Perspectives on Education in America

An Annotated Briefing

ABSTRACT **Sandia National Laboratories has been involved in education throughout much of its existence. Historically, the thrust of this involvement has been at the postsecondary level. At the behest of Admiral James Watkins, Secretary of Energy, Sandia is expanding its efforts with a greater focus on elementary and secondary education. The purpose of this study, conducted by the New Initiatives Department for the Strategic Studies Center, is to provide a foundation for Sandia's future activities in education. The study includes detailed analyses of dropout statistics, standardized tests, postsecondary studies, educational funding, international comparisons, and educator status. It also addresses future workforce requirements, the changing student demographics, and the education goals proposed by President Bush and the nation's Governors.**

Preface

When Admiral Watkins, the Department of Energy (DOE) Secretary, declared education to be "a matter of mission" for the DOE laboratories, we undertook a study to elucidate key issues in education and thereby help focus our laboratories' attention on the most pressing challenges. Although we are admittedly newcomers in the education field, through the application of our traditional systems analysis methods we found no shortage of interesting issues and puzzles. Through the experience we have gained and the discussion we present herein, it is clear to us that the problems in U.S. education are quite complex. Many past analyses suffer from attempts to oversimplify both the problems and possible solutions, and we are painfully aware that others may raise the same charges against our work.

Our most detailed analyses to date have focused on popular measures used to discuss the status of education in America. Where feasible, we looked at the data over time to put the performance of the current system in proper perspective. To our surprise, on nearly every measure we found steady or slightly improving trends. Does this mean education in America needs no further improvement? The answer is no—for three reasons. First, it is not clear to us that all the measures analyzed by us and others are appropriate barometers of performance for the education system (recall that our selection criterion was that a measure be popular, not necessarily appropriate). Thus, the trend data on some of these measures, positive or negative, may be irrelevant. Second, even if a particular measure is appropriate, steady or slightly improving performance may not be adequate to meet future societal requirements in an increasingly competitive world. Finally, in some appropriate measures, the performance of the U.S. education system is clearly deficient.

As our work unfolded, we began to solicit feedback from various peer groups in New Mexico and throughout the nation. After a limited release of the draft in the summer of 1991, we found ourselves to be a target for various groups—both those who found our observations in conflict with their particular views, as well as those who grasped our findings as "proof" to support their own theses. Although it was not our original intention to enter into the national debate on education, we feel professionally obliged to respond to the over 500 requests we have received for the report to date. We are fully aware of the potential for controversy in any study of educational issues. Nonetheless, we present this "outsider" report as a work still in progress. Our aim remains the same—to present relevant information in a form that will foster data-based decision-making that will be as free as possible of preconceived notions or agendas. We hope you will find this work a positive contribution to this end.

The Authors
April 23, 1992

Preface Update

Since completing this work in May 1991, we have received numerous reviews and comments. Some readers suggested we purposely omitted data in order to present only one side of an issue. Our intent was the opposite, to present balanced perspectives. We never intended this presentation to be a comprehensive summary of all relevant educational data. This effort was an attempt to collect, into a ninety minute briefing, data underscoring the most pressing issues in American education in 1991. We believe this collection is as relevant today as it was when it was prepared nearly two years ago.

The Authors
February 1, 1993

We have to pick up our society by its bootstraps and find a new mechanism to obtain science and math literacy . . . Education programs are going to be a matter of mission at Sandia National Laboratories.

Admiral James Watkins
Secretary of Energy
Source: Sandia Lab News, 23 Feb. 1990

Call to Action

Sandia National Laboratories has been involved in education throughout much of its existence. Historically, the bulk of this involvement has been at the post-secondary level, with some effort directed at selected groups of students at the high school level. In response to Energy Secretary James Watkins' interest in education, especially in general science and math literacy, Sandia's efforts are expanding. Much of the recent surge in activity is different from before in that it is directed at kindergarten through 12th grade levels, especially at kindergarten through 8th grade levels. This study was undertaken to help Sandia properly focus those new efforts.

The New Initiatives Department of the Strategic Studies Center began studying the American education system in late February 1990. The objective of this study was to provide a foundation for Sandia's expanding activities in education. Much of our effort involved detailed analyses of education and demographic data. Additionally, we have reviewed much of the current educational literature; interviewed over 400 educators, legislators, business leaders, and parent groups; conducted a number of site visits; and participated in several seminars and workshops on education.

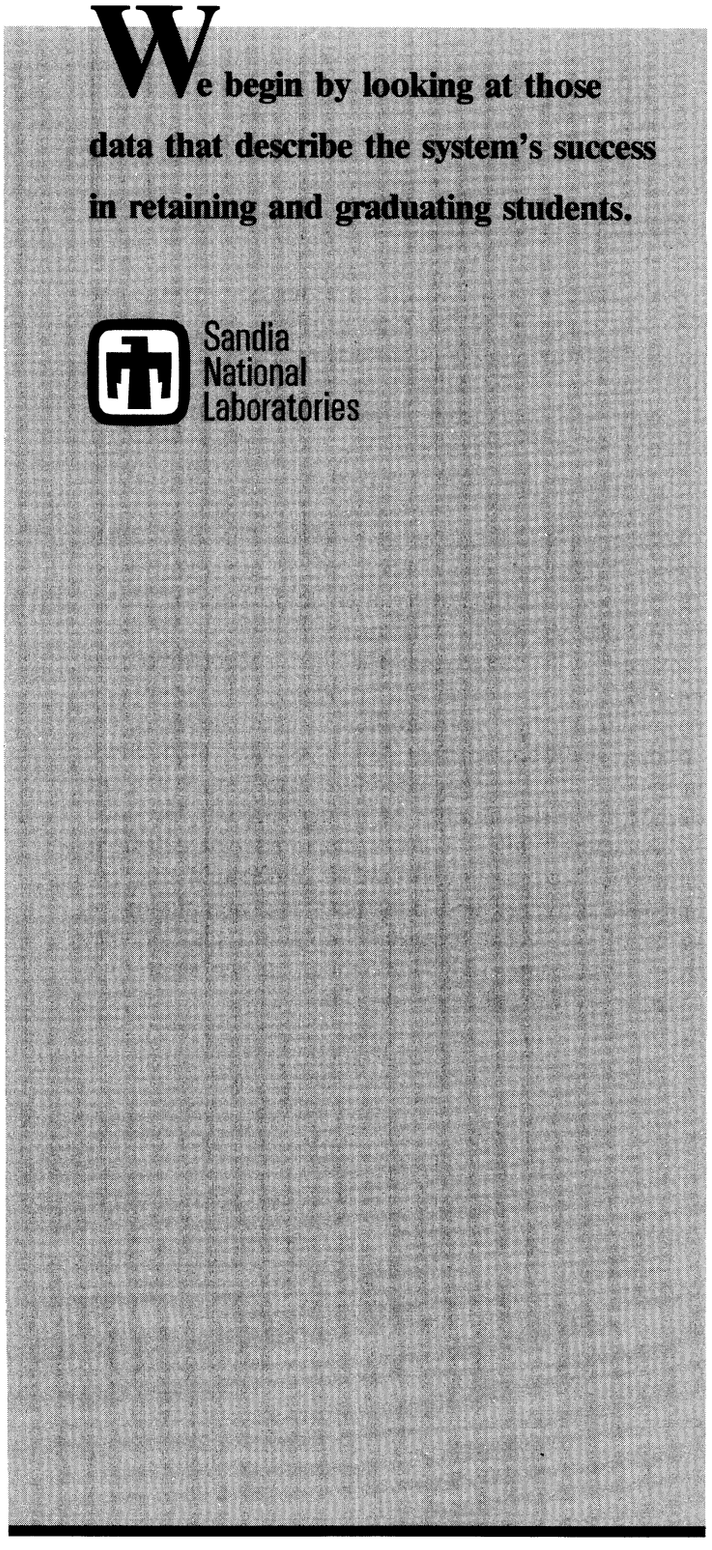
This presentation has been shared with selected groups, both within Sandia National Laboratories in Albuquerque, New Mexico, and throughout the country.

Our study is divided into two major sections: historical performance and future requirements. In the first, we address several historical indicators of educational progress. Our most detailed work thus far has focused on dropouts and college entrance exams. These are two of the more widely used measures of school performance and student achievement. In addition, performance on achievement tests is reviewed over time as a measure of basic skills proficiencies. Math and science "pipelines" and the number of technical doctoral degrees are often used as measures of availability for filling technical jobs. These are studied, along with expenditures for education, performance of U.S. students on international tests, and the status of educators.

In considering future requirements, we address workforce skills and changing demographics. We also briefly address some of the current debate surrounding the future of the public education system in the United States.

It should be noted that some data are available from as far back as 1870, whereas other data are available only from 1975. For completeness, we have attempted to show all available information, even though this leads to differences among the time axes on the various charts.

HISTORICAL PERFORMANCE
Dropout—Retention Rates



Dropout Rate Definitions

- **Event**
  - proportion of students who drop out in a single year.
- **Status**
  - proportion of population who have not completed high school and are not enrolled at one point in time.
- **Cohort**
  - dropout rate of a single group (cohort) of students over a specified period of time.

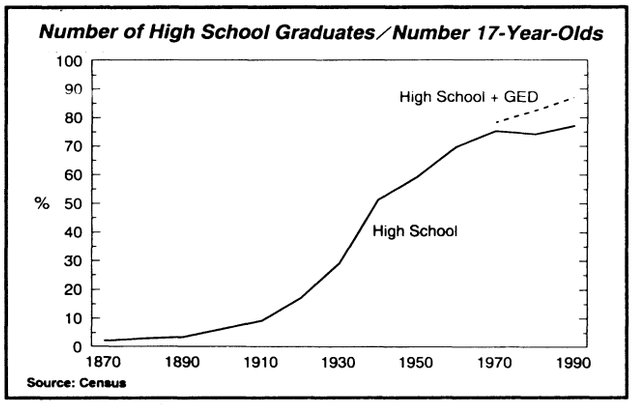
Source: NCES

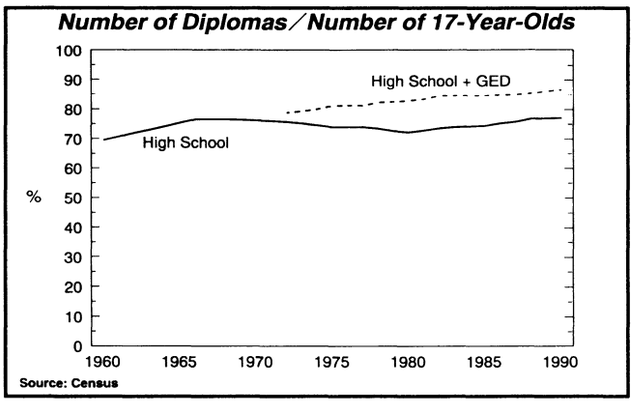
Although the concept of a high school dropout is straightforward, there are several definitions of dropout rates. The *event* dropout rate is simply the percentage of enrolled students who voluntarily leave school in a single year. This measure can be compiled directly from school data, so it is used most frequently by districts and states. Unfortunately, its value is weakened by double counting, repeat dropouts, and numerous other accounting problems.

The *status* dropout rate for a population is the percentage of that population that has not completed school and is not enrolled in school. This measure is the one most commonly used in census estimates.

The most appealing and least practical measure for dropouts is the *cohort* dropout rate, which is the percentage of dropouts in a single group over a period of time. While this measure might be the most useful, it is the most difficult to obtain. The increasing mobility of our society makes accounting for an entire cohort group over an extended period nearly impossible, though sample longitudinal studies of cohort samples are carried out and have proved quite valuable.

Most of our analysis will use the *status* rate to discuss the dropout rate. We believe this to be the most consistent and reliable data available at the present time.



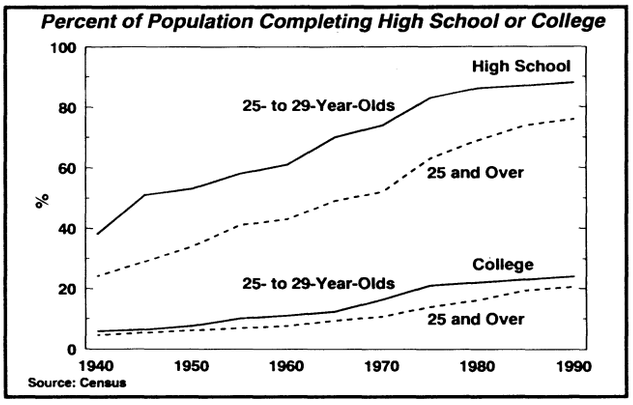


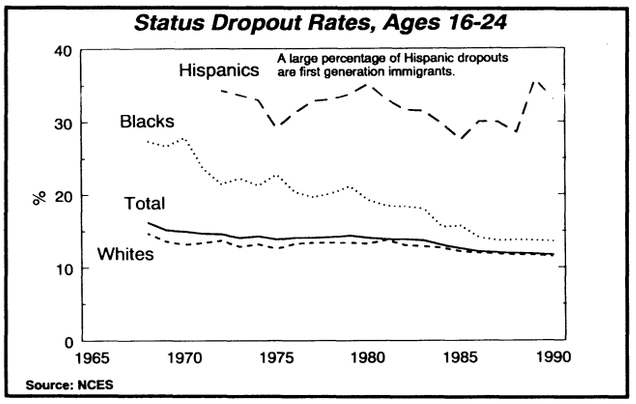
Before the mid-1980s, dropout rates were not carefully calculated in many school districts, and there were no consistent measures from district to district. As a result, there is little valuable historical information available from the education system regarding dropout/retention rates. Shown here is a measure of dropout/retention rates from 1870 to the present from Census data. The measure used is the number of high school graduates in a particular year divided by the number of 17-year-olds in that year. (We selected this measure for lack of any other consistent, long-term metric.) For the years before 1950, these data have been available at ten-year intervals. Since 1950, these data have been available at one-year intervals. This metric provides a relatively robust measure of school retention rate and gives results that are consistent with Census Bureau sampled data of high school completion. The General Education Diploma (GED) curve is shown for completeness, since GED is an integral part of our education system. Before the 1970s data are available only for the number of persons attempting the GED. More recent information also includes the number of passing scores.

These curves show an impressive increase in graduation rate from 1870 through the mid-1960s. After 1965, the graduation rate from traditional schools has remained steady at about 75%. The more recent of these data are shown in more detail on the following chart.

This chart is similar to the previous one except that data are shown only for 1960 to 1989. As previously stated, this ratio closely parallels the "on-time" graduation rate (generally defined to be the rate at which students graduate from "traditional" high schools without having experienced an interruption in their education) and has been steady at roughly 75% for the past 30 years. If GED completion is included, the high school completion rate is over 85%. This 85% high school equivalent completion rate is consistent with Census Bureau estimates for graduation rates of 20- to 24-year-olds shown on subsequent charts.

It should be noted that the information presented here includes all 17-year-old residents. This means that recent immigrants, many in their mid- to late-teens, are counted as dropouts if they do not complete high school in the U.S. This has become more significant in the last decade since the number of immigrants has increased dramatically. While it is important to educate all of our youth, it is equally important to understand that the language difficulty and poor academic preparation of many of the recent teenaged immigrants may prevent them from completing high school on the same time schedule as their native-born peers.





This chart, using census data, shows the cumulative percent of two populations who have completed high school and college (four-year degree or higher). The two specific populations are persons aged 25 to 29 (solid lines) and persons aged 25 and over (dashed lines). Currently, seven out of eight persons in the 25- to 29-year-old age group have obtained a high school diploma or its equivalent. A smaller portion of the entire population over 25 has done so, reflecting the time history shown by the previous charts of dropout statistics.

Approximately one in four persons in the 25- to 29-year-old age group has completed at least a four-year college degree. This rate is nearly the same as the U.S. high school graduation rate of the 1930s.

Although the previous chart shows that today's youth are obtaining high school diplomas at unprecedented rates, merely focusing on aggregate statistics can mask underlying realities in particular subpopulations. This chart shows some of the limited data available on dropouts by racial and ethnic categories. A direct comparison of this chart with the previous one should not be made because the age groups are different (16–24 vs. 25–29). However, the data here are complementary. The total status dropout rate for this age group has decreased significantly, from about 17% in 1968 to about 12% in 1989. Note that the dropout rate for the White population dominates the total since Whites make up nearly 80% of the young adult population.

The "fine structure" displayed here tells two different stories for minority populations. Over the past 20 years the Black status dropout rate has decreased impressively, from nearly 28% to under 15%. This value is currently within two percentage points of the rate for the White population.

On the other hand, the Hispanic population has experienced essentially no reduction in its status dropout rate over this same period. Our analysis of this phenomenon suggests that the Hispanic dropout rate over the past two decades has been heavily influenced by immigration. We believe that roughly 50% of the reported Hispanic status dropouts are first-generation immigrants, the majority of whom have never enrolled in school in the United States. In essence, many of the reported dropouts came to the U.S. as dropouts and entered the workforce.

