

**2006-694: RECRUITMENT IN ENGINEERING AND TECHNOLOGY PROGRAMS
INTEGRATING HOME SCHOOLERS, WOMEN AND INTERNATIONAL
STUDENTS.**

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Abstract

There is an increasing need for a technically literate workforce for the United States to maintain its leadership in today's interconnected global economy. Unfortunately, although the demand for engineering and technology graduates has increased the number of graduates has not increased for the last fifteen years. Because of phenomenon growth in emerging technologies and economic globalization it is rewarding to focus our whole hearted effort to recruitment. That is why the author has identified some promising areas such as steadily growing but relatively untapped home schoolers, women who make up 54% of the college population, and the international students eager to pursue education in the United States.

The future of the engineering and technology education can be secured by enrolling the potential students from our culturally diverse society. More emphasis should be given to influence a large population of K-12 home-schooled students because their average ACT or SAT scores are significantly higher than the national average. The author will present the nationwide trend in this area in the universities and colleges including the Northwestern State University at Natchitoches, Louisiana. Women who are nearly 50% of the talent pool in science, engineering and technology will be motivated so that the stagnant or even decreasing 20% level of enrollment in engineering and technology fields nationwide may be lifted by understanding that the careers in these areas are exciting, rewarding, satisfying and accessible. Since science, math and engineering education for domestic students has been declining and the demand for engineers and technologists outnumbers the supply the author will explore the potential of international students from certain regions of the world which has decreased very much in the past few years. In the long run, they can contribute their knowledge to this country with training and working visas. The overall job prospects along with ever lasting demands in some special categories will be pointed out to the employment concerned students.

The goal of this study is to motivate and lure interested students to enroll in engineering and technology majors in order to avoid technical labor shortage crisis that the nation demands and deserves.

Introduction

The problem of reduced enrollment and the consequent drop of the B. S. degrees since 1985 points to a potential shortage of engineers and technologists in the near future causing harm and stagnation to the industry. It is also established that the monumental growth and sweeping changes in engineering and technology will keep on shaping our society throughout the 21st century as we have already entered into economic globalization¹. It is the concern of the engineering and technology administrators as well as the industry people as it reduces the development and employment and the standard of living². Indeed, the demand for engineering

and technology graduates is expected to rise gradually in the foreseeable future as the industries are increasingly seeking graduates with appropriate background and training in different conventional and emerging fields of engineering and technology³. The nation must have to shift its reward structure from entertainment focus to technology focus. An increasing number of high school students are graduating from home schools for the last twenty years. In home schooling, the parents choose to construct and maintain strong, stable families that provide a nourishing home education environment for their children's learning and social development⁴. At this critical time the author thinks that we must look at this potentially untapped area to increase the undergraduate enrollment. Also women have become more likely than men to attend college. Many women are now going into fields that were once dominated by males such as law, medicine and dentistry. Engineering still continues to show the greatest inequality between male and female undergraduate students⁵. In 1999-2000, women earned only 19.5% of B.S. degrees in engineering and engineering technologies. The female engineers and technologists can relate the design of a product to the female section of the population resulting in a better chance of selling the product. It will surely take care of the consumer satisfaction part of the business. Also women excel in verbal and interpersonal skills and are very good collaborators which can improve the work environment⁶. It is very important for a technologically advanced society that the students as young as k-12 level be inspired to learn engineering, science, and technology as opportunities that are fun, rewarding and achievable.

A limited number of students are seeking higher education in engineering and technology fields due to limited exposure of engineering and technology related contents early in education. China produces almost 700,000 engineers per year which has been up over 100% in the last three years whereas the United States produces close to one-tenth of this number. At this time the media reports have highlighted the alarming decrease in the application and enrollment rates of international students at our colleges and universities for the year 2004. The Education Testing Service (ETS) analysts have also observed the significant drop in registration for Graduate Record Examination (GRE) which is required for admission in graduate programs in the United States starting 2004. This is a clear indication that the international students are turning away from American universities and enrolling into Canadian, Australian and European universities. We pride ourselves on attracting the world's brightest students both in undergraduate and graduate levels, but now America is in danger of losing the edge in brainpower and other advantages we have enjoyed since World War II. The author thinks that the careful scrutiny of those entering the United States can be done without complicating the visa processing⁷. This is why; the author thinks that it is vital to focus on recruitment first and subsequently to retention for the health of the technological society in which we are living. Recruitment is studied from several perspectives as mentioned earlier with more emphasis on home schoolers, women and international students. Suggested time allocation for the above three areas is given in figure 1.

