

Improving Enrolment and Retention of Females in the School of Engineering – A case study of The Copperbelt University.

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Abstract:

Globally, Science, Technology, Engineering and Mathematics (STEM) fields are facing many challenges with regard to the level of female retention. For Zambia to be a prosperous middle-income country by 2030, it needs enough well-trained engineers. This paper focuses on enrolment rates at the Copperbelt University(CBU) with reference to female to male ratio. It was found that the female enrolment rates are the lowest in the School of Engineering (SE) at CBU. In particular mechanical department is the worst hit with female enrolment rate of 3.2 %. Ways of improving enrolment and retention of female students in the SE were proposed, among them were advising and mentoring and professional development programmes.

Key words: Female, Retention, Engineering, Undergraduate diversity, CBU

1. Introduction

Zambia aspires to be a prosperous middle-income country by 2030 (Zambia, 2006) and for this it needs enough well-trained engineers. The developers of the Zambia 2030 Vision recognized this shortfall and they called for:

The development of a “Diversified, balanced and strong industrial sector, a modern agricultural sector and efficient and productive services sector”.

“Strong and cohesive industrial linkages in the primary, secondary and tertiary sectors”.

This calls for the engagement of all Zambians, including women, in all sectors of the economy as is clearly stipulated in the Zambia National Gender Policy (NGP, 2000). A survey conducted by the Zambian Mining Industry (Hamukoma, 2011) indicates that there are shortfalls in the number of graduate engineers needed to fulfil the mining industry’s annual recruitment needs.

The objectives of the research were to establish the number of students enrolled in each programme at CBU for the past five academic years with regard to male – female ratio and to propose ways of encouraging

female students' enrollment and retention in the school of engineering

2. Background

The girl child is underrepresented in the STEM related subjects. This trend has unfortunately gone on in both developed and undeveloped nations. In 2013, a survey was conducted in the United Kingdom and was found that out of the 42% of women who represented the workforce in the country, only 7 % were in engineering and 4 % were engineering technicians (Amna & Cait , 2014). It was concluded from the study that not only does the engineering industry fail to attract women, but also recruits from a limited pool (Amna & Cait, 2014).

Studies reveal that better career guidance at key stages would help increase the number of girls in STEM related fields and would also help to break down misconceptions about what an engineer does and who can become an engineer. Gendered attitudes towards science continue to limit women's progression in scientific careers. It has been found that both parents and young people (aged 11–14) believe that parents are the most important influencer of young people's career choices: 68 per cent of the young people aged 11–14 interviewed said they were influenced by their parents 'a lot' when it came to career choice – more than by their teachers and career advisers (BIS, 2014) (Atkins, 2013). A research in 2013 by Wellcome Trust indicates that only 18 per cent of young people reported feeling that teachers are the most useful source of

information on possible careers. It was concluded that family knowledge and encouragement of engineering and engineering careers is important in shaping science aspirations. More specifically. Research by (Atkins, 2013) found that almost four in 10 women engineers had a family connection to the occupation, most frequently their father, and 11 per cent had a friend who was an engineer. Taken together, this suggests that the influence of close family or social factors can play an important role in encouraging girls into engineering. Addressing the lack of science capital available to girls is one way of overcoming the gender imbalance in STEM subjects and engineering occupations. Improving families' knowledge about STEM is likely to lessen the impacts that stereotypes have on shaping career aspirations. Encouraging more young women to pursue STEM subjects and the 'engineering pathway' will therefore involve working with families as well as students.

According to research that has been done (Johnson, 2004), the primary features of successful programs for women and minorities include "strong financial support, successful learning environment, access to role models and faculty mentorship, and existence of peer support".

Nokes and Gustafson (1994) found that recruiting women into engineering programs is sometimes not the problem; but it is keeping them there until the end of the degree that has been more challenging.

3. Methodology

To clearly understand the need for improving enrolment and retention of female students, it was important to collect data on students' demographics for CBU and specifically for SE at least for the past five years. The sources of primary data were CBU academic office, heads of department and individual lecturers. Data collected from the academic office was cross checked with data collected from heads of department on registered students for the specific departments, i.e. electrical, mechanical and civil. To verify the collected data, formal interviews were conducted with specific lecturers who take the students on various courses in third, fourth and fifth year. The variables of the data collected were both numerical and categorical. Numerical variables were the numbers of students enrolled in each school and each programme in SE. Categorical data showed the gender of the students.

To analyse the enrolment trends of students in the different time series graphs and frequency distribution tables were used. Frequency table was used to present the number of student enrolled in each school. Percentages were then calculated to show the male to female ratios in each school and in each programme in SE.

Literature was reviewed so as to find the best solution to address the low enrolments rates of female students in STEM

4. Results and Discussion

4.1 Demographics of the Copperbelt University

The Copperbelt University demographics of 2015 show that the School of Engineering had the lowest percentage of 6% as shown in figure 4.1

2015 CBU Gender Demographics

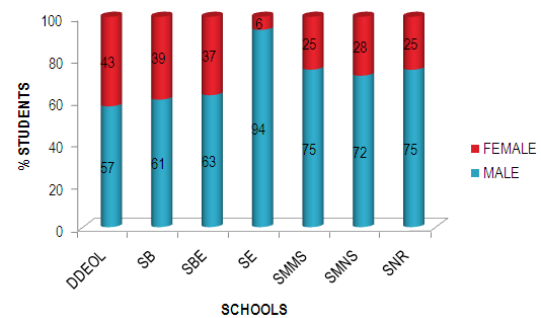


Fig. 4.1: 2015 CBU gender demographics

Figure 4.2 shows the CBU Undergraduate enrolment trend for the past 5 years. It is clear that the enrolment for female students is almost constant.

