

Student Enrollment in Postsecondary Information Technology and Engineering Programs

The Pipeline Study

**A report compiled by the
Applied Information Management Institute**



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Executive Summary

The Information Age is upon us. All phases of business and private life are rapidly being influenced by the emerging global networks and the transformation of the world's knowledge to numerical digits. This has led to a rapid growth in demand for knowledge workers to develop the required business, marketing, and communications systems. Unfortunately, the needed skilled workers are scarce.

Not only have traditional postsecondary academic programs failed to keep pace with the new requirements of an electronic global economy, the number of graduates have dropped. In the recent eight-year period from 1985-1986 to 1992-1993, the number of baccalaureate degrees in computer science granted by all U.S. public and private colleges and universities dropped from 41,889 to 24,200. When all degree levels are included (associate, bachelor, master, and Ph.D.) the number of degrees awarded dropped from 61,007 to 44,364.

Engineering and engineering related technologies degrees awarded also dropped during this same eight-year period. Baccalaureate degrees in engineering dropped to 77,877 or an 18.6% decline.

For Nebraska postsecondary institutions, the number of computer and information science degrees awarded at all levels is also down. This sluggish growth must be reversed to meet the business demand for both high quality and quantity of new entrants.

The compelling questions are: Why have enrollments lagged in the face of a rapid growth in demand? How do students make decisions about college courses and programs they will take? Who influences these decisions? What must be done to encourage more students to consider technology degrees?

To address the above questions, AIM used both primary and secondary research methodologies. Focus group meetings were held with high school students from Fort Calhoun, Creighton Prep, Omaha South, Omaha Central, Bellevue East, Omaha Northwest, and Sutherland schools.

The results suggest enrollments lagged for a variety of reasons. In the late 1950s the Russians beat the USA in the race to launch the first satellite. President Kennedy announced a national goal to successfully place a man on the moon and return him safely during the decade of the 60s. These national goals lead to an energized focus on science and math that affected a generation. Other priorities now seem to prevail with the new generation of students.

In recent years there has been a general trend across the nation to raise graduation requirements. While these trends are encouraging, the professional and technical positions of the future rely heavily upon students that are competent (or can become competent) in math and sciences. The relatively small percent of the graduating class with good math and science skills are in high demand to fill science- and business-based academic programs in college. The gradual growth in the number of students and test scores may significantly lag behind in demand for the foreseeable future.

In 1993 there were over 900,000 high school teachers in U.S. public schools. Only 9,134 or 1% were computer science teachers.

In 1993-1994, 55.4% of all degrees awarded by the nation's public and private universities were to women. For computer science, women accounted for 49.9%, 28.4%, 25.8% and 15.4% of the graduates at the associate, bachelors, masters, and Ph.D. levels respectively. For engineering, only 16.4% of the baccalaureate graduates were women with even lower percentages at the masters and Ph.D. levels.

Television seems to be an important influence on students as they consider occupations. Not all occupations are equally represented in TV drama. "Over represented" TV occupations include doctors, judges, entertainers, police, and private investigators. They are frequently presented as important, with status, respect, and success. The characters are rarely seen actually "working," creating a media image of occupations that are highly favorable compared to teachers, clerical, secretarial, sales blue collar, and other under represented occupations.

These TV occupations account for only 8.3% of the civilian work force. Half of the Nebraska students participating in the AIM focus groups were planning careers in these "over represented" TV occupations.

Focus group and survey data also suggested a substantial lack of knowledge by parents, teachers, and counselors about career choices. The nature of work for most jobs is now hidden from casual observation. In earlier times it was easy to view and understand the work of a shopkeeper, farmer, assembly line worker, and various crafts, trades, and professions. Today it is not easy to visualize and understand the day to day work of computer programmers, web masters, investment bankers, technical writers, research chemists, fire wall administrators, systems analysts, etc. Communication between students and adults informed about specific careers appear to be key to decision making.

Students' decisions seem to be most influenced by favorable experiences. Both the business community and postsecondary academic institutions should aggressively seek to create favorable applied experiences for high school students. Opportunities may include internships, mentor programs, field trips, classes at corporate sites, special events, etc.

Colleges and Universities must become more creative in attracting prospective students to their programs. Internet provides an outstanding opportunity for communicating to students and faculty alike.

Partnership between firms and area junior or senior high schools could help teachers and students better understand business needs while the firms' employees more effectively empathize with and support academic institutions.

Finally, the ability to retain classroom IT teachers is a chronic problem. As their professional competency grows, many are recruited to higher paying corporate positions. Incentives need to be developed to assist school districts in attracting and retaining these very scarce teachers.

Background

The Information Age is upon us. All phases of business and private life are rapidly being influenced by the emerging global networks and the transformation of the world's knowledge to numerical digits.

These trends are creating exploding requirements for business and commerce to modify historical business practices. New services and new ways to reach customers are being announced daily. No business, social, educational, or governmental institution is untouched. The rate of change will accelerate for the foreseeable future. There is no longer a debate about the direction. All institutions are clamoring for ways to embrace emerging technologies to achieve their unique missions. These changes have led to a rapid growth in demand for knowledge workers to develop the required business, marketing and communications systems.

A. Supply of Graduates

Unfortunately, the supply of skilled workers that will build and use the emerging technology is scarce. The nation's academic institutions have been slow to develop the courses, curriculums, and degree programs required by the emerging era. Many existing academic programs focus on a single dimension of the emerging technological environment, such as electrical engineering, computers, communication technologies, audio/video production, graphic arts, etc. These and other disciplines, however, are rapidly converging leading to new requirements for systems integrators, website developers, firewall administrators, project managers, electronic payment specialists, systems administrators, etc.

Not only have traditional postsecondary academic programs failed to keep pace with the new requirements of an electronic global economy, the number of graduates has dropped (Appendix A). These are amazing statistics. In a recent eight-year period from the 1985-1986 to 1992-1993, the number of baccalaureate degrees in computer science granted by all U.S. public and private colleges and universities dropped 42% from 41,889 to 24,200¹. When all degree levels are included (associate, bachelor, master, and Ph.D.) the number of degrees dropped 27.3% from 61,007 to 44,364.

Within business curriculums, there are several computer/communications degree options. Long-term historical data are not available for these programs. However, between the academic years 1991-1992 to 1993-1994, business-based computer degrees (associate, bachelors, masters, and Ph.D.) increased from 12,854 to 14,875 or a 16% growth offsetting some of the decline in computer science programs (Appendix B).

¹ U.S. Department of Education, Office of Educational Research and Development

Like computer science, engineering and engineering-related technologies degrees awarded also dropped during this same eight-year period. Baccalaureate degrees in engineering dropped to 77,877 or an 18.6 % decline.

An interesting side note, the proportion of baccalaureate graduates that were women dropped proportionately faster for IT but increased slightly for engineering:

Percent Women Graduating		
	Academic Year	
	1985-1986	1992-1993
Computer and Information Science	35.8%	28.1%
Engineering	13.1%	15.7%
All other degrees	NA	55.4%

For Nebraska postsecondary institutions, the number of computer and information science degrees awarded at all levels (associate, baccalaureate, and graduate) totaled 320 in the 1989-1990 academic year. By academic year 1994-1995 degrees awarded grew to 441. This data, however, shows another significant trend. Table 1 documents that programs under two years grew very rapidly while baccalaureate degrees declined. As a result, the average years of college for all computer science students in 1989-1990 was 3.14 compared to 2.77 years for the 1994-1995 period.

Table 1 Number of Computer & Information Science Degrees Awarded by Nebraska Public and Independent Colleges and Universities²		
	Academic Year	
	1989-1990	1994-1995
Programs under two years	56	161
Associates	86	93
Bachelors	152	127
Masters	21	57
Doctoral	5	3
Total	320	441
<i>Average years of college</i>	<i>3.14</i>	<i>2.77</i>

While these data show growth in certificate programs, stronger growth at the bachelors level must also occur to meet the business demand for both high quality and quantity of new entrants. Appendix C provides greater detail on Nebraska graduates between academic years 1989-1990 to 1992-1993.

² Source: Coordinating Commission for Postsecondary Education, Lincoln, Nebraska

There are other measures of academic pursuit such as the number of students enrolling in specific classes. These data are available at the college or university level. Enrollments in some computer- and communications-based enrollments have been growing at some metropolitan colleges in the mid 1990s. Continuation of this trend could lead to increased graduations in the future.

The state data for Iowa is similar to Nebraska. Between academic years 1989-1990 to 1992-1993, the total number of information science degrees awarded dropped from 571 to 449, a 21.4% decline. Iowa data for 1994-1995 are not available. Table 2, however, shows that virtually all the decline was in associate degrees awarded.

Table 2
Number of Computer & Information Science Degrees Awarded by Iowa Public and Private Colleges and Universities³

	Academic Year	
	1989-1990	1992-1993
Associates	184	54
Bachelors	324	326
Masters	57	56
Doctoral	3	13
Total	571	449

Engineering Degree completion in Nebraska between the Academic 1989-1990 and 1994-1995 years increased. The following table shows engineering degrees awarded were 14.4% higher than at the start of the decade.

Table 3
Number of Engineering Degrees Awarded by Nebraska Public and Private Colleges and Universities⁴

	Academic Year	
	1989-1990	1992-1993
Associates	1	7
Bachelors	213	224
Masters	62	90
Doctoral	17	14
Total	293	335

³ Integrated Post Secondary Education Data System, 1993 C.D. National Center for Educational Statistics, U.S. Department of Education

⁴ Source: Coordinating Commission for Postsecondary Education, Lincoln, Nebraska

Engineering graduates in Iowa declined slightly from 1,270 in academic year 1989-1990 to 1,240 in 1993-1994. During this period, the bachelors degrees dropped by 26 to 915, masters were down by 18 to 231, while Doctoral degrees increased by 14 to 94 graduates.

B. Demand for Graduates

On the demand side, however, corporate requirements for professional knowledge workers continue to expand. Very favorable and increasing salaries accompany that growth in demand.

As the economy moves into the information age, the value of a college education is growing. The following quote from the editorial page of the August 9, 1996, edition of the *Wall Street Journal* quantifies the demand.

Most Americans are still discovering returns to education are at a historic high in the global economy. Precisely how high within the U.S. alone becomes clear in some of the new economic literature. The University of Chicago's Kevin Murphy looked at how much more a year of formal schooling is worth these days than it used to be. He notes that back in the late 1970s when "The Over Educated American" came out, college grads earned some 40% more than high school grads, a rate down from the 50% of the early 1970's. But that trend changed. By 1994 the gap was close to 80% ... He notes that we're at an amazing moment. "In 15 years," he writes, "the premium for a college education had doubled and was at its highest level in more than 50 years."

According to *Careers and Education in Nebraska*⁵ the demand for software engineers is growing much faster than average both nationally and in Nebraska. Computer programmer jobs are growing very rapidly in Nebraska.

It is quite likely that the salary advantages for those in information technologies (IT) and engineering will accelerate even more rapidly. These architects of the emerging networks and applications are in short supply both in Nebraska and globally.

AIM estimates that Greater Omaha businesses need 1,500 to 2,000 new IT professionals each year just to meet the demand for normal growth of existing firms. A major new employer of IT professionals would increase that demand further. Statewide, the number of graduates at all levels is only a fraction of the job openings in Nebraska.

For engineers, the short fall is nearly as bad. AIM estimates the Greater Omaha demand is for 260 to 300 new engineers annually with an available supply of approximately 100 graduates annually.⁶ (In 1993 UNL graduated 287 engineers with bachelors and 132 with masters and

⁵ *Careers and Education in Nebraska*, Nebraska OICC, 1996, 5500 S. 16 Street, Lincoln, Nebraska, p. 9

⁶ AIM Institute, "Greater Omaha Business Requirements for Educational Services in Engineering," p. 24

Ph.D.s. An estimated 50% of the graduates leave the state and 50% of those that remain work in the Greater Omaha area.)

The questions from this analysis must be: Why have enrollments lagged in the face of a rapid growth in demand? How do students make decisions about college courses and programs they will take? Who influences these decisions? What must be done to encourage more students to consider technology degrees?

c. Study Methodology

To address the above questions, AIM used both secondary and primary research methodologies including Internet searches, research of printed materials, AIM questionnaires, and focus groups of Nebraska students and teachers.

