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Self-Efficacy In Undergraduate Women In Engineering- A Case Study

Hemlata Gaikwad[1], Sushma S Kulkarni[2]
[1] Department of Business Administration, Rajarambapu Institute of Technology Rajaramnagar, Maharashtra, India
[2]Director, Rajarambapu Institute of Technology Rajaramnagar, Maharashtra, India
[1]hemlata.gaikwad@ritindia.edu
[2]sushma.kulkarni@ritindia.edu

Abstract: Self-efficacy refers to the belief in a persons' ability to perform a specific task. Although efficaciousness applies to any situation, it is particularly important in choosing and executing constructive actions in situations that are perceived as negative or a barrier to success .Self-efficacy has been found to be an important factor in the success of women studying engineering. Given that women are generally under-represented in engineering classrooms specially in fields like Mechanical, civil, Automobile etc., a strong sense of efficacy can help them to persist in such situations. Earlier studies have found that Starting in middle school, girls tend to underestimate their abilities in Science, Technology, Engineering and Mathematics (STEM). This confidence gap among girls persists through high school into college . This gap is presumed to be partially responsible for the gender gap in engineering and other STEM fields. A number of studies have been conducted on women in engineering but a very few studies have focused on the issue of self-efficacy .The present study was designed to test the self efficacies of women in three engineering institutes .The study was carried on for two consecutive years for a sample of 100 women from each Institute for two years i.e. a total of 600 women students had participating in the survey. The self -efficacy will be measured by LAESE survey instrument (longitudinal assessment of engineering self-efficacy). LAESE is a validated instrument developed via the NSF-funded Assessing Women in Engineering (AWE) project.

LAESE provides results in six sub-scales i.e.

1. Engineering self-efficacy 1
2. Engineering career expectations
3. Engineering self-efficacy II
4. Feeling of inclusion
5. Efficacy in coping with difficulties
6. Math outcomes efficacy

Our analysis plans to examine the data for longitudinal differences in the subscales and will also include disaggregated analysis by institution and year-standing.

Keywords: Engineering Education, Women Engineers, STEM , Self- efficacy

Hemlata Gaikwad
Department of Business Administration,
Rajarambapu Institute of Technology Rajaramnagar,
Maharashtra, India
hemlata.gaikwad@ritindia.edu

1. Introduction

Engineering and pertaining fields is basically a male dominated field specially when it comes to hard core engineering," and women in engineering are

underrepresented everywhere, including India. A quick glance at the world and Indian statistics of engineering reveals that the percentage of women enrolling themselves for engineering education field is approximate of their male counterparts. But, a simultaneous analytical look at will also show a pretty darker side of it . The percentage of women engineers in the industry and at leadership positions is nowhere in its comparison. A report by McKinsey and company, In India, 57 percent of women whose performance is comparatively higher study STEM subjects the percentage in Morocco, is 37 percent and 25 percent in Turkey. It is seen that Women who are aptly competent in engineering often fail to pursue engineering -related careers because they have low self-efficacy perceptions about their competence. It is well researched in psychological fields that individuals who show more confidence always motivates themselves to succeed. confidence level are positively correlated with self-efficacy. Students having higher engineering self-efficacy are definitely more capable of setting more challenging goals and aim to work harder to accomplish those goals as compared students with low engineering self-efficacy. In addition to that, high self-efficacy is implies greater self-disciplined approach towards the studies, more efficient use of problem-solving strategies and acomparatively better management of working time. In addition to all these it is observed that efficacious individuals put in more efforts and persist longer to complete any task they take in hand, particularly in the face of obstacles and adversity .Therefore, on an average STEM self-efficacy and performance levels in the task related to STEM are related positively..

2. Women's Participation in Engineering at World Level

Women are constituting almost fifty percent of the world's population. Durchholz (1997) opines that Still we find that their contribution in most of the engineering related professions is limited which is the second largest profession in the world. Historically, the existence of women in engineering almost as long as men. Although the first women to obtain an engineering degree is reported to be as early as in 1892 (Jagacunski et. al., 1987), the percentage of women in engineering has continued to remain quite low the world over (Nguyen, 2000). Even in developed countries like US and Europe, which are widely known for their commitment to gender equity, equal employment opportunities and their policies for integration of women's integration into almost all spheres of public life have experienced low women participation in engineering occupation. Indeed it is observed thatwomen in these countries have entered the labour market in a better strength in recent decades, which has resulted in a situation wherein there are now roughly equal numbers of men and women workers in the labour force.US S & E degree recipients in India are found to be comparatively low as compared to china (Science and Engineering indicators , 2012) as is seen from the figure 1. But still the growth in number has improved and is found to be phenomenon ally good.

In contrast to the same , if we see the positioning of engineering women in workforce we see that India is a very low performer as compared to the countries like United States, European Union , Indonesia , South Africa and others. (figure 2)