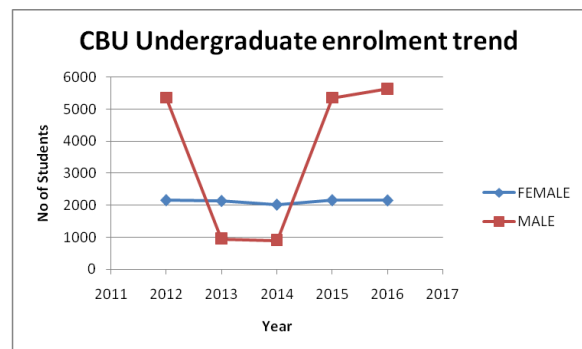


Fig 4.2: CBU undergraduate enrolment trend

4.2 Demographics of the SE, CBU

Reviewing the demographics of the School of Engineering (SE) at the Copperbelt

University in the last 5 years, considering only years 3, 4 and 5, shows that on average only about 10% of the students are female.

The demographics by department show that Mechanical Engineering is the least diverse with only about 3.2% being female students, while Civil Engineering is the most diverse with about 17.3% of the students being female.

Table 4.1: Demographics of School of Engineering

		2012	2013	2014	2015	2016	Average
Civil	Female	11%	17%	18%	18%	22.70%	17.30%
	Male	89%	83%	82%	83%	77.30%	82.80%
Mechanical	Female	1%	4%	4%	4%	6.80%	3.20%
	Male	99%	96%	96%	96%	93.20%	96%
Electrical	Female	8%	10%	9%	3%	18.50%	9.70%
	Male	92%	90%	91%	97%	81.50%	90.30%

The School of Engineering needs to increase the diversity of its student body to satisfy the needs of the country for a diverse and well-trained group of engineers capable of leading the push for a prosperous middle-income country by 2030.

The following solutions have been proposed to address low female rates of enrolment in the School of Engineering.

Advising & Mentoring

An advising and mentoring program should be put in place to encourage and mentor female students. The students should be assigned a departmental advisor/mentor from second year until graduation. The mentor should be trained on diversity and

addressing the special needs of female students.

Professional Development Programmes

The proposed professional development programmes include:

- Career fairs
- Study skills
- Coping strategies workshops
- Engineering role model seminars

Career Services

Career services will involve industrial exposure for the student. This service will help place students in respective industries and will have external supervisors.

Social Networks

Social networks are meant to give the student a sense of community and social support. Students will be encouraged to form and participate in their respective professional organizations designed to assist engineering students with networking and addressing issues relevant to engineering education.

For CBU the above proposed solutions will be implemented in a SCHOOL OF ENGINEERING BUILDING UNDERGRADUATE DIVERSITY(SEBUD) project.

The School of Engineering Building Undergraduate Diversity (SE-BUD) project is an institutional support network that will recruits and retains female engineering students. This project aims to increase the number of female students who are recruited

and retained in the School of Engineering from the current 10% to about 15% in five years.

The specific objectives are set to: Provide scholarships for academically talented and financially needy female students; Develop and implement an advising and mentoring program that specifically addresses the needs of female students in the school of engineering; Create a professional development program to prepare students early in their academic careers in engineering.

The relevant details for the SEBUD project can be accessed from CBU School of Engineering.

5. Conclusion

Engineering is crucial to any country's economy. It is a diverse industry that plays an important role in maintaining the country's competitive edge in the global economy. Not only is engineering integral to an economy, it is also a profession that is in high demand. Engineers are required to maintain vital national industries and services. Zambia needs enough engineers to achieve the middle-income dream of Vision 2030. Currently, there is a shortage of engineers in Zambia for most of the engineering industry. Also, there is very few females taking up and remaining in the engineering career.

This paper triggered a discussion through the research questions related to why few female students enter a bachelor's degree in engineering and why some of them exit the profession at the end of their studies; and to

find solutions to encourage more female students to take engineering degrees in general and mechanical engineering in particular at the CBU. Through that discussion, it has been shown that at the CBU very few female students enter the mechanical engineering field compared to those entering other fields of engineering. This research has shown that CBU has about 10% females enrolled into engineering in general. It also is clear that efforts to recruit females into the engineering profession and to eliminate obstacles within the education system are obviously insufficient.

Therefore, SE-BUD Initiative advocates tapping into the under-utilised female population to enhance female participation in engineering as a potential solution to the shortage of engineers Zambia is facing. Also, organizations need a variety of different talents that are represented by both women and men. In line with the Vision 2030, the SE-BUD proposal is some intervention strategy to the challenge of shortage of engineers in Zambia. Furthermore, the proposal to at least ensure that potential females but financially incapacitated engineering students are supported throughout their career through an advisory and mentorship programme will have some positive impact towards the poverty reduction strategies government has outlined to achieve the "middle-income" status by 2030.

Employment and recruitment policies must be revised to ensure that women have a reasonable chance of pursuing a career in

engineering. The gender component in this SE-BUD approach would provide new perspectives in engineering to offer underprivileged female students the possibility of finding role models and following their dream career. It is the authors' wish to make a case for affirmative action to reinforce the role of women in engineering in order to meet equal rights legislation in the NGP, 2000.

Deliberate actions must be aimed at an increase in the ratio of females to increase their participation in engineering; and to create female role models to help female students to feel more comfortable in a still male-dominated world. It is these positive actions by various stakeholders, such as the implementation of the SE-BUD project, which will encourage more female students to enroll in these technical degrees. The SE-BUD project is perceived to step up the current recruitment and retention levels by about 3% overall in 5 years. With support from stakeholders and policy makers, the SE-BUD project can then be extrapolated to other higher and tertiary education institutions offering engineering courses; a move which will in turn generally improve the numbers of engineering professionals being rolled-out into Zambian industry.

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