

Broadening Participation Data Trends on Minorities and People with Disabilities in Computing

Seeking a comprehensive view of minority student demographics to determine what programs and policies are needed to promote diversity.

INCREASING DIVERSITY IN computing is very important for multiple reasons. First, there is the issue of the work force. According to the U.S. Census, Blacks and Hispanics were approximately 12% and 16% of the U.S. residents in 2010, respectively. According to the 2008 Census Bureau projections, Hispanics, African-Americans, and Native Americans/Alaska Natives are projected to account for 47% of the U.S. population by 2050. Second, there is the issue of having diverse perspectives involved in the design of products thereby having more robust end products on the market. Lastly, there is the issue of inclusion—that the field be representative of society.

Given the importance of increasing diversity, it follows that trends about the demographics of students in the computing field are necessary to determine what programs and policies are needed to promote diversity. To this end, we present different sources for data on minorities and discuss the importance of having multiple sources to get a comprehensive view. In addition, we begin a discussion about what the data indicates with respect to minorities and the difficulties in the data collection process for people with disabilities. In particular, the focus is on Blacks/African Americans, Hispanics, Native Americans, and

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people with disabilities. The graphs shown in the accompanying figures were developed by the Center for Minorities and People with Disabilities in IT (CMD-IT).^a

For this column, the focus is on two major data sources:

- ▶ Computing Research Association (CRA) Taulbee reports (<http://www.cra.org/resources/taulbee/>) for computer science only. (Data source used for minorities at CRA-affiliated universities, which are primarily Ph.D.-granting institutions.)

- ▶ WebCASPAR (<https://webcaspar.nsf.gov/>), using IPEDS/NCES—the Integrated Postsecondary Education

Data System (IPEDS)—which is a survey conducted by the U.S. Department of Education’s National Center for Education Statistics (NCES), to obtain data for race and ethnicity. The WebCASPAR database provides easy access to a large body of statistical data resources for science and engineering at U.S. academic institutions. The focus, however, is on the field of computer science. (Data source used for minorities at over 1,000 institutions, including community colleges, for-profit institutions, undergraduate institutions, and Ph.D.-granting institutions.)

The different data sources have different sets of U.S. institutions for which data is obtained. Examining multiple data sources can help find gaps in some data sources and help validate data in other data sources. The union of the data sources helps give a picture of the demographics of the broad computing community. In particular, it is important to include non-Ph.D.-granting institutions, community colleges, for-profit institutions, as well as Ph.D.-granting institutions. For example, in fall 2006, there were approximately 11.2 million students enrolled in four-year institutions and approximately 6.5 million students enrolled in two-year institutions.^b It is important to consider all degree levels: associate’s, bachelor’s,

^a Center for Minorities and People with Disabilities in IT, CMD-IT (pronounced “command it”); <http://www.cmd-it.org>.

^b *Digest of Education Statistics 2008*, Table 194.

master's, and doctorates because they represent stages in the pipeline. Further, it is important to have the data broken down by gender and ethnicity to allow analysis of trends related to minority women. It is recognized that surveys regarding ethnicity and gender are usually based upon self-identification, for which people may select the option to not provide the information. The survey results, however, provide the best data available for understanding trends.

Associate's Degrees

The primary data source for the associate's degree is WebCASPAR. With respect to number of institutions, for 2009, WebCASPAR included 1,065 institutions for the associate degree. The CRA Taulbee data does not report on the number of associate degrees; data is given for bachelor's, master's, and doctorate degrees. Table 1 provides the number of degrees awarded to students from the different ethnic groups in addition to the total number of degrees awarded for the past five years. With respect to associate's degrees, the data indicates the number of degrees awarded is along the same order of magnitude as the bachelor's degree for minorities. This trend, however, does not occur when considering the total number of degrees at the different levels; the total number of bachelor's degrees far outnumbers the total number of associate's degrees. This high participation of minorities at the associate's degree level indicates the importance of encouraging students at the community colleges to complete the bachelor's degree. Hence, while significant recruiting for minorities occurs at the high school level, significant effort needs to be devoted to recruiting minorities at the associate's degree level.

Table 2 identifies the number of minority women for the associate's degree. The data indicates the number of minority women for all three ethnic group numbers increased from 2000 to 2005, but then decreased by 2009. This trend, however, is consistent with the trend for total number of associate's degrees.

Bachelor's Degree

The WebCASPAR and Taulbee data sources have vastly different numbers of institutions for the bachelor's degree. For example, for 2009, WebCAS-

Table 1. Number of associate's and bachelor's degrees awarded.