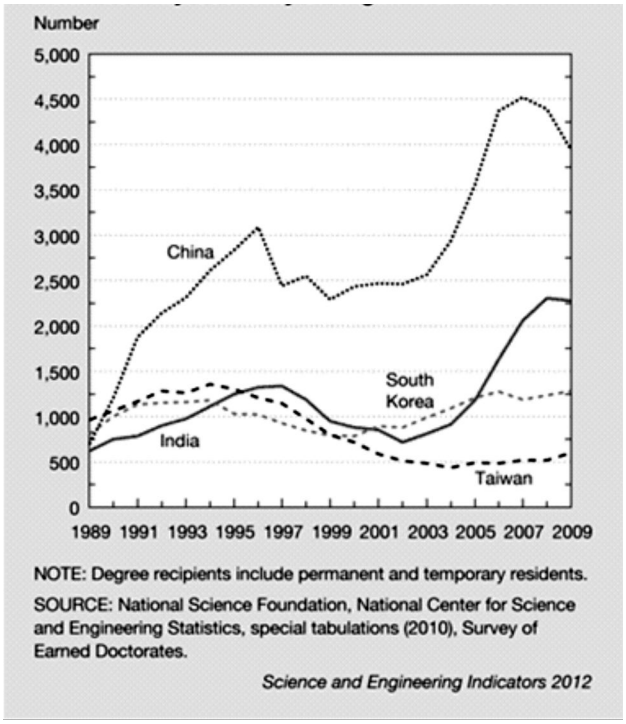

Fig. 1 : S & E Degree recipients in US

Numerous research studies have been carried out at international level on measuring self- efficacies of women especially engineering women while the area is somewhat neglected as far as national scenario is concerned. The darker side of the whole picture is that studies at all level show that engineering women are facing difficulties in utilizing their potential and maintaining their self confidence while facing career challenges. It is high time that something needs to be

done so as to bring a good number of women

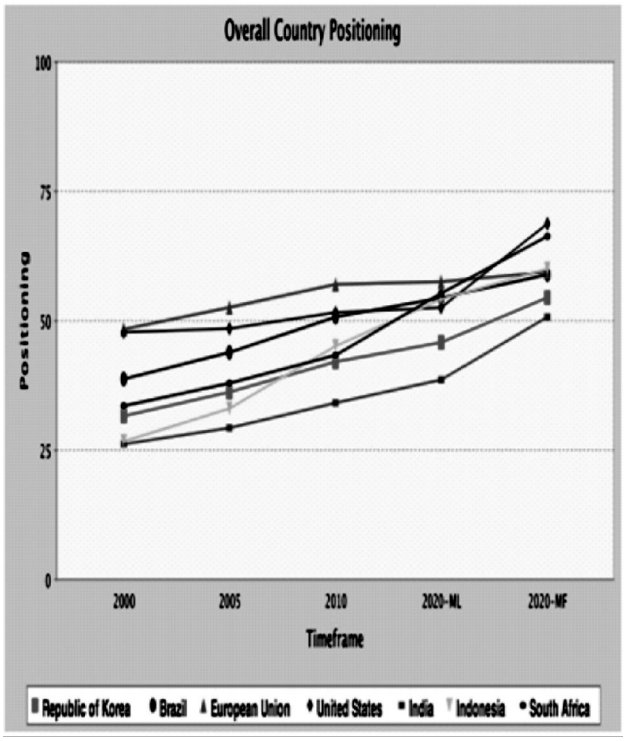

Figure 2 : Overall country Positioning of women engineers in workforce.

engineers in the industries at both national and international levels.

3. Research Methodology

The present study is designed to find out the problems faced by the undergraduate women in engineering . The study is based on the self -efficacy will be measured by LAESE survey instrument (longitudinal assessment of engineering self-efficacy). LAESE is a validated instrument developed via the NSF-funded Assessing Women in Engineering (AWE) project. LAESE provides results in six sub-scales i.e.

1. Engineering self-efficacy 1
2. Engineering career expectations
3. Engineering self-efficacy II
4. Feeling of inclusion
5. Efficacy in coping with difficulties
6. Math outcomes efficacy

The present study was designed to test the self efficacies of women in three engineering institutes .The study was carried on for two consecutive years for a sample of 100 women from each Institute for two years i.e. a total of 600 women students had participating in the survey.

4. Data Analysis Tools :

The questionnaire was designed on a seven point likert scale . Statistical tools such as chi - square and ANOVA were used to analyze the data obtained.

The sample was as follows :

Table 1 : Sample Distribution of the respondents

	Year			
		Second	Third	Total
Institute	Institute A	100	100	200
	Institute B	100	100	200
	Institute C	100	100	200
	Total	300	300	600

Hypotheses:

The following hypotheses were framed for the study :

1. The longitudinal differences are positively correlated with the student years.
2. The longitudinal differences are positively correlated with the institutions.
3. The engineering career expectations are positively correlated with the engineering self efficacies I and II.

Results :

 When the data obtained was analyzed using repeated measures of ANOVA, the following interpretations were made :

 A significant difference was visible on all subscales as per the student's year

 This shows that the self efficacies has visible differences year wise i.e. with the increase in year the the self- efficacies increases in all subscales except .Engineering career expectations and feeling of inclusion.

Subscale	F- Value	P-Value
1. Engineering self-efficacy 1	2.667	0.56
2.Engineering career expectations	2.59	0.000
3. Engineering self-efficacy II	2.339	0.302
4. Feeling of inclusion	3.145	0.0021
5. Efficacy in coping with difficulties	2.7	0.245
6.Math outcomes efficacy	2.99	0.23

 No differences were observed as per the institution wise groupings.

Item	Pearson's R	P-value
engineering career expectation self -efficacy I	0.654	0.125
engineering career expectation self -efficacy II.	0.79	0.23

 It was observed that the engineering career expectations were highly positively correlated with the self -efficacies I and II.

Conclusion and direction for future research :

The results of the study reveals that with the increase in year the self- efficacies increases in all subscales except Engineering career expectations and feeling of inclusion. This implies the potential implications for the engineering educators:

- The rapport with the women undergraduates should be increased via conducting interactive sessions such as seminars , group assignments and team projects. This will develop feeling of inclusion among these undergraduates. This will enhance their self confidence to perform better.

- The differences observed year wise showed only a minor increment , which indicates that there is not much increase in self- efficacies year wise which points a weakness either in curriculum or teaching pedagogies.

As only three institutes were considered for this research , a higher sample is needed to be researched to reinforce the same. A comparison with male counterparts will be a better tool to come to strong recommendations.

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