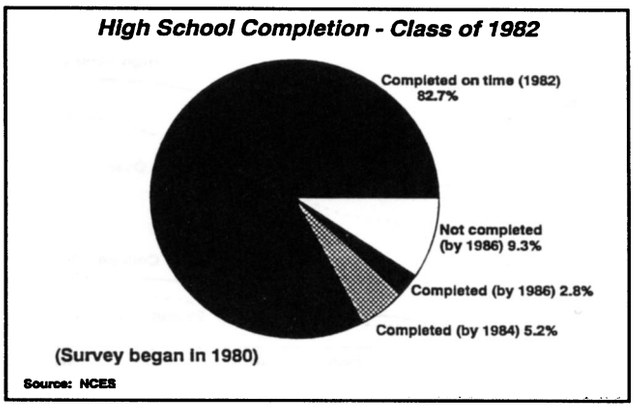
The educational needs of immigrants cannot be ignored. However, we believe it is misleading to count adult immigrants as dropouts from the U.S. education system if they never attended a U.S. school. We believe that the trend line for the status dropout rate for native-born Hispanics closely follows the trend line for Blacks, whereas the trend line for immigrant Hispanics is steady at over 70%. The impact of immigration on the U.S. education system is covered in more detail in a later section.

U.S. Dropout Rates (1988 - Status)

	Rural	Central City	Suburban	Total	Trend ***
Total	13.7	20.6	11.1	14.6	Declining
White	13.1	20.5	11.8	14.3	Declining
Blacks	17.8	23.0	6.8	17.9	Declining
Hispanics	33.3	36.1	23.7	31.2	No Change

*** 5, 10, 15, & 20 year trends.

Source: NCES

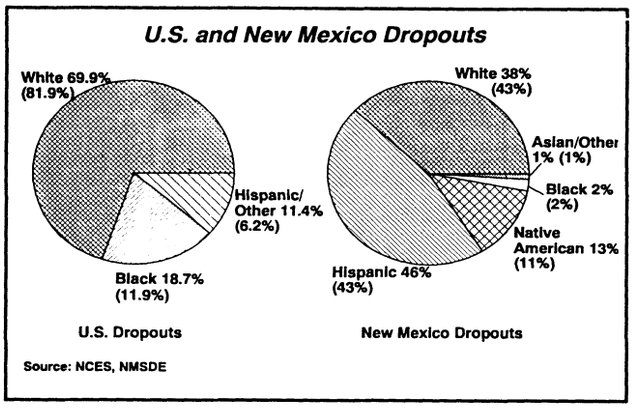


Shown here are the 1988 status dropout rates by ethnicity and community types. (Again, direct comparisons with previously shown data are difficult owing to the differences in age groups.) It is notable that the reported status dropout rate for Hispanics is much higher than the White and Black rates. Additionally, students in inner city schools, regardless of race, tend to drop out at a higher rate than students in other community types.

The most encouraging data on the chart are the trends. Dropout rates are declining for all ethnicities and community types with the exception of Hispanics. As indicated previously, this may not be as disturbing as it appears. Recent research indicates that the U.S.-born Hispanic dropout rate is likely to be about the same as the Black dropout rate. Perhaps as many as half of all Hispanic dropouts are immigrants.

As we mentioned at the beginning of this section, the cohort, or longitudinal, dropout rate is perhaps the most revealing dropout statistic. Because it tracks a specific group of students, factors such as immigration and repeat dropouts, which can inflate event and status dropout statistics, have little influence. Unfortunately, cohort dropout rates are nearly impossible to compute at district and even state levels due to student mobility and inadequate database capabilities.

This chart shows the cohort dropout rate from a national sample of the class of 1982. Conducted by NCES, the survey started in 1980, when these students were sophomores. As can be seen, nearly 83% of the sample completed high school on time and an additional 8% did so by 1986, either by graduating late or through the GED program. Thus, within four years of their scheduled graduation date, over 90% of this cohort group completed their high school studies.



Dropout/Retention Rates

Perspectives:

- The U.S. on-time high school completion rate has been steady for over 20 years.
- The percentage of young adults with a high school diploma or GED is approaching 90%.
- The "fine structure" indicates that the most significant dropout problems are among disadvantaged urban and rural students.
- Immigration may mask the true dropout rate picture.

Although the previous charts are good indicators of national dropout trends, we found that each state and school district has a unique dropout story.

This chart compares the dropout statistics for the U.S. and the State of New Mexico. The number next to a group is the percentage of all dropouts coming from that segment of the population. The numbers in parentheses are the relative representations of each group in the population. Given New Mexico's unique demographics, it is not surprising that the New Mexico dropout situation is quite different from that of the nation as a whole. The following table presents the ratio of dropouts relative to their representation in the population, and makes one difference clear. The Hispanic dropout rate is much lower in New Mexico than in the United States in general. We believe this is because many Hispanic New Mexicans have roots in the community. They are not, as a rule, first-generation immigrants. The dropout experiences of Hispanics in New Mexico may be quite different from those of Hispanics in areas of high immigration.

Group Dropout Rate/Group Participation Rate

Race/Ethnicity	U.S.	New Mexico
White	0.85	0.88
Black	1.57	1.00
Hispanic	NA	1.07
Hispanic/Other	1.84	NA
Native American	NA	1.18

Consistent in both sets of data is the overrepresentation in the dropout pool of racial/ethnic groups that are clearly in the minority of a specific population. This appears to be true whether one considers Native Americans in New Mexico or Blacks and Hispanics in the United States.

Our investigation shows that America's "on-time" high school graduation rate has been steady for over 20 years, at roughly 75% to 80%. However, some students require more than four years to complete high school, and many dropouts avail themselves of opportunities to re-enter (GED, night school, etc.) resulting in an overall high school completion for young adults of over 85%.

Merely reporting gross national numbers, however, can mask underlying problems. The "fine structure" indicates that the most significant dropout problems are among minority youth and students in urban schools. Nearly 80% of White students complete high school "on time," and about 88% do so by age 25.

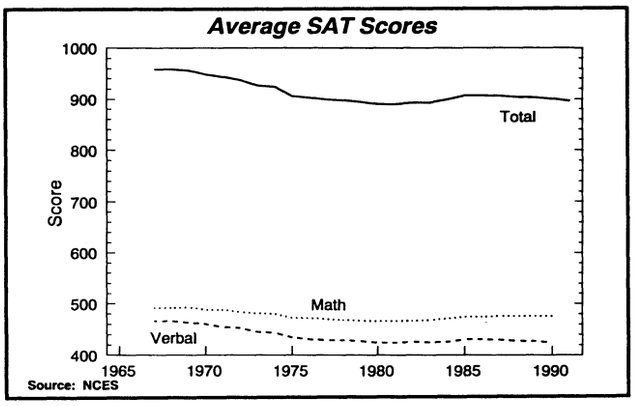
Minorities do not fare as well. Only 70% of Black students and 50% of Hispanic students graduate "on time." By age 25, about 82% of Blacks complete high school (only 6% less than Whites), but only 60% of Hispanics do so. National dropout statistics indicate that urban students and those from a low socioeconomic status, regardless of race, drop out at very high rates.

Finally, we believe that the recent immigration of youth who do not have the background to succeed in our high schools is inflating dropout statistics for the Hispanic population. Further analysis of this phenomenon is essential in order to properly understand the educational needs of this growing population.

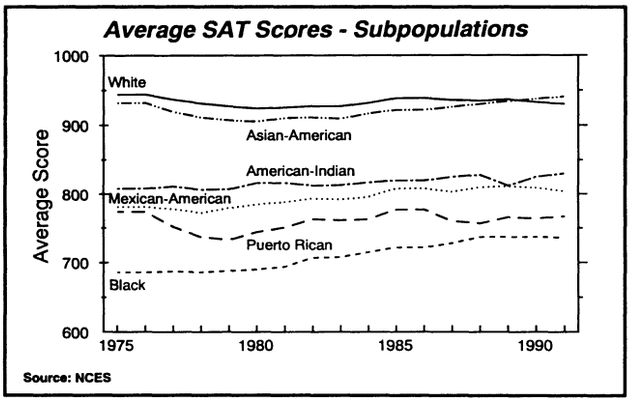
Standardized Tests

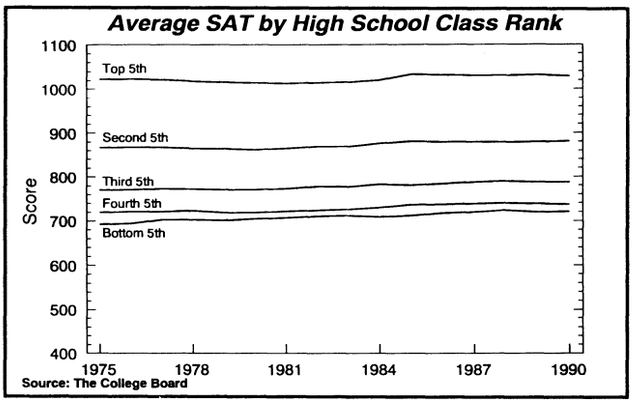
In this section, we look at those data that describe the performance of students on standardized tests. This is done in an attempt to gauge the quality of the education that is received by those students that the system retains.

Sandia National Laboratories



One measure of educational performance receiving much attention is the average score on the Scholastic Aptitude Test (SAT). This chart shows that the average SAT scores have declined (about 5%) over the past 20 years. We learned, however, that this decline in average scores does not mean that today's high school students are not as capable as their counterparts in the 1960s. This is explored in the next four charts.



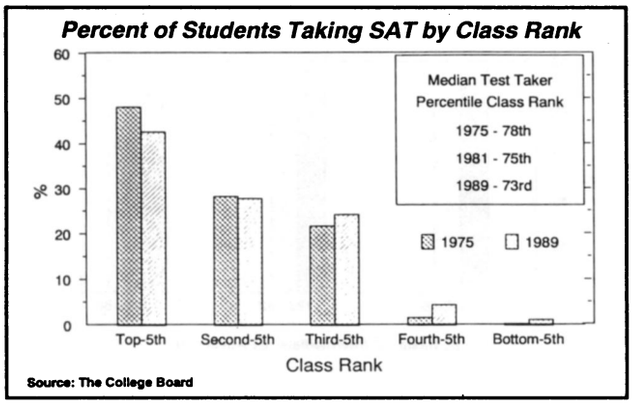


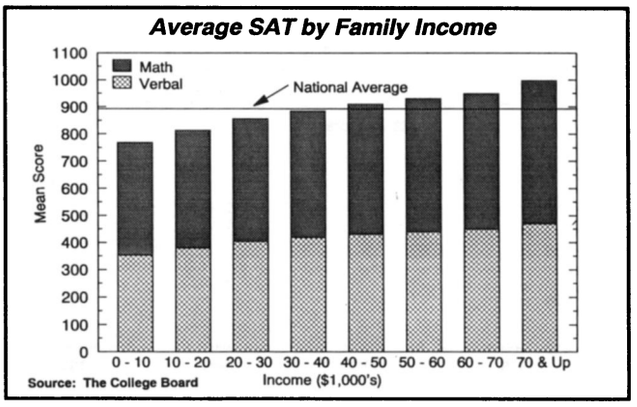
Following the declines in the 1970s by some groups, every minority subpopulation taking the SAT has shown general improvement in its average score during the 1980s while White scores have remained relatively stable.

White and Asian students continue to outperform other students; however, the performance gap is slowly closing. These data are available only in the years since 1975. Unfortunately, we could not track this trend before that time.

This chart raises an interesting question. If every ethnic or racial population has maintained or generally improved its average SAT score in recent years, how can their combined average score decline during that same interval? This phenomenon is explored in the next three charts.

This chart shows the average score on the SAT by self-identified high school rank. The scores of students in each rank category have remained steady from at least 1975. Data for scores by class rank are not available before that time. Given this consistency in scores by class rank, the logical explanation for a decline in the combined average score is that the demographics of the students taking the exam has changed. This is, in fact, true and is clearly shown on the next chart.





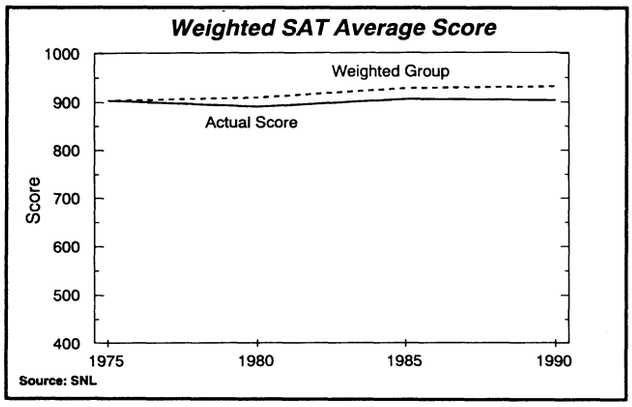
The data on this bar chart illustrate that proportionately fewer students taking the SAT in recent years have been in the top 20% of their class than was true 15 years ago. Students in the next 20% make up the same proportion of test takers as in the past; however, students in the lower 60% of their class comprise a much larger percentage of the test takers than at any time in the past.

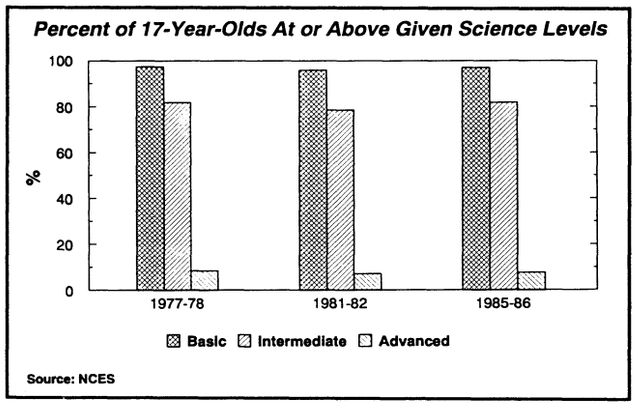
One result of this gradual shift in the composition of the test takers is shown in the box. The median class rank of SAT test takers in 1971 was in the 79th percentile (or top 21% of the class). In 1989, the median class rank was in the 73rd percentile. The drop in average SAT scores during this interval is due to this shift.

The drop from 79th to 73rd percentile for the median test takers is not trivial. The median being the 79th percentile would be achieved if the entire top 42% of a class took the exam. To lower the median rank to the 73rd percentile, the portion of the class between the 58th and 46th percentiles would have to be added to the group taking the test. It would be surprising if this change did not lower average test results.

The data in this chart illustrate another factor that highly correlates with average SAT scores: family income. On the 1991 SAT there was a strong positive correlation (R-square $|m = 0.98$) between average student score and reported family income. On average, students from families earning less than $40,000 a year scored below the national average of 896, whereas those students whose families earn more than $40,000 scored above the national average. In 1991, 16% of all graduates who took the SAT came from families with annual incomes of less than $20,000, but 41% of Puerto Rican, 38% of Black, and 36% of Mexican American and Other Hispanic test takers came from such families.

Another demographic factor correlated with the declining national average Verbal score is the increasing percentage of test takers who are non-U.S. citizens or who report that English is not their primary language. In 1991, 8% of the test takers indicated they were non-U.S. citizens (up from 5% in 1987), and 8% indicated English was not their primary language (up from 5% in 1987). Finally, although 92% of all SAT takers were U.S. citizens in 1991, this percentage included only 56% of Asian American and 65% of Other Hispanic test takers, two rapidly growing populations.





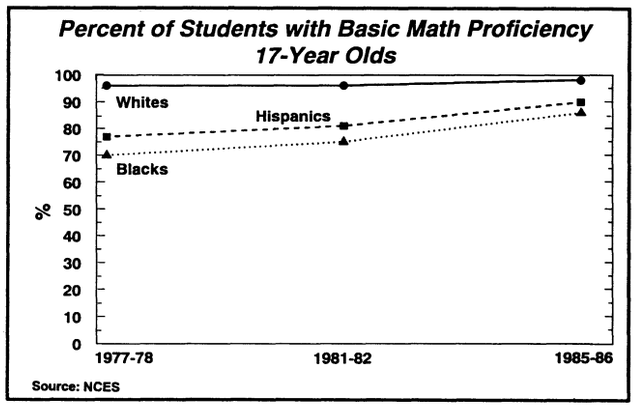
This chart illustrates improved performance on the SAT over the past 15 years. The solid line shows the performance of the students who actually took the exam each year. In contrast, the dashed line represents the year-by-year performance if the actual SAT scores obtained are weighted so that the population of students taking the test is adjusted to match the gender and class rank profile of the 1975 test takers. This illustrates again that average SAT scores are declining because a more diverse group of test takers is being added to the traditional* pool of test takers.