The student questionnaire (Appendix D) was administered both via Internet and hand delivered – 230 responses were received. The teacher questionnaire (Appendix E) was distributed via Internet with 113 responses.

Focus group meetings were held with high school students from Fort Calhoun, Creighton Prep, Omaha South, Omaha Central, Bellevue East, Omaha Northwest, and Sutherland schools. Appendix F shows the questions used in these focus groups.

Why Enrollments Have Lagged

A. National Attitudes Toward Math And Science.

In the late 1950s the Russians beat the USA in the race to launch the first satellite. That event sounded a national “wake up call” that led to national priorities in science and technology. President Kennedy announced a national goal to successfully place a man on the moon and return him safely during the decade of the ‘60s.

These national goals led to an energized focus on science and math that affected a generation. Since then, however, national priorities have changed. Nationally, bachelors degrees conferred in computer science peaked in the academic year of 1985-1986 at 41,889. Bachelors degrees in engineering peaked a year earlier at 95,828. By 1992-1993 computer and information services were 24,200 and engineering was 77,877. Today’s generation seems less focused on math- and science-based programs.

B. High School Math and Science Enrollments

In recent years there has been a general trend across the nation to raise graduation requirements. There has also been a renewed emphasis on math and science curriculum. The following data documents recent U.S./Nebraska and Iowa enrollments.

Table 4
Percent of Students Taking Selected
Mathematics Courses by Graduation⁷
1991-1992

	U.S.	Nebraska	Iowa
Algebra 1 or Integrated Mathematics 1	91	95	95
Geometry or Integrated Mathematics 2	61	67	76
Algebra 2 or Integrated Mathematics 3	55	58	67
Trigonometry/Pre-calculus	29	22	32
Calculus	11	14	12

⁷ “State Indicators of Science and Mathematics Education,” Council of Chief State School Offices, Washington, DC, p. 19

Table 5
Percent of Students Taking Selected
Science Courses by Graduation⁸
1991-1992

	U.S.	Nebraska	Iowa
Biology, 1st year	Over 95	Over 95	Over 95
Chemistry, 1st year	49	50	64
Physics, 1st year	21	24	30

A report from the Council of Chief State School Officers suggests there is some success in raising both the number of students taking math and science courses as well as modest improvements in grades since 1990. Test scores also have increased. “The 1992 grade 12 average was 299 (on a scale of 0 to 500) as compared to 294 in 1990.”⁹

Table 6
Trends in Course Taking in Science and Mathematics¹⁰
1982-1990

	% Students Enrolled 1982	% Students Enrolled 1990
Algebra 1	65	80
Algebra 2	35	56
Calculus	5	9
Biology, 1st Year	75	90
Chemistry	31	51
Physics	14	22

These data are encouraging. However, many of the professional and technical positions of the future rely heavily upon students that are competent (or can become competent) in math and science. The above data show a relatively small percent of the graduating class with the good math and science skills that are in high demand to fill postsecondary academic programs. The gradual growth in both the number of students and test scores may significantly lag behind in demand for the foreseeable future.

C. Computer Science Teachers

There are over 900,000 9-12 grade teachers in U.S. public schools. The following shows the number of public school math and science teachers by discipline for the nation. The data suggest

⁸ Ibid. p. 23

⁹ “State Indicators of Mathematics Education,” p. 9

¹⁰ Blank, Ralf K. & Engler, Pamela, “Has Science & Mathematics Education Improved Since A Nation at Risk?” Council of chief State School Officers, One Massachusetts Avenue, NW, Washington, DC

that the percent of faculty teaching computer science is low. Junior high and high school faculty influence student career choices. This low number of computer science teachers may help explain low college enrollments in information technologies.

For high schools, only 3.6% of all math and science teachers taught computer science. For junior high, only 3.1% were computer science teachers. In both cases, teaching computer science was not their main assignment.

Table 7
Number of 9-12 Grade Math & Science Teachers
with Percent Main Assignment¹¹

	US	% Main Assignment
Math	116,849	79%
Biology	46,864	68%
Chemistry	21,277	59%
Physics	13,610	34%
Earth Sciences	12,273	54%
General Science	14,469	57%
Physical Science	18,670	46%
Integrated Science	793	41%
Computer Science	9,134	37%
Total	253,939	

Table 8
Number of 7-8 Grade Math & Science Teachers with Percent Main Assignment¹²

	US	% Main Assignment
Math	52,516	64%
Science	46,528	69%
Computer Science	3,435	47%
General (math/science)	9,729	86%
Total	112,208	

D. Gender Differences and Trends

In 1993-1994, 55.4% of all degrees awarded by the nation's public and private universities were to women. In all degree levels except Ph.D., women graduates outnumber men. 1979 was

¹¹ Ibid. pp. 84-88

¹² Ibid. p. 89

the first year that women enrolled in college exceeded men. Women have exceeded male enrollments every year since that date.

Table 9
Degrees Conferred by U.S. Public and Private Colleges and Universities¹³ - 1993-1994

	Degrees Conferred	Percent Women
Associates	542,449	59.3%
Bachelors	1,169,275	54.5%
Masters	387,070	54.5%
Doctoral	43,185	38.5%

For engineering, computer science, and other disciplines, however, the ratios are much different. Table 10 documents that enrollment of women in numerous business and technical degree programs are well below the national norms for all degrees. Increased enrollment by women in technology-based occupations would be favorable for business.

Table 10
Selected Degrees Conferred by U.S. Public and Private Colleges and Universities¹⁴ - 1993-1994

	Associate		Bachelors		Masters		Doctoral	
	Degrees Conferred	Percent Women	Degrees Conferred	Percent Women	Degrees Conferred	Percent Women	Degrees Conferred	Percent Women
Business Management	108,310	68.5%	246,654	47.6%	93,437	36.5%	1,364	28.2%
Architecture & Related Programs	353	67.4%	8,875	35.8%	3,943	38.4%	161	31.1%
Engineering	2,799	12.6%	62,220	16.4%	28,621	15.4%	5,963	11.1%
Mathematics	765	43.0%	13,396	46.3%	4,100	38.2%	1,157	21.9%
Precision Production Trades	9,661	19.5%	420	26.7%	2	10.0%	0	N/A
Engineering-related Fields	36,877	11.1%	16,005	9.0%	1,133	17.4%	16	0.0%
Computer & Information Systems	9,465	49.9%	24,200	28.4%	10,416	25.8%	810	15.4%
Communications Technologies	2,789	35.2%	663	49.3%	515	44.9%	8	75.0%

¹³ The Chronicle of Higher Education almanac, Vol. XLIII, No. 1, September 1996, 1255 23rd Street, Washington, DC, p. 22

¹⁴ Ibid. p. 22

E. Student Migration

A possible reason for slow growth of technology programs could be Nebraska students leaving the state to attend college elsewhere. Data for the fall 1994 enrollments suggest that this may not be the case.

According to data from the National Center for Education Statistics, Nebraska residents who graduated from high school in the last 12 months and enrolled in an institution of higher education totaled 11,463. Of these, 2,229 Nebraska students left the state to attend college while 2,298 out of state students chose to enroll in Nebraska institutions. The result was a net gain of 69 first year college students.

Only two other states were in closer balance – Washington State lost 39 students while Oklahoma gained 34 students. Net migration rates for adjoining states were:¹⁵

State	Net Migration	% Enrollment from In-migration	% Enrolled Residents Leaving State
Iowa	+3,085	26.16%	15.30%
Kansas	+1,481	20.77%	13.17%
South Dakota	+444	35.92%	29.36%
Wyoming	+113	28.97%	26.44%
Colorado	+975	30.62%	26.74%
Nebraska	+69	19.93%	19.45%

These data do not, however, document which programs are pursued by incoming or out-migrating students.

¹⁵ Residence & Migration of First-time Freshmen Enrolled in Higher Education Institutions, Fall 1994, National Center for Education Statistics, E.D. Tabs March 1996, U.S. Department of Education

How Students Select Careers

A. Television

It is widely believed that television programming affects attitudes and values in many parts of society. If this is true, perhaps television may affect student decisions concerning employment and careers.

High school students do watch television. In the 1985 study “Monitoring the Future Survey” conducted by the Institute for Social Research at the University of Michigan, over 3,000 high school seniors were surveyed from approximately 125 public and private high schools. One question was “How much TV do you estimate you watch on an average weekday?” The results were:

None	4.0%
1/2 hour or less	13.3%
About 1 hour	19.4%
2 hours	21.3%
3 hours	17.5%
4 hours	11.6%
5 hours or more	11.9%

Occupational roles are central to most, if not all, television plots. Not all occupations are equally represented when compared to U.S. labor force demographics. In a study completed by Nancy Signorielli, from the University of Delaware, “Among the most over represented occupations on television are doctors, judges, entertainers, police, and private investigators. The groups who are most under represented include teachers, clerical and secretarial workers, sales workers and other blue collar workers (laborers, craft workers.)” The following table from the Signorielli study documents this over and under representation. The index value is the percentage over and under representation with a score of 100 signifying equal TV representation compared to U.S. Census figures.

Table 11
Occupational Distribution for Men and Women in the U.S.
and in Prime Time Network Television Drama¹⁶

All People	% U.S. Civilian Employment	% TV Presented Occupations	Index
Professionals	11.8	19.7	167
Doctors	0.4	3.4	810
Nurses	1.2	1.5	121
Judges	<0.1	0.5	1,667
Lawyers	0.5	1.5	312
Teachers	4.2	1.1	26
Scientists	0.8	0.5	60
Entertainers	0.2	0.5	60
Artists/Writers/Athletes	1.1	3.5	312
Other	3.3	5.2	158
Public Officials	0.3	1.1	333
Managers*	10.0	7.9	79
Secretaries/Clerks	15.1	3.3	22
Sales	9.9	1.1	11
Blue Collar Workers	42.3	7.5	18
Restaurant Workers	4.6	3.1	67
Police/Private Investigators	0.6	12.5	2,102
Guards	0.7	1.0	152

Note: The index is the ratio of the percentage of television representation to the actual U.S. population percentage, multiplied by 100.

**Includes the self-employed*

Not only were certain positions over represented, they were presented as important, afforded status, respect and are particularly successful at what they do. They were categorized as successful as follows:

% Portrayed as Successful

Police or Private Investigators	61.3
Doctors	47.7
Lawyers	43.1
Other Blue Collar Workers	45.5
Business-related Activities	33.1

¹⁶ Source: U.S. Census, Table 277, Detailed Occupation of the Experienced Civilian Labor Force by Sex; and 1985 Statistical Abstracts of the United States, Table 673

Finally, most TV characters, except law enforcement and medical occupations, are rarely seen actually “working.” This creates a media image of occupations with status, respect, and success but little work.

Data from focus groups conducted by AIM were not as comprehensive as the Signorielli study. However, of the 34 students that reported the data, TV watching is still a significant event in most high school students’ lives. Hours of TV watching per day were:

None	1
1/2 hour or less	3
About 1 hour	14
2 hours	10
3 hours	6
4 hours	0
5 hours or more	0

Focus group responses did not suggest that TV was either a positive or negative criteria in selecting possible career choices. The AIM study simply asked what is your career choice. Of the students responding the following summarizes their stated career choices.

49 Nebraska High School Focus Group Participants			
Professionals		Other	
Doctors	3	Public Officials	0
Nurses/Therapists	0	Managers*	6
Psychologist	6	Secretaries/Clerks	0
Judges	2	Sales	0
Lawyers	1	Blue Collar Workers	2
Teachers	3	Restaurant Workers	1
Scientists/Architects	0	Police/Private Investigators	1
Entertainers	1	Guards	3
Artists/Writers/Athletes	0	Military	3

According to the Signorielli study, the over represented occupations on TV account for only 8.3% of the U.S. civilian workforce.

The data from the Nebraska students participating in the AIM study showed 50% planning to seek careers in these over represented TV occupations. The AIM sample is probably too small to assign these attributes to all Nebraska high school students, but the comparison to the national results is striking. (Twelve students were undecided about career choices and two designated military service).

