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The United States' Challenges in Science and Engineering Education

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Abstract - *Numerous statistical data indicate that science and engineering workforce in the United States is aging and nearing retirement. Moreover, various studies show that it has become increasingly difficult to attract American students to science and engineering fields. We present supporting data for different ethnic groups and international students for various degrees in these fields. The situation is particularly grim for Hispanics, who are the fastest growing segment in the population. They remain an untapped in resource, which could either present the solution needed to overcome this challenge, or further deteriorate the situation. The objective of this manuscript is to shed some light on the situation and suggest some solutions to this predicament that the nation is facing.*

Keywords: Science and engineering education, student retention, United States universities, underrepresented minorities.

1 Introduction

The United States has, in recent years, found that a high percentage of its science and engineering workforce is nearing retirement age. According to the U.S. National Science Foundation [4], in 2005 about 26% of Science and engineering degree holders are age fifty or more. Accordingly, one out of four science and engineering related workforce is eligible for retirement by 2017. The situation is more grim for specific fields such as nuclear science and engineering. For instance, according to a 2004 report by the Department of Energy [5], by 2012, "about three-quarters of the workforce in nuclear engineering will reach retirement age." Accordingly, the nation is facing an aging workforce and is in danger of losing most of its expertise as such talented workforce retires. Therefore, the United States is in dire need for a young and diverse workforce in all areas of science and engineering.

A major part of the solution to the national need is at the university level. Fortunately, the nation is well equipped to tackle the problem at this level. Indeed, the United States and its territories have 4,391 degree granting institutions of higher education (IHE) with a total student enrolment of 17,570,569 [9]. Of these institutions, there are 1,730 or 40% that have only programs of study that are at least two years but less than four years. These two-year institutions have 37% of the total student enrolment. These institutions typically offer associate degrees, but they also provide a pipeline of students to IHEs that offer Bachelor degrees or higher. Out of all IHE, there are 1,737 or 40% that are public with 74% of the total student enrolment, while the rest of the institutions are private. Of these private institutions, 908 or 52% are for-profit with 20% of the total private student enrolment, while the rest of the private institutions are not-for-profit. The United States higher education gained an international reputation largely due to the activities of 96 institutions, classified by the Carnegie Foundation for the Advancement of Teaching as RU/VH, or research universities with very high research activity [9]. However, these institutions constitute only 2% of the U.S. IHE, and 13% of the total student enrolment.

The other predicament is that it has become increasingly difficult to attract and retain students into the scientific and technical fields necessary for the nation to compete in a global arena. According to a report by the U.S. National Science Foundation [4], in 2005, the U.S. institutions conferred 640,910; 1,437,200; 567,875 and 52,588 associate, bachelor, master and doctoral degrees, respectively. In other words, total degree conferral is less than 15% of the total U.S. student population, which hints to a low retention rate. For example, ideally for a successful four-year program, this rate should be around 25% of the student population. The corresponding percentage of degrees in science and engineering was 7%, 32%, 21%, and 54%, associate, bachelor, master and doctoral degrees, respectively. However, the proportion of these degrees awarded to students on temporary visas was 3%, 4%, 28% and 36%, respectively.

Indeed, since its birth the United States has been a nation of immigrants and its success is largely attributed to attracting the best talent and brains from all around the world. This led to the quick and easy solution to fixing national needs in every domain by admitting more immigrants who eventually become Americans. Accordingly, the U.S. Census Bureau points out that in 2004 about 11% of the U.S. population aged 25 to 44 was naturalized citizens [2]; that is citizens who obtained U.S. citizenship by means other than

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parent or birth in the United States or its territories. The other traditional approach to solving the national need was by taking jobs beyond U.S. borders to gain from the expertise of foreign nationals at a cheaper cost, which is referred to as outsourcing.

Using 2005 data, [4] points out that 25% of science and engineering graduate student enrolment in the U.S. was on temporary visas. In addition, 4%, 28% and 36%, of science and engineering bachelor, master and doctoral degrees, respectively, were awarded to students on temporary visas. Many foreign students tend to stay in the U.S. after graduation however. For example, according to [4], 74% of Ph.D. awardees on temporary visas tend to stay in the U.S. after graduation. However, this situation is changing due to global demand and various restriction that were introduced in response to 9/11 events. Nevertheless, in 2004 the U.S. accounted for 22% of internationally mobile students [4]. This percentage is decreasing though according to the same resource.

