis.

The engineering programmes in scope of this study are Chemical Engineering, Civil Engineering, Computer Engineering, Electrical and Electronics Engineering, Information and Communication Engineering, Mechanical Engineering and Petroleum Engineering. Also, the 11 years in scope are the academic sessions from 2006 to 2017.

2.2 Data Collection and Analysis
The data used for this study is based on the approved final graduation lists over 11 years. This data was sourced from the University’s database. The data collected were analysed numerically by converting all data point to a percentage of the total gender in order to identify the trend in performances by gender.

3. Result and Discussion

The result showing the overall performance of female students versus male students all through the years covered is shown below in Figure 1.

This shows that in the course of the 11 years studied, the breakdown for female students is 14% graduated with first class, 56% with second class upper, 27% with second class and 3% with third class. However, for the male students, 10% graduated with first class, 46% with second class upper, 38% with second class lower and 7% with third class. This suggests that in comparison to the male students, larger percentage of female students graduated with first class and second class, while larger percentage of male students graduated with second class lower and third class.

3.1 Performance by Programme

Figures 2,3,4,5,6,7 and 8 show how each of the gender performed in the seven (7) engineering programmes being offered in the institution.
In Chemical Engineering, the percentage having first class, second class upper, second class lower and third class are 14%, 58%, 23% and 4% respectively for the females and 8%, 49%, 38% and 5% respectively for the males.

In Civil Engineering, the percentage having first class, second class upper, second class lower and third class are 12%, 64%, 24% and 0% respectively for the females and 10%, 44%, 39% and 7% respectively for the males.
In Computer Engineering, the percentage having first class, second class upper, second class lower and third class are 12%, 54%, 30% and 4% respectively for the females and 7%, 39%, 42% and 12% respectively for the males.

In Electrical and Electronics Engineering, the percentage having first class, second class upper, second class lower and third class are 22%, 58%, 18% and 1% respectively for the females and 12%, 48%, 35% and 4% respectively for the males.
In Information and Communication Engineering, the percentage having first class, second class upper, second class lower and third class are 13%, 55%, 27% and 5% respectively for the females and 10%, 43%, 42% and 6% respectively for the males.

In Mechanical Engineering, the percentage having first class, second class upper, second class lower and third class are 18%, 56%, 26% and 0% respectively for the females and 10%, 49%, 35% and 6% respectively for the males.
In Petroleum Engineering, the percentage having first class, second class upper, second class lower and third class are 10%, 49%, 40% and 2% respectively for the females and 7%, 45%, 42% and 6% respectively for the males.

The trend of performances by gender across all programmes is similar to the overall performance whereby the percentage female students with first class and second class upper is more than male students, and the percentage male students with second class lower and third class is more than female students.

Across all programmes, the highest female percentage having first class is from Electrical and Electronics Engineering at 22% and the lowest female percentage having first class is Petroleum Engineering at 10%. Furthermore, the highest female percentage having second class upper is from Civil Engineering at 64% and the lowest female percentage having second class upper is Petroleum Engineering at 49%. This shows that female engineering students tend to have more outstanding results in Electrical Engineering and Civil Engineering, whereas Petroleum Engineering is consistently trailing in the performance trend for female students.

### 3.2 Year to Year Performances
Likewise, moving the analysis focus to the result of the students annually, Figure 9 shows how the female students has progressed each year over the 11 years. In addition, Figure 10 shows for the male students and Figure 11 shows what the trend looks like overall, irrespective of the gender.
Figure 9: Progress on Female Engineering Students Performance over 11 Years

In 2006/07 session, only 5% of the female students had a first class and by 2016/17, the percentage of female student with a first class has increased to 28%, giving us a whopping 23 points increase in female percentage with first class over the 11 years. The session with the highest female percentage in a third class was 2007/08 with 8% and a downward trend has been consistently observed since then. In 2016/17, which is the latest year in scope, no female student graduated with a third class.

Figure 10: Progress on Male Engineering Students Performance over 11 Years
In 2006/07 session, 8% of the male students had a first class and by 2016/17, the percentage of male students with a first class has increased to 19%, giving us an 11 points increase in male percentage with first class over the 11 years. In 2006/07 session, 8% of the male students also had third class and by 2016/17, the percentage of male students with a third class has reduced to 3%, giving us a 5 points drop in male percentage with third class over the 11 years.