Year	Associate's Degree				Bachelor's Degree			
	Blacks	Hispanics	Native Amer.	Total No. Degrees	Blacks	Hispanics	Native Amer.	Total No. Degrees
2005	5,119	3,888	352	36,140	5,815	3,529	281	54,588
2006	4,617	3,261	325	31,170	5,275	3,351	274	48,000
2007	3,988	2,980	291	27,680	4,588	2,970	249	42,596
2008	4,171	2,897	298	28,327	4,011	2,923	221	38,922
2009	4,316	2,995	293	30,050	3,868	2,999	213	38,496

Source: WebCASPAR; <https://webcaspar.nsf.gov/>

Table 2. Number of minority women for the associate's degree.

Year	Black Women	Hispanic Women	Native Amer. Women	Total No. Degrees
2000	1,711	1,097	153	23,576
2005	2,239	1,159	156	36,140
2009	1,567	675	107	30,050

Source: WebCASPAR; <https://webcaspar.nsf.gov/>

Table 3. Number of minority women for the bachelor's degree.

Year	Black Women	Hispanic Women	Native Amer. Women	Total No. Degrees
2000	1,698	693	59	37,519
2005	2,383	930	86	54,588
2009	1,330	591	60	38,496

Source: WebCASPAR; <https://webcaspar.nsf.gov/>

PAR included at least 1,283 institutions for the bachelor's degree, 442 institutions for master's degree, and 97 institutions for the doctorate degree. In particular, the institution counts correspond to those that reported awarding at least one degree at the given level. By contrast, for the 2009–2010 academic year the CRA Taulbee data is based upon completed surveys from 150 CS programs. It is noted that CRA is focused on research, for which the

primary membership of CRA entails Ph.D.-granting institutions.

Figure 1 compares the data from WebCASPAR with that obtained from CRA Taulbee for the bachelor's degree. We consider the computer science bachelor's degree only because for the WebCASPAR classification variable of "Academic Discipline, Detailed (standardized)" computer science is given, but not computer engineering. The data indicates a significant difference in the trends reported by the two data sources regarding minorities. For WebCASPAR, the percentage for Blacks is in the 10%–11% range, in contrast to 3%–4% as indicated with Taulbee. In the case of Hispanics, there is some difference in the percentages, with WebCASPAR indicating percentages in the range of 5%–8% with Taulbee indicating percentages in the range of 3%–6%. For the case of American Indian/Alaska Native, the percentages are less than 1% for both data sources. Further, it is noted that the Taulbee data indicates a

It is recognized that surveys regarding ethnicity and gender are usually based on self-identification.

recent decline in the percentage of Hispanic bachelor's degrees in contrast to the WebCASPAR data, which indicates a recent increase in the percentage of Hispanic bachelor's degrees. Hence, the data indicates a large number of minorities at the bachelor's level are not at the Ph.D.-granting institutions.

With respect to the number of minority women at the bachelor's degree level indicated in Table 3, we see similar trends as that given with the associate's degree. The numbers increased from 2000–2005 and then decreased from 2005–2009. Similarly, the total number of degrees had a similar trend. It is noted that the number of minority women at the bachelor's level is very small in comparison to the total number of degrees. Hence, significant effort is needed to increase the number of minority women.

Master's Degrees

Figure 2 provides data on the percentages of the different ethnic groups awarded master's degrees for Taulbee and WebCASPAR. While the number of WebCASPAR institutions is much smaller for the master's degrees than the bachelor's degrees, there is still a significant difference between the percentages for the Black and Hispanic groups for WebCASPAR versus Taulbee. For Blacks, the WebCASPAR source indicates percentages in the range of 4%–5.5% in contrast to the Taulbee source, which indicates percentages in the range of 1%–2%. Both sources indicate a slight decline in the percentages when going from 2008–2009. For Hispanics, the WebCASPAR range is between 2%–3% in contrast to the Taulbee range, which is between 1%–2%. Both data sources provide similar trends. For the case of American Indian/Alaska Native, the percentages from both sources are consistently small, less than 1%. With respect to the percentage of minority women at the master's degree level, the percentage of women from the three groups remains approximately flat in the range of 2% for Black women, 0.8% for Hispanic women, and 0% for Native American women from 2000–2009.

Doctorate Degrees

In Figure 3, which focuses on the doctorate degrees, the numbers are very small from both data sources as the

Figure 1. WebCASPAR and Taulbee data for percentage of bachelor's degrees awarded to minorities.

