Arab Women in Engineering Education: Current State and Future Perspective

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Abstract:

It is now accepted that educating girls is one of the most productive investments that society can make in terms of its social, economic, and health development. Societies have learned that educating girls leads to better social environment for themselves, their families and the society as well. The percentage of women in engineering profession is low in most of the Arab World compared to their counterpart in other parts of the world. There is no accurate updated statistics of the percentage of women neither in technical/engineering profession nor in higher engineering education in most of the Arab universities.

This paper discusses the current situation of women in engineering higher education in the Arab World, and outlines the main causes of the low presence of women in engineering/technical education in some of the Arab countries. The paper ends with recommendations on how to promote and improve the retention of women in engineering higher education, and use of ‘woman engineering role models’ to cultivate future Arab women faculty in engineering fields.

Introduction:

It is now accepted that educating girls is one of the most productive investments that society can make in terms of its social and economic development. Societies have learned that educating girls leads to better health in their adult years — not only for themselves, but for their families as well. Every year of schooling for a woman increases the chances that her babies will survive and live healthier lives.

No topic is more complex than that of the role of women in Arab societies. And it is made even more complex because of the lack of information about the multiple forces that act on women as they navigate a life path between competing interests in family, school and work. While enrolment statistics of women in engineering in some Arab countries are impressive, information about the career paths which women engineers follow after graduation is not adequate to enable anyone to declare victory over gender differences. Certainly patterns of women’s enrolment in technical or engineering disciplines sometimes reveal cultural constraints and restrictions in potential employment. Many people see the expansion of participation of Arab women in their societies as a barometer for advancement of the entire region.

The growing demand for qualified engineers will soon reach a critical level. Jobs in the Arab world are growing most rapidly in areas that require science, engineering, information technology, and technical knowledge and skills. Some business leaders are warning of a major shortage in skilled Arab workers —primarily in information technology and technical knowledge —that threatens the ability to compete in international marketplace.

Gender stereotyping continues to prevail in technical and professional fields. Even where women have open access to all professions, they overwhelmingly opt for traditionally "female" occupations, such as medical and teaching fields. At the same time, in some Arab countries, the number of women attending vocational training programmes remains very small compared, for example, to Western or Asia countries.
Investment in girls’ education yields some of the highest returns of all development investments, yielding both private and social benefits that accrue to individuals, families, and society at large by:

- Lowering infant and child mortality rates. Women with some formal education are more likely to seek medical care, ensure their children are immunized, be better informed about their children's nutritional requirements, and adopt improved sanitation practices.

- Lowering maternal mortality rates. Women with formal education tend to have better knowledge about health care practices, are less likely to become pregnant at a very young age, tend to have fewer, better-spaced pregnancies, and seek pre- and post-natal care.

- Increasing women’s labour force participation rates and earnings. Education has been proven to increase income for wage earners and increase productivity for employers, yielding benefits for the community and society.

- Creating intergenerational education benefits. A mother with a few years of formal education is considerably more likely to send her children to school. In many countries each additional year of formal education completed by a mother translates into her children remaining in school for an additional one-third to one-half year.

There is an increasing awareness and recognition among the majority of Arab governments of the persistent gender bias within education systems, reflected in textbooks and educational curricula, as well as in teacher attitudes and training [1]. In efforts to combat these biases, Arab countries, especially in the Middle East, should take various actions to eliminate gender bias in engineering education and promote girls for technical education.

1. Why Bother About Women in Engineering Education?

According to the report produced by the United Nations of Developed Programs (UNDP), literacy which is now 40% among Arab women was only 20% in 1970. There is every hope that this literacy rate may also double during the next few years to reach 80% in the year 2020. Some Arab countries, like Jordan, have already exceeded 80% literacy among women. Simultaneously enrolment rate of Arab women in primary and secondary education has more than doubled from 30% in 1970 to over 65% in 1996, pointing to a much better future for them. University attendance and young girls graduates have become common features in practically every Arab society.

The percentage of girls in schools and universities is increasing, and in some classes in Egypt, Sudan, or Lebanon, we might find that the percentage of girls might exceed 50%. The majority of specialities which are chosen by, or directed for, girls when entering universities or colleges, especially in the Middle East, are religious studies, art, biology, literature, and medicine. In the industry sector there is a gap in engineering fields which are filled with foreigners, especially in the Middle East countries.

