

**Ministry of Higher Education and Scientific Research**  
**Office of Higher Education Policy and Planning**  
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**THE STATUS OF SCIENCE AND ENGINEERING EDUCATION IN THE  
UNITED ARAB EMIRATES**

The rapidly growing economy of the United Arab Emirates is increasingly expanding in areas such as construction, shipping, tourism, finance, and energy. Over the years, the UAE has depended on the importation of high skill labour to provide the needed workforce for economic development and diversification. Today, over eighty percent of the population is expatriate, the remaining Emirati nationals. To assure the role of Emiratis in the economic future of the country, and for the UAE to have a competitive workforce of competent engineers and professionals, increased numbers of graduates in the field of science, maths, and engineering will be needed. International studies point to the number of bachelor degrees produced in science and engineering as an important indicator for each country's economic development. Other competing economies are addressing the same issue, some with more success, such as Indonesia, Singapore, Malaysia, South Korea, and others.

In the UAE, Emirati students make choices during their secondary education, to pursue a science or humanities curriculum, and whether or not to take calculus, a subject needed for science, maths, and engineering (SME) education. Better data on students and curriculum are needed in this area, especially in higher education where international definitions and international organizations use differing definitions of science education. However, the data generally indicate that this is a relevant issue for the Ministry of Higher Education and Scientific Research in the UAE and its campuses, the United Arab Emirates University (UAEU), Higher Colleges of Technology (HCT), and Zayed University (ZU).

In the UAE, the UAE University has science and engineering programs, HCT has selected applied baccalaureate programs, and ZU is primarily an institution for females that awards related degrees. Three issues emerge for higher education concerning Emirati attainment of degrees, 1) the total number of students receiving degrees, 2) the need to increase male enrollment in all bachelor level programs, including SME, and 3) the role

of non-federal or private institutions in this area as they now enroll over 18,000 Emirati students.

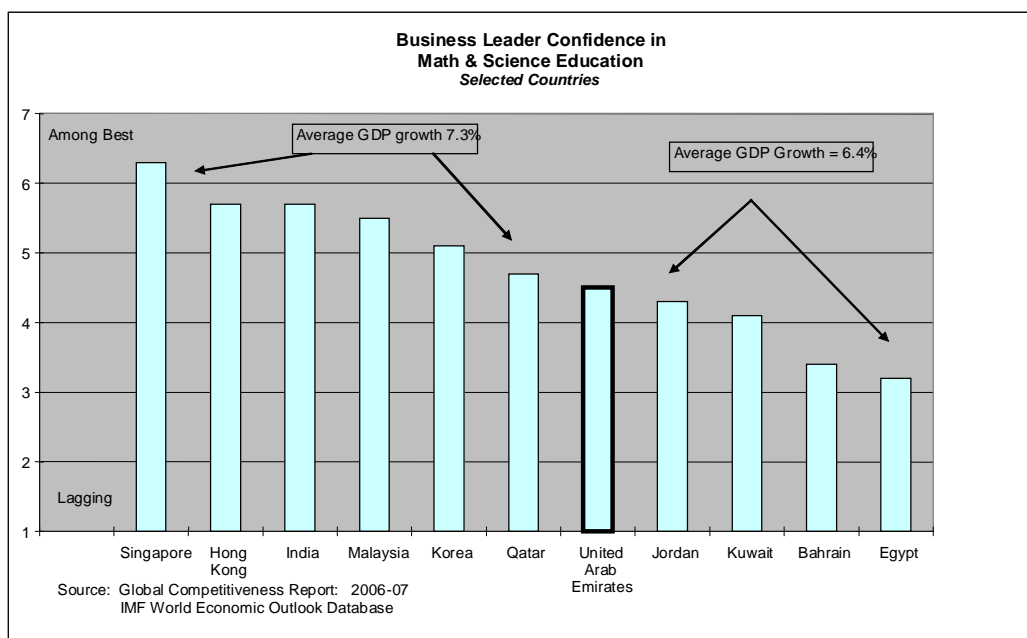
In general, the United Arab Emirates ranks fairly well in international comparisons for science and engineering students, but an examination of the issues reveals the need to focus on this issue and increase the number of students, increase the number of programs, and assure the rigor of the curriculum to meet international standards.