The dashed line indicates that the average performance of "traditional" test takers on the SAT has actually improved over 30 points since 1975. However, we hasten to point out that this apparent improvement may be as misleading as the apparent decline mentioned in previous charts. The improved scores of "traditional" students may be due to improved test preparation or other non-aptitude factors. Thus, the issue of student performance on the SAT is far too complex to be discussed in terms of decline or improvements in average scores.

* For this chart we define traditional SAT test takers as those who have the same gender and class rank mix as the 1975 group.

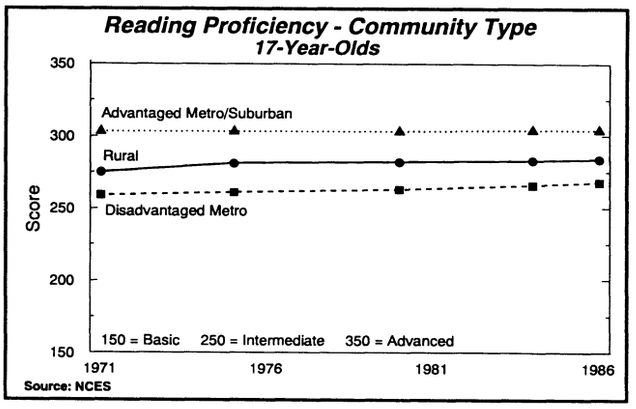
A widely used and important indicator of educational progress and achievement is the National Assessment of Educational Progress (NAEP). The NAEP exams are given nationwide on a two-year cycle to 9-, 13-, and 17-year-olds. These exams are given in six broad subject areas: mathematics, science, reading, writing, geography, and computer skills. This chart shows the fraction of 17-year-olds scoring at or above given competency levels in science. The trends shown here are consistent with the results of exams in other subject-matter areas. The fraction of students scoring at or above a given level has generally remained steady or has increased for all age groups and subject areas.

Although the gains have been modest at best, the national data on student performance do not indicate significant declines in any area. However, we are not implying that these performance levels are adequate for today's or tomorrow's society, or that these levels are comparable to those of students in other countries. These issues are addressed in later sections of this report. These data merely show that, according to the NAEP assessments, student performance is not in decline.



This chart shows basic math proficiency for 17-year-olds by race. Note the steady improvement by Blacks and Hispanics and the slight improvement by Whites.

When viewed in conjunction with declining dropout rates, this chart indicates that a large percentage of minority youth are staying in school and are achieving higher scores than their predecessors. We see this as a result of the education system's focus on two primary issues since the mid-sixties: increased access and improved basic skills. However, these data reinforce the dropout findings, indicating that the performance of racial/ethnic minorities continues to lag behind the performance of Whites.



This chart shows the average reading proficiency for 17-year-olds by community types. Students in each community type have shown steady-to-improving performance over the past 20 years. As with the previous chart, large differences in performance are seen among the different groups.

This chart reinforces the previous two, showing that there have not been recent declines in performance on skills tests. If anything, today's students are performing better than previous students.

Standardized Tests

Perspectives:

- **Declining average SAT results underscore that a more diverse mix of students is taking the test.**
- **Performance on standardized tests is steady or improving.**
- **Average performance of minority and urban students remains low despite improvements over the past 20 years.**

Our investigation of the SAT data revealed that the much publicized "decline" in average SAT scores misrepresents the true story about student SAT performance. Although it is true that the average SAT score has been declining since the sixties, the reason for the decline is not decreasing student performance. We found that the decline arises from the fact that more students in the bottom half of the class are taking the SAT today than in years past. Since 1971, the median test taker has dropped from the 79th percentile in class rank to the 73rd percentile. More people in America are aspiring to achieve a college education than ever before, so the national SAT average is lowered as more students in the 3rd and 4th quartiles of their high school classes take the test. This phenomenon, known as Simpson's paradox, shows that an average can change in a direction opposite from all subgroups if the proportion of the total represented by the subgroups changes.

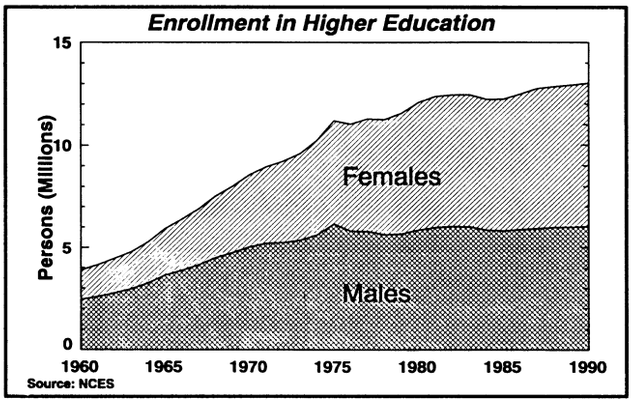
Our investigation of the NAEP data revealed that performance has been steady or improving in nearly all subject areas tested, and that the greatest gains have been made in basic skills. Furthermore, these gains have not been at the expense of advanced skills.

However, as in the dropout data, analysis of the "fine structure" indicates that minority youth continue to lag far behind their White peers on the standardized tests. For example, despite a 50-point improvement over the past decade in average SAT score, Black students still average nearly 200 points lower than Whites. Similarly, Hispanic and Native American scores lag behind White scores by more than 100 points. This disparity may be better correlated with the school setting or family variables than with race or ethnicity. Disadvantaged urban and rural students, regardless of race or ethnicity, score significantly lower on standardized tests than their suburban peers.

College and University Data

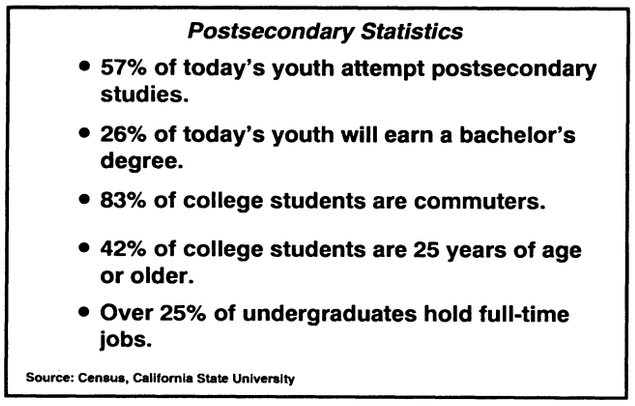
In this section, we consider some of the data that describe the U.S. system as it applies to postsecondary education.

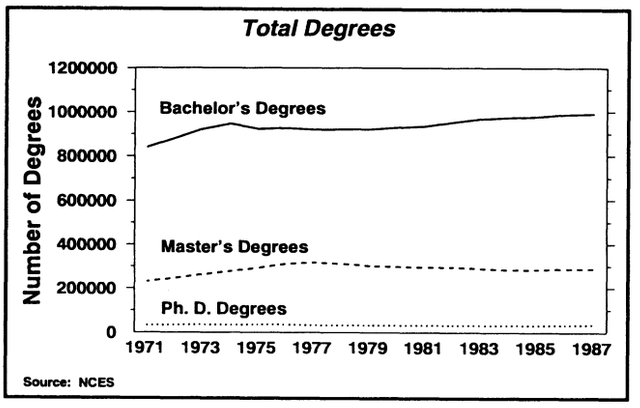
Sandia National Laboratories



This chart shows the number of students in the United States enrolled in institutions of higher education. Since 1965, the total number of college students has more than doubled, from about 5 million to about 13 million. Since the late 1970s, more women than men have been enrolled in college. By comparison, only about one in five Japanese college students is female.

Note that male participation has not increased substantially since the mid-seventies. Women, on the other hand, have enrolled in steadily increasing numbers to the point where, in recent years, more bachelor degrees have been awarded to women than to men. If these trends continue, by 1995 more master's degrees will be awarded to women, and by year 2000 more Ph.D.s will go to women than to men.

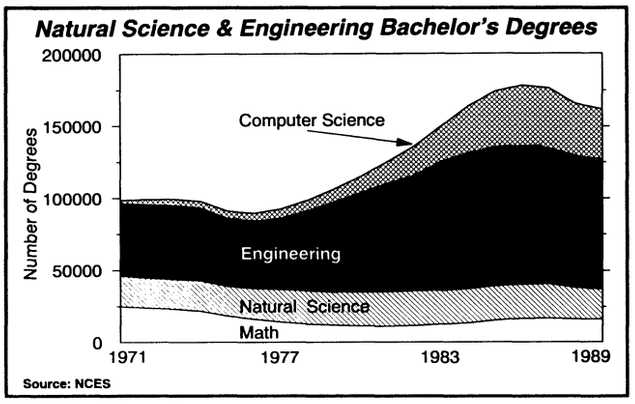


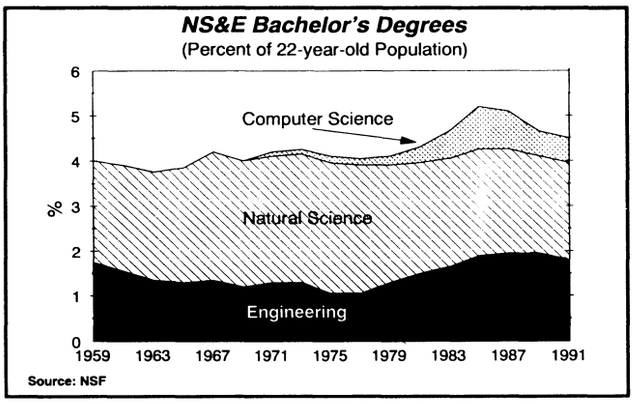


This chart summarizes some important statistics about postsecondary students. About three in five U.S. youths attempt postsecondary studies. This is roughly the high school graduation rate of the early 1950s. Moreover, this rate is about twice that of Japanese students attempting postsecondary studies. About two-thirds of those students undertaking postsecondary studies start in a four-year degree program. The other one-third enter vocational or other accredited programs.

Current data indicate that almost half of the students who attempt some level of college studies will earn a bachelor's degree. In other words, more than one in four of our current 18-year-olds will earn at least a bachelor's degree, and this proportion is increasing. About 83% of today's college students are commuters, who spend little time on campus outside of the classroom. Nearly half (42%) are beyond the "traditional" age of college students. This is due partly to the fact that over half of all undergraduates work more than 20 hours per week and one in four works full-time. These data show that, for many students, college is largely a part-time experience.

This chart shows the number of degrees granted each year since 1971. The number of bachelor's degrees has increased almost 20%, to a total each year of approximately one million. The number of master's degrees has increased by over 25% over this period, to almost 300 thousand per year. The decrease in master's degrees since the late 1970s is largely due to the decline, by about 40%, in the number of master's degrees granted to education majors. The number of Ph.D.s granted each year has remained steady at 32 to 34 thousand per year.





This chart shows the number of math, computer science, engineering, and physical science bachelor's degrees granted over the past 20 years. The cumulative number of degrees for these areas is also shown. These data show the number of engineering and computer science degrees increasing dramatically over this period of time-by factors of 2 and 15, respectively. The number of physical science degrees has remained steady. The number of mathematics degrees has decreased about 40% over this same period of time. The cumulative number of degrees in these areas has increased by about 75%.

Although not shown on this particular chart, trends in Ph.D.s in these areas are also interesting. After experiencing significant declines in the mid- to late-1970s, both engineering and physical science Ph.D.s are increasing. Engineering Ph.D.s are at or near an all-time high. Physical science Ph.D.s are within a few percent of an all-time high. We discuss trends in advanced degrees, including the foreign contributions, later in this section.

This chart, from a National Science Foundation report, shows that the percentage of 22-year-olds obtaining NS&E bachelor's degrees was rather stable from 1960 to 1980, at nearly 4%.

Interestingly, the 1980s data indicate that youth today are choosing NS&E degrees at a higher rate than their peers in the 1960s. The dropoff in percentage since 1985 has resulted primarily from a decline in computer science degrees. Engineering and natural science rates remained relatively stable during this interval.

Math, Computer Sci, Natural Sci, and Engineering

Bachelor's Degrees by Race and Gender (1977-1987)

Subgroup	1977		1987	
White (Non-Hisp)	80,599	(91%)	130,965	(84%)
Black (Non-Hisp)	3,150	(4%)	7,897	(5%)
Asian	2,067	(2%)	10,761	(7%)
Native American	244	(<1%)	519	(<1%)
Hispanic	2,209	(2%)	5,468	(4%)
Total	88,269	(100%)	155,610	(100%)
All Males *	69,162	(84%)	117,511	(75%)
All Females *	13,260	(16%)	39,995	(25%)

* (1976 vs 1986 data)

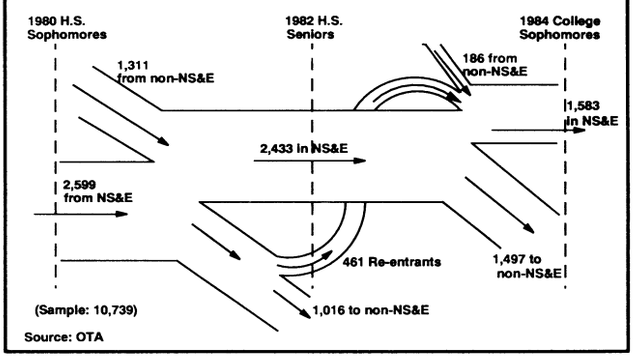
Source: NSF

This chart shows the breakdown of technical degrees by race and gender. From 1977 to 1987, the total number of bachelor's degrees awarded to U.S. citizens in math, computer science, physical science, and engineering rose over 75%, from roughly 90,000 degrees in 1977 to over 155,000 degrees in 1987. Although the White, non-Hispanic contribution to this total is by far the largest, this group's dominance is declining as more minority students pursue technical fields. During this interval, the number of degrees awarded to Whites rose 62%, but their overall contribution declined from 91% of all degrees in 1977 to 84% in 1987.

The largest gain was among the Asian-American subpopulation as their contribution rose from 2% to 7% in just ten years. Blacks and Hispanics were awarded both a larger number and larger percentage of these degrees during this interval, but these groups are significantly underrepresented compared to their total representation in the workforce. Native Americans continue to make up a very small proportion of the degree recipients in these fields.

During the ten-year interval from 1976 to 1986, the number of males receiving bachelor's degrees in these fields rose 70%, to over 117,000. During this same period, female degree recipients rose over 200%, to an annual rate of nearly 40,000 degrees. This rise has resulted in women accounting for 25% of bachelor's degrees in these fields in 1986, up from 16% in 1976. Despite this rise, women still lag behind their male peers in technical degree attainment.

Natural Science and Engineering (NS&E) "Pipeline"



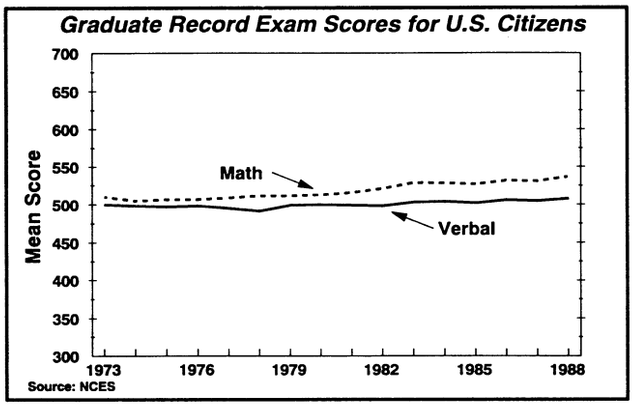
Source: OTA

Much concern is expressed about the numbers of students in the technical "pipeline." This chart depicts the nature of that pipeline. It is derived from an Office of Technology Assessment (OTA) analysis of the U.S. Department of Education longitudinal study of the 1980 high school sophomore class.

In 1980, about one in four high school sophomores surveyed (2,599 out of 10,739) was interested in a career in natural science or engineering (NS&E). The fields of study included life and health sciences, engineering, computer sciences, physical sciences, and mathematics.

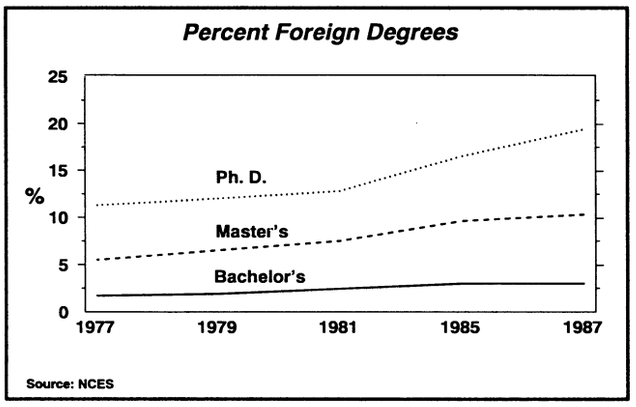
Two years later, as high school seniors, roughly the same *number* (2,433) of students remained interested in pursuing science and engineering careers. However, this senior group included only 1122 (43%) of the original sophomore group expressing interest. The remaining 1311 interested seniors were from the group that stated they were not interested as sophomores.