According to a study undertaken by the International Union of Arab Labour, Arab Labour force has reached 65 million at the turn of the century, and is expected to reach 96 million by the year 2015, making an annual increase of Arab labour force 3.3% annually. Still the participation of Arab Women in the labour force remains the lowest of any region in the world. Whereas in 1996, women composed 40% of the world labour force, the participation of Arab Women in the Middle East and North Africa at the time did not exceed 26%. Many factors contributed to Arab women's modest involvement in the labour force, the most important of which are; high illiteracy rate, high fertility and birth rates, as
well as the collective social set up of Arab societies that view women as dependent and secondary income earner (UNIFEM Annual Report 1999 - 2000).

While enrolment statistics of women in engineering in some Arab countries are impressive as compared to the weaker numbers in US universities, information about the career paths which women engineers follow after graduation is not adequate to enable anyone to declare victory over gender differences. Certainly patterns of women’s enrolment in engineering disciplines sometimes reveal cultural and society constraints and restrictions in potential employment.

The stereotyped female occupations of teaching, nursing clerical and secretarial jobs attract most of the educated Arab women seeking employment. Although there has been notable increase in female enrolment in schools at different levels, still the ratio of girls pursuing vocational and engineering education remains very low in some of the Middle east countries. Laws stressing equality of treatment and opportunity of work for men and women remain theoretical.

3. Low level Presence of Girls in Engineering Education in the Arab World

In 2000, the youth literacy rate of Arab women was 68% while that of men in the same age group was 83% as shown in Figure 1 [2]. In 2000/01, total net enrolment ratio in primary education in the Arab countries was 80.9%.

According to the United Nation, 7.4 million children (1 out of 5) were out of school, in which 4.4 million were girls! In 2000/01, total gross enrolment ratios in tertiary education reached 19.7%, furthermore, 17.8% of women and 21.6% of men were enrolled in tertiary education. More women tend to join the fields of education, arts and humanities than men, who dominate in the field of engineering. Figure 2 shows the number of women students for every 100 men students by field of study for some selected Arab countries for the year 2000/2001. As can be seen in Figure 2, the percentage of girls student in the engineering field in some of the Arab countries is the lowest rate. This is due to the fact that, in the Arab world, misleading perceptions that science and technology are boys subjects. In addition, there is a belief that, there is failure of the curricula to relate science and technology to reality of both girls as well as boys.
Figure 2: Number of women students for every 100 men in tertiary education in the Arab World

Figure 3 shows the percentage of females to the total enrolled students in Science disciplines in the Arab universities. Women’s share of the labor force was generally lower in high-income Arab countries (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and UAE) ranging between 13%-23%. Today in the Middle East, especially Saudi Arabia, girls are under-represented in engineering/technical schools and in engineering field work. This is due to several factors, which are mainly socio-cultural-political factors. The percentage of females enrolled in science and technology university range from 82% in the UAE in 1999 to 8% in Djibouti.
Figure 3: Percentage of females to the total enrolled students in Science discipline in the Arab universities [8]

Ten to fifteen year ago in the Middle East, women have been confined largely to local institutions that do not always offer the range of disciplines available to men (e.g., engineering in Saudi Arabia). Thus, while many higher education institutions are usually coeducational, in the Middle East states, institutions are, with some exceptions, gender specific.

Table 1 shows the percentage of female students in selected specializations in certain Arab universities for the academic year 2002/2004. As can be seen in Table 1, the percentage of female students in engineering is low compared, for example, with art, science, and business. Also, it is noticed that Palestine and Jordan have the highest percentage of female students in engineering, whereas in some countries of the Gulf, especially Saudi Arabia, this percentage is near null.