![Progress on All Engineering Students Performance over 11 Years](image)

In 2006/07 session, 7% of the all students had a first class and by 2016/17, the percentage of students with a first class has increased to 22%, giving us a 15 points increase in the percentage with first class over the 11 years. In 2006/07 session, 6% of the students also had third class and by 2016/17, the percentage of the students with a third class has reduced to 2%, giving us a 4 points drop in the students’ percentage with third class over the 11 years.

4. Conclusion

Over the years, the number of engineering graduates with first class has increased from 7% to 22% and this research suggests that the key driver of this upward trend is the rate of female students in engineering with first class, which have increased from 5% to 28% within the same period. Therefore, to drive phenomenal results in engineering schools, it is recommended that more women should be encouraged to study engineering courses.

In addition to this, it was observed that a larger percentage of the first-class grades are from Electrical and Electronics Engineering (with 22%) and followed by Mechanical Engineering (with 18%). On the other hand, only 10% female students had first class in Petroleum Engineering in the same period, which is the least across all engineering programmes. Thus, it is safe to say that more female students thrived studying Electrical and Electronics Engineering and Mechanical Engineering than they did when studying Petroleum Engineering.
5. **Recommendation**
We recommend that similar analysis should be carried out in other Universities in Nigeria, so as to confirm that the result in this research can be used to establish a trend in the country.

6. **Acknowledgements**
We thank all the authors whose work was cited in this study for their immense work. Ultimately, we acknowledge the financial support, which Covenant University has offered to enable an actualization of this research work for publication.

**References**
[1] Battle, J., & Lewis, M. (2002). The increasing significance of class: The relative effects of race and socioeconomic status on academic achievement. Journal of Poverty, 6(2), 21-35.

[2] Zainal, R., Yahya, R., & Rahman, K. A. (2014). Influences of gender on academic achievement of Fiber Optic Communication System: An experience of Politeknik Merlimau Melaka. IOSR Journal Of Humanities And Social Science (IOSR-JHSS). 19(8), 108-111.

[3] Long, J. S. (2001). From scarcity to visibility: Gender differences in the careers of doctoral scientists and engineering. Washington, DC: National Academy Press.

[4] Naderi, H., Abdullah, R., Aizan, H. T., Sharir, J., & Kumar, V. (2009). Creativity, age and gender as predictors of academic achievement among undergraduate students. Journal of American Science, 5(5), 101-112.

[5] Xie, Y., & Shauman, K. (2003). Women in Science: Career Processes and Outcomes. Cambridge, Mass.: Harvard University Press.

[6] Pearson, W., & Fechter, A. (Eds.). (1994). Who Will Do Science? Educating the Next Generation. Baltimore: Johns Hopkins University Press.

[7] Fox, M. F., & Stephan, P. (2001). Careers of young scientists: Preferences, prospects, and realities by gender and field. Social Studies of Science, 31, 109–122.

[8] Sonnert, G., & Fox, M. F. (2012). Women, men, and academic performance in science and engineering: The gender difference in undergraduate grade point averages. The Journal of Higher Education, 83(1), 73-101.

[9] Awoniyi, S.A (2000). Sex Differences in Academic performance. Nig. J. of Gender and Dev. 1(1&2), 35-40.

[10] Abdullahi, Z. M, Kalejaiye-Matti, R. B., Garba, B & Balogun, R.B.(2007). Gender Stereotype in Nigeria Educational System: Teachers moderating Role. International J. of Res. in Educ. 4(1&2),34-38.

[11] Ajao, A. M. & Aina, J. K. (2001). Girl child citizenship education in Nigeria: A tool for woman empowerment. Lafiaji J.of Sci.Educ.3(1&2),172-180.

[12] Bamidele, O. M. F. (2001). Promoting Science and Mathematics Education Amongst females in Nigeria. A paper presented at The NCCE/UNESCO 5-Day Train the Trainer Workshop for The revitalization of science Education in Nigeria.

[13] Olarewaju, R. R. (2006). Gender related difficulties in the learning of biology concepts in era of technology. J. of Educ. Res. and Dev. 1 (1), 32-37.

[14] Abioye, A. A., Atanda, P. O., Abioye, O. P., Akinlabi, S. A., Akinlabi, E. T., Bolu, C. A., Afolalu, S.A., Ajayi, O.O. & Ohijeagbon, I. O. (2018, September). A Review on Automotive Industries and Foundries in Nigeria. In IOP Conference Series: Materials Science and Engineering (Vol. 413, No. 1, p. 012003). IOP Publishing.
[15] Kola, A. (2013). Gender analysis of students’ academic performance in physics practical in colleges of education, Nigeria. Advances in Arts, Social Sciences and Education Research, 3(5), 447-452.