B. Focus Groups

While TV and other general societal forces may be a general influence in the way an individual student makes choices, personal relationships, skills, and experiences are also very important.

Focus groups at seven urban and rural Nebraska schools were conducted in the fall of 1996. There were 75 participants or an average of 11 students per focus group. Participants were selected by school administrators and included 46 males and 29 females. Appendix E shows questions that were asked by AIM moderators. In addition, students were asked to complete a survey.

1. When asked, “What influenced your career decision?” the responses could be grouped into several major categories:

Percent of Total Responses	
Parents	9.5 ¹⁷
Teacher	3.5
Other Adult	13.0
Interest/Experiences	10.0
Other/Income	2.0
Not Defined	7.0

Parental influence seemed to fit into two major categories, (1) a source of information and someone to talk to, and (2) the parent’s occupation was viewed as acceptable or unacceptable. The unacceptable view was based upon the income levels, physical requirements, and the general desirability of the work being done (“I want more than that”).

Other adults were noted most frequently. These contacts tended to be positive. These other adults usually included older siblings, relatives, and parents of friends.

Interest/experiences were also of key importance. Once again, these were almost always positive factors. Experiences at internships, summer jobs, and other situations were important in helping the student make initial career decisions.

Teachers had a surprising low impact on student career considerations. The influence was positive but general (my favorite teacher) and did not demonstrate the job specific influence that student reported from other adults.

¹⁷ One student mentioned both parents and teachers.

2. When asked, “How did you get information about careers?” the predominant category was adults other than parents.

Number of Responses	
Parents	3
Adults Other than Parents	17
Career Labs and Libraries	7
Career Fairs	5

This data reinforces the previous questions. Less than 15% of the students mentioned career counselors at school. This result, plus low teacher influence mentioned above, may suggest that the array of job specific information required to be knowledgeable for increasingly complex careers may be greater than any one teacher or counselor can master.

The nature of work for most jobs is now hidden from casual observation. In earlier times it was easy to view and understand the work of a shopkeeper, farmer, assembly line worker, and various crafts, trades, and professions. Today it is not easy to visualize and understand the day to day work of computer programmers, web masters, investment bankers, technical writers, research chemists, firewall administrators, systems analysts, etc. Communication between students and adults informed about specific careers appear to be key to decision making.

3. When asked, “What classes are you taking to prepare for your career choice?” 21 of 28 students noted specific classes or courses. Many were core courses like science and math. Others noted specific classes like computer programming. Generally, once a student made a decision on the direction of his/her career, the data suggests a willingness to prepare academically. In several cases, the career interest was also affecting non-classroom activities such as internships, various forms of computer usage, and part-time jobs.

C. Student Questionnaires

AIM and the Educational Service Unit #3 developed Internet-based student (Appendix D) and teacher (Appendix E) questionnaires. A total of 230 student and 113 teacher responses were received. The responses were from schools across Nebraska with most student responses from Class A schools. Teacher responses were more evenly distributed across school sizes.

Internet Questionnaire Responses		
School Size	Of 230 Students	Of 113 Teachers
Class A	92.2	58.4
Class B	3.9	5.3
Class C	1.3	10.6
Class D	1.7	12.4
Not reported	0.0	13.3

Below are the summary results from student responses to the Internet questionnaires.

Do you feel your high school program prepared you for a job or college courses in IT or engineering?

Yes	67.0%
No	33.3%

Students seem to feel the schools are doing a good job in preparing them for IT and engineering careers.

How could your school inform you of the opportunities available upon graduation?

School counselors	39.1%
Summer Internships	24.8%
Special Seminars	39.1%
Field Trips/Outside Speakers	63.5%
Internet Sites about the Topic	34.8%

These results strongly support the focus group findings that outside knowledgeable experts are viewed as a key way to get career information.

Do you have career plans in the area of information technology and engineering?

Yes	47.4%
No	52.6%

This data will have a clear bias toward IT and engineering. The questionnaire was distributed over the Internet. A student that would find and complete it would be computer literate.

In addition, we asked members of the focus groups and 92 participants in the summer of 1996 AIM Internet Cyber Camp to complete this questionnaire. Once again, these students were probably more focused on IT and engineering than the average Nebraska high school student.

What are those plans?

Get a job	5.2%
Go to a trade school	13.5%
Go to a community college	4.8%
Go to a four-year college	37.4%
Not responding	39.1%

The need for postsecondary education for careers in IT and engineering are well understood by high school students.

Are you aware of the jobs available and their pay levels?

Yes	43.0%
No	57.0%

Would starting salaries between \$25,000 and \$40,000 interest you?

Yes	69.6%
No	30.4%

Students were generally not aware of salary opportunities. They appear to be responsive to favorable salary levels.

Would you be willing to listen to a presentation about job availability?

Yes	81.7%
No	11.7%
No Response	7.6%

Finally, they indicated a strong willingness to learn more about these fields. The data was also summarized by gender. The findings did not differ between male and female students.

In a 1995 national study, 240,022 college freshmen documented reasons noted as very important in deciding to go to college (Appendix F).¹⁸ Economic reasons and academic interest ranked highest. These important reasons were:

To be able to get a better job	77.3%
To learn more about things that interest me	74.0%
To be able to make more money	72.3%
To gain a general education and appreciation of ideas	62.5%

That same study (Appendix H), also showed reasons noted as very important in selecting a college to attend. The most important reasons were:

College had a very good academic reputation	49.2%
Graduate got good jobs	43.1%
Size of college	33.8%
Offered financial assistance	31.6%

¹⁸ Chronicle of Higher Education Almanac, Vol. XLIII No. 1, September 1993, 1255 23rd Street, Washington, DC, p. 19

The least important reasons were:

Advice of private college counselor	2.3%
Not accepted anywhere else	2.5%
Recruited by college	4.3%
Teacher’s advice	4.4%

These data may provide some clues about strategies for postsecondary institutions to market their specific IT and engineering programs.

D. Teacher Questionnaires

The teacher questionnaire was designed to measure, in part, their understanding of IT and engineering careers as options for their students. In addition, it sought to document when and how information should be presented to have the most impact. The following summarizes the results from 113 teacher respondents across the state.

At what grade level do you think students should be introduced to career opportunities in the area of Information Technology and Engineering?

Kindergarten	19.5%	Seventh	10.6%
First	4.4%	Eighth	7.1%
Second	1.8%	Ninth	9.7%
Third	8.8%	Tenth	8.0%
Fourth	5.3%	Eleventh	0.9%
Fifth	7.1%	Twelfth	1.8%
Sixth	7.1%	No response	8.0%

Respondents were asked to give one grade only. The above results suggest the earlier the better with kindergarten getting the most “votes” followed by the seventh grade. The median group was the fifth grade. These results support other secondary information that suggests many students have a general career focus or direction by the junior high years.

What courses do you believe would best prepare students for careers as Information Technologists or Engineers?

Math	89.4%
English	63.7%
Written Communications	70.1%
Extracurricular Activities	42.5%
Science	86.7%
Social Studies	50.4%
Computer/Internet Applications	93.8%
Other	11.5%

Math, science, written communications and computer/Internet applications were the courses viewed as most important by the teachers. Computer/Internet applications are probably not a prerequisite for most postsecondary institutions; however, courses in these areas will help the high school student further define and refine their interests. Demonstrated competencies in written communications are a highly desired attribute of most employers.

What starting salary range could new college graduates in Information Technology and Engineering expect?

Two Year Degree	
Less than \$15,000	4.4%
\$15,001-\$20,000	20.4%
\$20,001-\$25,000	42.5%
\$25,001-\$30,000	13.3%
\$30,001-\$35,000	5.3%
More than \$35,000	4.4%
No response	6.2%
Four Year Degree	
\$20,001-\$25,000	9.7%
\$25,001-\$30,000	24.8%
\$30,001-\$35,000	23.0%
\$35,001-\$40,000	14.2%
\$40,001-\$45,000	8.0%
More than \$45,000	10.6%
No response	6.2%

Teachers were asked to check the most appropriate range for two-year certificate programs and four-year baccalaureate degrees. The data suggest that the teachers were most likely to underestimate salaries for both two-year certificates and students with bachelors degrees. Many two-year graduates start at near \$30,000 from IT programs and baccalaureate degree IT and engineering students start near or above \$40,000.

To more effectively counsel students, do you need information about:

IT career opportunities	73.4%
Job descriptions	63.7%
Salaries	41.6%
Job location	6.2%
Trade schools, colleges & university programs	49.6%
Firms using IT	60.2%
Other	35.4%
No response	35.4%

Teachers also expressed a need for more information to effectively counsel students. Information about career opportunities, job descriptions, and firms using IT showed the highest needs. These findings confirm earlier statements that it is not easy to visualize and understand the day to day work of computer programmers, analysts, webmasters, etc.

How could your school inform you of the opportunities in Information Technology and Engineering available to students upon graduation?

Printed materials	76.1%
Internet website	64.6%
In-school visits	49.6%
Field trips	59.3%
Summer internships	56.6%
Other	7.1%

As an industry, the IT professionals have probably been less effective than engineering in developing the printed materials for teachers. Both industry groups should seek in-school visits and present field trip opportunities.

An emerging tool is Internet. A well designed site showing college and university programs, job opportunities, salaries, job locations, tuition/scholarship data, internship/co-op opportunities, etc. could be very effective, particularly as Internet access is available at more schools and as Internet literacy increases.

Would you be willing to listen to a presentation?

Yes	44.3%
No	46.4%
No Response	9.7%

Less than half of the teachers were willing to listen to a presentation about these career fields. These findings suggest that career information will be most effective if it is a part of the normal academic life of the teacher and student rather than a “canned” or formal presentation.

E. Nontraditional Students

The average age of U.S. and Nebraska college students has increased in recent years. Appendix I documents that total Fall 1993 college enrollment in the United States was 13,898,000 students. Full-time enrollees totaled 9,019,000 while part-time students totaled 4,879,000.

Full-time and Part-time Students by Age Group and Academic Level - 1993

Age	Associate		Baccalaureate		Graduate	
	Full Time	Part Time	Full Time	Part Time	Full Time	Part Time
15-24	72.9%	37.9%	85.4%	32.6%	35.2%	11.6%
25 and older	27.0%	62.0%	14.6%	67.4%	63.8%	88.5%

It is no surprise that full-time students are younger on average than part-time students.

More specifically, these data document two dramatically different markets in which educational services must be delivered. Many of these part-time students will be making career decisions as they select their course of study. With part-time students accounting for 36.1% of all students, additional research may be required to document how older students selected their academic programs.

Conclusions

Nationally, degrees awarded in information technology and engineering have trended downward since the mid 1980s. There are some indications that these trends have reversed with engineering starting a recovery in the early 1990s.

Meanwhile, graduates in the humanities, social sciences, and behavioral sciences (which account for one-third of the 1,169,275 baccalaureate graduates in 1992/1993) increased between 25 to 50% over the last five years. This growth is well above the national 15% gain for all baccalaureate degrees.

In Nebraska, degrees awarded in information technology have also trended downward since the mid 1980s. Statewide, that trend also appears to have reversed by the mid 1990s. The decline in Nebraska engineering degrees awarded also started to change in the early 1990s.

The Nebraska employers' demand for information technology and engineering professions greatly exceed the supply of new graduates resulting in very competitive local labor markets. This pattern also exists nationally.

Decisions how and why students make career or college decisions are complex and beyond the ability of most adults to fathom. Data from this research provides some clues. The evidence is from secondary literature, AIM's focus groups, and questionnaires to students and teachers.

The national debate about the quality of secondary education appears to be resulting in efforts to strengthen the academic rigor of high school programs. Nebraska and Iowa data show that the percent of student taking math and science courses exceed national levels. If trends continue, the number or percent of students equipped to take information technology and engineering courses will increase.

The lack of interest women show for these two disciplines is significant. Even though 59.3% of all associate degrees and 54.5% of all bachelor degrees are awarded to women, women account for less than 17% of engineers graduating at these degree levels. For IT, about half of the associates degrees were awarded to women but only 28% of the bachelors degrees went to female graduates.