Table 1: Percentage of female students in selected specializations in certain Arab Universities 2002/2004
(Source http:gmr.ui.unesco, 2006)

<table>
<thead>
<tr>
<th>Country</th>
<th>Humanities and literature</th>
<th>Business, law, social sciences</th>
<th>Science</th>
<th>Engineering, industry and construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bahrain</td>
<td>83</td>
<td>60</td>
<td>71</td>
<td>24</td>
</tr>
<tr>
<td>Djibouti</td>
<td>52</td>
<td>52</td>
<td>18</td>
<td>25</td>
</tr>
<tr>
<td>Jordan</td>
<td>37</td>
<td>37</td>
<td>51</td>
<td>30</td>
</tr>
<tr>
<td>Lebanon</td>
<td>56</td>
<td>56</td>
<td>42</td>
<td>21</td>
</tr>
<tr>
<td>Mauritania</td>
<td>23</td>
<td>23</td>
<td>14</td>
<td>-</td>
</tr>
<tr>
<td>Morocco</td>
<td>45</td>
<td>45</td>
<td>34</td>
<td>22</td>
</tr>
<tr>
<td>Palestine</td>
<td>34</td>
<td>34</td>
<td>49</td>
<td>35</td>
</tr>
<tr>
<td>Qatar</td>
<td>65</td>
<td>65</td>
<td>72</td>
<td>16</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>30</td>
<td>30</td>
<td>41</td>
<td>1</td>
</tr>
</tbody>
</table>

Source: http:gmr.ui.unesco.org/ (14/2/2006 assembled from various tables).

Adult and youth literacy rates have increased for both women and men. However, in 2003, an estimated 44 million adult Arab women were illiterate, among the youth (15-24 yrs), 8.5 million women were illiterate. Figure 4 shows the unemployment rates, for both men and women, for the year 2001 in the Arab World [3]. As can be seen in Figure 4, the difference in unemployment rate between girls and boys is above 10.8%.

There are also social perceptions as to which types of employment are particularly suitable to women and men. In the education and health sectors, for instance, there are increasing opportunities that are open to women as teachers, educators, doctors and nurses; the same applies to secretarial and social work as well as opportunities in the clothing and textile industries. However, women are anxious to venture into new employment areas such as engineering education and science, where competition is already severe and would escalate in the future.
4. What Challenges Are Left to Face in the Arab World?

In some Arab countries, girls are often deprived of basic education in mathematics, science and engineering training, which provide knowledge they could apply to improve their daily lives and enhance their employment opportunities. Advanced study in science and technology prepares women to take an active role in the technological and industrial development of their countries, thus necessitating a diverse approach to vocational and engineering training. Technology is rapidly changing the world and has also affected the developing countries. It is essential that women not only benefit from technology, but also participate in the process from the design to the application, monitoring and evaluation stages. The task of promoting and encouraging girls to take engineering education is a daunting task, which requires joint effort of the parents, the government, the university, and the society.

While education has made headway among the younger generations, illiteracy has proved difficult to eradicate. Therefore, the overall educational achievement among adults in Arab countries remains low on average. Arab countries have nevertheless made tangible progress in improving literacy: the estimated rate of illiteracy among adults dropped from approximately 60 per cent in 1980 to around 43 per cent in the mid-1990s. However, illiteracy rates in the Arab world are still higher than the international average and are even higher than the average in developing countries. Moreover, the number of illiterate people is still increasing, to the extent that Arab countries embark upon the twenty-first century burdened by over 60 million illiterate adults, the majority of whom are women.

The mid-1990s witnessed higher total enrolment rates for the secondary and tertiary levels in the Arab countries (54 per cent and 13 per cent, respectively) compared to developing countries (49 per cent and 9 per cent, respectively). However, these percentages are lower by far than those prevailing in the industrialized countries for that period (106 percent and 60 percent, respectively). Arab countries are not expected to catch
up with the industrialized countries' mid-1990s enrolment levels for all three levels of education before 2030.

Curricula and teaching materials remain gender-biased to a large degree, and are rarely sensitive to the specific needs of girls and women. This reinforces traditional female and male roles that deny women opportunities for full and equal partnership in society. Lack of gender awareness by educators at all levels strengthens existing inequities between males and females by reinforcing discriminatory tendencies and undermining girls' self-esteem.

5. Role of Parents and Society in Encouraging Women for Engineering Education

The factors suggested to explain the gender stratification of Arab faculty evolve around the male dominated characteristics of Arab societies and their effects on the subordination of women within higher education institutions. In a 1988 study of Arab academics [4], found that the majority of faculty women under study came from middle- and upper-class backgrounds. Still, their integration as equal members of an academic community continued to be subject to an array of male-imposed practices. Also, the study has shown that "Arab academia is--through its aims, division of power, and process of decision-making--an almost entirely man-moulded, man-minded, and man-oriented institution and place." [5].