The nation has an untapped in resource to solve the country's shortage in science and engineering expertise. Many minority segments of the population are traditionally underrepresented in science and engineering fields. Most notably are African Americans and Hispanics. Nationally, the underrepresentation of minorities in science and engineering careers has been a topic of research and concern for educators and policy makers. Research has consistently shown the benefits of a workplace that reflects the diversity of the broader community [8]. Many national committees are formed to help focus on removing obstacles preventing minority and women participation in science and engineering careers [4]. This prompted various federal agencies to allocate a variety of scholarships, fellowships, and other incentives specifically designed to attract minorities to science and engineering disciplines. Many universities utilize pipeline models to help carry students interested in a science and engineering domain from one level of participation to more advanced levels in order to help students gain experience and knowledge; see [7] for a detailed discussion on this topic.

Unfortunately, minority participation in science and engineering related disciplines remains a serious challenge. For example, while African Americans and Hispanics make up 12.8% and 15% of the U.S. population, respectively [3], they each only account for 5% of the science and engineering workforce [4]. Furthermore, the annual increase rate of representation of Hispanics in science and engineering education is less than half of their annual population increase rate. Thus, although the situation may seem slightly improving, looking at the bigger picture more needs to be done to avoid certain catastrophic results. Accordingly, in this paper we present various data to illustrate these challenges and indications of improvement of the situation. Thus, in the next section we present and analyze student's demography for each ethnic race in the United States. Percentage data is presented in graphs while the actual percentage data is laid out in tables provided at the Appendix for ease of presentation and reading of this paper. In Section 3, we suggest some solutions to mitigate the situation and transform failures to successes. Section 5 presents summary and concluding remarks.

2 Students' demography

Figures 1 to 5 plot the percentage of various science and engineering degrees awarded by U.S. institutions to different ethnic groups and international students. They also present the percentage of these groups at the graduate level in science and engineering. The percentage of international students (students on temporary visas) is taken with respect to the total student enrolment. The percentage of American ethnic groups is taken with respect to the total student enrolment that is either U.S. citizen or U.S. permanent resident. Since at the doctoral level separate data for U.S. permanent resident students was available, the ethnic percentage was taken with respect to the U.S. citizen student enrolment only. The actual percentage data is presented in tables at the Appendix. The data typically runs from 1977 to 2005, except when it was not available. The raw data was obtained from [4] and previous editions. While reading the data, it is important to note that according to the 2000 U.S. Census, population aged 10 to 19 amounted to 40,747,962, of which 62.9% White who are not Hispanic, 15.5% Hispanic, 14.9% Black, 3.5% Asian, 1.2% American Indian and Native Alaskan, and 0.2% Native Hawaiian and Pacific Islander [1]. Thus, for 2009, we can claim the same percentages for U.S. population aged 19 to 28, a reference that we will use for our analysis.

2.1 Internationals

Figure 1 presents the statistics for international students. This group is not much represented at the associate and bachelor degrees. Accordingly, the percentage of associate degrees fluctuates between 1.8 and 3.3 since 1985. On the other hand, the percentage of bachelor degrees is also small and is almost stable; fluctuating between 3.6 and 4.1 since 1981. Conversely, the percentage at the graduate level of international students is starkly different though. This is due to the fact that many international students are attracted to the U.S. for its graduate education. Consequently, the percentage of international graduate enrolment has peaked to 28.3 in 2002; however, it is in constant decline since then by about one percentage point each year. This is largely due to the measures taken by the U.S. government after the events of 9/11/2001, where it became increasingly difficult for international students to obtain a visa to continue their studies in the United States. Due to the length of the program, the percentage of master degrees peaked to 30 in 2003, and is decreasing since then by an average of one percentage point a year. However, the percentage of doctoral degrees is still peaking though, where it has reached 36.3 in 2005. This percentage has been increasing since 2002 at an average annual rate of almost two percentage points. Nonetheless, this percentage is expected to decrease as the international students' pipeline has decreased and the average length for doctoral programs is over six years.