Secondary research suggests a combination of sociological forces is at work in the youth culture that directs students away from more technical career fields. National attitudes towards math and science were favorable during the space programs of the 1960s and 1970s. A generation of students later, other priorities have replaced the "space race," leaving science and math enrollments and test scores lagging. This declining "pool" of students with science and math skills at the secondary level creates a very competitive postsecondary environment for those programs that need students with a strong math and science foundations.

Role models are important to primary and secondary school students. For some students a teacher may be important in helping shape a career interest. Of the over 900,000 9-12 grade teachers in the U.S. public schools, 1% are computer science teachers. And computer science was their main assignment for only 37% of those. There were only 3,435 7th and 8th grade computer science teachers, most of which had other higher priority assignments. This low proportion of computer science teachers presents relatively few “role model” opportunities in primary and secondary schools.

It may be argued that “the best and brightest” students leave the state to attend college. The number of Nebraska residence who graduated from high school in the last 12 months and enrolled in an out of state school totaled 2,229 in the fall of 1994. The number of such students entering Nebraska schools that same period totaled 2,298.

The influence of television may be important in career selection. Over 58% of high school students watch two hours or more of TV each workday. Occupations and work of characters in TV drama do not equally represent employment patterns in the U.S. The “over represented” medical, legal, entertainer/artist, and police/private investigators TV occupations account for less than 10% of all occupations in the U.S. These over represented occupations are generally presented as successful with status, respect, and with little “actual work.” Secondary data suggests these favorable images are important in initial career considerations for students. One-half of the students in AIM focus group discussion were planning careers in these “over represented” TV occupations.

These AIM focus groups, however, documented that adults and experiences were also key factors in student career decisions. When asked, “What influenced your career decision?” relative, parents of friends, and family acquaintances were mentioned most frequently. An Internet survey of 230 junior and senior high students conducted by AIM noted that field trips and outside speakers were listed the most important when asked, “How could your school inform you of the opportunities available upon graduation?”

An AIM Internet-based survey of 113 teachers suggests career exposure should start early and continue from primary school through high school.

This same survey suggests teachers would like more information about career opportunities and many are not aware of the competitive salaries commanded for an associate or bachelors degree in computer science.

The average age of U.S. and Nebraska college students has increased in recent years. With part-time students accounting for 36.1% of all students, additional research may be required to document how older students select their academic programs.

Recommendations

Favorable Experiences

Student decisions seem to be most influenced by favorable experiences. Both the business community and postsecondary academic institutions should aggressively seek to create favorable applied experiences for high school students. Opportunities may include internships, mentor programs, field trips, classes at corporate sites, special events, etc.

Internships

Work study arrangements should be developed by IT and engineering firms. Summer high school internships at area firms could provide opportunities for both students and firms alike.

Paid high school faculty internships during the summer could provide excellent opportunities to faculty members to gain first hand experience about business practices and general operations of the firms offering such internships.

Mentors

Many firms have employees that would be motivated to work with junior and senior high students in a formal mentor program. Emerging Internet technologies could create opportunities to mentor students across the state.

Field Trips

Field trips have been used for years. More corporations should invite students to their sites with focused and energized presentations showing applied and relevant information technology and engineering applications and careers.

Classes at Corporate Sites

AIM is working with FDR to develop a program where high school students take classes taught by high school teachers at a site provided by First Data Resources. This corporate teaching site provides teachers and students the opportunity to become familiar with the business of the firm. Experts from the firm work with the class as “guest specialists” giving greater insight to and familiarity with business opportunities. Other firms should consider such options for Information Technology and Engineering disciplines.

Special Events

During the summer of 1995 AIM created a “Cyber Camp” to allow junior and senior high school students to learn Internet and develop their own web page. The camp was over booked. Sessions are now planned for the current school year. This experience, jointly sponsored by MCI

and the College of Saint Mary, provided a positive IT experience for area students. Other such camps, retreats, contests, sponsored by academic and business organizations could create positive experiences for parents, students, and teachers.

Website

Internet provides an outstanding opportunity for communicating with students and faculty alike. This technology is widely used today. Its use in primary and secondary school will rapidly accelerate in the future as more schools gain Internet access and the tool is taught to more faculty and students.

Colleges, universities, and firms may all wish to target a web presence that focus on young audiences. These sights may include textual and image data plus favorable experiences that help the students better understand the nature and character of work and careers. Such favorable experiences that challenge the student may include visual presentations, problematic situations, strategic challenges of the firm, puzzles, etc.

Corporate Partnerships with High Schools

A major force affecting U.S. business over the last decade has been reengineering, right sizing and downsizing of firms. One by-product has been the demand for “job ready” employees who can be productive very quickly. Meanwhile, the graduates from colleges and universities have increasingly made academic choices toward fields that are less likely to make them “job ready” upon graduation.

Partnership between firms and area junior or senior high schools could develop a framework to help teachers and students better understand business needs while the firms’ employees more effectively empathize with and support academic institutions.

The nature and character of these partnerships would likely be quite varied based upon the bilateral decisions between the firm and school. The opportunities would most likely be long term with significant communitywide impact if enthusiastically and energetically undertaken by firms and schools alike.

Nontraditional Students

More analysis is required to determine how nontraditional students make “first time” or “career change” decisions. With over one-third of all college students listed as part time, this market segment probably differs substantially from traditional full-time students. Additional research is required to better understand strategies that will attract these individuals to information technology and engineering/engineering technology opportunities.

Curriculum Needs

There are presently several joint high school and business-based curriculum advisory committees operating in the Greater Omaha community. These groups are the response of schools seeking to make their curriculum increasingly relevant in the very rapidly changing world of information technologies.

They include the classroom professionals working with the business communities IT professional. The spirit of these initiatives is very good. Success of this strategy could be very fruitful for the academic community, their students, and future employers. These initiatives must continue.

Classroom IT Teachers

Perhaps one of the most chronic problems is the ability to retain classroom IT teachers. These teachers not only teach the courses but are frequently the students' only role model for an IT professional. The retention problem is created as these classroom IT professionals are hired by the business community as their professional competency grows. The market is extremely tight for quality IT teachers. Perhaps some incentives need to be developed to assist school districts in attracting and retaining these very scarce teachers.

Targeted Grants/Scholarships

State government and others may wish to target grants and scholarships to high demand fields such as information technology and engineering. These programs designed to keep Nebraska students in Nebraska to meet high demand positions could benefit state academic institutions, employers, and ultimately local and state income tax revenues.

Institutional Barriers

Schools and accrediting authorities may wish to look at various institutional barriers that may prevent computer and communications content qualified individuals from teaching at the secondary levels.

College and University

Colleges and universities have an opportunity to be more creative in "matching" their programs to prospective students. "Reasons noted as very important in selecting a college to attend" in a study of 240,082 freshmen completed in the fall of 1995 notes that economic and academic interest ranked highest. Least important were advice of private college counselor, recruited by college and teacher's advice.

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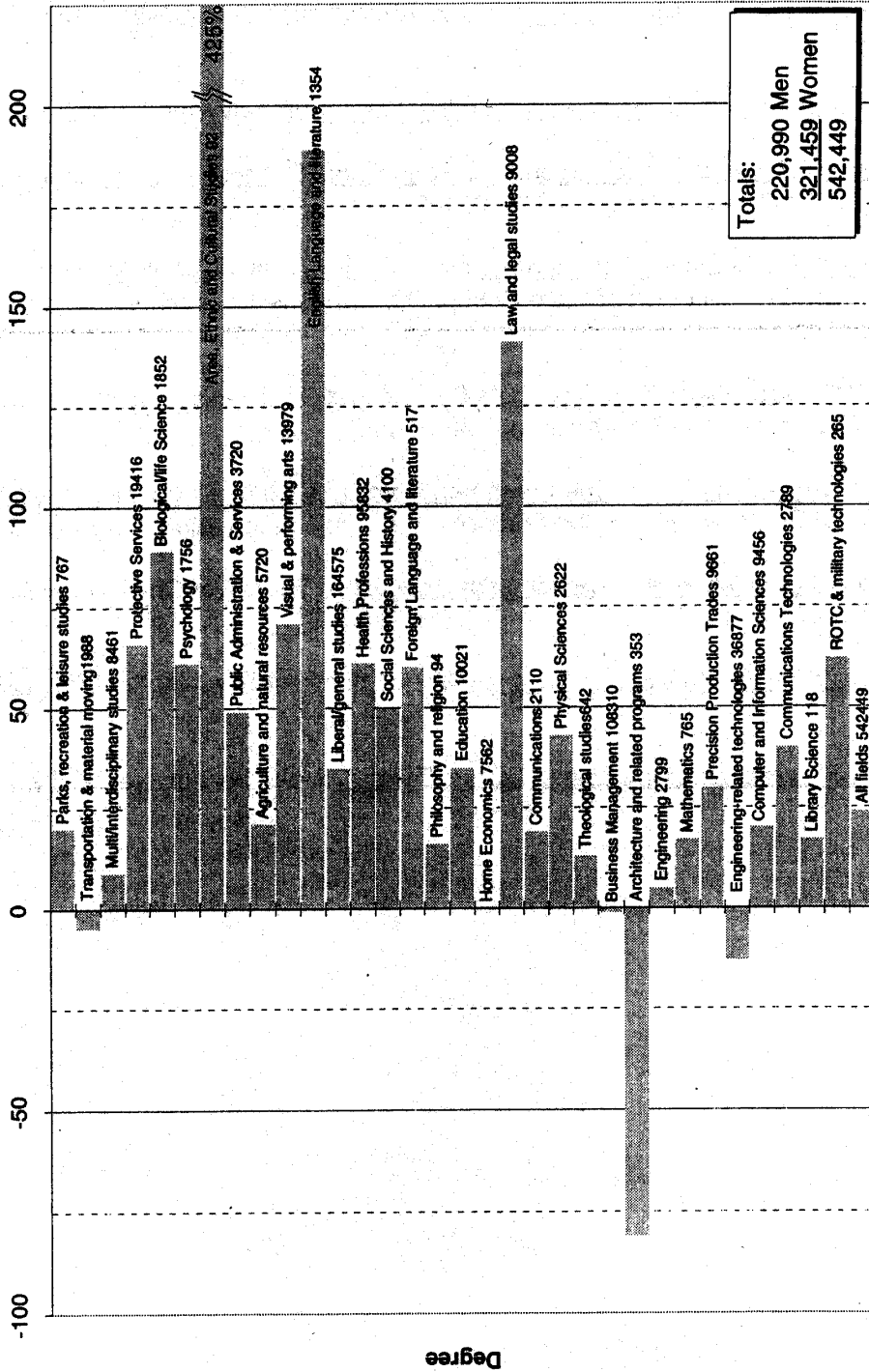
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Appendices

Appendix A

Five Year Change in Associates Degrees Conferred by US Colleges & Universities

Academic years 1988-1989 through 1993-1994
Labeled with Degree and 1993-1994 Graduates

