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AUTHOR Humphries, Frederick S.
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ABSTRACT

This paper outlines recent Black achievements in higher education, particularly in science and engineering. Stressed, however, is the fact that while Black achievement has greatly increased in recent years, it still lags far behind national averages. Cited are five studies comparing Black and non-Black enrollment in various disciplines, degrees granted in various disciplines, and number of student majors by departments in historically Black colleges. Recommended is stronger emphasis upon programs such as the Science Curriculum of the Thirteen-College Curriculum Program and greater financial awards to Black students majoring in scientific disciplines. (SL)

# BLACK COLLEGES–A NATIONAL RESOURCE FOR THE TRAINING OF MINORITY SCIENTIFIC AND ENGINEERING MANPOWER

By

FREDERICK. S. HUMPHRIES, PRESIDENT

TENNESSEE STATE UNIVERSITY

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## Introduction

Of the critical areas of manpower shortage in the minority community, science and engineering represent areas of the most critical deficiencies. Approximately 1 percent of all professional engineers are Black and approximately 4 percent of the scientific-technical work force is Black. The acknowledgment of this shortage is not new. We have known the acuteness of the shortage for over a decade, since the Southern Regional Education Board (SREB) report on Scientific Curricula in Black Colleges. In this report in 1968 the SREB called for rectification and strengthening of the scientific disciplines in the predominantly Black institutions as a means of producing more competently trained scientists.

In 1968 the Intensive Summer Studies Program, headed by Harold Stahmer, and Institute For Services to Education (ISE) co-sponsored a two-day conference in Boston, Mass., to call attention to the lack of scientifically trained personnel. There have been modest attempts in rectifying the supply pool of minority scientists-- summer programs for talented high school students and summer college programs for science majors. The attempts have not approximated the level of both the coordination executed on behalf of increasing the supply of Black doctors in the country and the financial resources applied. At this time we are now experiencing a well defined

and coordinated national effort toward the rectification of minority representation in engineering. In this instance, private philanthropists, the Sloan Foundation especially, Business and Industry, and the federal government are cooperating. We have to arrive at a point of a national program which has as its major focus parity representation in the physical sciences and the life sciences.

## Black Students' Interest in Science and Black Student Production in Science

Recently, within the last two years, two studies have been done relating to the career interest of Black students in higher education. The studies canvassed the career interest of Black students on predominantly white campuses and Black students on predominantly Black college campuses. William Boyd, in his book entitled, "Desegregating America's Colleges" reports that the career plan of Blacks on white college campuses have a traditional focus. "Blacks continue to follow paths which have traditionally been open to them and which do not penalize them greatly for weaknesses in their preparation."[1] Boyd found that the most popular majors were as given in the Table below for Black college students at predominantly white institutions.

Table 1

| College Major | Percentage of Black Students |
|---|---|
| Social Sciences | 28 |

| College Major | Percentage of Black Students |
|---|---|
| Business | 15 |
| Education | 15 |
| Biological Sciences | 6 |
| English | 4 |
| Engineering and Mathematics | 4 |
| Physical Sciences | 2 |
| Black Studies | 1 |

A similar study conducted on Blacks on predominantly Black college campuses show the following major fields of choices as indicated in Table 2. This data is for the freshman year.

Table 2

| College Major | Percentage of Black Students |
|---|---|
| Arts and Humanities | 12.8 |
| Biological Sciences | 4 |
| Business | 19.6 |
| Education | 13.6 |
| Engineering | 3.2 |
| Health (non-M.D.) | 6.4 |
| Physical Sciences | 3.7 |
| Pre-professional | 6 |
| Social Science | 24.6 |

The typical white freshman at a predominantly white institution show the following interest in majors upon entering college:

| College Major | Percentage of White Students |
|---|---|
| Physical Science | 6.1 |
| Biological Science | 5.7 |
| Engineering | 5.5 |
| Health (non-M.D.) | 7.6 |
| Social Science | 16.1 |
| Education | 13.6 |
| Business | 11.6 |

In these studies,[2] Black students on Black college campuses were found to be poorer and to score two standard deviations below whites in predominantly white institutions on academic aptitude tests. The Blacks in the predominantly Black institution scored one standard deviation below Blacks on white college campuses. Notwithstanding though, Blacks in predominantly Black institutions are more likely to aspire for the doctorate degree. On the other hand, Blacks at predominantly white schools are more likely to aspire for professional schools than Blacks at predominantly Black institutions. It appears from the data that has been indicated in the Tables above, that Blacks and whites both are drifting away from education and the physical sciences as choices or major fields since 1968, when these choices held higher percentage ratings. There is an increasing interest in engineering, business and social sciences.