By the sophomore year in college, the group interested in NS&E had decreased to about 15% of the total; however, this 15% was not merely the remnant of those who had previously expressed interest. In fact, only about one in five of those with continuing interest in science and engineering had expressed that interest at all three points in the survey. Even more striking is that about one in four of the college sophomores enrolled in NS&E fields had pursued noncollege-bound (vocational or general) courses of study in high school. Thus, the NS&E pipeline is quite permeable and not restricted to high school students in the college-bound track. It contains a fair number of latecomers and re-entrants.

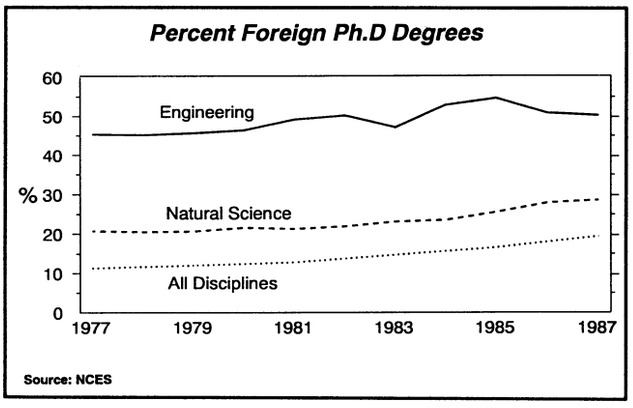


This chart shows the math and verbal scores of Graduate Record Exam (GRE) test takers since 1973 (although total GRE scores are available before 1973, NCES reports the separate scores only since 1973). Like the SAT, GRE test takers are a self-selected group of students who contemplate continuing their education, in this case to graduate school. Thus, GRE results are not a good indicator of average abilities of all college students. If the demographic makeup of the test takers is stable from year to year, however, GRE trends can be used to roughly compare the overall academic skills or "quality" of test takers from year to year.

Since 1973, the percentage of college graduates taking the GRE each year has been stable at approximately 31%. The average verbal score of the roughly 300,000 U.S. students taking the test has been stable at 500. The average math score, however, has risen 32 points since 1974. These data underscore the previous chart from NSF, which showed that today's students are pursuing technical degrees at a higher rate than ever before, and dispute the claim that the academic "quality" of college graduates, more specifically the one-third electing to take the GRE, has declined over the past two decades.

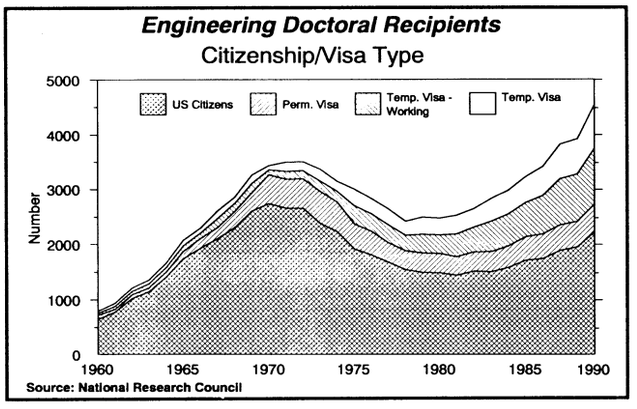


This chart shows the foreign share of all degrees granted by U.S. universities. For bachelor's degrees, the foreign share has increased slightly, up to about 3% from about 2.5%, over the past decade. The foreign share of master's degrees has increased from about 5% to about 10% over the same period of time. The foreign share of Ph.D.s has increased from about 12% to about 18% over the past decade. We look more closely at the Ph.D. data in the next chart.



This chart shows the foreign share of Ph.D.s over the past decade. The foreign share of engineering Ph.D.s has increased from 45% to 50%. The foreign share of Ph.D.s in the physical sciences has increased even more dramatically, from 20% to 28%. In some fields of study, such as physics, the foreign share of Ph.D.s is over 50%.

The increases in math, science, and engineering Ph.D.s that have occurred over the past few years have resulted in part from an increase in the foreign share of Ph.D.s. The number of undergraduate degrees awarded to U.S. students in these fields indicates that this is not a result of a declining pool of capable U.S. students. Recall from previous charts that the number of bachelor's degrees awarded to U.S. students in these fields rose nearly 75% during the 1980s.



This chart relates the number of engineering doctoral degrees to student citizenship and visa type. Consistent with the previous chart, it shows that half of the U.S. engineering doctoral degrees are currently being granted to foreign students. However, nearly three-quarters of these students have permanent visas or work in the United States following their graduate studies. Thus, both the number of foreign students enrolled in U.S. universities and the number remaining after their studies are growing.

The number of U.S. students receiving doctoral degrees is increasing and is approaching the all-time high recorded in the early 1970s.

College and University

Perspectives:

- **Entrance and completion rates are increasing for traditional students.**
- **The college population is increasingly more diverse: age, gender, race/ethnicity ...**
- **The supply of U.S. graduates with technical bachelor's degrees generally increased during the 1980s.**
- **The technical degree attainment for females and racial/ethnic minorities remains considerably below that of White males.**

Nearly 60% of today's youth attempt postsecondary studies at accredited institutions in the U.S., and two-thirds of these (40% of all youth) enroll in four-year institutions. Eventually, one in four of today's youth will obtain at least a bachelor's degree, the highest rate in the world. These entrance and completion rates are increasing and are higher than at any other time in our history.

The number of women enrolled in college has been increasing steadily for 30 years, whereas male enrollment has remained constant. Female enrollment surpassed male enrollment in the mid-seventies. Moreover, college populations are aging as more people enroll in postsecondary studies later in life, and many students are pursuing their studies part-time. As a result, many universities are evolving from traditional residential four-year institutions to a more flexible environment that better meets the needs of today's population.

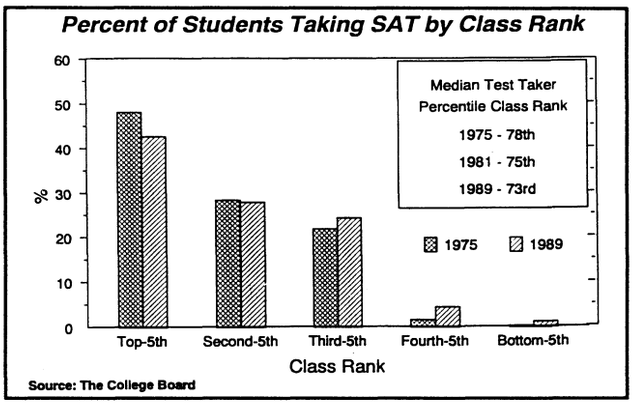
About 200,000 U.S. students earn technical bachelor's degrees each year, representing a fairly steady rate of 4–5% of U.S. youth getting degrees in natural science and engineering. The United States grants a large number of advanced technical degrees to non-U.S. citizens. Nearly 50% of engineering Ph.D.s and 25% of science Ph.D.s are awarded to non-U.S. citizens annually. Statistics show, however, that over half of these recipients remain in the United States.

Although the total number of technical degrees awarded to females and minority students is increasing, their participation continues to lag behind their White male peers.

Expenditures for Education

The previous three sections reviewed publicly available trend data on dropout rates, standardized test scores, and college and university participation of American youth. In general terms, most of the popular "outcome" indicators reveal that the U.S. education system is performing as well as or better than ever before. This is not to say that the system is performing in the most effective manner to meet current or future societal needs. The disaggregated data clearly indicate that portions of the education system, those serving disadvantaged students in particular, are experiencing serious difficulties.

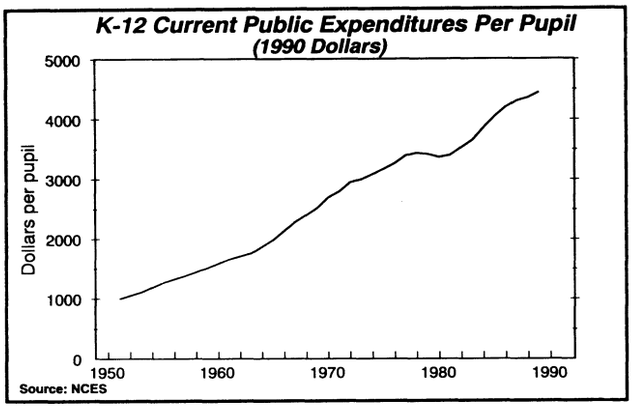
We now turn our attention to the area of school finance to investigate one of the major "inputs" into the education system.



The data on this bar chart illustrate that proportionately fewer students taking the SAT in recent years have been in the top 20% of their class than was true 15 years ago. Students in the next 20% make up the same proportion of test takers as in the past; however, students in the lower 60% of their class comprise a much larger percentage of the test takers than at any time in the past.

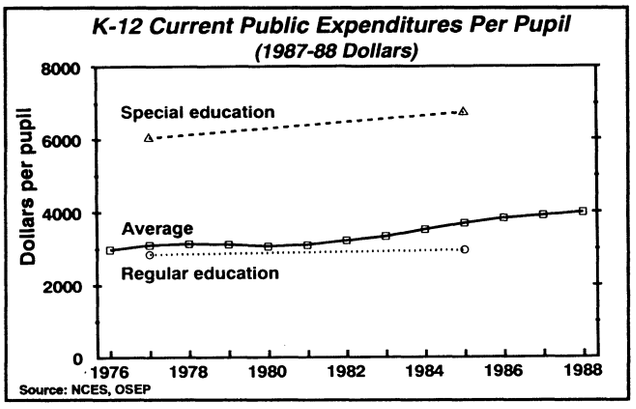
One result of this gradual shift in the composition of the test takers is shown in the box. The median class rank of SAT test takers in 1971 was in the 79th percentile (or top 21% of the class). In 1989, the median class rank was in the 73rd percentile. The drop in average SAT scores during this interval is due to this shift.

The drop from 79th to 73rd percentile for the median test takers is not trivial. The median being the 79th percentile would be achieved if the entire top 42% of a class took the exam. To lower the median rank to the 73rd percentile, the portion of the class between the 58th and 46th percentiles would have to be added to the group taking the test. It would be surprising if this change did not lower average test results.



This chart shows the increase in average per-pupil expenditures for elementary and secondary education over the past three decades in constant 1990 dollars. Total spending per pupil increased steadily from 1950 to 1977, with a slight decline of 2% from 1978 to 1981. After 1981, total per-pupil spending quickly recovered, resulting in an estimated overall increase of 30% for the decade. It is clear from this figure that the nation's funding commitment to the education of its children has risen over the past several years. Coupled with the "outcome" indicators in the previous section, it appears to many that the nation's increase in spending is resulting in flat, or slightly improving, performance.

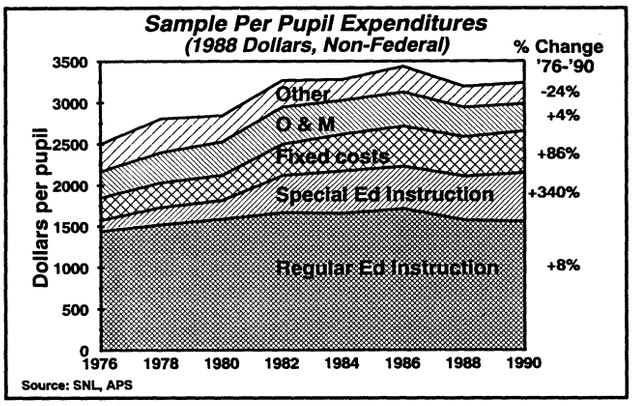
The next three charts explore this in greater detail. Once again, it is essential that the data be disaggregated in order to determine precisely where the country is increasing its investment in education, before making any judgments about the returns on this investment.



Since the late 1970s, the Education Department's Office of Special Education Programs (OSEP) has annually published per-pupil expenditures for students enrolled in special education programs throughout the country. However, since the majority of special education students do not receive these services full-time, it is difficult to accurately determine the true cost of special education. For the 1989 report, OSEP contracted Decision Resources Corporation (DRC) to conduct a survey of 1985 Special Education expenditures in 60 school districts in 18 states in order to determine the cost differential between regular and special education. In its report, DRC estimated that the average current expenditure per pupil enrolled exclusively in regular education was $2780. The average cost per pupil for students enrolled in special education programs amounted to $6335, $3555 per pupil more than regular education pupils. The estimated average cost per pupil for all students for that year was $3472.

A separate study conducted by the Rand Corporation provided a similar breakdown of educational funding in 1977. DRC's analysis of that report determined that the average per-pupil expenditures for regular and special education students were $1538 and $3264, respectively. When adjusted for inflation, the 1985 and 1977 data points reveal that the average per-pupil expenditures for regular education rose 4% during the eight-year period between 1977–78 and 1985–86, and those for special education students rose 10%. As can be seen in this chart, though average per-pupil current expenditures have risen since the mid-1970s, the investment in regular education has remained essentially constant.

In addition to rising costs for special education services, the average cost for all students is affected by the percentage of students receiving those services. According to the National Center for Education Statistics (NCES), the percentage of all students enrolled in special education programs has increased from 8.33% in 1976 to 11.10% in 1987. Thus, not only has the cost for special education increased over the past 15 years, the percentage of students receiving these services has grown as well.

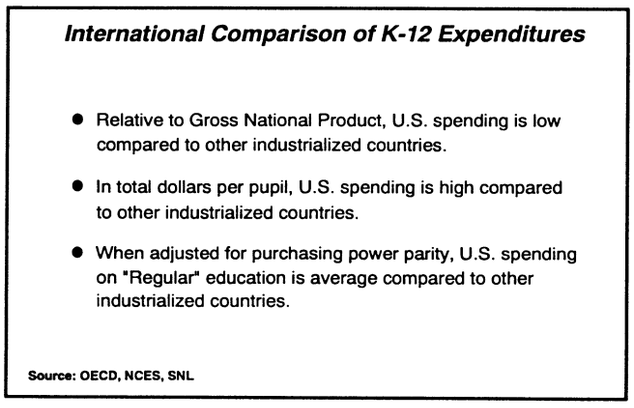


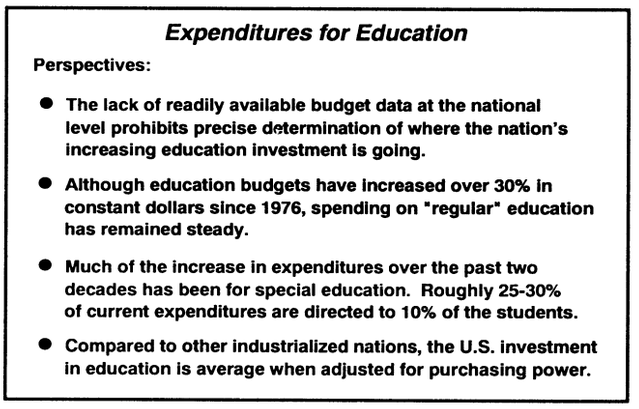
Disaggregating the available national data appears to indicate that two of the driving factors behind the growth in average per-pupil expenditures are the growth in the costs associated with special education and the increasing percentage of all students enrolled in these programs. However, it is difficult to make such assertions based on the sparse data available at this level. Although we made repeated attempts to gather more robust data from OSEP, the Congressional Research Service, and the Senate Budget Committee, staff members of these organizations indicated that such data were simply not available. To obtain a better indication of the actual trends in educational funding, we turned to a local school district. The Albuquerque Public Schools (APS) district is one of the largest districts in the nation, with nearly 90,000 students and a current annual budget of over $320,000,000. APS is acknowledged as having one of the most comprehensive special education programs in the nation. Roughly 17% of all APS students are enrolled in special education programs, including gifted and preschool programs.

The chart shows our estimates of the per-pupil current expenditures for APS, from 1976 to 1990 in constant 1988 dollars. Similar to the increase reported on the national level, the total per-pupil current expenditures for APS increased approximately 30%, from roughly $2500 per pupil in 1976 to over $3200 per pupil in 1990 when adjusted for inflation. However, unlike the sparse national data, this district data can be disaggregated to determine where the increases have gone. During this 15-year interval, per-pupil funding for regular education instruction increased 8% overall, but actually declined in the latter part of the 1980s. Over the same time period, funding for special education increased dramatically in the district with the 1990 figure nearly 3.5 times larger than in 1976. Additionally, fixed costs rose significantly in recent years. The rise in these costs has been dominated by increases in the retirement fund, social security taxes, and insurance. Operations and Maintenance (O&M) costs remained relatively steady during the interval whereas Other* costs declined. Although one cannot say with absolute certainty that these local data are indicative of national trends in educational funding, our discussions with special education professionals and Education Department officials have indicated that the expenditure trends for APS are not atypical for large districts. Additionally, the relatively small increase in regular education instruction and the growing costs of special education appear to agree with the DRC study of national data.