The UAE economy will benefit from a skilled workforce of both Emiratis and expatriates, and expanded diversification will result from increased SME graduates. For nationals to fulfill their role in the economic growth of the nation, this issue will require further attention by relevant authorities.

Information from the World Economic Forum

According to data developed through the World Economic Forum’s survey of key global executives, the United Arab Emirates ranked 41<sup>st</sup> out of 125 nations. The results of the survey are largely consistent with other global indicators. Singapore received the highest rankings, along with the Northern European countries of Finland, Belgium, and Switzerland. African countries consistently placed low in the survey.

**Figure 1: Business Leaders Rating of Math & Science Education**



While the results from the WEF are encouraging, they do highlight a key opportunity for improvement. According to recent reports from the International Monetary Fund, the six countries in *Figure 1* with better math & science education saw real GDP (after inflation) grow an average of 7.3 percent. By comparison, the countries with lower math & science education saw real GDP grow an average of 6.4 percent.

This pattern suggests that improvements in science and engineering education can be beneficial for positive real economic growth. Consider, for example, the rapid economic growth of countries such as China, South Korea, Hong Kong, Taiwan, Singapore, and Malaysia. Each of these countries has enjoyed significant economic growth, as well as rapid improvement in science and engineering education. In simple, but clear terms, science and technology investments are key to active participation in the global economy.

The data from the World Economic Forum are entirely consistent with the work conducted by Nobel Laureate, Robert Solow. Many years ago, in his research on economic growth, Solow found that real economic growth depends almost entirely on technological change. Investing in science and technology represents an opportunity for the UAE. Using the previously calculated figure of approximately 1 percent of GDP from Figure 1, if the UAE's real economy grew by an extra 1 percent, the economy would be worth many more billion AED annually.

### **Present Status of Science and Engineering**

Development analysts use three key measures to determine the status of science and engineering education in a country:

- A) First degrees: This includes all bachelor-level awards granted by some entity
- B) First degree in Science & Engineering: This figure focuses on degrees earned in any science, engineering, or social science field.
- C) First degree in Natural Science and Engineering: This figure excludes social science credentials.

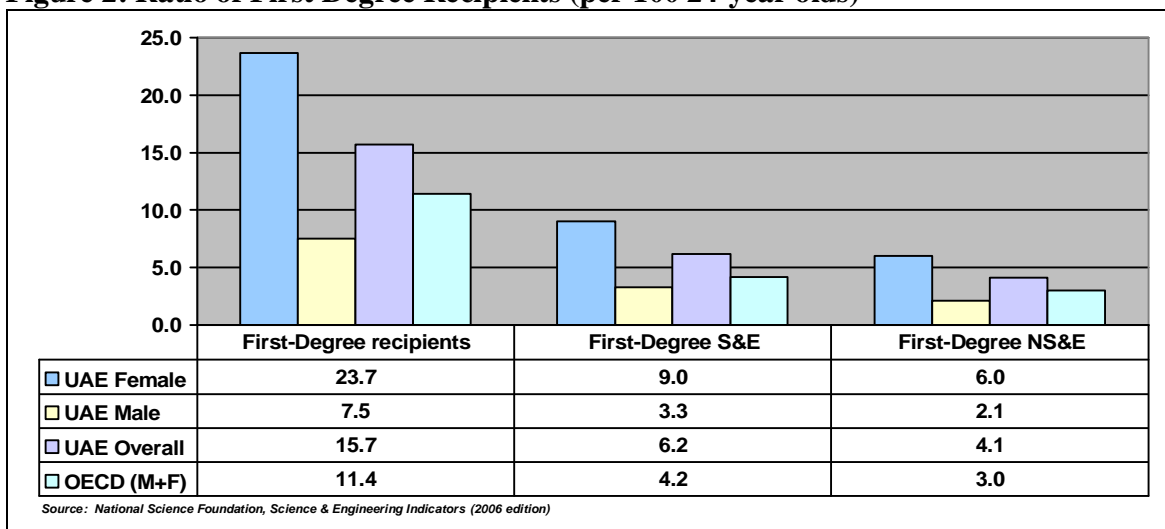
Because countries vary considerably in size, it is helpful to compute proportions or ratios that provide more meaningful comparisons. For example, the US-Based National Science Foundation estimates that for every 100 24-year-olds globally, there are:

- 11.4 new first-degrees
- 4.2 new first-degrees in a science or engineering field
- 3.0 new first-degrees in a natural science or engineering field.