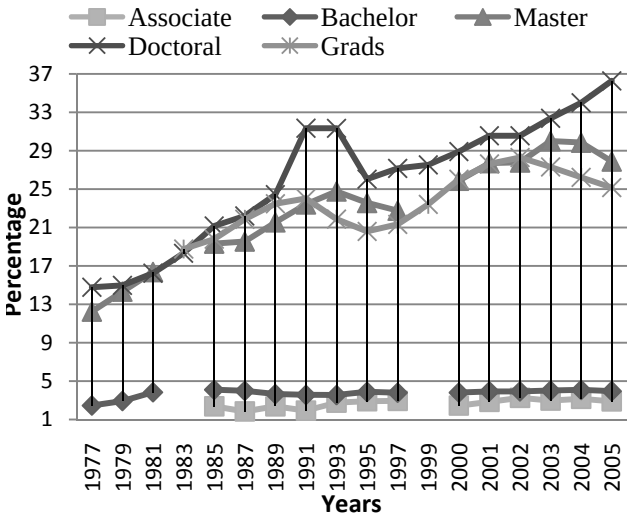

Figure 1 Yearly percentage of science and engineering degrees obtained by students on temporary visas at U.S. institutions.

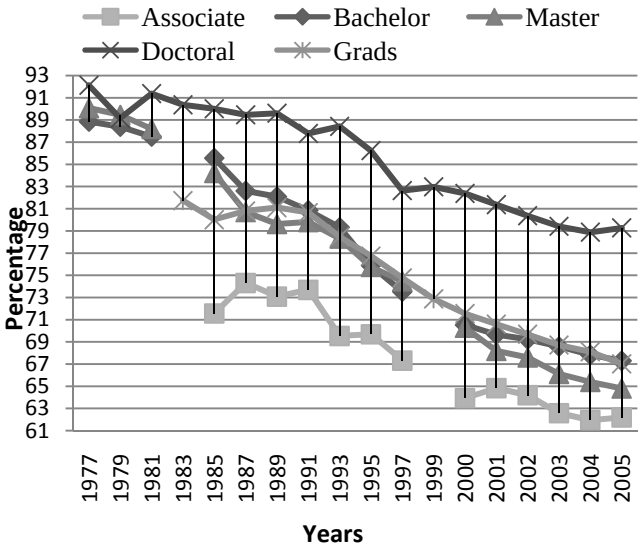

Figure 2 Yearly percentage of science and engineering degrees obtained by whites at U.S. institutions.

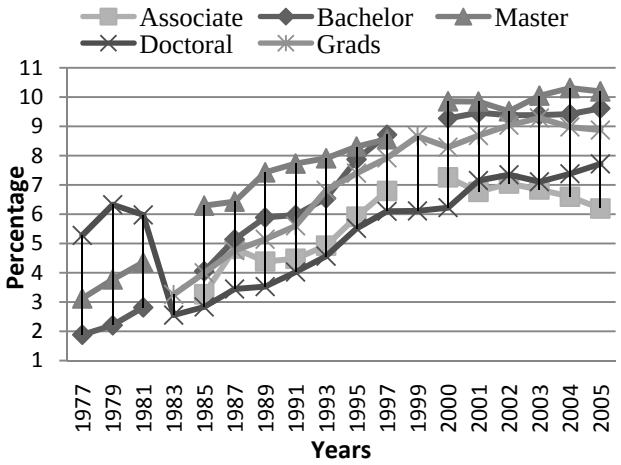

Figure 3 Yearly percentage of science and engineering degrees obtained by Asians and Pacific Islanders at U.S. institutions.

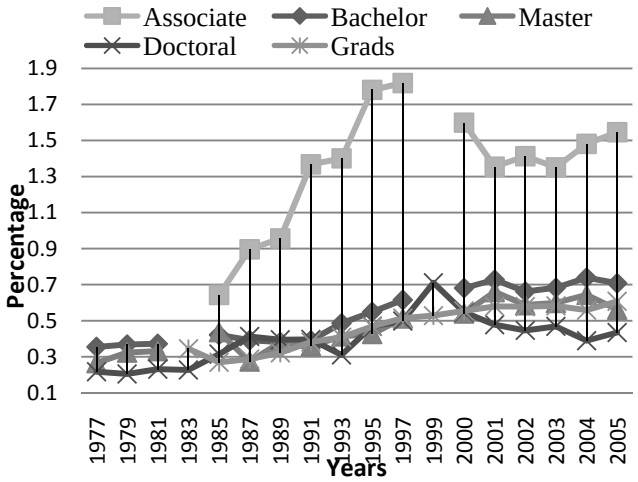

Figure 4 Yearly percentage of science and engineering degrees obtained by American Indians and Alaskan Natives at U.S. institutions.