Based on the method one uses to calculate per-pupil special education funding, the average cost of educating a special education student is between 2.5 and 7 times greater than the average cost of educating a student in the regular education program. The lower figure, 2.5, results from determining special education on a per-pupil basis. However, since the majority of special education students do not receive these services full-time, this accounting underestimates the true cost per pupil. If student participation is measured on a full-time equivalent (FTE) basis (e.g., one FTE = 6 student hours of instruction), the expenditures are quite different. Estimating costs in this way results in costs that are roughly 7 times greater for special education students when compared to their regular education peers.

*The "Other" category is a combination of transportation, administration, noninstructional student services, community service, and other minor budget categories.





One final issue concerning educational funding has received much national attention. This is the comparison of funding levels among industrialized nations. This chart summarizes U.S. expenditures for elementary and secondary education compared to other industrialized countries. As a percentage of GNP, U.S. spending is relatively low however, given the size of our GNP, it is reasonable to expect some economies of scale resulting in lower average costs. In total expenditures per pupil, U.S. spending is high. Only Switzerland spends more, and Sweden spends roughly the same. This measure is also inadequate because of the relatively high proportion of U.S. special education expenditures. Many countries do not include as part of their education spending much of what the U.S. includes in special education. Thus, a more appropriate measure is the expenditure for "regular" K–12 education adjusted for purchasing power. Using this measure, the United States is an average spender for education.

Perhaps an appropriate measure for comparing educational expenditures is to compare our expenditures with those of Japan. The measure we use here is expenditure per pupil (including special education) divided by per-capita income:

Average Per-Pupil Expenditure/Average Per-Capita Income (1986)

Level	U.S.	Japan
K–12	0.27	0.40
12+–Ph.D.	0.62	0.70
K–Ph.D.	0.34	0.45

Thus, even though our expenditures are significant, the U.S. actually spends a lower portion of its income on education than does Japan.

Our investigation of local and national educational expenditure data has led us to the following perspectives.

The lack of readily available data at the national level prohibits one from precisely determining where the nation is increasing its investment in education. When compared to other industrialized nations, the relative ranking of the United States is highly dependent on the measure chosen. We believe that the most appropriate measure is total elementary and secondary expenditures on regular education. By this measure, which we believe "levels the playing field" best, the United States is an average spender when compared to other industrialized countries.

Although education budgets since 1976 have increased over 30% in constant dollars, spending on regular education instruction has remained steady.

Much of the increase in expenditures over the past two decades has been for special education services. We estimate that 25–35% of all elementary and secondary expenditures are directed toward the education (regular and special) of roughly 10% of all students.

At this point, we want to emphasize that the purpose of this discussion of regular and special education should in no way be interpreted as an indication that we believe special education is overfunded. This analysis of educational funding data has not led us to a conclusion as to the value of the nation's "return" on its widely recognized growing investment in special education. This is partly because the nation may be improperly accounting for the investment. For example, as the schools accept the responsibility for the education and care of severely handicapped children, hospital care for those students may be reduced. Although a state's education budget may be increasing for special education students, some of this increase may be offset by reductions in other state agencies.

International Comparisons

Another area receiving extensive media coverage is the comparison of U.S. students with students from other nations. A weakness of such comparisons is that by necessity, they must utilize single-point estimates of educational attainment. For example, they measure student capabilities at one age or in one academic area. Education is a complicated process; and it is difficult to decide whether attainment at age 13, age 17, age 22, or in adulthood is most important. It is even harder to decide how to measure that attainment.

In this section, we discuss common measures used to compare the education systems of different nations.

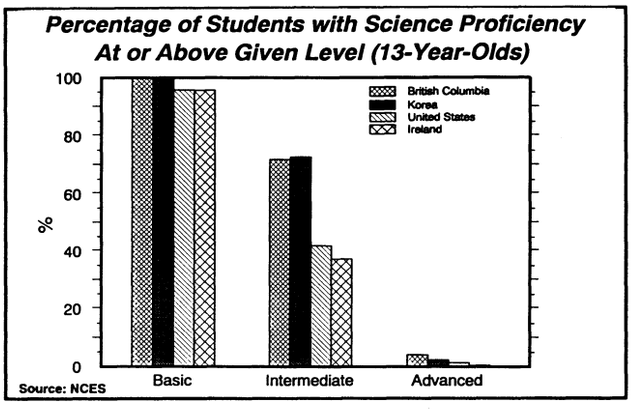
International Comparisons
Average Proficiency - Age 13

	Category	US Ranking (out of 12) *
• Math	1) Numbers & Operations	12
	2) Relations & Functions	12
	3) Geometry	11
	4) Measurement	12
	5) Data Organization	9
	6) Logic	11
• Science	Category	US Ranking (out of 12) *
	1) Life Sciences	9
	2) Physics	12
	3) Chemistry	10
	4) Earth, Space	9
	5) Scientific Methods	11

* (US, UK, Spain, Ireland, Korea, 7 Canadian Groups)
Source: NCES

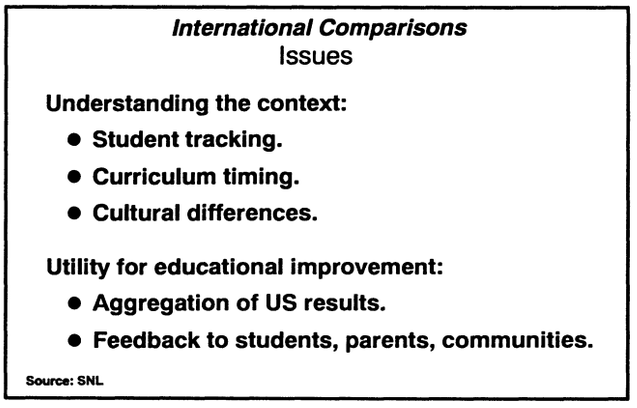
This chart shows the relative ranking of the U.S. on the 1988 International Assessment of Educational Progress (IAEP) test. This test was given to 13-year-olds in Korea, Spain, the United Kingdom, Ireland, the United States, and Canada. Four Canadian provinces were tested. Three of these were broken into two sections each for a total of seven Canadian regions: Quebec-English- and French-speaking; New Brunswick-English-and French-speaking Ontario-English and French speaking; and British Columbia.

U.S. students did not perform well in any category in this series of tests. In fact, U.S. students ranked last in composite math scores and ninth in composite science scores. Both of these rankings put the U.S. students in the lowest performing group for each test.



This chart shows the percentage of students in selected groups scoring at or above given levels of science proficiency on the IAEP test, described in the previous chart. In average science proficiency, Korea and British Columbia were clearly the top performers; the United Kingdom, Quebec (English and French), Ontario (English), New Brunswick (English), and Spain formed a group somewhat below the top performers; and the United States, Ireland, Ontario (French), and New Brunswick (French) were in the lowest group of performers.

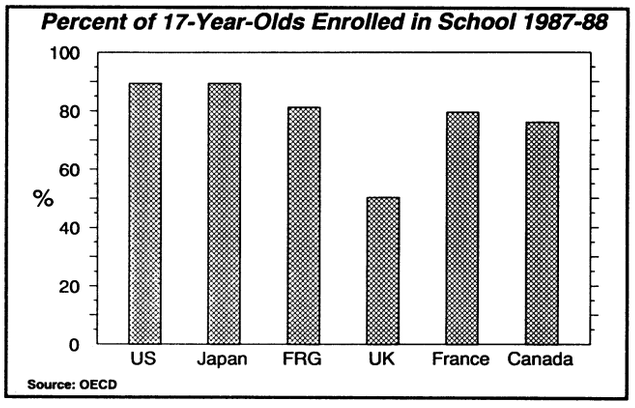
In average mathematics proficiency, Korea was the lone country in the top performing group. The United States and Ontario (French) were in the lowest performing group, with the other nine participants filling the middle-performance groups.



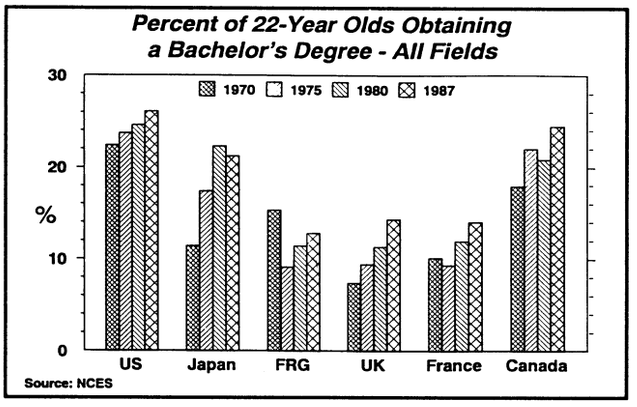
Many researchers have documented the difficulties of attempting to conduct fair international assessments of student capabilities. This chart addresses some of the major difficulties encountered by both test administrators and policy makers, who must make sense of the results.

Of prime importance is understanding the context of the testing situation, the student body taking the test, and the school and cultural environments. Student tracking is common in many countries. Unlike the U.S., these countries begin specialized education (college prep, voc-ed, etc.) as early as age 14. Often, students at this age take life-determining tests that specify their eventual position in the workforce, and this better prepares them to perform in a testing environment. Curriculum timing and content are essential issues since these international comparisons are single-point, rather than longitudinal, comparisons of students' knowledge levels. If geometry is on the test of 13-year-olds, a country such as the United States that routinely teaches geometry to 15-year-olds will be at a disadvantage. Finally, differences in cultures across nations can greatly affect student performance. Some cultures place great emphasis on exams in general and these comparisons in particular, whereas others may view them as unnecessary invasions into the classroom. These factors make it very difficult to ensure a level playing field.

Regardless of one's views about the ability to have a level playing field, the utility of these assessments to educational improvement in the United States is negligible. First, the highly aggregated, "national" results of IAEP-I provide little insight into the performance of particular subpopulations (Whites, Easterners, urban students, etc.). Thus, it is very difficult, even on the national level, to discuss the implications of the results. Second, the U.S. data, representing nearly 3 million students, were compared with data from subpopulations in Canada, such as French New Brunswick, representing only 3500 students. Albuquerque, New Mexico public schools have more 13-year-olds than some of the groups involved in IAEP-I. Finally, because these international assessments compare only data on a national level, virtually no feedback is provided to students, parents, or communities as to strengths and deficiencies of local programs.

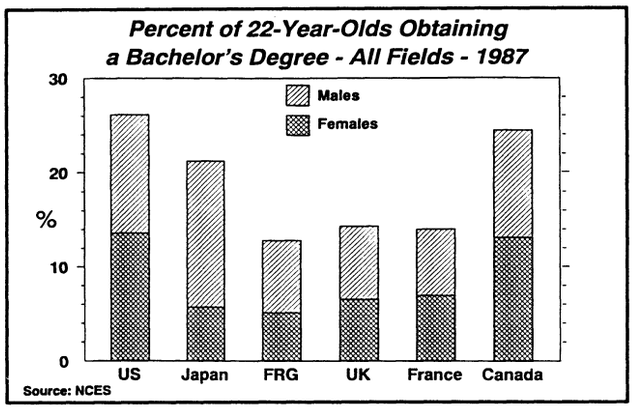


Because of the difficulty of making direct comparisons of vastly different education systems, very little data exist on the international level. The IAEP data on the previous charts, though weak, are probably the most robust. Other data do exist, however. This chart, obtained from an article in The Economist magazine, contains data from the Organization for Economic Cooperation and Development (OECD). The chart compares the percentage of 17-year-olds still enrolled in school in the United States with five other leading industrialized countries. According to OECD, only Japan matches the United States in this category. Of the eighteen countries in the report, only two—Belgium and Finland—have 17-year-old participation rates greater than that of the U.S. Their rates were slightly over 90%.

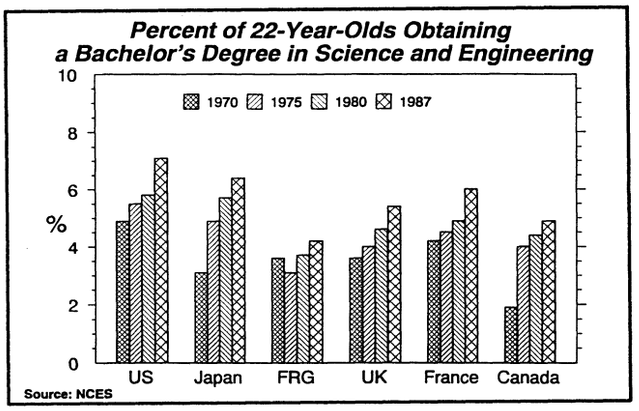


The next four charts display data about the degree attainment, both technical and nontechnical, of 22-year-olds in the United States and its major economic competitors.

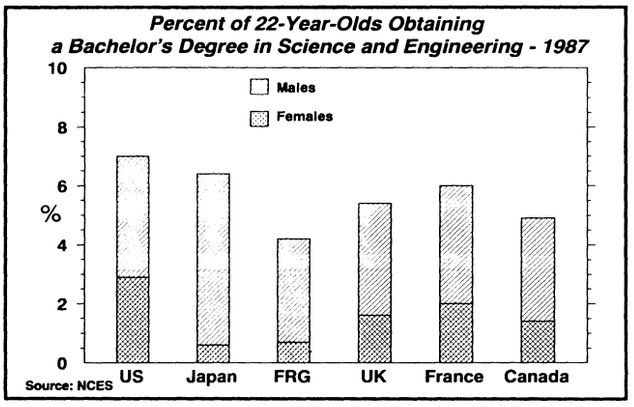
This chart shows the percentage of 22-year-olds in each country possessing a bachelor's degree. For the past 20 years the United States has had a higher percentage of its youth obtain a bachelor's degree than any other country. Canada comes in a close second to the U.S. After doubling its percentage during the 1970s, Japan has actually seen its percentage decline in recent years.



This chart shows the gender breakdown of the 1987 degree recipients for each country. Only Canada comes close to matching both the total percentage and gender ratio of the leading country, the United States. Although Japan grants the highest percentage of degrees to males, it has the least well-balanced male/female ratio of all the countries in the comparison. In Japan, only one in four college graduates is female.



Narrowing the focus to technical degrees in science and engineering yields the results in this chart. Again, the United States has consistently produced a higher percentage of technical degrees over the past 20 years. This chart complements the data shown in the previous section on College and University data. The 1980s saw a dramatic increase in percentage of U.S. youth completing technical studies. On the other hand, Japan's growth decelerated during the 1980s after rapid growth in the 1970s.



This chart shows the gender breakdown of the technical degree recipients. Not only does the United States produce the highest percentage of technical degrees, it also has the most balanced field of recipients. Again, the participation of women is lowest in Japan. Female participation drops from one in four for all fields to one in thirteen for technical fields.

Workforce Comparisons

	Engineers (*)	Ph. Sc. & Engr. In R & D (*)
USA	184	74
Japan	188	72
West Germany	182	57
UK	137	36
France	104	48

* Per 10,000 Workforce

Source: NSF, ASME

Perhaps the best comparison of education systems would be one that rates the education of school leavers in the respective systems, whether they be dropouts, high school graduates, or PhD.s. Because of obvious difficulties in administering such a comparative evaluation, we have opted to look at workforce comparisons as a way to compare systems of education.

This chart summarizes the U.S. technical workforce relative to the technical workforces in other countries. The first column displays the number of engineers employed per 10,000 workers. The U.S., Japan, and Germany clearly lead the world in utilizing engineers in the workplace. The second column displays each country's commitment to research and development in science and engineering. Here, Germany falls off, leaving only the United States and Japan to lead the world.

International Comparisons

Perspectives:

- **Average performance of U.S. students on international standardized tests remains low.**
- **Relative to other industrialized countries, U.S. technical and non-technical completion rates are unsurpassed at both undergraduate and graduate levels.**
- **Comparisons of technical workforces reflect well on U.S. education.**

We found little credible data on international comparisons of education. The most complete data are found in the International Assessment of Educational Progress (IAEP) report. Based on the sparse data available for international comparison over the past several decades, average U.S. student performance continues to be low in both math and science compared to other participants. The major differences in education systems and cultures across countries diminish the value of these single-point comparisons.

Other single-point international indicators of education system performance reflect well on the U.S. Only Belgium and Finland exceed the U.S. in the percentage of 17-year-olds enrolled in school. The United States continues to lead the world in the percentage of young people obtaining bachelor's degrees and in the percentage of degrees obtained by women and minorities. This is true for both technical and nontechnical degrees. The U.S. also has the most balanced male/female ratio for both technical and nontechnical degrees.

Our comparison of technical workforces reflected well on the U.S. education system. Although the United States lags behind other countries in certain specialties (such as industrial engineering), the overall technical and nontechnical degree attainment by the workforce and population as a whole is unparalleled in the world.

Status of Educators

This final section in our look at system performance covers one of the least quantitative areas we investigated. Yet, our conviction that it is important forces us to discuss it.