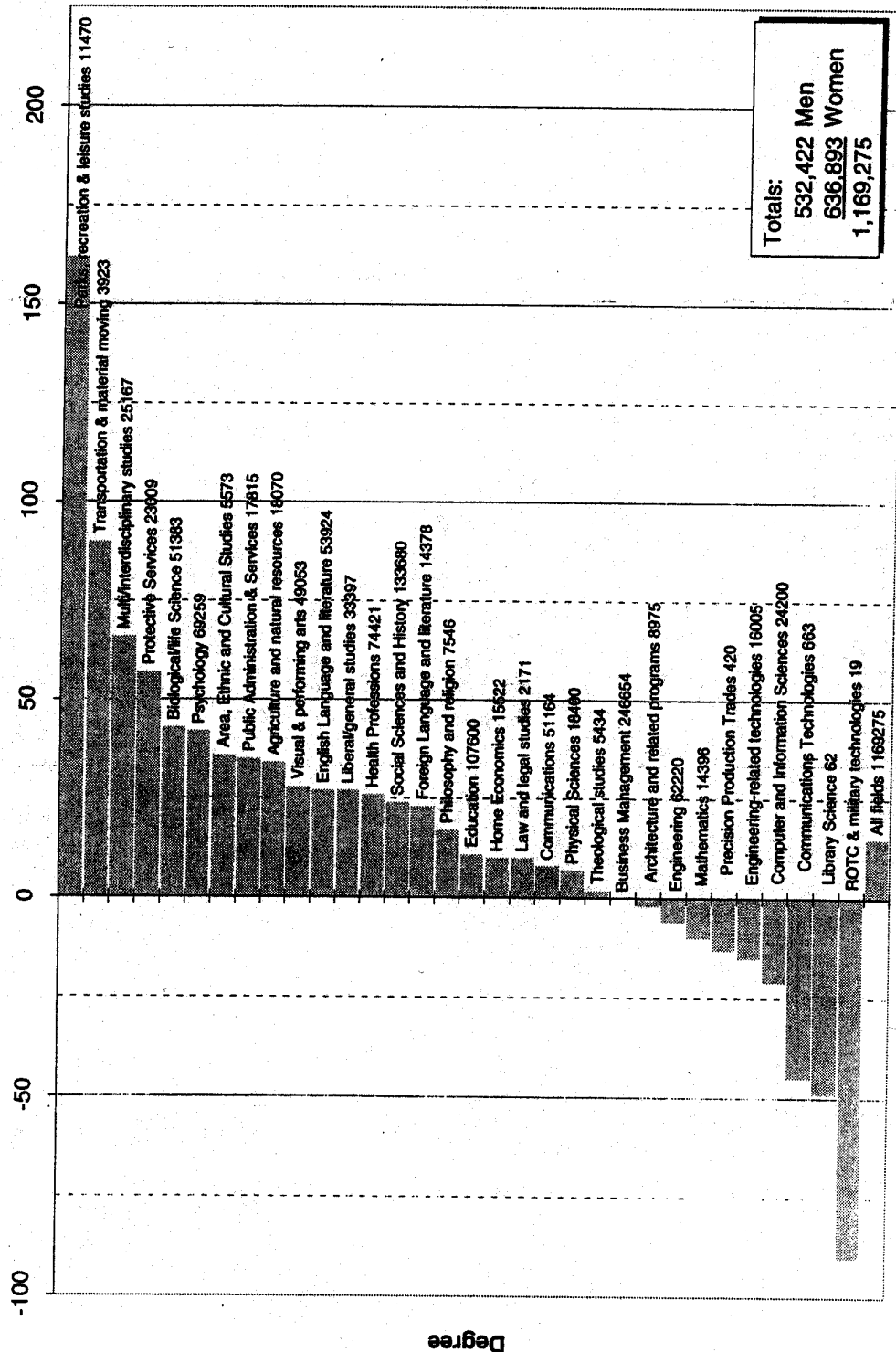


Percent Change

Source: Chronicle of Higher Education

Five Year Change in Baccalaureate Degrees Conferred by US Colleges & Universities

Academic years 1988-1989 through 1993-1994
Labeled with Degree and 1993-1994 Graduates



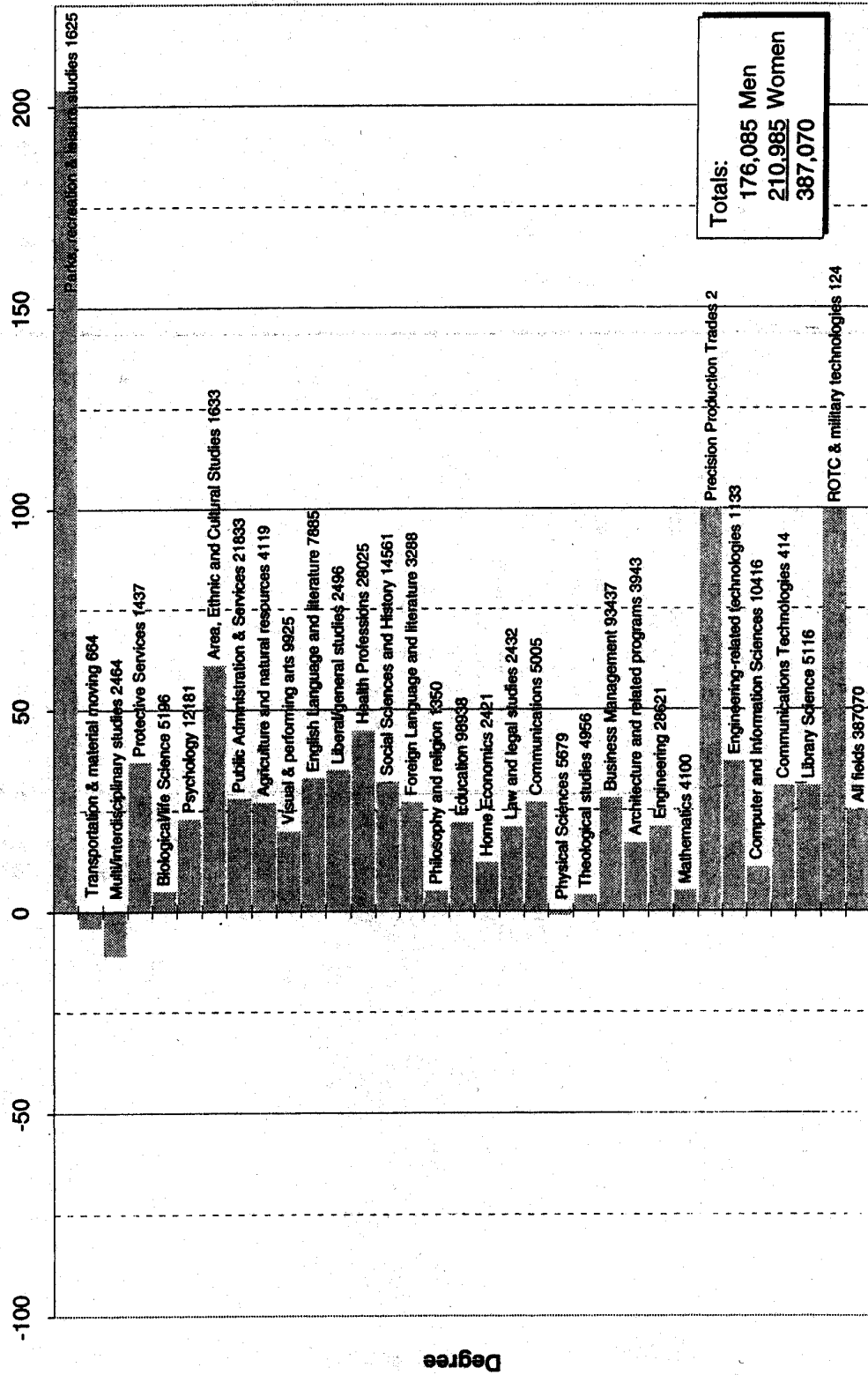
Totals:
532,422 Men
636,893 Women
1,169,275

Percent Change

Source: Chronicle of Higher Education

Five Year Change in Masters Degrees Conferred by US Colleges & Universities

Academic years 1988-1989 through 1993-1994
Labeled with Degree and 1993-1994 Graduates



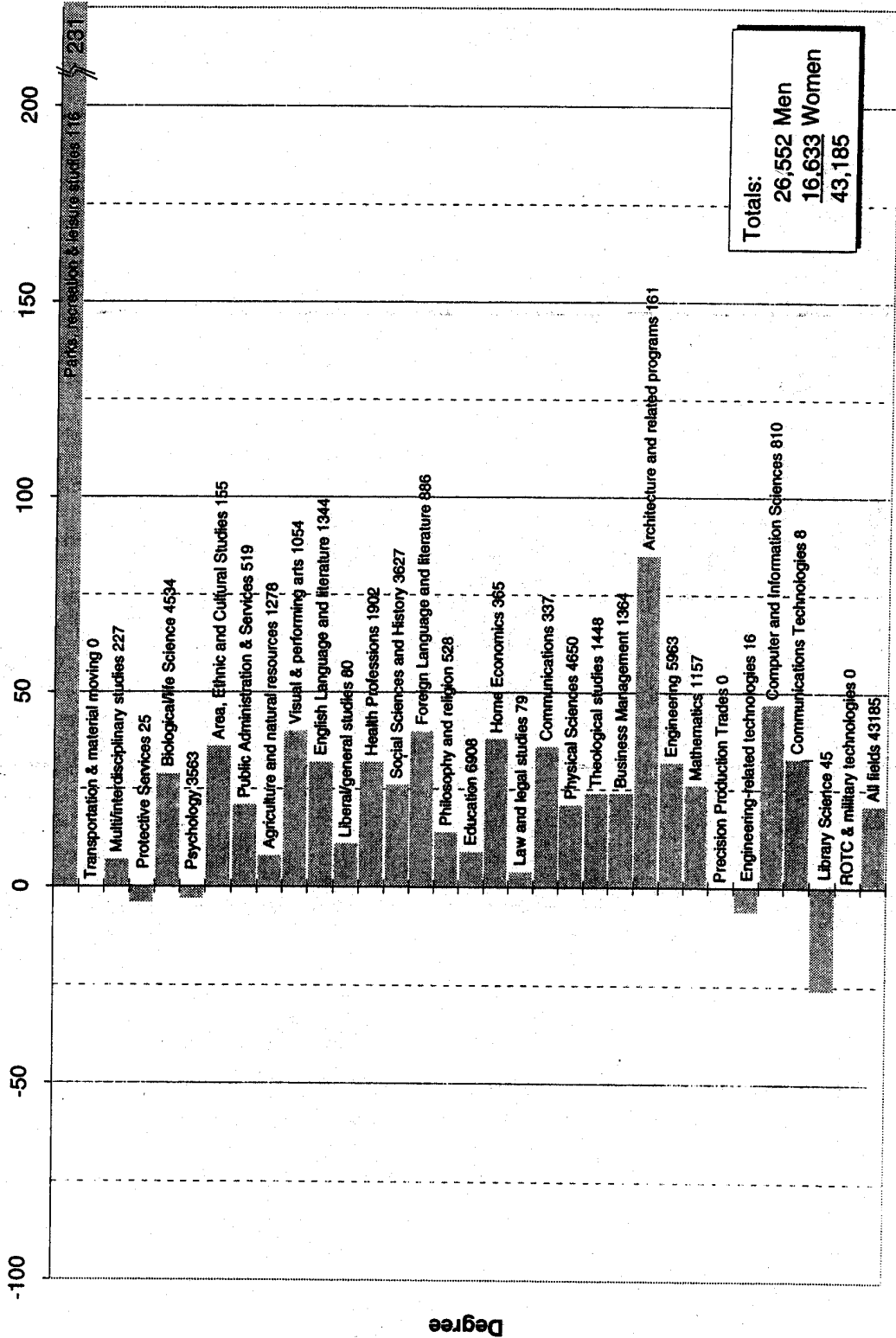
Totals:
176,085 Men
210,985 Women
387,070

Percent Change

Source: Chronicle of Higher Education

Five Year Change in Doctoral Degrees Conferred by US Colleges & Universities

Academic years 1988-1989 through 1993-1994
Labeled with Degree and 1993-1994 Graduates