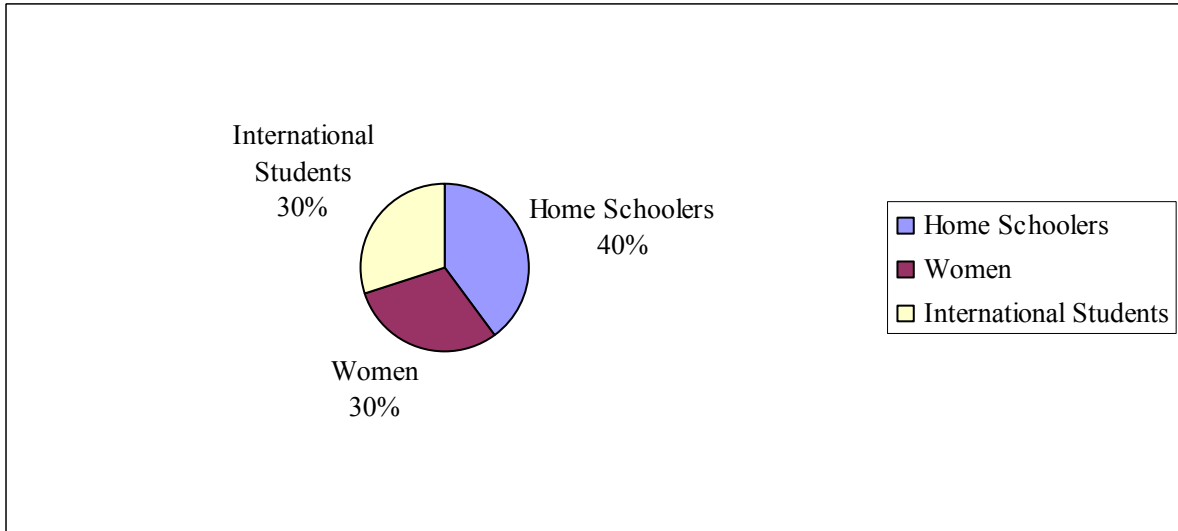


Figure 1 Distribution of allocated times in three areas of recruitment.

Home Schoolers

Home-based education appears to be the fastest growing form of education. This statement is supported by an estimated 1.7 to 2.1 million home educated children (K-12 grades) during 2002-2003 in the United States. The rate of growth is about 7 percent per year since 2001. Their academic achievements on average are significantly above that of public school students. The scores for reading, language and math are in the range of 65-80 in comparison to 50 for public school students⁸. Unfortunately, they are comparatively weak in math even though they outperform the average American students. In math home schoolers have scored 19.2 compared to the national average of 20.2 in ACT of 1996. The reason is that the parents of these high school students often feel inadequate to teach the high school math and science courses. Some parents are looking for better ways to educate their children instead of using some of the prepackaged home school courses for math. The author thinks that the engineering colleges and universities can develop review materials for home school parents in math and science curriculum. They can also provide home school courses in math, science or freshman engineering⁴. College admission offices must have to adopt reasonable policies for home school applicants, taking into account their unique circumstances and talents. The Home School Legal Defense Association (HSLDA) met with both the American Council on Education (ACE) and the American Association of State Colleges and Universities (AASCU) and requested these colleges to change their policies regarding home schooled students. Home schooling is now a legal option for parents in all 50 states. The national center for home education concluded a survey on home school admission policies in all the states in 1996. The portfolios for their work in lieu of an accredited diploma or GED are accepted by 93% of the polled colleges. The Wall Street Journal confirms that many colleges and universities are adjusting their admissions policies to accept portfolios for work instead of transcripts, a letter of recommendation and results of SAT and SAT II etc. The senior admission officer of Harvard University reveals that the applicants from home schoolers are definitely increasing. Similar are the cases for Yale (CT), Princeton (NJ), Texas A & M, Brown (RI), Carnegie Mellon Institute (PA), University of Arizona, Virginia and Maryland. The successes of home schoolers are reported in many journals, newspapers and alumni magazines. Their passion for knowledge, independence, the self respect,