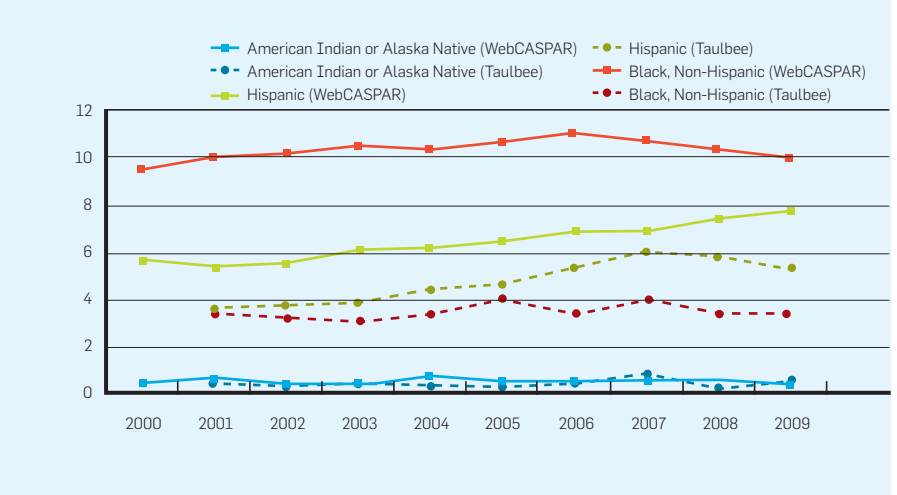


Figure 2. WebCASPAR and Taulbee data for percentage of master's degrees awarded to minorities.

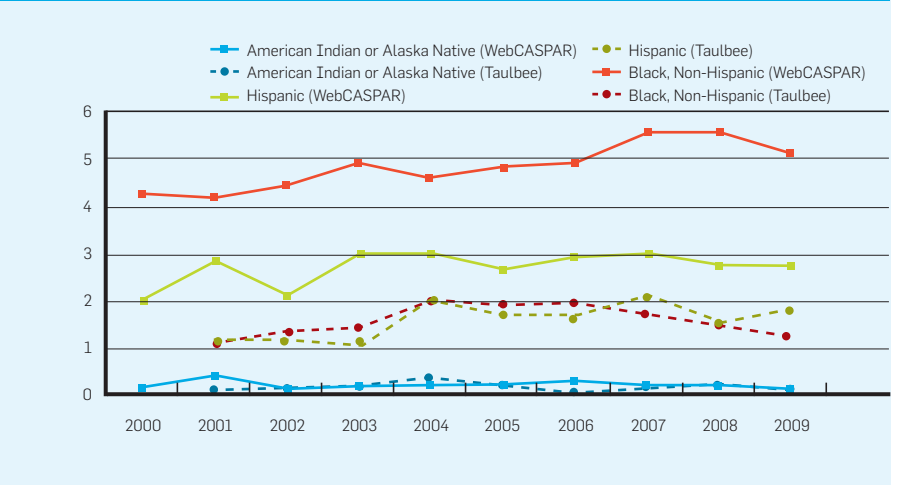
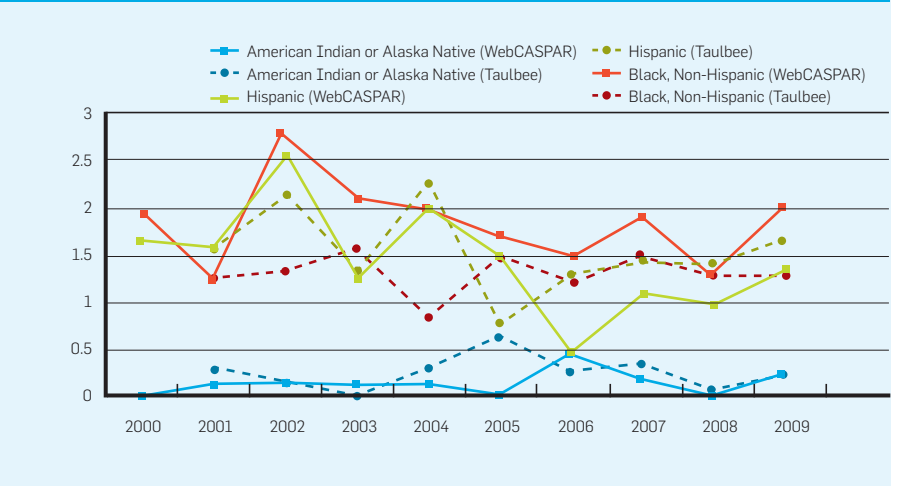


Figure 3. WebCASPAR and Taulbee data for percentage of doctorate degrees awarded to minorities.



maximum percentage is only 2.80% in 2002. Because the focus is on Ph.D.-granting institutions, the data from the two sources are fairly close. From

the NCES data source, the percentage of minority women at this level has remained flat in the range of 0.7% for Black women, 0.3% for Hispanic wom-

en, and 0% for Native American women from 2000–2009.