Given varying education and reporting practices across the globe, precise international comparisons are admittedly illusive. At the same time, organizations such as UNESCO and OECD are rapidly improving international standards for measuring science and engineering. Comparative information provides an opportunity to estimate the UAE’s relative production of science & engineering students. Given this context, the Office of Higher Education Policy & Planning extended the NSF analysis to provide comparisons with the UAE.

Figure 2 shows the ratio between the number of various first degree recipients, and the number of 24-year-old UAE nationals.<sup>1</sup>

**Figure 2: Ratio of First Degree Recipients (per 100 24-year olds)**



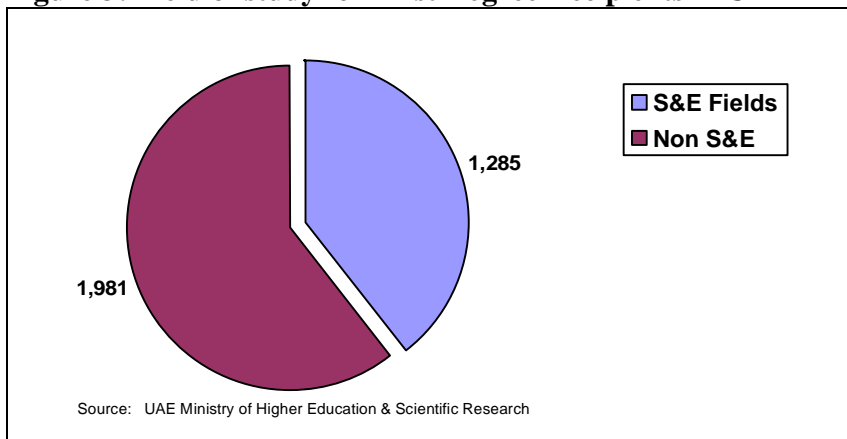
<sup>1</sup> The UAE is approximately 80 percent expatriate. However, Federal institutions in the UAE system of higher education are designed to serve UAE Nationals. OHEPP estimated the number of 24-year-olds using official figures from the 2005 Census.

The figures shown above include only students from the federal sector of higher education. The totals would improve minimally if degree data from the private sector of higher education were added. Recent data provided by the Ministry’s Commission for Academic Accreditation show that approximately 17 percent of UAE nationals that enroll in private institutions intend to attain a degree in the sciences or engineering. However, the number of nationals graduating in 2005-06 was not large. Etisalat University College awards bachelors degrees which may increase in number in the future, and the UAE Petroleum Institute has recently issued its first degrees which may also increase in the future.

### Science and Engineering in Higher Education

All three federal institutions in the UAE award degrees related to science and engineering.<sup>2</sup> Using the most recent information available, UAEU, HCT, and ZU combined awarded 3,266 first degrees in academic year 2005-06. Of these, 1,285 – or approximately 39 percent of all first degrees were awarded in Science & Engineering fields. By comparison, figures provided by the US-based National Science Foundation suggest that approximately 37 percent of students that earn first credentials globally will graduate with credentials in science & engineering.<sup>3</sup>