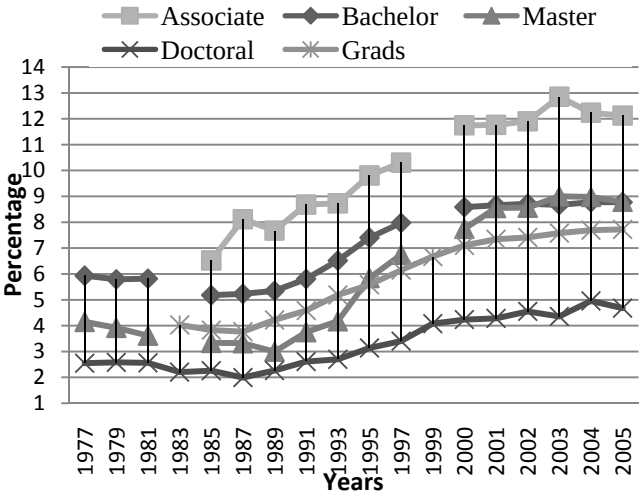

Figure 5 Yearly percentage of science and engineering degrees obtained by African Americans at U.S. institutions.

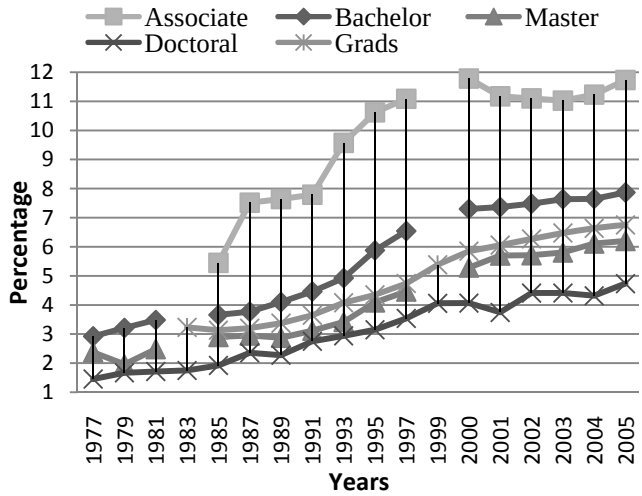

Figure 6 Yearly percentage of science and engineering degrees obtained by Hispanics at U.S. institutions.

2.2 Whites

Based on the 2000 census data [1], Whites make up 62.9% of the U.S. population aged 19 to 28. Nevertheless, this percentage is expected to decrease to 59.9% and 58.4% by 2015 and 2020, respectively. It makes sense to see Whites making up the majority in science and engineering. However, as Figure 2 illustrates, since the seventies their percentage has been in constant decline reaching 67% of graduate students in 2005, which is down from 81.7% in 1981. Their average annual decrease is more than 0.8 percentage points since 1999. The percentage in 2005 was 62.2%, 67.3%, 64.8%, and 79.3% of associate, bachelor, master and doctoral degrees, respectively. This is also a downfall from 74.3% in 1987, 88.9% in 1977, and 92.1% in 1977 for associate, bachelor, master and doctoral degrees, respectively. Since 2000, Whites' average annual decrease at the bachelor, master, and doctoral levels is more than 0.5, 0.9 and 0.5 percentage points, respectively. This is more than their demographic decrease of about 0.5%. Thus, although Whites make up the majority, their representation is in steep decline, which may soon cause them to become underrepresented in science and engineering.

2.3 Asians and Pacific Islanders

According to the 2000 census data [1], Asians and Pacific Islanders make up only 3.7% of the U.S. population aged 19 to 28. This percentage is expected to decrease slightly to 3.5% by 2020. Yet this group is by far the most successful minority in terms of representation in science and engineering education and their corresponding percentage of representation has increased dramatically since the seventies, as Figure 3 demonstrates. Accordingly, their representation in graduate school has almost tripled, fluctuating between 7.9 and 9.3 since 1997. For associate degrees, their percentage has doubled, and is fluctuating between 5.9 and 7.3 since 1995. For bachelor degrees, their percentage has been increased five folds, and is slowly increasing from 8.7 in 1997 till 9.6 in 2005. For master degrees, their percentage has tripled, and is fluctuating between 9.5 and 10.3 since 2000. Their doctoral degree representation has also tripled since 1983, when it was 2.6% and is fluctuating between 7.1 and 7.7 since 2001.