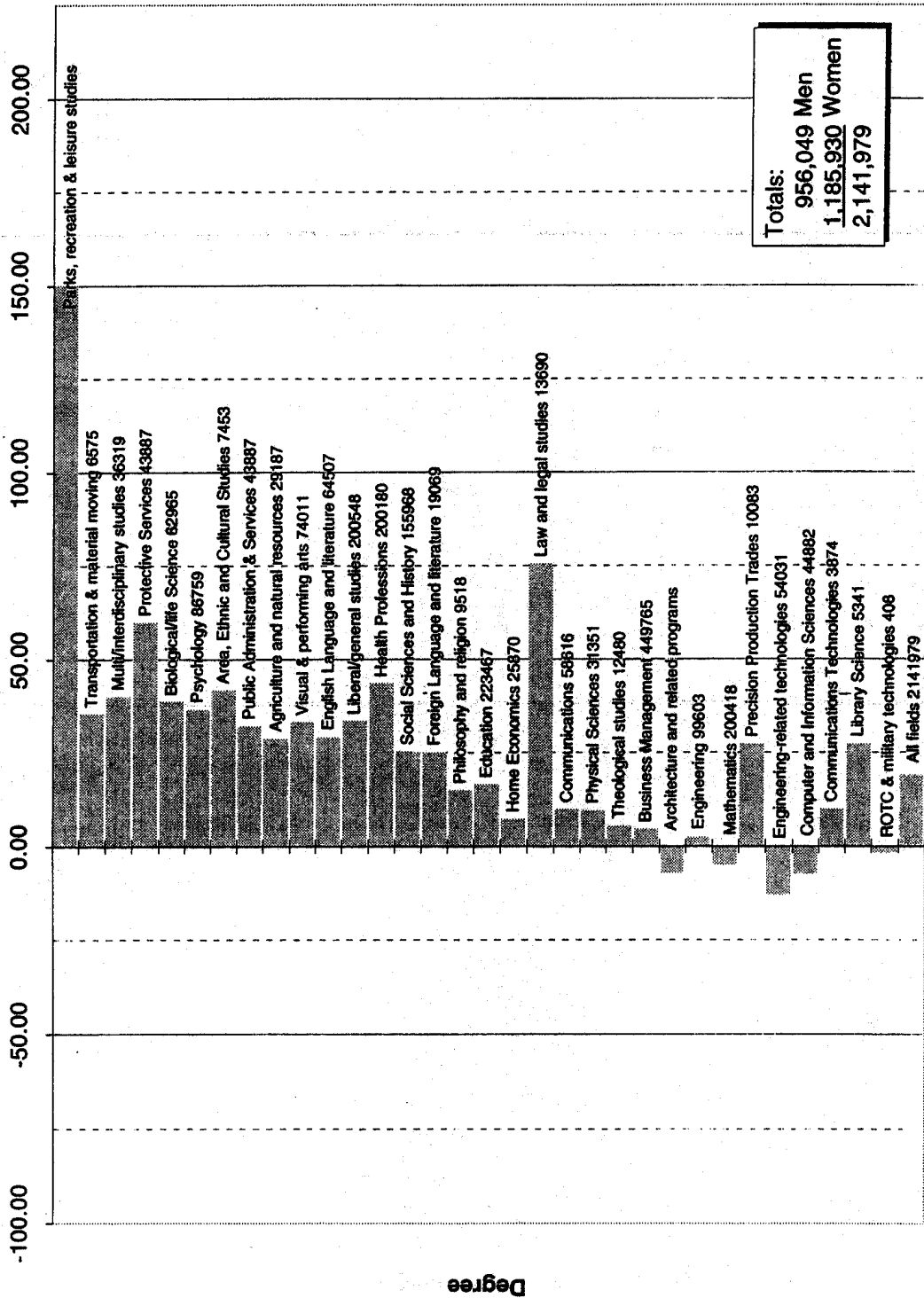


Source: Chronicle of Higher Education

Percent Change

Five Year Change in All Degrees Conferred by US Colleges & Universities

Academic years 1988-1989 through 1993-1994
Labeled with Degree and 1993-1994 Graduates



Percent Change

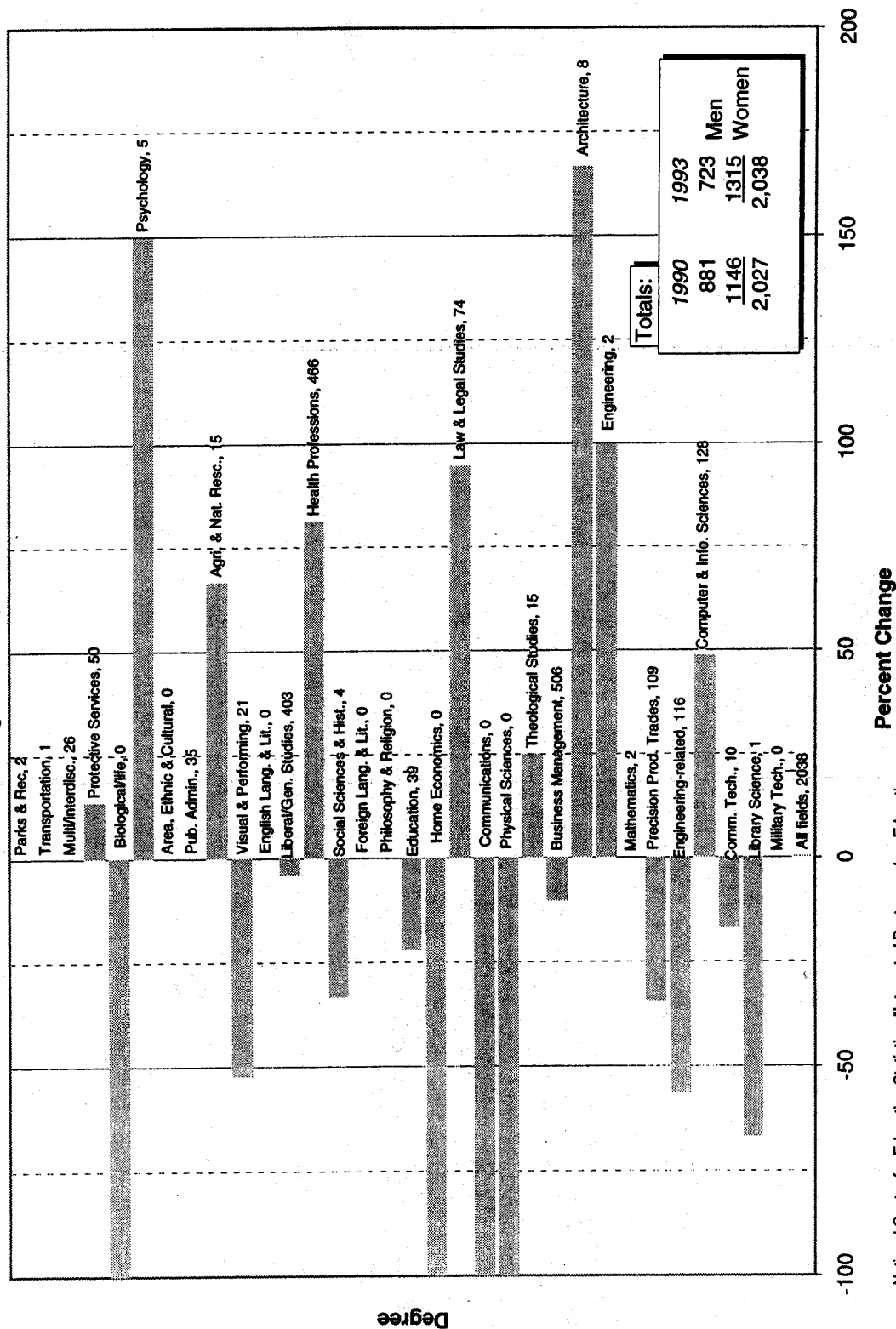
Source: Chronicle of Higher Education

Appendix B

Degrees Awarded by U.S. Colleges and Universities Academic Year 1991-1992 through 1993-1994

	Total			Associate			Bachelors			Masters			Doctoral		
	91-92	92-93	93-94	91-92	92-93	93-94	91-92	92-93	93-94	91-92	92-93	93-94	91-92	92-93	93-94
Total All Degrees	2,034,281	2,091,651	2,141,979	504,231	514,756	542,449	1,136,553	1,165,178	1,169,275	352,838	369,585	387,070	40,659	42,132	43,185
Total All Business Degrees	427,951	431,833	431,027	93,762	91,719	96,203	248,907	249,711	240,709	84,044	89,064	92,759	1,138	1,339	1,356
Computer Degrees in Business															
Management Information Systems Business Data Processing	8,743	9,423	10,074	2,758	2,650	2,750	4,528	5,174	5,434	1,440	1,592	1,877	8	7	13
Business Computer Programming/Programmer	2,708	2,755	3,187	2,678	2,724	3,134	30	31	53	0	0	0	0	0	0
Business Systems Analysis and Design	295	381	418	223	245	260	72	128	131	0	8	27	0	0	0
Business Systems Networking and Telecommunications	259	305	321	30	20	101	104	103	95	125	182	125	0	0	0
Business Computer Facilities Operator	346	345	268	288	288	220	58	57	48	0	0	0	0	0	0
Business Information and Data Processing Services, Other	503	493	607	417	398	418	86	77	78	0	18	111	0	0	0
Computer Degrees in Business – Total	12,854	13,702	14,875	6,394	6,325	6,883	4,878	5,570	5,839	1,565	1,800	2,140	8	7	13

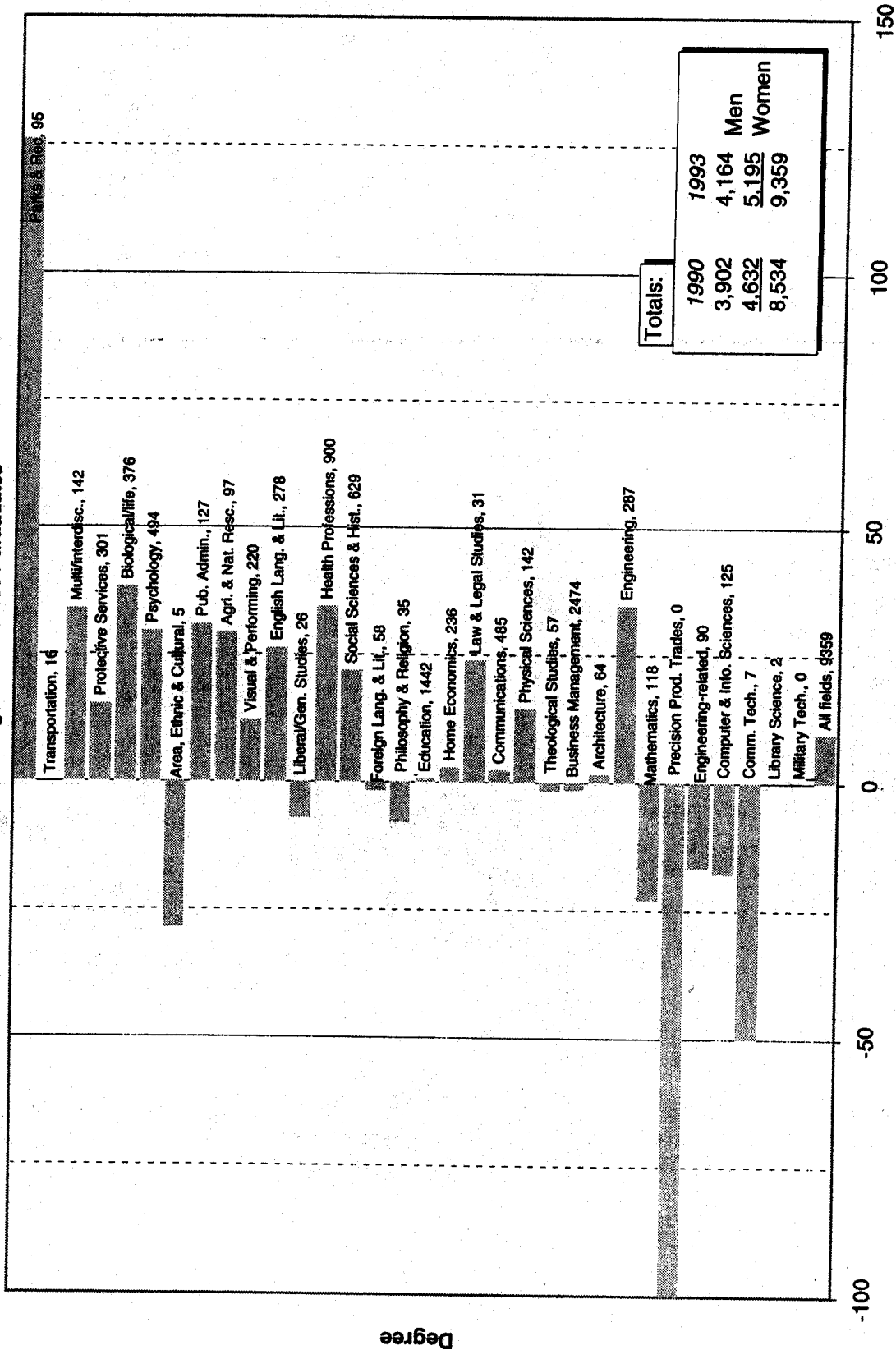
**Four Year Change in Associate Degrees Conferred by
Nebraska Colleges & Universities
Academic years 1989-1990 through 1993-1994
Labeled with Degree & 1993-1994 Graduates**