**Figure 3: Field of study for First Degree Recipients in UAE**

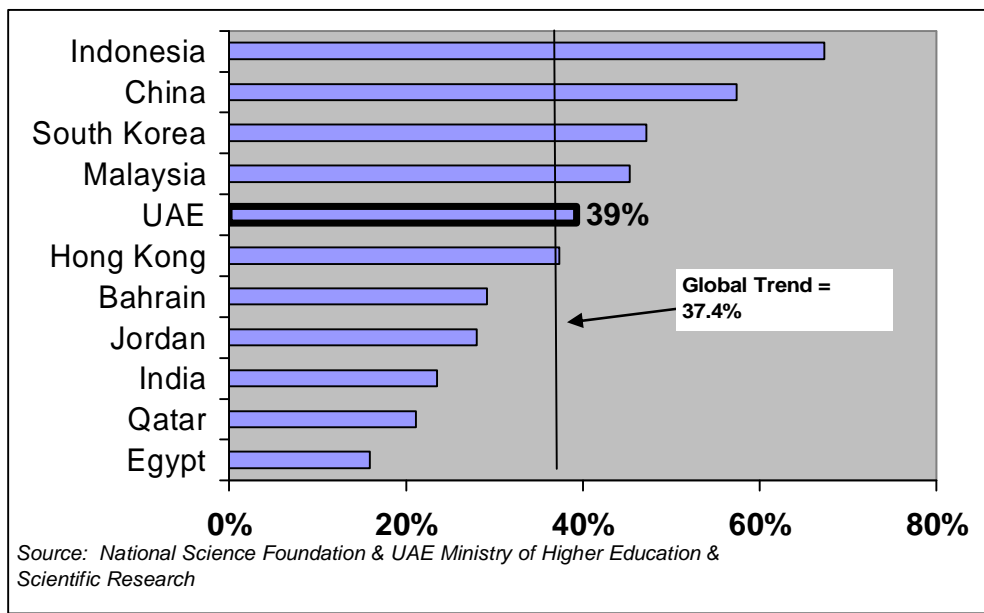


<sup>2</sup> We continue to focus on “First Degrees in Science and Engineering.” Following international practices, the OECD definition of “Science and Engineering” includes physical, biological, computer, math, agricultural, social, and behavioral sciences, as well as engineering.

<sup>3</sup> National Science Foundation, *Science & Engineering Indicators (2006)*.

These figures suggest that UAE nationals that progress to first degrees are no less interested in science and engineering than their global peers. At the same time, it is important to note an important pattern seen in rapidly growing Asian economies. As Figure 4 shows, UAE students are more likely to study science and engineering, compared to their counterparts in nearby countries. However, they are less likely to study sciences compared to students from the key expanding Asian economies.

**Figure 4: Proportion of First University Degrees in S&E**



Key Challenges

Looking at the ratios, one issue that becomes apparent in this analysis is the shortage of male Science and Engineering graduates. Compared to females and global trends, males appear less likely to earn first-degrees, less likely to study Science & Engineering, and less likely to study Natural Sciences & Engineering. This pattern is evident throughout higher education in the UAE. According to recent reports from the UAE Ministry of Higher Education & Scientific Research, males represent only 27 percent of all college and university students enrolled in federal institutions in the UAE.<sup>4</sup> Additionally, males represent only 24 percent of all UAE first degree recipients, and only 26 percent of all students receiving S&E credentials.

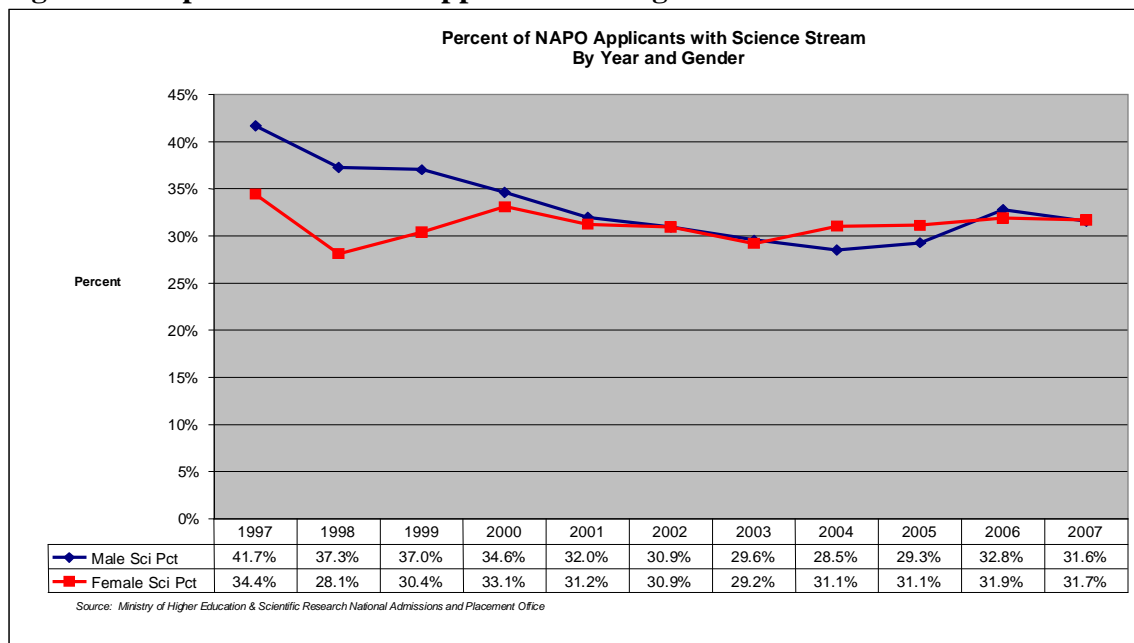
<sup>4</sup> This figure improves slightly to 34 percent if students from both public and private sectors are counted.