2.4 American Indians and Alaskan Natives

In reference to the 2000 census data [1], American Indians and Alaskan Natives make up only 1.2% of the U.S. population aged 19 to 28 and this percentage is expected to decrease slightly to 1.1% by 2020. Thus, it makes sense to see them the least represented in science and engineering in terms of percentage as depicted in Figure 4. Nevertheless, their representation is constantly improving since the seventies. Their graduate enrolment doubled from 0.3% in 1989 to 0.6% in 2000, and is constant since then. They are fairly represented with respect to associate degrees, where their percentage tripled from 0.6 in 1983 to 1.8 in 1997 and is fluctuating between 1.4 and 1.6 since 2000. Their bachelor degrees is slowly improving, it has increased from 0.4 in 1991 to 0.7 in 2000 and is constant since then. Similarly, their master degrees doubled from 0.3 in 1987 to 0.7 in 2001, but it is constant at 0.6 since 2002. Their doctoral degrees tripled from 0.2 in 1983 to 0.7 in 1999, but it decreased since then, fluctuating between 0.4 and 0.5 since 2000. All in all, except at the associate degree level, American Indians and Alaskan Natives are still underrepresented with respect to all other degrees in science and engineering. The situation has slowly improved in the past, but still more need to be done.

2.5 African Americans

As noted by the 2000 census data [1], African Americans or Blacks constitute 14.9% of the U.S. Population aged 19 to 28. This percentage is expected to increase to 15.6% by 2015, yet decrease to 14.6% by 2020. However they are traditionally underrepresented in science and engineering as Figure 5 illustrates. Thanks to various federal support programs and initiatives [10], their representation is slowly increasing, but they remain a potential resource to solve the nation's shortage. In graduate school, their representation has been slowly increasing from 7.1 in 2000, to 7.7 in 2005. Their associate degree representation has almost doubled since 1983, and is slowly fluctuating between 11.7 and 12.9 since 2000. Their bachelor degree representation has been constantly increasing since mid seventies, but only gained less than three percentage points since then. It is increasing at a slower rate from 8.6 in 2000 to 8.8 in 2005. For master degrees, the representation has more than doubled since late seventies, and is fluctuating between 8.5 and 9.0 since 2001. For doctoral degrees, the Blacks percentage has tripled since 1987, and is fluctuating between 4.1 and 5.0 since 1999.

2.6 Hispanics

The United States Census Bureau considers Hispanic to mean a person of Latin American descent (the Caribbean and Central and South America) living in the U.S. who may be of any race or ethnic group (white, black, Asian, etc.). Based on the 2000 census data [1], Hispanics constitute 15.5% of the U.S. population aged 19 to 28. However, this percentage is expected to increase to 17.6% and 19.4% by 2015 and 2020, respectively. Thus, their average annual increase is around 0.4 percentage point. Hence, Hispanics are the fastest growing ethnic group in the United States.

According to the U.S. Census Bureau, between 2000 and 2006, Hispanics accounted for one-half of the nation's growth and their growth rate was 24.3%, which is more than three-times the total U.S. population's growth rate, which was 6.1% [6]. Thus, the 15.5 percentage is expected to increase dramatically. Yet Hispanics are well underrepresented in science and engineering, in comparison with the other ethnic groups. Although their percentage representation is improving as illustrated in Figure 6, the increase is too small compared to the Hispanic population growth rate. Therefore, they are

getting more and more underrepresented in science and engineering. Yet Hispanics still remain a valuable resource to address the nation's shortage.

Hispanics representation in graduate school has doubled from 3.4% in 1989 but is still less than half of their representation in the society. Since 2000, it is increasing at an average annual rate of less than 0.2 percentage point. However, this is much less than their average annual increase in population aged 19 to 28, which is around 0.4. Thus, their underrepresentation in science and engineering is getting worse. Their associate degree percentage doubled from 1985 to 1995, but it is slowly fluctuating between 11.0 and 11.8 since 1997. Their bachelor degree representation has increased steadily since 1977; it doubled to 5.9 in 1995, and continued its slow increase at an average of 0.2 points a year. This is also the average annual increase for their master degree representation since 1989, which reached 6.2% in 2005. At the doctoral degree level, their representation has tripled since 1977, reaching 4.7 in 2005, however their average annual increase since 1995 is less than 0.2 points a year.