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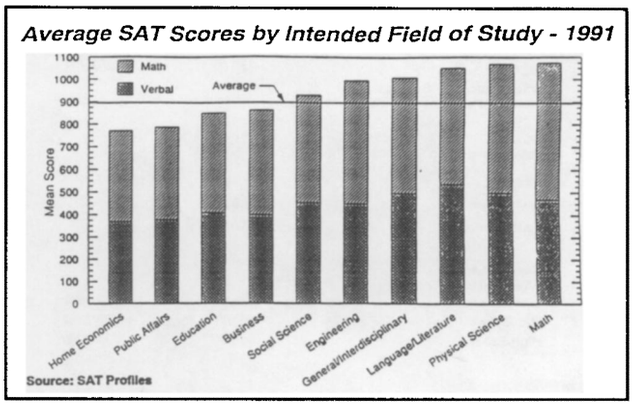
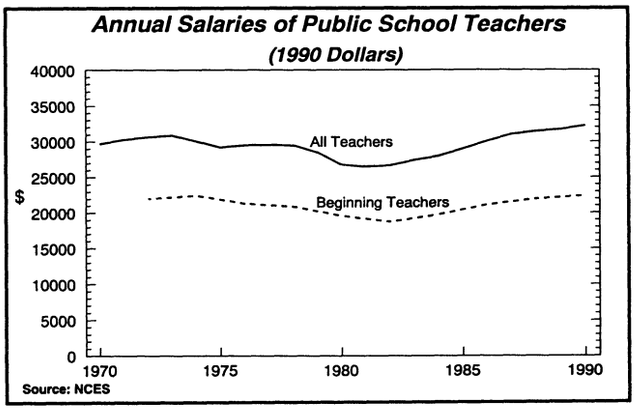


This chart shows the average SAT score relative to the test taker's intended field of study. The data are based on student surveys before taking the exam. A popular opinion today is that the United States must attract "good" students into science, math, and engineering. This chart clearly shows that these students (as measured by the SAT exam) intend to enter those fields. On the other hand, it is interesting to note that one of the lowest scoring groups, on the average, is the group that intends to enter the field of education. Although this is not proof that the lowest performing group actually became teachers (in fact, many teachers have math and science degrees as well), it is an indication of the status and prestige of our educators among high school seniors.

Teacher Salary Comparisons

Category	US	JAPAN
Average Teachers' Salary Divided By Per Capita Income	1.67	2.43
Salaries Relative to Engineers:		
Starting	0.58	1.12
Mid-career	0.61	1.00
Late-career	0.64	1.15
Education Levels (% Assoc./Bach./Grad.)		
Elementary	0/55/45	41/59/0
Mid-School	0/53/47	26/74/0
High School	0/44/56	11/84/5

Source: OERI



This chart shows several comparisons of teacher salaries and education levels between the United States and Japan. (Japan was selected because, as has been pointed out, it seems to be the only other country whose education system rivals ours in numbers and quality of output.) The first measure is average teacher salary divided by per capita income. This measure shows that the average teacher in Japan earns almost 50% more than his/her American counterpart, relative to incomes in their respective countries.

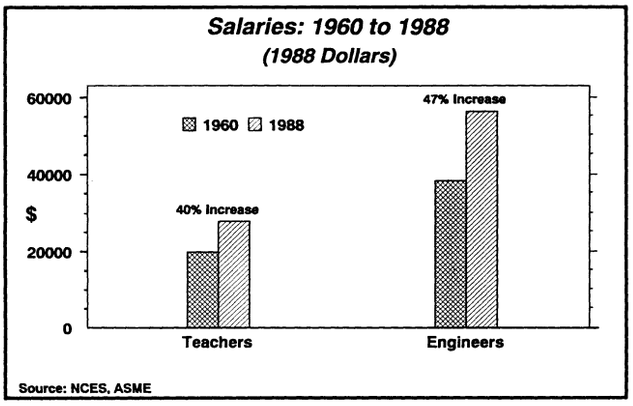
The next three measures compare teacher salaries at early-, mid-, and late-career with those of engineers. In each case, the Japanese teacher earns as much as or more than an engineer in Japan, whereas U.S. teachers consistently earn less than two-thirds the salary of their peers in engineering.

The final set of figures shows the distribution of degree levels for American and Japanese teachers. The average Japanese teacher has a bachelor's degree or less. The average American teacher has a master's degree or more.

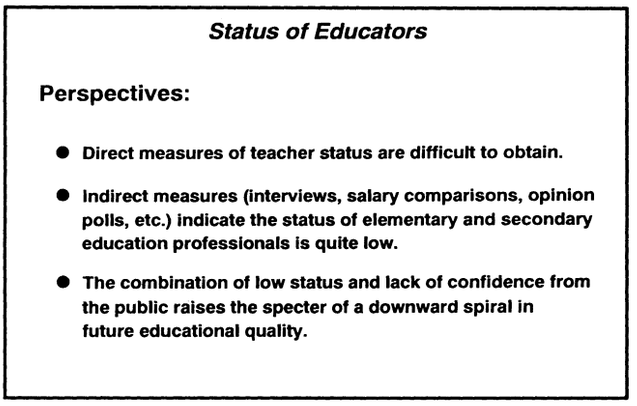
This chart shows average salaries for K–12 teachers since 1970 in constant 1990 dollars.

After a slight rise in the early 1970s, the average salary for all teachers slowly declined over a 10-year interval, reaching a low of $27,000 in the early 1980s. Since then, however, salaries have rebounded nearly 20%, resulting in an overall increase of roughly 10% during the 20-year interval.

Average salaries for beginning teachers followed a similar pattern. After a slight rise in the early 1970s, starting salaries eroded to a low of $19,000 by the early 1980s. Like teaching salaries in general, starting salaries have rebounded somewhat in recent years. However, the rebound in starting salaries was not as great. In constant dollars, beginning salaries in 1990 are the same as those of the 1970s.



This chart shows the salary and salary increases of engineers versus teachers from 1960 to 1988.



The interviews we conducted during this study resulted in an interesting contrast. The common view among educators was that they were competently handling an increasingly demanding job with little support or recognition from the general public. The common view among non-educators was that educators were no longer delivering a quality product and should be pressured to perform better.

The combination of low status of educators and a lack of confidence from the public may paint a bleak picture for the future. It raises the specter of a downward spiral in future educational quality.

FUTURE REQUIREMENTS
Workforce Skills

One feature common to all aspects of the historical performance of our education system is change. Both the system and its results have constantly changed over the past several decades, and this change will continue. Many argue that the future will be so different that we must change the way we educate our youth. Others see less need for a systematic change and focus on modifying the current system to meet the needs of the future.

This section of the presentation addresses two of the most publicized potential reasons for change in the U.S. system of education: workforce skills and demographics. It also looks briefly at the issue of leadership in educational change.

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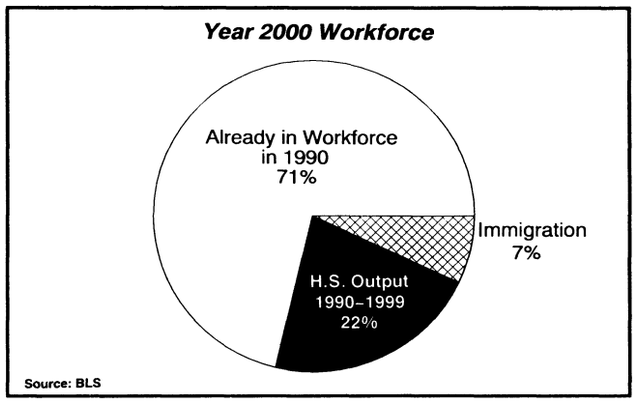
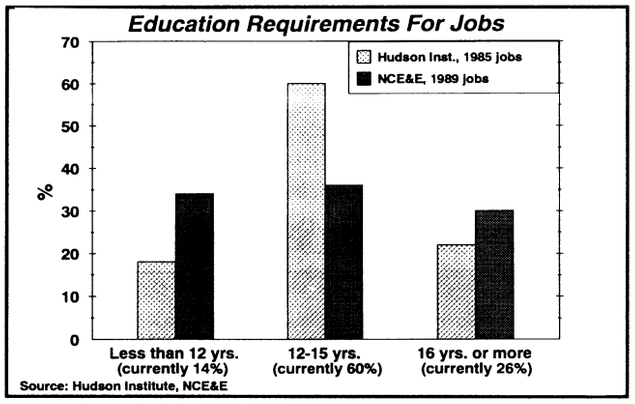


It has been popular to use the year 2000 workforce to investigate a potential "skills gap" among American workers. In doing so, we must recognize that over 70% of the year 2000 workforce is currently employed in 1990. An additional 7% of that future workforce will immigrate to this country over the next ten years. Finally, the U.S. K–12 education system will contribute approximately 22% to the pool of workers employed in the year 2000.

This underscores an interesting point about the impact of K–12 education reform on workforce skills in the near term. Regardless of the potential skills gain that education reform may stimulate over the next decade, it will affect at most one in five workers in the year 2000 workforce; and these individuals can only be affected in the later stages of their education. Furthermore, these workers will be young, entry-level employees with little impact on the productivity of the workforce.

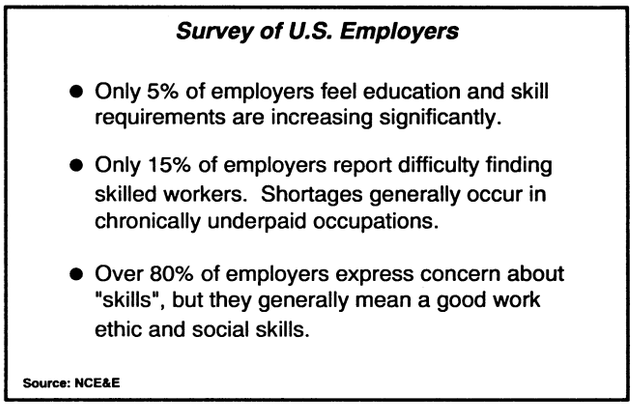
If business needs workers with higher skills by the year 2000, it is the adult population that must be trained. The nation cannot fill a perceived near-term skills gap by improving pedagogy in elementary and secondary schools. Education reform must be focused on skills improvements more than a decade in advance, and predicting skills requirements that far ahead is problematic.



This chart illustrates the difficulty of making long-term predictions by comparing the results of two major studies on current or near-term workforce requirements. The bar on the left is from the Hudson Institute's "Workforce 2000" report; the one on the right was recently published in the National Center on Education and the Economy's report "America's Choice: High Skills or Low Wages!". The current output of our system is shown in parentheses.

The comparison illustrates two points. First, it underscores the significant differences in two projections of late 1980s education requirements in the United States. Differences such as these arise when common data are approached by different researchers, and such differences complicate policy-making. Clearly, policies or opinions should not be based on a single analysis.

Second, neither projection paints a bad picture for the current education system. The Hudson numbers are almost exactly the same as the current education output numbers. The education system turns out in today's youth roughly 26% as college graduates, an additional 60% with 12 to 15 years of schooling, and the final 14% with less than a high school diploma. The NCE&E projections indicate that the current education system is actually overeducating many students for the work they will eventually perform, while undereducating a few. They found that fully one-third of all jobs today require less than a high school diploma. They also discovered, however, that 30% of all jobs require a college degree or more, a number slightly higher than being produced today.



During its research on workforce skill requirements, the Commission on the Skills of the American Workforce surveyed hundreds of U.S. employers and solicited their opinions about current and future workforce skills. The findings of the survey were somewhat surprising.

Only one in twenty employers believed that the skill requirements in the workplace would increase significantly during the decade of the 1990s.

Although the lack of skilled workers is often advanced by business leaders as a major problem, only 15% of those surveyed had difficulty filling skilled positions. A closer look at these shortages revealed that these positions existed in the chronically underpaid occupations, such as nurses, skilled secretaries and clerks, and in craft apprentice trades. The Commission attributes these shortages to the fact that many people formerly filling these high-skilled, non-college jobs are now attending college and obtaining higher paying positions.

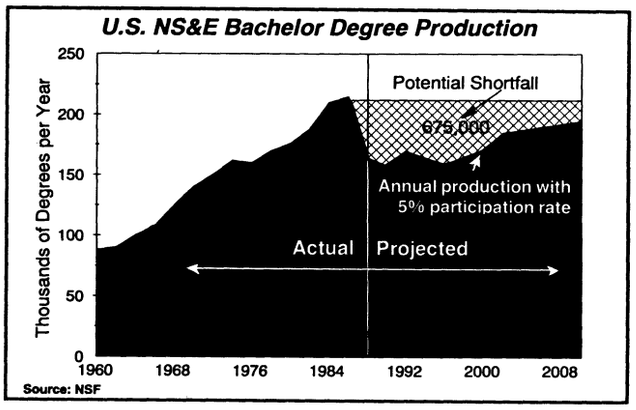
Finally, even when the surveyed businesses complained about worker "skills," they often alluded to work ethic and social skills, not academic skills.

The results of this survey suggest that the business leaders surveyed are generally satisfied with the skill levels of their employees, and the problems that do exist do not appear to point to the K–12 education system as a root cause.

Surveys of Workforce Skill Requirements

	Michigan	Rochester
5 most important "skills" for employment	No substance abuse	No substance abuse
	Honesty, integrity	Follow directions
	Follow directions	Read instructions
	Respect others	Follow safety rules
	Punctuality, attendance	Respect others
5 least important "skills" for employment	Mathematics	Natural sciences
	Social sciences	Calculus
	Natural sciences	Computers
	Computer programming	Art
	Foreign Languages	Foreign Languages

Source: Michigan Ed. Dept., Rochester School Dist.



In many communities, public pressure has mounted for school systems to improve student workforce "skills." In response, states and even school districts have surveyed businesses to identify future "skill" requirements for the workplace. Shown above are the results from independent surveys conducted by (1) the Michigan Employability Skills Task Force for the Michigan Legislature and (2) the National Center on Education and the Economy for the Rochester City School District Board, Rochester, New York.

The results of both surveys are consistent with those of the previously discussed national survey. According to business leaders polled, the most important workplace "skills" for future employees were not academic skills. Rather, behavioral "skills" such as being free from substance abuse, honesty, respect, and punctuality were all listed in the "highly critical" categories. Two out of 38 academic skills made the "most critical" list, but they were the most basic skills in the academic category (reading, following directions).

The least important "skills" in both surveys were academic. According to the surveys, business places the lowest priority on understanding foreign languages, mathematics and natural science, computers, and the social sciences. This appears to be in direct conflict with those who forecast that these will be the most critical skills for the 21st century workplace.

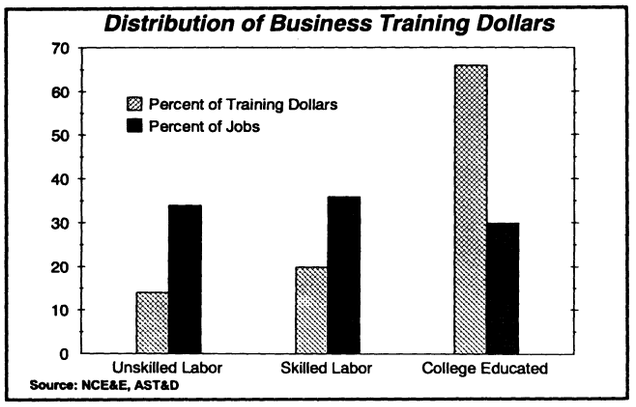
A caveat mentioned in the Michigan report points out that the Task Force believed that respondents were most concerned about immediate needs rather than future needs. We have found this to be true in our interviews with the business community. Forecasting workforce skills beyond one or two years into the future is highly speculative and is uncomfortable for those we interviewed.

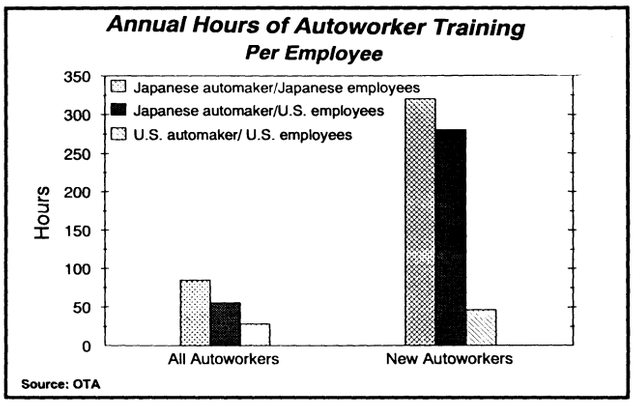
A recent National Science Foundation (NSF) unpublished report on the attainment of technical bachelor degrees is another frequently cited indicator of the potential technical "skills gap" facing the nation in the next two decades.