motivation, curiosity, and the capacity to be responsible for their education are well recognized by colleges and universities such as University of Montana, Pennsylvania State University, Lewis and Clark college (OR), Dartmouth college (NH), University of Alaska/ Fairbanks, Hillsdale college (MI), University of North Carolina Chapel Hill, Boston University etc. Some universities and colleges such as Oral Roberts University (OK), University of Delaware, Belhaven college (MS), College of Southwest (NM) are providing scholarships and grants for home school students above and beyond all other financial supports⁹. The admissions office at Northwestern State University at Natchitoches, Louisiana is also encouraging the home schoolers to enroll. Required admission criteria are portfolios for work and ACT score of 21 or above. They are being considered as out of state students. The percentage of home schoolers is increasing slowly but steadily.

Women

As women constitute 51% of the population, an increase in women choosing careers in these fields could help curb the predicted shortfall in the professional workplace. In the United States the job growth rate for the scientist and engineers should be twice the rate of rest of the economy around 2000s. Women must be the other source in the engineering and technology rather than traditional white male. In 1999-2000, 57% of all degrees earned in the U.S. went to women. If this trend persists, women will obtain 59% of the bachelor's degree by 2010. The number of woman in medicine and law is projected to stabilize close to 50 percent in a decade. However, young women are not choosing technical careers at the same rate as young men. For engineering, it has been around 20% for several years. Numerous programs designed between 1993 and 2003 to increase the woman enrichment in engineering did not make any fundamental change. There is no discovery of any convincing explanation or one to two useful remedies. If it is not the lack of programs, websites, goodwill, research, or budget that failing us, it must be some thing else. The engineering classroom has preserved many of its 1950s qualities whereas the alternate programs such as medicine and law often offer a friendly and inviting atmosphere, modern teaching method and a much more immediate connection to real world applications. The author thinks that we must change the direction. The time has come to try consciously to develop an engineering curriculum aiming deliberately at young women. The end result may attract even many talented men who are repelled by the same of deficiencies of the current curriculum that have driven most women away. Also, we need to develop new workplace model with better harmony with the tastes, sensitivities, lifestyle, and family obligation of the modern middle class women¹⁰. For example, in Kerala, India the cultural, social, and political aspects of the region pushed the women enrollment in engineering to levels that are rarely seen in the United States or the Western World¹¹. Another example is that University of Hartford has revitalized its programs in electronics and computer engineering technology just to reverse the declining enrollment by changing the outdated curricula. They have realized to change both what was being taught and how it was being taught. The curriculum is keeping pace with the rapidly changing fields within electronics and computer technology. The goal of the curriculum restructuring is to improve marketability which is essential for survivability¹².

International Students

The science, math and engineering education for domestic students has been falling steadily whereas the demand for engineers and technologists is rising. United States department of labor has stated that by 2008 there will be 51 percent more jobs requiring science, engineering and technical training than that had been in 1998. The number of international students enrolled in colleges and universities in the United States has decreased by 2.4 percent in 2003/2004. Especially in engineering which is one of the three leading fields of study for the international students has reported a decrease of enrollment in 2005 compared to 2004¹³. Historically, U.S. colleges and universities have served as a magnet to attract the world's best and brightest minds that have helped make this country the world leader in technology and innovation. Not anymore. Some of the blames can be placed on the restrictive immigration and visa laws implied after 9/11. Increased difficulties in obtaining visa approval from the United States government as well as the horror stories (with varying degrees of credibility) concerning a newly hostile, foreign-phobic America have contributed to a perception that the international students are no longer welcome here⁷. The other nations have seized this opportunity to recruit these talented foreign students to their universities. Indirect effect is that United States has moved to 17th (among developed nations) from 3rd in 1975 in the proportion of college students majoring in science and engineering, according to 2005 National Science Board (NSB). The international students have brought \$13.3 million to the U. S. economy during 2004. The U.S. is seeing slowing decline in international students during 2004/2005 which is not good enough¹⁴.