3 Issues and Solutions

It is clear from the previous analysis set forth in this paper that both Blacks and Hispanics represent one-third of the U.S. population aged 19 to 28 and climbing, yet with the exception of associate degrees (less than 25%); they are both only represented by less than 10% in science and engineering education. Moreover, the situation for Hispanics may seem improving at an average annual rate of 0.2 percentage point. However, in comparison with their population's average annual increase rate of 0.4 percentage point, their underrepresentation in science and engineering is only getting worse. Thus, more attention needs to be given to Hispanics and more aggressive approaches need to be implemented to not only mitigate this predicament, but to utilize them as a valuable resource for solving the nation's need.

There are various federal programs and initiatives designed to improve the situation [10], however as the presented data show, the progress is very small. Thus, due to their current demography and population growth, Hispanics and Blacks are a resource that can either bridge the gap for national need or deteriorate the situation further. They both remain an untapped in resource to improve the situation in the future. Accordingly, students at associate degree programs can be a good resource to improve the situation if they are motivated to continue their education and obtain higher degrees. The fact that Hispanics and Blacks are much better represented at the associate degree level, shows that they have some interest in science and engineering, yet other factors prevent them from continuing their education to obtain a higher degree. These obstacles include but are not limited to their previous education at K-12, financial constraints, language and cultural barriers, many are first in their families to seek a college degree, etc. Although it is tempting for a privileged person to claim that different segments of the population are good at different domains, the nation cannot afford to continue such attitude and ignore these growing minorities.

More scholarships and fellowships should be available to attract students to such fields. In addition, serious collaboration between U.S. national laboratories and universities should be established through internships, coops, and research collaboration that include both students and faculty. Various strategies need to be implemented to motivate students and faculty to benefit from such opportunities. Such strategies should include e-collaborative initiatives in the research and education presented to minority serving institutions [10] by research institutions and universities, national laboratories, educational entities, and federal agencies. Such institutions can provide weekly remote lectures to expose minority students to the thrill of science and engineering and facilitate their recruitment by the corresponding institution. The students need to be exposed to cutting edge research to feel excited about their field of study and who they can play a vital role in the future for the development of the society at large. These e-collaborative efforts could incorporate Internet2 (www.internet2.edu) and GENI project (www.geni.net) to increase the bandwidth and make such collaborative efforts more feasible, enjoyable and productive.

4 Conclusions

The United States is facing an aging workforce and is in danger of losing most of its expertise as such talented workforce is due to retire soon. It has also become increasingly difficult to attract students into the scientific and technical fields necessary for the United States to compete in a global arena. Although the situation has improved from the past for various ethnic groups, Hispanics and African Americans are untapped in resource to remedy the situation. Various strategies need to be implemented to attract and retain students in science and engineering. In addition, serious collaboration between U.S. national laboratories and universities should be established through internships, coops, and other research collaborations that include both students and faculty. By this manuscript, we hope that we have shed some light on the grim situation and rang an alarm bell so that policy makers take aggressive strategies to avoid catastrophic results.

References

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Years	U. S. Citizens & Perm Residents %	Whites %	Asians % Pacific Islanders	Blacks %	Hispanics %	American Indians Alaska Natives %	Other U. S. %	Temporary Visa %
1983	81.2	81.7	3.3	4.0	3.2	0.3	7.4	18.8
1985	80.2	80.0	4.0	3.8	3.1	0.3	8.8	19.8
1987	78.1	80.8	4.8	3.8	3.2	0.3	7.2	21.9
1989	76.5	81.1	5.1	4.2	3.4	0.3	5.8	23.5
1991	76.0	80.7	5.6	4.6	3.6	0.4	5.1	24.0
1993	78.1	78.5	6.8	5.2	4.1	0.4	5.1	21.9
1995	79.4	76.7	7.4	5.6	4.3	0.5	5.5	20.6
1997	78.7	74.8	7.9	6.1	4.7	0.5	5.9	21.3
1999	76.6	72.9	8.7	6.7	5.4	0.5	5.9	23.4
2000	74.0	71.5	8.3	7.1	5.8	0.6	6.7	26.0
2001	72.4	70.6	8.7	7.3	6.1	0.6	6.7	27.6
2002	71.7	69.7	9.0	7.4	6.3	0.6	7.0	28.3
2003	72.7	68.7	9.3	7.6	6.5	0.6	7.4	27.3
2004	73.8	68.1	9.0	7.7	6.6	0.6	8.0	26.2
2005	74.8	67.0	8.9	7.7	6.7	0.6	9.0	25.2