People with Disabilities

People with disabilities are an important group to consider because they are underrepresented in science and engineering fields, and there are a number of programs to increase their number in computing fields. The data collection process, however, is very difficult for a number of reasons. First, institutions differ in how they count students with disabilities. The counts can be based on services or accommodations provided, self-reporting to the disability support service office, verification of disabilities, or external/proxy report to the disability support service office. Further, institutions differ in how they maintain records of students with disabilities. Some institutions include data on students with disabilities in the general student record system from which degree data is reported to the Department of Education. Further, it is noted that one cannot consider the pipeline with people with disabilities, as a person can become or be recognized as disabled at any point in one's life. For example, a person with the degenerative syndrome retinitis pigmentosa is not born blind, but will become blind gradually over time. Moreover, a student may not be recognized with a learning disability until problems arise when the student attends college.

We are very fortunate that Joan Burrelli, retired Senior Science Resources Analyst from the NSF National Center for Science and Engineering Statistics was able to provide us with data for this column from the National Center for Education Statistics, 2008 National Postsecondary Student Aid Study (available through their Data Analysis System and the National Science Foundation) and the 2008 Survey of Earned Doctorates. These reports indicate that in terms of enrollment between the years 2004–2008, 12% of undergraduate IT majors and 8% of graduate IT students had a disability (where IT refers to computer science, information science and systems, and computer engineering).

By contrast, only 0.7% (63 Ph.D.'s) received a doctorate in computer science in the same period. The 12% at the undergraduate level is considered

What are the factors influencing the institution choice for minorities majoring in computer science?

close to the percentage of all students who have a disability attending college. The low percentage reported in the Survey of Earned Doctorates may have two contributing factors. First, data from the 2008 National Postsecondary Student Aid Study indicates students with disabilities are significantly less likely to persist to obtain a bachelor's degree than those without a disability, with about 40% persistence for those with a disability compared with 60% persistence for those without a disability. Second, the data in the Survey of Earned Doctorates is self-reported, and there may be some reluctance for a person with a disability who has achieved such a high level to report their disability.


Summary

The data presented in this column demonstrates the importance of using multiple sources with respect to obtaining the data about minorities and people with disabilities in computer science. To understand the broad trends about minorities in computer science, one must consider two-year institutions, for-profit institutions, non-research institutions, as well as Ph.D.-granting institutions. For example, the number of minority students receiving associate's degrees is in the same range as the number receiving bachelor's degrees in computer science.

It is good to find the trends for Blacks and Hispanics at the bachelor's and master's levels are not as bleak as portrayed in the Taulbee data. The percentage of Blacks earning bachelor's degrees at the 1,283 WebCASPER institutions is about 10%, which approaches the approximately 12% representation in the general population (2010 census). The percentage of Hispanics earning bachelor's degrees at the WebCASPER institutions is about 7.8% compared to

approximately 16% representation in the general population (2010 census). By contrast, the percentages reported in the most recent Taulbee survey are 3.4% (Blacks) and 5.3% (Hispanics). These large differences reflect the different sets of institutions represented in the two data sources. However, at the doctoral level, the two sources of data show more similar percentages for all groups, Blacks, Hispanics, and Native Americans. This reflects the similarity between 97 WebCASPAR institutions and the 150 Taulbee institutions.

Further, the data indicates minorities at the bachelor's level are not at the Ph.D.-granting institutions. The number of minorities receiving associate's degrees is approximately the same as the number receiving bachelor's degrees; this is not the case when comparing total number of degrees at the two degree levels. These trends raise a number of questions. First, what are the factors influencing the institution choice for minorities majoring in computer science? Second, how much recruiting for minorities at the bachelor's degree level is targeted to community colleges? Lastly, for the Ph.D.-granting institutions, how much recruiting for minorities for the Ph.D. is done at non-Ph.D.-granting institutions? These are all important questions, whose answers could lead to actions that improve the number of undergraduate and graduate minority students at Ph.D.-granting institutions.

Finally, our comparison of the Taulbee and WebCASPER data and the results from the recent TauRUs (Taulbee for the Rest of Us) survey¹ indicate a need for a more comprehensive annual report of the demographics of computing students than is currently being done. Decision makers at all levels need better data about minority and disabled students on which to base their decisions. 

Reference

1. Goldwasser, M. TauRUs: A Taulbee Survey for the Rest of Us. *ACM Inroads* 2, 2 (2011), 38–42.

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