The highest number of students are coming from the Asian countries. But these countries are establishing effective strategies to retain their students. The outsourcing success in India is increasingly encouraging bright students to pursue the bachelor's degree there and to defer or even postpone their post graduate education¹³. Here in the United States the news about outsourcing (off shoring) engineering jobs whether accurate or not has not helped towards enrolling in engineering and technology programs. As a result we will keep on losing on both the accounts until something is done about it. The decline in enrollment will have a profound impact on our future economic growth and standard of living.

Employment Opportunities

The goal of the colleges and Universities is to prepare the technical workforce for immediate employment in a wide variety of industries and businesses. In today's education environment the graduates are coping with a combination of high debt and an uncertain job market. Evidence from the U. S. shows that reducing the debt of first-year students from low-income backgrounds significantly increases college retention. The occupations are influenced by the ups and downs of the economy, as some are more sensitive to economic fluctuations than others. Also the sectarian unemployment rate varies relative to overall unemployment level. The labor market and the prevailing unemployment rates in particular affect attrition. Students are more persistent when they perceive that holding a diploma/degree will give them a competitive edge to find employment in a difficult time. The information about job markets and realistic employment prospects must be an on-going service to the students. They may realize their long-term benefit from completing the program by achieving increased marketability, flexibility and income potential throughout their working life. The students should also be notified that recession does

not last for long time specifically in the engineering and technology fields. The recession of 1991 and the boom for the last decade (1991-2001) have proved it. There will be no shortage of jobs in the global market in these fields. Thus the clear picture about prospects of jobs in these fields will help students to enroll and hang around until completion of diploma or degree programs. A positive awareness about engineering profession in the society will establish the prestige they deserve.

Conclusion

Recruitment and subsequent retention of students is an important goal for the universities and colleges in the United States. The time has come for the engineering schools to reconstruct their recruiting efforts. It will definitely be worthwhile to tap into the relatively untapped arena of home schoolers. It is unbelievably cheap as only one tenth of the cost of public schooling per pupil is utilized. The author believes that they will likely welcome assistance in the above mentioned areas from the engineering and technology programs of the colleges and universities. In return, they will supply some of the best and the brightest students to the fields of engineering and technology. These fields can become more diverse as women are involved. A competitive nation can not allow girls to write off math and science as exclusive male domain. It is necessary to change our attitude. The proven success in other part of the world as illustrated must be implemented here otherwise engineering and technology will become marginalized and other programs will seek out and make a place for them. Motivation towards sisters and daughters at home can elevate interest to enroll in these fields. In today's rapidly shrinking world, global awareness is indispensable. We must focus on the projected increase of 6 million international students in the next 20 years. A considerable percent of international students provides service to this country through the training and working visas. However, some of them go back to their native country as leaders and maintain lasting ties to the United States. It is a win-win situation for both the parties. We must make this issue a priority otherwise the higher education may follow the same path that the auto, textile and electronics industries did and its competitive advantage will be lost. At the same time, overreacting to achieve security can bring insecurity and low standard of living in the long run.

The author's goal is to help the colleges and universities to recruit motivated and prepared students and to stare them to succeed which society deserves. It can be achieved by following the examples and suggestions presented here.

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Biography

Dr. RAFIQUUL ISLAM is a faculty of the Northwestern State University at Natchitoches, Louisiana in the Department of Engineering Technology. He had been on the faculty of the DeVry Institute of Technology, Calgary, Alberta, Canada, for five years. He also taught for four years at the West Coast University, Los Angeles, California. He has sixteen years of working experience in the areas of communications and computer applications in power and control systems. His areas of interest include cellular and PCS phones, microwave and satellite systems, fiber optics and wireline and wireless LANs and WANs.