In a research report published by Institute for Services to Education in 1974 entitled, "Degree Awards and Enrollment Trends in Black Colleges: An Eight-Year Study," it was reported that the degrees granted by historically Black colleges in the physical and biological sciences were declining as was occurring nationally. "In 1966, 2.6 percent of the baccalaureate degrees granted in historically Black colleges and 3.3 percent of those granted nationally were in the physical sciences. In 1973, physical science

comprised 1.6 percent of the historically Black college baccalaureates and 2.4 percent of those granted nationally."[3] It was found in the study that the actual number of baccalaureate degrees in the sciences remained fairly constant over the eight years of the study. For example, in biological sciences, 1050 degrees were granted in 1966; 1060 degrees in 1972; and 872 degrees in 1973.

It is important to know that over the eight-year period of the study, Black colleges produced 8,382 earned degrees in the biological sciences and 3,332 earned degrees in the physical sciences. It is also important to note that in 1968, mathematics and biological sciences produced approximately the same level of baccalaureate degrees. As my own campus reflects the Black college campus, in 1975-76, mathematics is considerably off compared to biological sciences. Tennessee State University's production in 1968 was approximately 28 baccalaureate degrees; today there are only abour 5 or 6 students at the senior level prepared to graduate.

Black Ph.D's Production and Ph.D's in the Work Force in Engineering and Science

The recent report, prepared by the Commission on Human Resources of the National Research Council, and entitled "Minority Groups Among U. S. Doctorates, Level of Scientists Engineers and Scholars 1973," stated that, in 1973, approximately 4,000 members of minority groups obtained doctorate degrees.

Of this 4,000, 975 were Blacks. Of the 975 Blacks, 760 were U. S. citizens. In 1973, Ph.D's were awarded to 27,868 U. S. citizens. The 760 Ph.D's awarded to Blacks represent approximately 2.7 percent of the Ph.D's awarded U. S. citizens. The Blacks who obtained degrees were distributed across the various disciplines as follows:

| | |
|---|---|
| Engineering, mathematics, and physical science | 8.6 percent |
| Life Science | 9 |
| Psychology | 3.9 |
| Social Science | 6.5 |
| Humanities and Arts | 9.4 |
| Professions | 3.1 |
| Education | 59.5 |

On the other hand, the white Ph.D. recipients distributed themselves according to the following:

| | |
|---|---|
| Engineering, mathematics and physical science | 22.8 percent |
| Life Science | 14.1 |
| Psychology | 8.3 |
| Social Sciences | 10 |
| Humanities and Art | 17.7 |
| Professions | 4.3 |
| Education | 22.8 |

Blacks were noted also to have a greater potential for choosing jobs among educational institutions versus government, industry, and non-profit organizations. In the

total work force of Ph.D.'s in engineering and science, Blacks comprise 1,860 Ph.D.'s out of a total 244,829 U. S. citizens doctorates. The total of Blacks constitute .75 percentage of doctorates in the labor force. Though advances have been made within the last two or three years, it is quite clear that they have not been made to the extent that parity representation is a near reality.

Black Colleges and Their Science Capability

Among the 89 four-year historically Black colleges and 6 schools of engineering and 6 departments of computer science, Approximately one-third of the four-year institutions offer a physics degree and over 67 percent of them offer degrees in mathematics, chemistry, and biology. Within the last 15 years, almost every historically Black insit-tution has built new science facilities or renovated completely old science facilities. The science facilities have been equipped with modest, modern equipment. Throughout the historical Black colleges, to some degree, one will find present sophisticated, scientific equipment. By no means is every college equipped well. The point that is being made is that within the historical Black colleges are the modern means for doing sophisticated and complex scientific research. A recent survey[5] of the historical Black colleges, conducted by Dr. William McArthur of Knoxville College, and assisted by Dr. Frederick S. Humphries of the Institute For Services to Education, demonstrated that within the

division of the physical and natural sciences, 46 percent of all teachers held the Ph.D. degree or its equivalent in historical Black colleges and universities; 66 percent of all chemistry teachers and the comparable percent degree for biology, mathematics, and physics are 49 percent, 40 percent, and 48 percent respectively. Eighty-eight percent of all Professors and 53 percent of all Associate Professors hold terminal degrees. No department within the division of natural and physical science has less than 91 percent terminal degrees at the rank of Professor except that of computer science. In the more substantial Black institutions, it is often found that all of the members of the various departments have terminal degrees. The largest faculty size for the respective departments of the natural and physical sciences were 17 members for biological sciences, 18 for chemistry, 6 for computer science, 24 for mathematics, 17 for physics, and 13 for other natural science departments. In the smaller historical Black colleges reporting, a few were found to have only one full-time faculty member in a given department. The teaching load within the various departments were found to compare favorably with teaching loads of other institutions of higher education. The publication of research papers by the various departments of the natural and physical science departments were found to compare with the order of size of the departments and

the credentials of the faculty. The order in terms of the available number of papers published is chemistry, biology, computer science, physics, and then mathematics. The average number of papers published by the faculty of the various departments ranged from a high of 4 for chemistry to a low of 0.75 for mathematics. The average number of faculty papers published per faculty member for biological sciences, computer science, and physics were respectively 1.5, 1, and 1. The ranges for the number of student majors by department are indicated in the Table below.