The family in the Arab world, in most cases, provided girls with shelter, basic necessities and a relatively secure future, which meant there was little incentive to look for a job or seek other remunerative sources of employment. One of the obstacles of preventing girls to choose engineering education in some is the interference of parents, society environment, and educational system against the wish of the girls, especially in the Middle East. It has been observed that within the socio-cultural context of Gulf societies gender segregation, beyond its embedded discrimination, sometimes provides women with sheltered educational and occupational opportunities [6]. These arrangements lessen or totally avoid competition with men and enable women to carve out their own professional and occupational spaces in gender-based occupations (e.g., medicine and education). Such a gendered division of opportunities has been called a "patriarchal gender contract." [7]. Thus beyond its modernizing effects, access to higher education in the Arab states also serves as a mechanism for social control and political cooptation. It reproduces existing class and gender stratification under differential opportunity structures available to gender groups or to distinct social classes.

Programs and services must be made available to women and girls through career and engineering programs that will enable them to achieve high wage/high skill and non-traditional employment that leads to economic self-sufficiency. Women and girls in secondary career and engineering education programs must have access to technology courses and the same rigorous academic curriculum, including higher level academic courses, as all students.

6. Summary

There is great emphasis on girl’s education and their participation in degree courses, including engineering related disciplines. However, because local socio-cultural forces in some Arab countries do not encourage women to participate in the labour market, their presence in the engineering sector is likely to be limited. Join efforts is required from the government, parents, educational system, and society to promote engineering education for girls, and to prepare the ground for future development of engineering education for women.

National Research activities in the Arab world, including those conducted by the National Assessment of Vocational/Engineering Education, must include research on: (1)
the participation and outcomes of women and girls in career and engineering education; (2) barriers faced by female students and faculty in career and engineering education programs and practices that address those barriers; (3) effective practices in recruiting and retaining female students in non-traditional careers; and (4) progress that states are making in eliminating sex bias and stereotyping in career and engineering education.

7. Recommendations

To encourage and improve girls’ access to engineering education, science and technology in the Arab world, the following recommendations should be adopted:

1. Universities, colleges, and academic institution should use open engineering week, to raise public awareness of engineers' positive contribution to the quality of life. It promotes recognition among parents, teachers and girl students of the importance of engineering education and a high level of math, science, and technology literacy, and motivates youth, especially girls, to pursue engineering careers in order to provide a diverse and vigorous engineering workforce.

2. Provide information to girls on the availability and benefits of engineering education and vocational training and programmes of continuing education;

3. Engineering educators could help individual girl students, by establishing strong mentoring programs to support girls’ professional aspirations, by creating re-entry programs for girls who want or need to re-engage in the profession after a period of time spend at home, by making available entrepreneurship programs which would enable them to design jobs that fit their familial obligations, and by gathering more information about their girls students and the decisions they make.

4. Eliminate gender disparities in access to all areas of engineering education by ensuring that girls have equal access to career development, training, scholarships and fellowships, and by adopting positive action when appropriate;

5. Increase enrolment and retention rates of girls by allocating appropriate budgetary resources; by enlisting the support of parents and the Arab community, as well as through campaigns, flexible school schedules, incentives, scholarships and other means to minimize the costs of girls' education to their families and to facilitate parents' ability to choose engineering education for the girl;

6. New developments, such as E-learning help provide opportunities in engineering education to a greater number of girls in the Arab world, especially Saudi Arabia.

7. Creation of a Society for women engineers in academic establishments.

8. Develop and implement education, training and retraining policies for girls to provide skills to meet the needs of a changing socio-economic context for improving their employment opportunities;

9. Diversify vocational and engineering training and improve access for and retention of girls and women in education and vocational training in such fields as science, mathematics, engineering, environmental sciences and technology, information technology and high technology, as well as management training;

10. Develop curricula and teaching materials and formulate and take positive measures to ensure girls better access to and participation in engineering and scientific areas, especially areas where they are not represented or are underrepresented;
11. Increase training in engineering, managerial, agricultural extension and marketing areas for girls in agriculture, construction, business, arts and crafts, to increase income-generating opportunities;

12. Create flexible engineering education, training and retraining programmes for life-long learning that facilitate transitions between girls activities at all stages of their lives.

References
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