The potential gap identified is a result of the significant reduction in college-age youth in the post-Baby-Boom decade of the 1990s. If one assumes that the required number of technical degrees granted never should decrease, then the requirement for future technical degrees must be no less than the peak. Using this assumption, the NSF set the required supply of technical degrees at about 210 thousand per year. This number was not based on future demand for these degrees but on the average production from 1984 to 1986. Using the trends displayed previously, the NSF projected that 5% of college graduates, primarily 22-year-olds, will obtain NS&E technical degrees each year in the future. The difference between the assumed requirements (the 1984–1986 average production) and the 5% of 22-year-olds is the identified "shortfall." This number accumulates to 675,000 by the year 2010.

NSF defines shortfall only as a decline in production rates, not an actual shortage of scientists and engineers. In fact, nearly 40% of all NS&E bachelor degree recipients do not pursue careers formally classified as scientist or engineer. Many choose to use their skills in related jobs, such as management of scientific businesses, or to pursue professional careers in business, law, and medicine. This is true for nearly every profession as young adults continue to make life-changing career decisions even after college graduation.

Using NSF's benchmark year of 1986, we find that the economy absorbed approximately 126 thousand (60% of 210 thousand) NS&E degree recipients into science and engineering careers that year. If we use this number (i.e., demand) as the benchmark, we find that the NS&E pipeline is overproducing graduates every year, even though total annual production is lower than the 1986 peak. Thus, no shortage is predicted by NSF's analysis. In fact, the overage accumulates to over one million by the year 2010.





The common perception that our schools are not producing the graduates that businesses need leads to much discussion about the remedial basic skills training that businesses are required to give. The Commission on Skills of the American Workforce investigated this issue. This chart, from their report, shows the distribution of business training dollars as reported by the American Society for Training and Development (AST&D). AST&D reports that two-thirds of all training dollars expended by businesses go to college-educated employees. However, these employees make up only 30% of the workforce in America. This money is spent on white-collar training of managers, professionals, supervisors, and salespeople.

The remaining one-third of the business training dollars is spent on the non-college-educated employees. A closer look at these training dollars indicates that they are spent primarily on upgrade training for skilled technical employees, such as craftsmen and technicians. Fewer than 10% of all business training dollars go to blue-collar, entry-level workers. Additionally, very little of this small sum is spent on basic skills training. Training for these workers consists primarily of orientation for new hires and motivational training for long-term employees.

Additional information on basic skills training is published annually by TRAINING magazine. Although there are over 8 million companies in the U.S., reliable data can be gathered only on firms with over 100 employees (133,694 firms or 1.6% of the total). In their 1990 Industry Report, TRAINING reported that very few companies were providing remedial basic skills training in the three R's. Of those firms surveyed, 5.3% responded that they offer basic math and reading courses, 6.2% offer writing courses, and 3.3% offer English as a second-language course. These numbers get even smaller when one looks at the number of employees actually taking the courses. In each of the four course areas listed above, the median number of employees enrolled per year was less than 20 per company.

As we have done in other sections of this report, we thought it would be valuable to compare the Japanese perspective to that of the United States. In its report entitled "Worker Training: Competing in the International Economy," the Office of Technology Assessment (OTA) states: "When measured by international standards, most American workers are not well trained. Many in smaller firms receive no formal training. Larger firms provide more formal training, but most of it is for professionals, technicians, managers, and executives. Our major foreign competitors place much greater emphasis on developing workforce skill at all levels." (p. 3) This comment supports the data shown on the above chart.

This chart shows the great disparity in worker training between Japanese and U.S. automakers. It compares annual hours of training per employee for Japanese autoworkers working in Japan (wide crosshatch), U.S. autoworkers employed in Japanese-owned plants in the United States (narrow crosshatch), and U.S. autoworkers employed in U.S.-owned plants in the United States (left-hatch).

In the "All Autoworkers" category, Japanese autoworkers get more than three times as much training annually as their U.S. counterparts in U.S.-owned plants. In the "New Autoworkers" category, the disparity is even greater. New Japanese autoworkers receive over 300 hours of training in their first six months, whereas new autoworkers in U.S.-owned plants receive less than 50. It is also interesting to note that Japanese automakers invest less in their U.S. employees than in their Japanese employees.

Changes in Skill and Education Requirements

	1973-1979	BLS Projection 1988-2000
	(Ten-Year Rates of Change)	
Skill Indices:		
Handling data	4.01%	1.31%
Verbal aptitude	2.19%	0.72%
Intellectual aptitude	2.02%	0.63%
Handling people	1.71%	0.72%
Handling things	-0.57%	-0.68%
Education Levels:	(Percentage Point Change)	
Less than H.S.	-1.42%	-0.37%
H.S. Graduate	-0.92%	-0.55%
Some College	0.57%	0.13%
College Graduate	1.77%	0.79%

Source: Economic Policy Institute, BLS

WORKFORCE SKILLS

PERSPECTIVES:

- **Recent surveys indicate that business is far more concerned with employees' personal and social skills than academic skills.**
- **Nearly 90% of business training dollars are spent on college-educated and skilled employees.**
- **Japan, Germany, and other nations invest far more in worker training than the United States.**
- **Skills levels are projected to increase slowly, not dramatically, during the nineties; and the rate of increase is decelerating.**

This chart on workforce skills addresses the rate of change taking place in the American workplace. In a report entitled "The Myth of the Coming Labor Shortage: Jobs, Skills, and Incomes of America's Workforce 2000," the Economic Policy Institute (EPI) challenges the notion that education and skill requirements for jobs in America are outstripping the education system's capacity to produce skilled labor. This chart displays the ten-year rates of change for skills and education for the 1973–1979 time period. It also shows the most recent Bureau of Labor Statistics (BLS) projection for the 1988–2000 timeframe.

During the 1973–1979 interval, skill indices for the American workplace rose significantly for handling data, verbal and intellectual aptitude, and handling people. Predictably, the skill index for handling things declined as the number of manual labor positions declined. Education levels required for jobs rose as well. More and more positions required postsecondary education from 1973–1979, whereas fewer required a high school diploma or less.

According to BLS projections, these trends will continue during the 1988–2000 timeframe but at a *lesser rate*. The Handling Things index will continue to drop, but the others will not maintain the rate of change of the seventies. Similarly, education levels required for jobs will continue to increase but not at previous rates. According to EPI, this deceleration argues that the "skills gap" is actually narrowing. Thus, the U.S. workplace will not experience an explosive growth in skilled positions during the nineties.

Of late, much of the education debate has focused on the education system's alleged inability to produce students with adequate "skills" for a modern workforce. According to many, this is the primary cause for a perceived decline in U.S. international economic competitiveness.

Our review of the limited research in business education and training practices found that very few companies point to inadequate academic preparation of new employees but, rather, focus on social "skills" such as punctuality and personal appearance. Much of the information we collected in New Mexico is anecdotal, and we suspect the same is true for those gathering data at the national level.

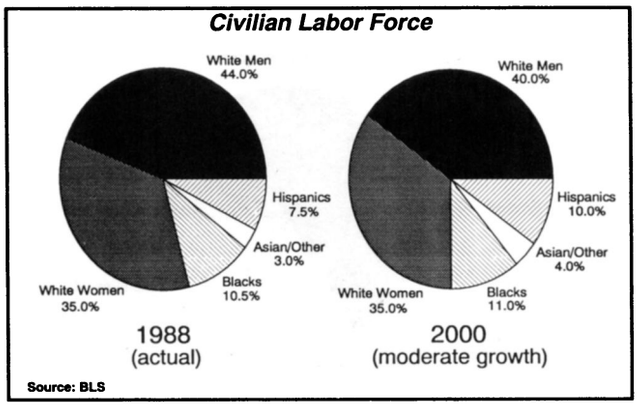
Nationally, nearly 90% of business training dollars go to college-educated employees (managers, professional sales, etc.) and skilled laborers. Very few business training dollars are dedicated to academic remediation of native-born Americans in the workplace. Also, much of the current "basic skills" training is directed at older workers, not recent graduates.

An OTA investigation of workforce training in the United States and its major competitors found that Japan, Germany, and other nations dedicate far more resources to worker training than does the United States—this despite the view of many that the U.S. education system is deficient when compared to the systems in these same countries.

Finally, a recent EPI report suggests that the Bureau of Labor Statistics projects gradual, not dramatic, increases in workplace technical skill requirements. Compared to past increases, the projected increases for the nineties actually represent a slowdown. These projections counter the widely held position that the "skills gap" is widening at an accelerating rate.

Changing Demographics

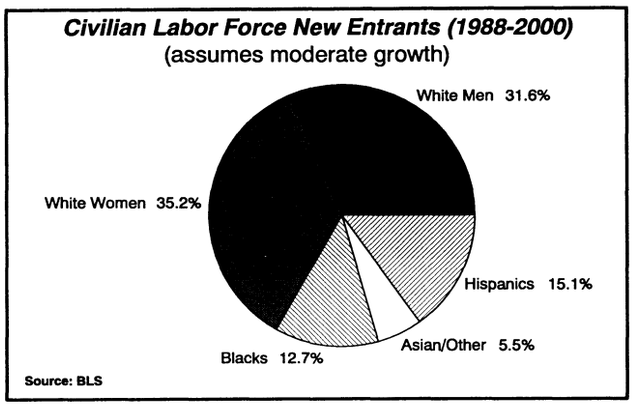
In considering the requirements that will be placed on the U.S. education system of the future, one observation becomes obvious. Tomorrow's school children, and thus tomorrow's schools, will be much different from before. No data underscore this better than those that describe demographics.



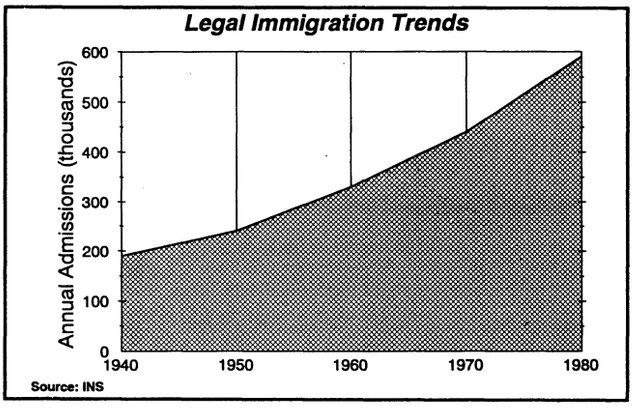
Very little demographic forecasting is done at the national level for the education system. Historical data indicate, however, that education demographic trends follow those of the civilian workforce, especially with respect to immigration. In the next several charts we explore demographic forecasts for the workforce and immigration trends and discuss their potential impact on the education system.

Unlike attempting to forecast future skill requirements for the year 2000 workforce, forecasting the demographic makeup of that workforce is more straightforward. The reason is that the vast majority of the year 2000 workforce is already in place, and the rest can be identified and counted.

As can be seen in this chart, minority participation in the U.S. workforce is projected to increase. In 1988, minorities represented 21% of all workers. This will increase to 25% of all workers by the year 2000, assuming moderate economic growth. Slower economic growth may reduce this rate slightly since minorities traditionally have higher unemployment rates than Whites. Hispanic and Asian representation is projected to increase the fastest, increasing by 30% of their current levels in the next decade; the percentage of White females will remain the same; and the percentage of White males will decline. Demographic shifts similar to these could be reflected in our schools as well.

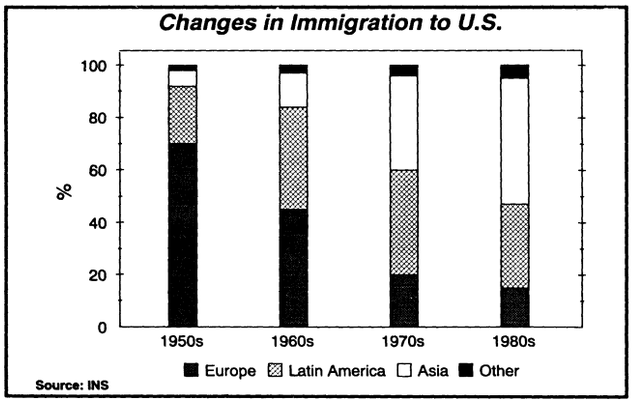


This chart looks at the same data in a slightly different fashion. When looking exclusively at the new entrants into the workforce over the same period, the demographic shift in the U.S. workforce is more dramatic. White males will make up less than one-third of the new entrants, assuming moderate growth, whereas minorities (male and female) will comprise slightly over one-third. The number of White female new entrants is expected to remain constant at 35%. As was pointed out in the historical section of this study, more and more female and minority youth are remaining in school and attaining higher education levels.



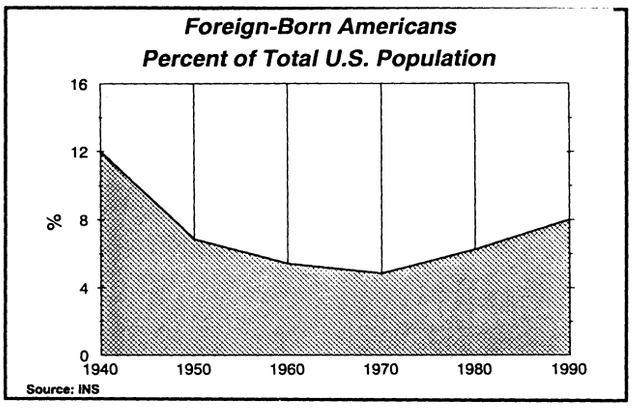
The next three charts show a contributing factor for this demographic shift in the workforce and in the schools. Legal immigration in the 1980s approached nearly 600,000 people per year. A preliminary review of the 1990 census revealed that nearly 30% of the nation's population growth in the 1980s appears to be from immigration. Not since the 1920 census has so much growth been attributed to immigration. The Immigration and Naturalization Service (INS) estimates that up to 200,000 additional people per year entered this country illegally. All told, nearly 8 million people immigrated to the United States in the 1980s.

The recently adopted Immigration Act of 1990 will increase legal immigration to 700,000 visas per year, with increased emphasis on Eastern European and African nations. Additionally, the INS estimates that nearly 130,000 immigrants per year will enter under the Refugee Act of 1980. Including an estimated 100,000 illegal entrants per year, the United States can anticipate an average of over 900,000 immigrants per year during the 1990s.

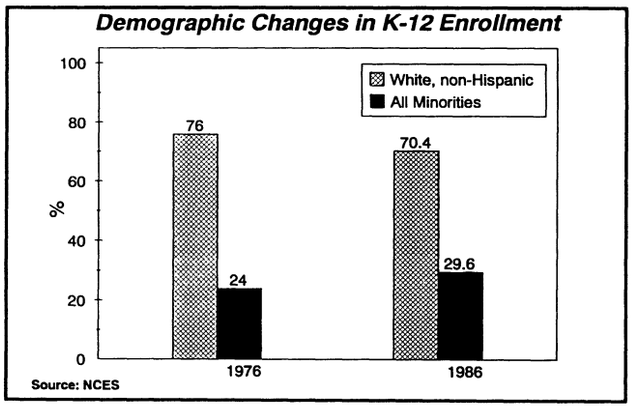


This chart shows the home countries of immigrants entering the country legally have changed dramatically over the past four decades. Immediately after World War II, the legal immigrants were predominantly Europeans. This has shifted to the point where, in the 1980s, less than one in five new immigrants was from Europe. The vast majority of immigrants are now from Asia and Latin America.

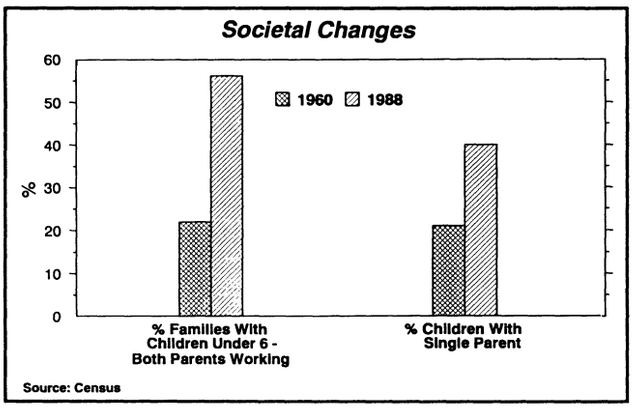
The Immigration Act of 1990 will attempt to increase Eastern European and African representation, reducing the combined Asian and Latin American percentage from 85% to 60–70%. However, this percentage will not include refugees and illegal immigrants, which are predominantly from Latin American and Asian countries.



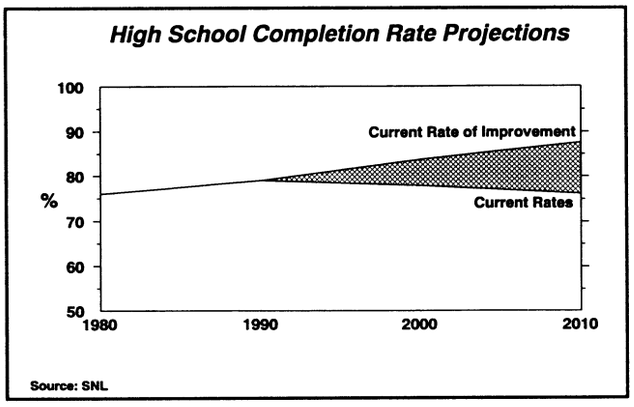
This final chart on immigration reflects again the growth in our immigrant population, this time as a fraction of the total population. Although the total number of immigrants has been rising steadily since World War II, the postwar baby boom actually reduced the impact of immigration on total population in the 1950s and the 1960s. However, the increasing levels of immigration in the 1970s and 1980s, coupled with declining native-born birth rates, have resulted in an increase in the percentage of foreign-born Americans. This is further evidence of the changing demographic situation in our schools.