Table 3

| Majors | Maximum | Minimum |
|---|---|---|
| Biological Science | 183 | 1 |
| Chemistry | 51 | 1 |
| Computer Science | 125 | 7 |
| Mathematics | 163 | 10 |
| Physics | 53 | 2 |

The maximum represents the number of majors for the largest department reported and the minimum represents the smallest number of majors reported. By comparison with the social science department, the natural and physical science departments within the historical Black colleges were found to have better credentials and to be more productive as to the number of papers published.

Within the science department, the study of goals of the various departments indicate that the natural and physical

science departments view teaching and the production of scientific personnel for the work world as their first priority. This was rather surprising as the graduate school is stressed very heavily. It is certainly true that the secondary goal of the departments were clearly to train students for professional (mainly medical and dental schools) and graduate schools. Moreover, the data indicated that the faculties of these departments were more willing to experiment with new content materials and approaches to more effective teaching of scientific materials.

## The Potential of the Black College as a Resource for Rectification of Deficits in the Sciences

Presently, Black colleges can double their productivity rate in the production of scientific personnel without an increase in faculty or an increase in physical resources. Given the present day statistic that over half of the baccalaureate degrees produced in the nation are produced by Black colleges clearly indicates their effectiveness and working proficiency with Black students in aiding them to achieve their educational aspirations.

Black colleges are producing over 50 percent of the baccalaureate degrees with only 30 percent of the Black enrollment in higher education. There are today more Blacks in four-year colleges and universities throughout the United States than there are in the historically Black colleges.

This, coupled with the former statement, indicates that predominantly white colleges are under-producing Black baccalaureate degrees.

Though the potential for an expanded role in increasing the manpower supply of scientifically trained personnel is inherently available within the historically Black institution, special factors must be noted and reacted to for that potential to be realized. First, the persuasive notion throughout the country that scientific manpower has been over-produced must be placed in proper perspective. Certainly the data that I have presented in this paper clearly demonstrates the need for greater production of Black scientific personnel. Affirmative Action requirements mandate this. A national program of clarification of the over-production notion needs to be executed. Such a program must counteract the notion that science is glutted and the opportunity for minority scientists are not great. Second, racism is still very much prevalent in the secondary schools of our nation. The impact of racism tends to rear itself through counselors, who tend to suggest Blacks choose other fields than science as a potential career. This normative recommendation of counselors is rooted in the supposition that Blacks do not have the requisite mental capabilities to conquer the disciplines of science and engineering. The effects of racism upon the students themselves tend to

create within them a self-perception that science and engineering is not a productive career choice for them to make. By and large Blacks tend to rate themselves on their ability to do science as inadequate. When coming from high school, Black students believe that science courses are important, extremely difficulty and generally well taught. They believe, however, that the price paid for the mastery of science and to obtain lucricative careers are too great to bear. A further extension of the syndrome is a widely held belief that science is not enjoyable. Consequently, as recorded in the data that I presently outlined in this paper, Blacks tend to major to a lesser degree in this field than other sub-groups of students.

The approach to rectification of these facts cannot be a traditional response. In most institutions where Blacks tend to major in the science and engineering programs and where Blacks show deficiencies, the approach has been to use remediation. Remediation is based upon the principle that the students must be prepared with more basic fundamental skills and facts before they are allowed to proceed into the collegiate scientific curriculum. This approach, of course, tends to certify the notions that have been promulgated in the secondary school system. It is debilitating as opposed to enhancement. If we are to have a large interest manifested in science clearly, new approaches must be one used in the teaching of science. That new approach must be one which

will recruit students into the sciences as well as reinforce the interest of those students who already have an interest in science. There are several models available in the higher education community which represent possibilities. One such model is the Science Curriculum of the Thirteen-College Curriculum Program, developed by the Institute For Services to Education, of which you will hear more about in this conference. The third factor which will make it possible for more Blacks and minority students to participate in science is to have specially designed programs of support. Black students are poor. Many more Blacks would choose the field of science and engineering if there were special incentive awards of a monetary nature to support their cost of education. Providing funds for the cost of education serves only to get students in the institution in a scientific discipline. This does not guarantee that they will make it as a scientist or an engineer. What I have suggested above will do that if effectuated well.

In the historically Black college is found a greater sensitivity to the problems of the education of the disaffected in our society. There is a propensity for change; there is a willingness to experiment; and there is a lesser holding on to tradition. These characteristics, along with modest new facilities and equipment and well-trained faculties, lend themselves very well to the requirements for the development of first-rate educational programs which will recruit in and maintain more Blacks in the scientific discipline.

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