Source: National Center for Education Statistics, "Integrated Postsecondary Education Data System 1993", (IPEDS), US Department of Education

Four Year Change in Baccalaureate Degrees Conferred by Nebraska Colleges & Universities

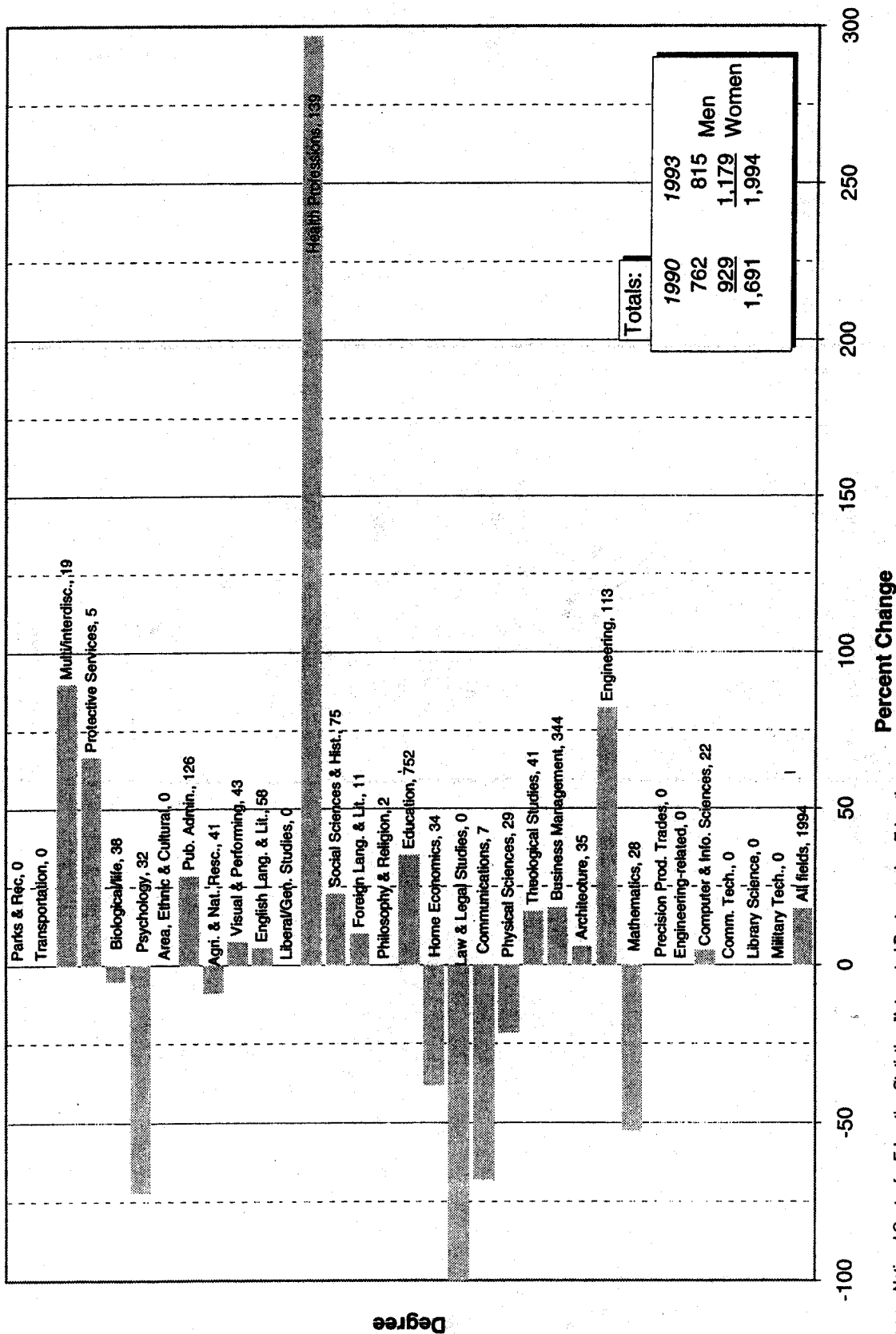
Academic years 1989-1990 through 1993-1994
Labeled with Degree & 1993-1994 Graduates



Source: National Center for Education Statistics, "Integrated Postsecondary Education Data System 1993", (IPEDS), US Department of Education

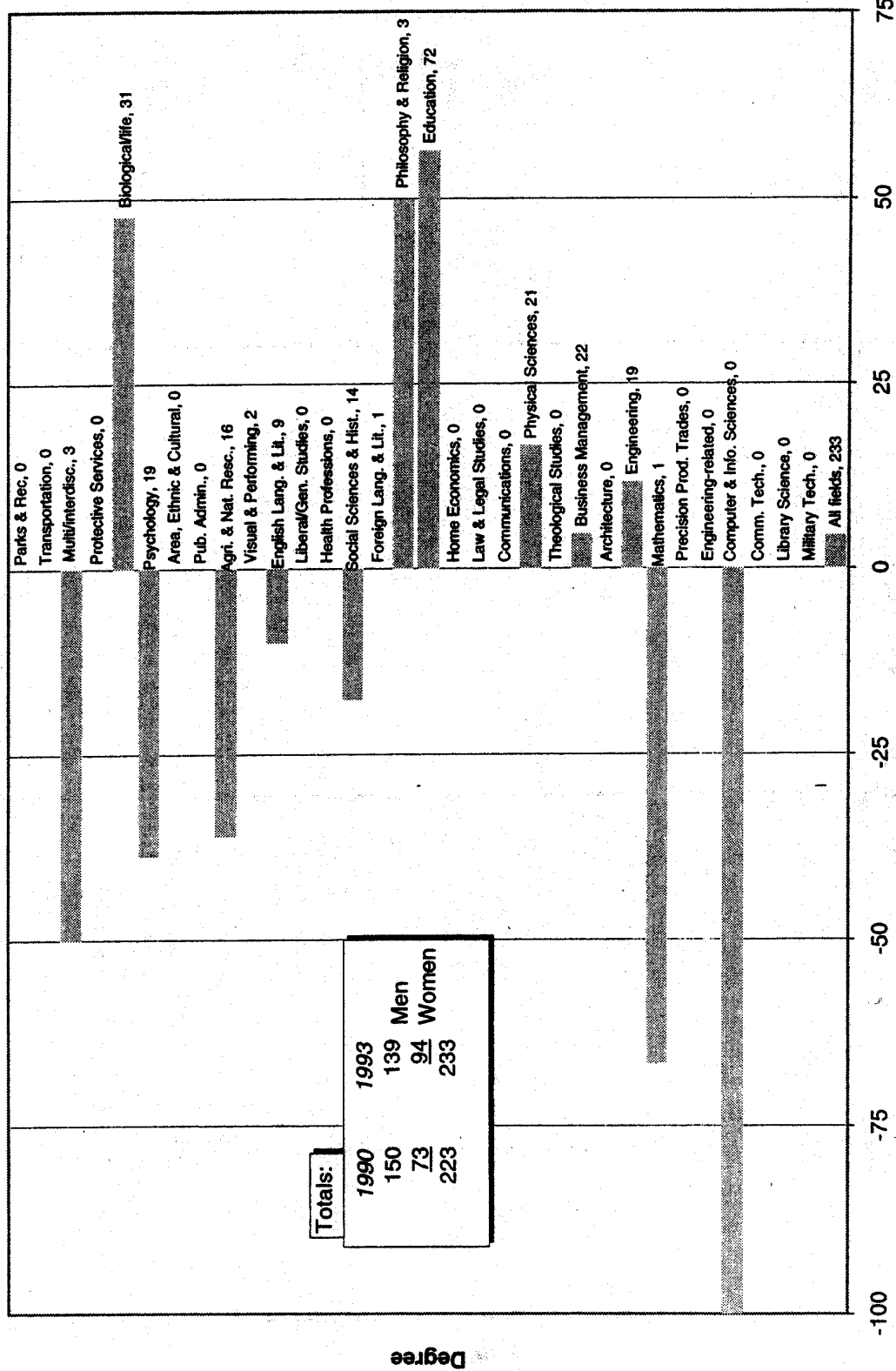
Four Year Change in Masters Degrees Conferred by Nebraska Colleges & Universities

Academic years 1989-1990 through 1993-1994
Labeled with Degree & 1993-1994 Graduates



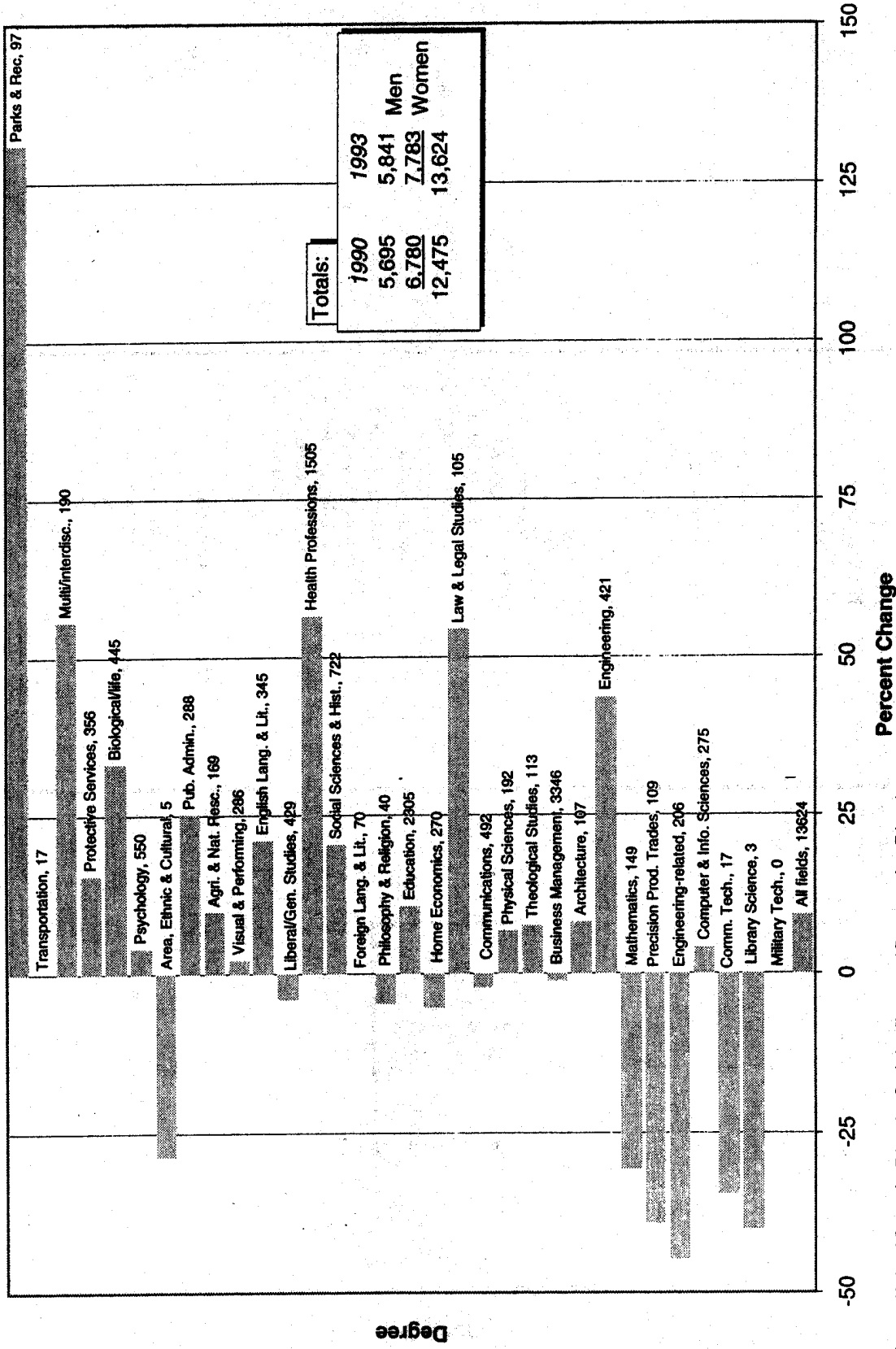
Source: National Center for Education Statistics, "Integrated Postsecondary Education Data System 1993", (IPEDS), US Department of Education

**Four Year Change in Doctoral Degrees Conferred by
Nebraska Colleges & Universities**
Academic years 1989-1990 through 1993-1994
Labeled with Degree & 1993-1994 Graduates



Source: National Center for Education Statistics, "Integrated Postsecondary Education Data System 1993", (IPEDS), US Department of Education

**Four Year Change in All Degrees Conferred by
Nebraska Colleges & Universities**
Academic years 1989-1990 through 1993-1994
Labeled with Degree & 1993-1994 Graduates



Source: National Center for Education Statistics, "Integrated Postsecondary Education Data System 1993", (IPEDS), US Department of Education

Appendix D

Total Responses: 230

Do you feel your high school program prepared you for a job or college courses in IT or Engineering?