This chart displays the impact that demographic shifts have made on the makeup of U.S. elementary and secondary schools. In only ten years, from 1976 to 1986, the percentage of all students from minority groups rose from 24% to nearly 30%. Indications are that the 1990s will continue to see this increasing trend. Some states, such as New Mexico, currently have a minority–majority population in the schools. Additionally, as the number of immigrants from underrepresented countries in Africa and Eastern Europe grows, the school system will experience an even more diverse population.



Another indicator of the demographic changes in the school-age population can be seen in this chart. From 1960 to 1988, the percentage of youngsters being reared in an environment where both parents work has risen dramatically. The percentage of children being reared by a single parent has seen a similar rise. These are two of the "at-risk" indicators identified by the U.S. Department of Education.

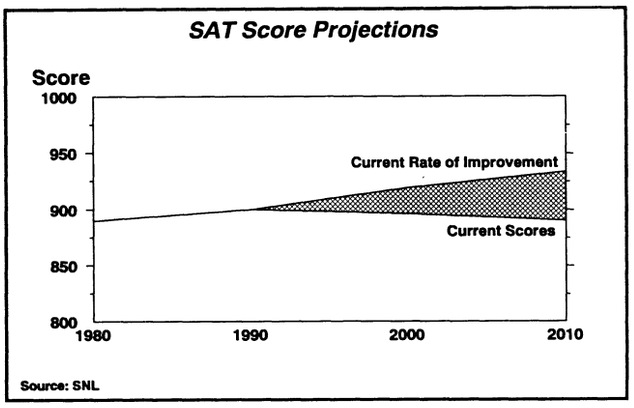


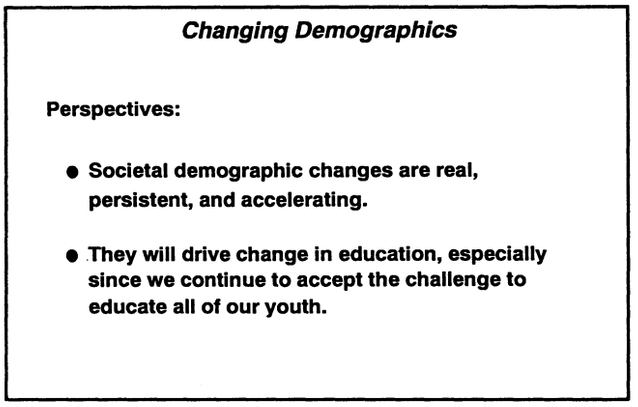
Although forecasting the demographic changes facing the nation for the next ten years can be accomplished with confidence, forecasting the impact of these changes on education cannot. In the next two charts we have attempted to place bounds on the possible outcomes based on past experience.

This chart is an attempt to bound the high school completion rate for the next 20 years. The lower bound assumes that the dropout rates for each subpopulation will remain at 1990 levels. Given no further demographic shifts in the population after 1990, this projection would result in a horizontal line from 1990 onward (every year's group would have the same total dropout rate as the 1990 group). However, if the rate of demographic change continues at recent rates, then an increasing fraction of minority students will be enrolled in our schools. Since these groups traditionally leave school at a higher rate than the White majority, the result will be a gradual decline in total completion rate, from nearly 80% in 1990 to about 75% in 2010.

The upper bound is based on a different assumption. Since the data from the past decade show a decline in the dropout rate for nearly every subpopulation, the upper bound assumes this trend will continue. For example, Black event dropout rates declined over 30% from 1980 to 1990 (from 9.6% to 6.4%). If we assume that this trend will continue over the next decade, then we predict the Black dropout rate to be roughly 4% (another 30% decline) in the year 2000. Using the same demographic change rates used in the lower bound calculation, the upper bound would be as shown. The positive rise (slope) of the upper bound indicates that the current rate of improvement in minority completion rates is greater than the current rate of demographic changes. This is not a trivial indication.

The upper and lower bounds are not absolute. Dropout rates could increase over the next decade, thus placing the actual value below the lower bound. Similarly, it is possible that intervention programs may reduce the minority dropout rate at a faster pace than in the past, placing the actual completion rate above the upper bound. However, the best indicator of future performance is past performance, so we believe that future completion rates will likely be somewhere in the shaded area.





One education indicator affected by demographic changes is the average SAT score. As stated in the historical section of this study, every subpopulation taking the test is performing better today than a decade ago. However, minority students currently score significantly lower on the SAT than their White counterparts. Thus, the changing demographics of test takers will impact the average SAT scores in the future just as it has up to now.

The lower bound for this projection is determined by freezing the SAT scores of all subpopulations at their 1990 levels. As with projections of high school completion on the previous chart, by allowing the fraction of minority students taking the SAT to increase at current rates, the average score for the entire group will gradually decline since minority student scores are lower than the White scores. The gradual decline will be from 900 (the 1990 level) to about 890 by the year 2010. This decline does not imply lower achievement of individual students, since they perform as well as the 1990 cohort group; it merely reflects a change in the population of test takers.

The upper bound allows each subpopulation to improve its score as it did throughout the 1980s. For example, the average score of Black students improved from about 690 to nearly 740 (a 7% improvement) between 1975 and 1989. The upper bound assumes this trend will continue, resulting in a Black score of about 830 in year 2010. Using the same demographic numbers as the lower bound results in the upper bound on the chart. Note that the rate of improvement in scores is greater than the rate of demographic change, resulting in a continued climb in scores.

As with the high school completion rates on the next chart, the upper and lower bounds on the SAT projections are not absolute. Actual student performance on the SAT could decline over the next decade, thus placing the average score below the lower bound. Similarly, the rate of improvement could increase at a faster pace than in the past decade, placing the average above the upper bound. However, we believe the most likely value of future average SAT scores is somewhere in the shaded area.

In our analysis, we found that a primary factor influencing future education requirements is the changing demographic makeup of the student body. Immigration was higher in the 1980s than in any other decade in this century except the 1920s. Coupled with slow native-born birth rates, this is creating significant changes in the demographic composition of today's classroom. It is estimated that up to five million children of immigrant parents will be entering the K–12 education system in the 1990s. More than 150 languages are represented in schools nationwide, and figures approaching this number occur in single large districts.

Also, the American family structure is changing, and teachers are encountering more children from single-parent homes and homes where both parents work. These demographic changes are real, persistent, and accelerating. They will drive change in education, and other social institutions as well, especially since we continue to accept the challenge to educate all of our youth.

Education Goals

Finally, in our look to the future, we examine the goals that this nation has defined for its education system.

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National Education Goals

By the year 2000:

1. All children will enter school ready to learn.
2. The high school graduation rate will increase to at least 90%.
3. All students will demonstrate competency in at least English, math, science, history, and geography.
4. American students will be first in the world in math and science achievement.
5. Every American adult will be literate and able to compete in the work force.
6. Every school in America will be free of drugs and violence.

Source: NGA, ED

The National Governors' Association and President Bush agreed on six goals for education by the year 2000. Goals 2, 3, 4, and 5 have been addressed in some form by this briefing; the others are beyond the scope of this study. Following is a summary of our views on the goals we have discussed.

Goal 2: The goal of 90% high school completion rate for all ethnic groups will be difficult to achieve if one demands that this be accomplished by "on-time" graduations. However, if we count students who re-enter and complete their education by age 24, this goal may be attainable by the year 2000. In addition, current completion rates are deflated by the fact that we count immigrants as dropouts if they have not obtained a high school diploma. It may be correct to do this if a young child immigrates and fails in our schools; however, it is not reasonable to hold the U.S. K–12 education system responsible for someone who "dropped out" in another country, then immigrated here past school age. Many immigrants are between the ages of 18 and 25. These individuals will most likely never "drop in" to a traditional U.S. school, but will be counted as dropouts by any status measure. The lack of educational attainment of a 20-year-old immigrant is not a reflection on the effectiveness of the U.S. K–12 education system. Education of adult immigrants relates to Goal 5.

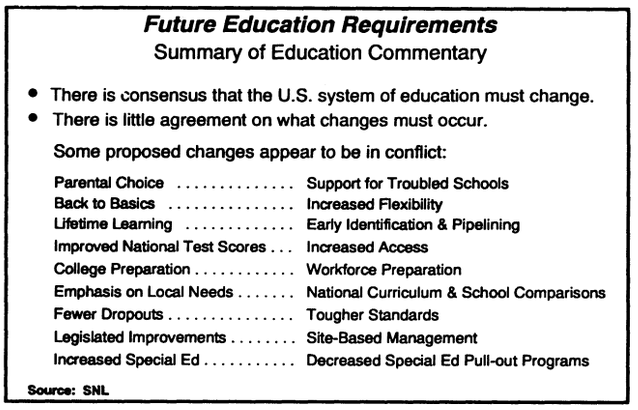
Goal 3: The student performance data clearly indicate that today's youth are achieving levels of education at least as high as any previous generation. However, challenging subject matter for the 21st century may demand even higher performance levels. The greatest challenge facing educators is in forming a consensus on what students should know and be able to do.

Goal 4: Comparing math and science achievements worldwide is an impressive task. Being first in the comparison depends primarily on the age of the students being compared and the measure being used. Previous tests comparing 17-year-olds are now considered invalid since many countries track their students by this age. For this reason, recent international comparisons focus on 13-year-olds. However, for many reasons, we ques-

tion the value of these comparisons or of any objective tests of youngsters.

Comparisons of adults or older students, perhaps those of college age, would be a better measure of education systems and may or may not reflect well on the U.S. education system. Postsecondary comparison data show that U.S.-educated students compare quite favorably with their international peers.

Goal 5: This issue was addressed in the workforce skills section of this study. One often hears that education is the foundation for economic competitiveness. If true, it relates primarily to upgrading or modernizing the education of adults. The K–12 education system is responsible for producing educated youth; but anticipating the needs of the workforce 10 to 20 years in the future is difficult if not impossible (for business or educators). The increasing educational attainment of Americans, coupled with the availability of education to all ages, tends to suggest that U.S. citizens have already accepted the notion of lifelong learning.



Although the call for education reform is widespread, our review of education commentary suggests to us that there is little consensus on how the nation should accomplish such a change. This chart lists some of the more popular suggestions being supported today and reflects the wide variety of opinions. We believe that many of the suggestions are in direct conflict with others. For example, emphasizing local "empowerment" that will allow parents to control their child's education (one of the critical thrusts of the current restructuring movement) may conflict with the concept of national curriculum, testing, and state-by-state comparisons (one of the most common calls from state and national legislators). Similarly, increasing students' flexibility to make them lifelong learners conflicts with the notion that students should be "pipelined" so that they can compete better on international tests of 13-year-olds.

Education Goals

Perspectives:

- **The call for education reform is widespread and includes many new voices.**
- **Some suggested initiatives have conflicting goals.**
- **Society has not clearly articulated the changes required to meet future goals. In fact, forming a consensus on required changes may be the greatest challenge facing education today.**

This chart summarizes the perspectives we have gained from our ongoing look at the widespread call for change in education.

The number of organizations and groups calling for change is large, and includes many new voices. Business leaders, education consultants, politicians, and many educators are proponents of change in the way we teach our children, assess progress, and manage the schoolhouse. Society is in a constant state of flux, and the many stakeholders agree that the education system must be responsive. Some of the recent debate is calling for revolutionary change.

Our investigation of recent proposals underscored the fact that many initiatives have conflicting goals. Implementation of several programs without proper coordination or a clear understanding of goals could result in little or no gain.

Finally, the large volume of commentary has not resulted in a clear articulation of the changes required to meet future goals in education. One difficulty with such a large volume of information is that it is difficult to find original research or ideas. Forming a national consensus on required changes may be the greatest challenge facing political leaders and professional educators. Even the concept of a national consensus is being debated. The U.S. education system was built on the foundation of local control, state influence, and federal interest. The existence of nearly sixteen thousand independent school districts nationwide attests to this concept. Forming a national consensus will be difficult.

SUMMARY OF ISSUES

In this last section, we summarize the perspectives discussed in the previous sections and identify major issues facing the U.S. education system.

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Summary

Primary Challenges Facing Education Today:

- **Forming a national consensus and finding leadership in educational improvement.**
- **Improving the performance of minority and urban students.**
- **Adjusting to demographic changes and immigration.**
- **Improving the status of elementary and secondary educators.**
- **Upgrading the quality of educational data.**

After examining education in America, we found the following challenges that need to be addressed.

1. *Forming a national consensus and finding leadership in educational improvement.* Developing strong, coordinated leadership at local, state, and national levels will be extremely difficult because education has so many stakeholders, but it is an essential ingredient for lasting educational improvement.

2. *Improving the performance of minority and urban students.* Throughout this research, a common theme in nearly every area was the poor performance of urban and minority students relative to their suburban peers. From student performance to the status of educators, the urban setting is lagging far behind the rest of the country. The education community has focused on this situation for several decades and progress is being made, but there is still much work to be done.

3. *Adjusting to demographic changes and immigration.* Throughout this century, the U.S. population has become increasingly heterogeneous and the demographics of our country are changing at an accelerating rate. Understanding and adjusting to this change will always be a requirement for education. Students are "customers" for education, not products on an assembly line. Unless we are sensitive to their individual needs, they cannot achieve to their maximum potential.

4. *Improving the status of elementary and secondary educators.* Much of the blame for problems in education, real and imagined, has been placed on teachers and administrators. This has resulted in feelings of low self-esteem and bitterness among many of the educators we interviewed.

5. *Upgrading the quality of educational data.* We found much of the educational data used by policymakers to be of poor quality. We believe this is due primarily to insufficient funding of data collection, synthesis, and analysis at all levels. In addition, these available data were collected for specific purposes. Because they are the only data, they are often used in unintended and sometimes inappropriate applications. This practice may result in poorly focused actions, with disappointing outcomes.

Summary (continued)

Barriers That Can Impede Educational Improvement:

- **Lack of a systematic view of status and future directions.**
- **Inadequate metrics and data on educational performance.**
- **Failure to integrate industrial needs with educational aims.**
- **Focus on forecasted "shortfalls" in technical degrees.**

The previous chart showed what we feel, based on our research, are the greatest challenges facing education in the 1990s. Unfortunately, we perceive several major barriers that must be successfully overcome in order to meet these challenges. Not surprisingly, these barriers complement the challenges, though there is not a one-to-one correspondence.

1. *Lack of a systematic view of status and future directions.* Educational reform must be based on a clear vision of the factors that have brought U.S. education to its current condition, particularly autonomous local control, along with a clearer vision of the desired end state that we should achieve in the future. Today, there is much confusion concerning the present status and performance of the U.S. education system, and even more confusion as to what the desired end state should be. We believe that a framework should be developed in which the relative importance of individual goals and objectives can be linked more directly to reform actions.

2. *Inadequate metrics and data on educational performance.* Major improvements must be made in the data used to analyze U.S. education if these are to be effectively used to diagnose ills and develop corrective actions. Many current metrics are ill-defined, and most researchers we dealt with during this study expressed their misgivings that such flawed data could ever be used to justify reforms. Yet many continue to cite such improper claims as "declining SAT scores" as evidence of education's failings. Similarly, decision makers at state and local levels often use sparse national data as their basis for decision making. Quite often, anecdotes are used to motivate change. We must move past anecdotal evidence to data-based decision-making.

3. *Failure to integrate industrial needs with educational aims.* There appears to be universal agreement the U.S. education system must help prepare students to become valuable members of society, and students should leave schools with the "skills" necessary to succeed in the 21st century workforce. There has been little success, however, in either defining or obtaining agreement about what those skills should be in order to maximize U.S. economic competitiveness in emerging world markets. American industry (as a "customer" of the education system) must achieve a linkage with U.S. educators (the "suppliers") to continually address and answer these questions. Both should also be concerned with developing relevant metrics of performance and obtaining benchmarks against other countries with whom we compete in the world marketplace.

4. *Focus on forecasted "shortfalls" in technical degrees.* The scientific community has done its part in distracting the nation from actual problems in education. By focusing on isolated shortages, such as Ph.D.s in mathematics, some groups are predicting an impending critical "shortfall" in advanced technical degrees. Our research does not substantiate such concerns. Widespread shortages have been predicted off and on since World War II, but none of these have materialized on a large scale. We believe isolated shortages will occur, but market forces will respond as they have in the past.