The topic of male participation in higher education has been discussed extensively in other studies conducted within the UAE. It is clear that one key strategy available for the UAE is to encourage greater participation of males in tertiary education. Once enrolled at the tertiary level, male students are slightly more likely to major in science and engineering disciplines.

When considering the status of S&E education in the UAE, it is important to examine trends from the secondary, as well as tertiary level of education. While the tertiary level offers science and engineering, it builds on a foundation that begins during the later phases of secondary education.

The Ministry of Higher Education & Scientific research maintains information on tertiary applicants, including the “stream” of secondary education for each applicant. According to application statistics managed by the Ministry’s National Admission and Placement Office, the proportion of tertiary applicants studying in secondary-level “science stream” has declined over the past decade.

**Figure 5: Proportion of NAPO Applicants Having Science Stream**



It is important to note here that as secondary education is restructuring throughout the UAE. For this reason, the continuity of this trend is less than certain. Still, the figures do not suggest any increase in science education in the secondary sector. Regardless of

how these figures might be adjusted, the level of interest shown by UAE nationals does not appear sufficient to sustain a science-driven, innovation-focused economy that has a high population of Emiratis participating in sectors requiring knowledge of engineering.

#### Implications

The limited information available suggests that colleges and universities are graduating students in science and engineering disciplines at a rate that is comparable to global averages, but significantly lagging behind the more rapidly emerging Asian/Pacific region.

Data on college and university applications, actual enrollment, and graduation do not show adequate increases in the number of students aspiring to study science, do not show significant enrollment in the sciences, and do not show enough graduates in science and engineering.

At the same time, science and engineering education will play a key role in the future of the UAE economy. The country has progressed remarkably well given its relatively recent entry into education and technology. To sustain progress, it is important that resources and strategies be aligned to foster more active participation among UAE nationals in science and engineering programs offered by the UAE's tertiary institutions. It is particularly important that tertiary education participation increases among males, that more students pursue education in science and engineering disciplines, and that science and engineering preparation is enhanced at the secondary level.

Given these needs, the Office of Higher Education Policy and Planning recommends that policy makers at the federal and emirate levels become engaged on this issue and consider the following:

- 1) Review higher education programs in science and engineering to ensure quality, consistency with international standards in public and private institutions, and appropriate curriculum.
- 2) Improve information acquisition to ensure the UAE benefits from complete and consistent data on the condition of science and engineering education in the UAE in all institutions.

- 3) Enhance cooperation between MOHESR and MOE to identify appropriate strategies to interest and prepare more students in science and engineering education.
- 4) Increase collaboration between private industry and higher education to better meet workforce needs.
- 5) Build on existing reform initiatives to improve secondary education, particularly in English, mathematics, and college preparation.

As Emiratis comprise about twenty percent of the population of the UAE, it is important that human resource development reach more nationals as their percentage of the population will decline over time as the country continues to grow rapidly. In engineering and related disciplines it is important to graduate increased baccalaureate level Emiratis so that they may participate fully in the professional development of the country, and the country increase its competitiveness. Increased attention to the issue of science and engineering education in the UAE will yield new opportunities for the next generation of Emiratis and the country.

#### References:

Barber Michael, Mona Mourshed, and Fenton Whelan, "Improving education in the Gulf" McKinsey Quarterly, March 2007

International Monetary Fund, Regional Economic Outlook: Middle East and Central Asia, May 2007

Ministry of Higher Education and Scientific Research, "Educating the Next Generation of Emiratis: A Master Plan for UAE Higher Education", Office of Higher Education Policy and Planning, January, 2007.

Mograby, Abdullah, "Human Development in the United Arab Emirates: Indicators and Challenges" Education & the Arab World, Emirates Center for Strategic Studies and Research, 1999.

National Science Foundation, Science and Engineering Indicators 2006

The State of Science and Technology in the World, UNESCO Institute for Statistics (2001)

UNESCO Science Report, 2005

World Economic Forum, Global Competitiveness Report, 2006-07