Table 1 Percentage of the science and engineering graduate student enrolment at U.S. universities based on citizenship and ethnicity from 1983 to 2005.

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Appendix

For the convenience of the reader, this appendix contains tables that present numerical values of percentage data that was depicted in the figures discussed in Section 2. Additional data is also presented in these tables. The data typically runs from 1977 to 2005, except when it was not available. The percentage data was obtained from numerical data provided in [4] and previous editions. Table 1 presents the data for graduate student enrolment in science and engineering disciplines at U.S. institutions. Tables 2 to 5, on the other hand, present data for associate, bachelor, master, and doctoral degrees awarded in science and engineering disciplines by U.S. institutions.

Years	U. S. Citizens & Perm Residents %	Whites %	Asians % Pacific Islanders	Blacks %	Hispanics %	American Indians Alaska Natives %	Other U. S. %	Temporary Visa %
1985	97.6	71.6	3.3	6.5	5.4	0.6	12.6	2.4
1987	98.2	74.3	4.8	8.1	7.5	0.9	4.3	1.8
1989	97.6	73.1	4.4	7.7	7.6	1.0	6.3	2.4
1991	98.1	73.7	4.5	8.7	7.8	1.4	4.0	1.9
1993	97.2	69.5	4.9	8.7	9.6	1.4	5.8	2.8
1995	97.1	69.7	5.9	9.8	10.6	1.8	2.2	2.9
1997	97.1	67.3	6.8	10.3	11.1	1.8	2.7	2.9
2000	97.6	63.9	7.3	11.7	11.8	1.6	3.7	2.4
2001	97.2	64.8	6.8	11.8	11.2	1.4	4.1	2.8
2002	96.7	64.2	7.0	11.9	11.1	1.4	4.4	3.3
2003	97.0	62.6	6.8	12.9	11.0	1.4	5.4	3.0
2004	96.8	61.9	6.6	12.2	11.2	1.5	6.5	3.2
2005	97.1	62.2	6.2	12.1	11.7	1.5	6.2	2.9

Table 2 Percentage of associate degrees in science and engineering awarded by U.S. universities based on citizenship and ethnicity from 1985 to 2005.

Years	U. S. Citizens & Perm Residents	Whites %	Asians % Pacific Islanders	Blacks %	Hispanics %	American Indians Alaska Natives %	Other U. S. %	Temporary Visa %
1977	97.5	88.9	1.9	5.9	2.9	0.4	0.1	2.5
1979	97.1	88.4	2.2	5.8	3.2	0.4	0.0	2.9
1981	96.2	87.5	2.8	5.8	3.5	0.4	0.0	3.8
1985	95.9	85.6	4.1	5.2	3.7	0.4	1.1	4.1
1987	96.0	82.6	5.1	5.2	3.8	0.4	2.9	4.0
1989	96.3	82.1	5.9	5.3	4.1	0.4	2.2	3.7
1991	96.4	80.9	6.0	5.8	4.5	0.4	2.5	3.6
1993	96.4	79.3	6.5	6.5	4.9	0.5	2.2	3.6
1995	96.1	75.9	7.9	7.4	5.9	0.5	2.4	3.9
1997	96.2	73.5	8.7	8.0	6.5	0.6	2.6	3.8
2000	96.2	70.5	9.3	8.6	7.3	0.7	3.6	3.8
2001	96.1	69.7	9.5	8.7	7.4	0.7	4.1	3.9
2002	96.1	69.2	9.4	8.7	7.5	0.7	4.5	3.9
2003	96.0	68.6	9.4	8.7	7.6	0.7	5.1	4.0
2004	95.9	67.8	9.4	8.8	7.6	0.7	5.6	4.1
2005	96.0	67.3	9.6	8.8	7.9	0.7	5.7	4.0

Table 3 Percentage of bachelor degrees in science and engineering awarded by U.S. universities based on citizenship and ethnicity from 1977 to 2005.