Yes	66.96%
No	33.04%

How could your school inform you of the opportunities available upon graduation?

School Counselors	39.13%
Summer Internships	24.78%
Special Seminars	39.13%
Field Trips/Outside Speakers	63.48%
Internet Sites about the Topic	34.78%

Do you have career plans in the area of Information Technology and Engineering?

Yes	47.39%
No	52.61%

What are those plans?

Get a Job	5.22%
Go to Trade School	13.48%
Go to Community College	4.78%
Go to a Four-Year College	37.39%
Not Responding	39.13%

Which profession is of greatest interest to you?

Information Technology	21.74%
Engineering	23.48%
Neither	53.91%

Are you aware of the jobs available and their pay levels?

Yes	43.04%
No	56.96%

Would starting salaries between 25K and 40K interest you?

Yes	69.57%
No	30.43%

Would you be willing to listen to a presentation about job availability?

Yes	81.74%
No	11.74%

Gender

Male	48.70%
Female	51.30%

What size school are you from?

A	92.17%
B	3.91%
C	1.30%
D	1.74%

Appendix E

Total Number of Responses: 113

Question 1: Introduction Grade Level

First	5	4.42%	Seventh	12	10.62%
Second	2	1.77%	Eighth	8	7.08%
Third	10	8.85%	Ninth	11	9.73%
Fourth	6	5.31%	Tenth	9	7.9%
Fifth	8	7.08%	Eleventh	1	0.88%
Sixth	8	7.08%	Twelfth	2	1.77%
No Response	9	7.96%			
Pre-school/Kindergarten	22	19.47%			

Question 2: How could your school inform you?

Printed Materials	86	76.11%
Internet Website	73	64.60%
In-school Visits	56	49.56%
Field Trips	67	59.29%
Summer Internships	64	56.64%
Other	8	7.08%

Question 3: What courses do you believe best prepare students for IT careers?

Math	101	89.38%
English	72	63.72%
Written Communications	80	70.80%
Extracurricular Activities	48	42.48%
Science	98	86.73%
Social Studies	57	50.44%
Computer/Internet Applications	106	93.81%
Other	13	11.50%

Question 4: To more effectively counsel students, do you need information about:

IT Career Opportunities	83	73.45%
Job Descriptions	72	63.72%
Salaries	47	41.59%
Job Location	7	6.19%
Trade Schools, Colleges & University Programs	56	49.56%
Firms Using IT	68	60.18%
Other	40	35.40%
No Response	40	35.40%

Question 5: Starting Salary for an IT Degree:

<u>Two Year Degree</u>			<u>Four Year Degree</u>		
Less than \$15,000	5	4.42%	\$20,001-\$25,000	11	9.73%
\$15,001-\$20,000	23	20.35%	\$25,001-\$30,000	28	24.78%
\$20,001-\$25,000	48	42.48%	\$30,001-\$35,000	26	23.01%
\$25,001-\$30,000	15	13.27%	\$35,001-\$40,000	16	14.16%
\$30,001-\$35,000	6	5.31%	\$40,001-\$45,000	9	7.96%
More than \$35,000	5	4.42%	More than \$45,000	12	10.62%
No response	7	6.19%	No response	7	6.19%

Question 6: Would you be willing to listen to a presentation?

Yes	50	44.25%
No	52	46.02%
No Response	11	9.73%

Question 7: What size school are you from?

Class A	66	58.41%
Class B	6	5.31%
Class C	12	10.62%
Class D	14	12.39%
No Response	15	13.27%

Appendix F

1. *Have you thought about what kind of career you'd be interested in pursuing? Why/Why not?*
2. *Who/what influences your career decision?*
3. *How do you get current career information?*
4. *Do you know what information technology careers are?*
5. *Do you know how fast they are predicted to grow and what the typical salaries are?*
6. *What classes would you take in high school to prepare you for a career in information technology?*
7. *How can we market career information to students? (videos, pamphlets, TV, etc.)*

Appendix G

*Reasons Noted as Very Important in Deciding to Go to College:**

	<u>Total</u>	<u>Men</u>	<u>Women</u>
My parents wanted me to go	33.8%	32.3%	35.1%
I could not find a job	7.3%	6.7%	7.8%
Wanted to get away from home	18.5%	17.9%	19.1%
To be able to get a better job	77.3%	76.4%	78.1%
To gain a general education and appreciation of ideas	62.5%	55.8%	68.1%
To improve my reading and study skills	42.6%	38.5%	46.1%
There was nothing better to do	3.6%	4.7%	2.6%
To make me a more cultured person	39.1%	33.0%	44.2%
To be able to make more money	72.3%	75.3%	69.7%
To learn more about things that interest me	74.0%	69.8%	77.5%
A mentor or role model encouraged me to go	14.9%	14.3%	15.5%

Note: The statistics are based on survey responses of 240,082 freshmen entering 473 two-year and four-year institutions in the fall of 1995. The figures were statistically adjusted to represent the total population of approximately 1.5 million first-time, full-time freshmen. Because of rounding or multiple responses, figures may add to more than 100%.

* Source: "The American Freshman: National Norms for Fall 1995," published by American Council on Education and University of California at Los Angeles Higher Education Research Institute.

Appendix H

*Reasons Noted as Very Important in Selecting a College to Attend:**

	<u>Total</u>	<u>Men</u>	<u>Women</u>
Relatives' wishes	9.4%	8.5%	10.2%
Teacher's advice	4.4%	4.6%	4.3%
College has a very good academic reputation	49.2%	44.4%	53.2%
College has a good reputation for its social activities	22.5%	21.8%	23.1%
Offered financial assistance	31.6%	27.2%	35.2%
College offers special education programs	20.6%	16.3%	24.2%
Low tuition	27.7%	24.4%	30.5%
Advice of high school counselor	7.4%	7.2%	7.5%
Advice of private college counselor	2.3%	2.5%	2.1%
Wanted to live near home	20.4%	15.9%	24.3%
Friend's suggestion	9.3%	8.7%	9.7%
Recruited by college	4.3%	4.9%	3.7%
Recruited by athletic department	6.5%	9.6%	3.9%
Graduates gain admission to top graduate/professional schools	25.5%	22.3%	28.2%
Graduates get good jobs	43.1%	40.4%	45.5%
Religious affiliation/orientation of college	5.1%	4.2%	5.8%
Size of college	33.8%	26.4%	40.2%
Not accepted anywhere else	2.5%	3.1%	2.0%
Rankings in national magazines	7.9%	7.9%	8.0%

Note: The statistics are based on survey responses of 240,082 freshmen entering 473 two-year and four-year institutions in the fall of 1995. The figures were statistically adjusted to represent the total population of approximately 1.5 million first-time, full-time freshmen. Because of rounding or multiple responses, figures may add to more than 100%.

* Source: "The American Freshman: National Norms for Fall 1995," published by American Council on Education and University of California at Los Angeles Higher Education Research Institute.

Appendix I

College Enrollment by Age of Student – Fall 1993 Percent of Number of Students

	All	Two Year		Four Year		Graduate	
		Full Time	Part Time	Full Time	Part Time	Full Time	Part Time
All Students							
15-17	0.9%	0.9%	0.8%	1.4%	0.4%	0.0%	0.0%
18-19	21.1%	36.5%	11.0%	31.5%	5.1%	0.3%	0.0%
20-21	19.7%	21.2%	11.1%	33.2%	8.1%	1.0%	0.2%
22-24	18.2%	14.3%	15.0%	19.3%	19.0%	34.9%	11.4%
25-29	13.4%	9.1%	17.8%	6.9%	19.6%	31.8%	20.9%
30-34	8.8%	6.7%	13.6%	3.0%	15.3%	14.0%	18.4%
35-39	7.0%	6.1%	12.6%	2.3%	11.3%	9.3%	13.9%
40-44	5.0%	2.0%	8.1%	1.2%	10.6%	4.2%	15.2%
45-49	3.3%	2.3%	4.8%	0.6%	6.0%	2.0%	11.6%
50-54	1.6%	0.7%	2.4%	0.3%	3.1%	1.2%	5.5%
55-59	0.5%	0.1%	0.8%	0.2%	0.6%	0.7%	1.5%
60-64	0.2%	0.0%	0.5%	0.0%	0.3%	0.6%	0.5%
65 +	0.4%	0.0%	1.4%	0.1%	0.6%	0.0%	1.0%
Total	13,898,000	2,274,000	1,922,000	5,720,000	1,591,000	1,025,000	1,366,000
Men							
15-17	0.8%	0.7%	1.1%	1.2%	0.3%	0.0%	0.0%
18-19	21.1%	38.4%	12.1%	29.4%	5.6%	0.0%	0.0%
20-21	20.7%	21.6%	15.0%	32.6%	9.8%	0.3%	0.4%
22-24	21.3%	18.1%	18.1%	22.6%	20.3%	34.4%	12.0%
25-29	13.8%	8.3%	15.1%	8.5%	23.0%	30.7%	20.5%
30-34	8.4%	4.8%	13.4%	2.3%	17.5%	15.7%	21.6%
35-39	6.0%	3.4%	11.9%	1.7%	11.3%	10.5%	13.4%
40-44	3.7%	1.5%	5.3%	1.0%	6.7%	4.0%	15.4%
45-49	2.3%	2.7%	3.9%	0.3%	2.0%	2.4%	10.0%
50-54	1.0%	0.4%	1.8%	0.1%	2.5%	0.7%	4.5%
55-59	0.3%	0.0%	0.7%	0.2%	0.2%	0.7%	0.9%
60-64	0.5%	0.0%	0.3%	0.1%	0.2%	0.5%	0.5%
65 +	0.3%	0.0%	1.3%	0.0%	0.6%	0.0%	0.7%
Total	6,324,000	1,006,000	742,000	2,806,000	640,000	579,000	551,000
Women							
15-17	0.9%	1.2%	0.7%	1.5%	0.4%	0.0%	0.0%
18-19	21.0%	34.8%	10.3%	33.6%	4.7%	0.7%	0.0%
20-21	18.8%	21.0%	8.6%	33.7%	6.9%	1.8%	0.0%
22-24	15.7%	11.3%	13.1%	16.1%	18.1%	35.9%	10.9%
25-29	13.1%	9.8%	19.6%	5.3%	17.5%	33.2%	21.1%
30-34	9.1%	8.2%	13.7%	3.7%	14.0%	11.9%	16.2%
35-39	7.9%	8.2%	13.1%	2.8%	11.4%	7.6%	14.1%
40-44	6.0%	2.4%	9.8%	1.4%	13.1%	4.7%	15.0%
45-49	4.1%	2.0%	5.4%	0.9%	8.7%	1.6%	12.8%
50-54	2.0%	0.9%	2.8%	0.6%	3.5%	1.8%	6.1%
55-59	0.6%	0.2%	0.9%	0.3%	0.9%	0.7%	2.1%
60-64	0.2%	0.0%	0.6%	0.0%	0.5%	0.7%	0.5%
65 +	0.4%	0.0%	1.9%	0.1%	0.4%	0.0%	1.2%
Total	7,574,000	1,268,000	1,179,000	2,914,000	951,000	446,000	815,000