Years	U. S. Citizens & Perm Residents	Whites %	Asians % Pacific Islanders	Blacks %	Hispanics %	American Indians Alaska Natives %	Other U. S. %	Temporary Visa %
1977	87.8	90.1	3.1	4.1	2.4	0.3	0.0	12.2
1979	85.7	89.5	3.8	3.9	2.0	0.3	0.6	14.3
1981	83.6	88.2	4.4	3.6	2.5	0.3	1.0	16.4
1985	80.7	84.2	6.3	3.3	2.9	0.4	2.8	19.3
1987	80.5	80.7	6.4	3.3	2.9	0.3	6.3	19.5
1989	78.5	79.6	7.4	3.0	2.9	0.4	6.7	21.5
1991	76.6	79.8	7.7	3.7	3.1	0.4	5.3	23.4
1993	75.3	78.3	7.9	4.2	3.4	0.4	5.8	24.7
1995	76.4	75.8	8.3	5.8	4.1	0.4	5.6	23.6
1997	77.3	74.5	8.6	6.7	4.5	0.5	5.3	22.7
2000	74.1	70.3	9.9	7.7	5.3	0.5	6.3	25.9
2001	72.3	68.2	9.8	8.5	5.7	0.7	7.1	27.7
2002	72.2	67.6	9.5	8.6	5.7	0.6	8.0	27.8
2003	70.0	66.1	10.0	9.0	5.8	0.6	8.5	30.0
2004	70.2	65.4	10.3	9.0	6.1	0.6	8.6	29.8
2005	72.1	64.8	10.2	8.8	6.2	0.6	9.5	27.9

Table 4 Percentage of master degrees in science and engineering awarded by U.S. universities based on citizenship and ethnicity from 1977 to 2005.

Years	U. S. Citizens %	Whites %	Asians % Pacific Islanders	Blacks %	Hispanics %	American Indians Alaska Natives %	Other U. S. %	Perm Residents %	Temporary Visa %	Unknown Citizenship
1977	77.3	92.1	5.3	2.6	1.5	0.2	5.7	5.6	14.8	
1979	77.1	89.2	6.3	2.6	1.7	0.2	7.1	5.4	15.0	
1981	75.7	91.4	6.0	2.6	1.7	0.2	4.6	4.9	16.2	
1983	73.3	90.4	2.6	2.2	1.7	0.2	2.9	4.8	18.3	3.5
1985	69.6	90.0	2.8	2.3	1.9	0.3	2.7	4.9	21.2	4.3
1987	65.6	89.5	3.4	2.0	2.4	0.4	2.3	5.4	22.2	6.7
1989	62.6	89.6	3.5	2.3	2.3	0.4	1.9	5.1	24.4	7.9
1991	61.5	87.8	4.0	2.6	2.8	0.4	2.4	5.4	31.3	1.8
1993	59.4	88.4	4.6	2.7	2.9	0.3	1.1	6.4	31.3	2.9
1995	58.9	86.2	5.5	3.1	3.1	0.5	1.5	13.0	26.0	2.1
1997	59.6	82.6	6.1	3.4	3.5	0.5	3.8	8.2	27.2	5.1
1999	61.8	83.0	6.1	4.1	4.1	0.7	2.1	6.3	27.5	4.4
2000	61.1	82.4	6.2	4.2	4.1	0.5	2.5	5.4	28.9	4.7
2001	59.6	81.4	7.1	4.3	3.7	0.5	3.0	4.9	30.6	4.9
2002	59.0	80.4	7.3	4.6	4.4	0.4	2.9	4.7	30.6	5.8
2003	58.7	79.4	7.1	4.4	4.4	0.5	4.2	4.3	32.4	4.6
2004	56.9	78.9	7.4	5.0	4.3	0.4	4.1	3.8	34.0	5.2
2005	54.2	79.3	7.7	4.7	4.7	0.4	3.2	4.0	36.3	5.6

Table 5 Percentage of doctoral degrees in science and engineering awarded by U.S. universities based on citizenship and ethnicity from 1977 to 2005.