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Chemistry Departments in Predominantly Black Institutions

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ABSTRACT

Chemistry programs in 87 predominantly Black institutions were compared by questionnaire survey. Advanced undergraduate courses were offered for chemistry majors by 86% of these schools, but only 28% offered research and independent study for undergraduates. Although there were extremes, most of the faculty taught 15 to 18 contact hours and their median salaries were below the national median. Library support seemed adequate with 1 to 1.5% of the total library materials being chemistry books, texts and reference, and the libraries of most schools had holdings of 15 principal chemistry-related journals. More than 90% of the schools were well-equipped with laboratory instrumentation for the undergraduate program. One-third of the schools were recipients of current grants, but less than 50% of these grants were for research. At the time of the survey there was a median of 13 chemistry majors in the schools, but this has been increasing since. On the basis of 45% response from individual faculty members of these schools, all faculty members had post-baccalaureate degrees, with 2/3 holding the doctoral degree. Only about 2/3 of the respondents indicated professional activity via scientific meeting attendance and/or recent publication. Most respondents (92%) were members of the American Chemical Society, but membership in other professional societies was much less common. Responses by these faculty members indicated that up-to-date instructional methods were generally being used.

INTRODUCTION

There are 123 predominantly Black institutions in the United States, and all but four are in the southern states. One third of these are junior colleges, 70% of the remainder are four-year liberal arts colleges and the rest have graduate programs with four institutions having programs leading to a Doctor's degree.

A majority of these institutions are small colleges with only an undergraduate program in chemistry and are not accredited with the American Chemical Society. Being small colleges they have all the handicaps of their size, yet they have the task of training undergraduates to the same level of academic standards as the undergraduates in the universities.

The field of chemical education itself has developed some problems. There have been rapid advances in the theoretical chemistry and drastic changes in the chemistry curriculum. These changes have resulted in producing graduates leaning only toward academic careers, ignoring government and industrial jobs.

This survey was undertaken to determine (1) how the predominantly Black institutions bridge the gap between the scholastic achievements of the undergraduate and the graduate schools and (2) how these institutions meet the task of inculcating an attitude besides providing formal training in the discipline.

The scope of the survey was limited to chemistry programs.

SURVEY METHOD AND RESPONSE

A three-part survey was undertaken to gather data on the chemistry departments in the predominantly Black institutions. Letters were sent to all the schools requesting a catalog and a list of their chemistry faculty. Upon the receipt of the faculty roster, two questionnaires were sent. One was to the department chairman concerning the individual characteristics of the department, such as facilities, salaries and the

instructional duties. The other questionnaire was sent to the individual faculty members requesting information on their credentials, plans for further study and teaching loads.

Standard errors and chi-squared tests were performed where applicable. The standard errors are reported to the nearest percentage.

Catalogs were received from 71 of the 87 schools that responded to the survey; 18 department chairmen and faculty members of 34 schools responded to the questionnaires. Table I summarizes the percentage response from the schools and their faculties. The response on catalogs and department chairmen has a distribution that is not different from the distribution of the schools by degree-granting level at the 90% level by a chi-squared test. This indicates that the results from these two aspects of the study are representative of the schools. The percentage of chairmen that responded was lower than was expected for no apparent reason.

The response from faculty members was higher from schools with graduate programs so the results may be biased. An overall response from 45% of the faculty, however, indicates that the results are not too atypical.

Table I. Responses to Survey of Chemistry Departments of 123 Predominantly Black Colleges and Universities

Highest Degree Granted	% Responded With Catalogs	% Department Chairmen Responded	% Faculty Responded
Bachelor's	81	22	34
Master's	78	17	50
Doctor's	100	25	75

RESULTS AND DISCUSSION

Schools. Sixty-five of the 87 predominantly Black institutions that responded to the survey offer only a Bachelor's degree; 18 offer a Master's degree and four offer a Doctor's degree.

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Forty-one percent of the schools are state supported and the remaining 59% are either church or privately supported. Seventy-five percent of the schools that offer a Master's degree are state supported whereas 75% of the schools that offer a doctoral degree are church or privately supported. A summary of these data is presented in Table II.

Table II. Characteristics of 87 Predominantly Black Colleges and Universities

Highest Degree Granted	Total No. Schools	No. Accredited	No. State Supported	No. Private or Church Supported
Bachelor's	65	55	22	43
Master's	18	17	13	5
Doctor's	4	4	1	3

Most of these institutions are small schools, 45% having an enrollment of under 1,000 students. Approximately 10% of the schools have student bodies that are over 5,000, most of these being state-supported institutions.

Chemistry Departments. It was found that 86% of the schools offer both Organic and Physical Chemistry for chemistry majors. Twenty-eight percent offer research or independent study for undergraduates. Other courses include Agricultural Chemistry, Chemical Literature, Colloid Chemistry, Food Chemistry, History of Chemistry, Quantum Mechanics, Textile Chemistry, Thermodynamics and Water Chemistry. Many of these courses indicate industrial orientation rather than training for graduate school. From a review of the catalogs it appears that these schools have chemistry programs comparable with those of most schools of similar size.

From the questionnaires completed by the department chairmen, 13% of the faculty are parttime. They teach one and sometimes two courses. Most of the schools have three to six faculty members. It was found that the full-time staff have a teaching load ranging from 6 to 17 credit hours and from 9 to 25 contact hours. Most of the teaching loads fall in the range of 9 to 12 credit hours and 15 to 18 contact hours.

In Table III is a presentation of faculty salaries on an academic year basis. Each school submitted a salary range for the various ranks. Because these ranges differed so greatly in both the salary level and the range itself, the midpoint of each one of these ranges was tabulated and used in the discussion. The salary range in Table III is of the midpoints and from this it can be seen that the range is very great. The median salaries can be compared with those from the National Science Foundation's survey of 1968. In all cases the median salary for the schools surveyed is below the NSF figure. The major discrepancy is at the professor level.

From information gathered on the school libraries and the chemistry books in the libraries, it was found that almost all schools have from 1 to 1.5% of their library in chemistry text and reference books (not including the journals). This indicates that they have several hundred chemistry books, including student references. Considering the number of chemistry students, this appears to be an adequate number of text and reference books. Table IV contains a list of the journals that are desirable in school libraries and the percentage of schools that have them.

The schools are generally well equipped. The response concerning 10 common instruments desirable in an undergraduate program indicated that over 90% of the schools have such instrumentation. Included were such items as pH meters, spectrophotometers, colorimeters, recorders, balances and

nuclear counting equipment. Many schools stated that their acquisitions were through the National Science Foundation institutional equipment grants. From this response, it appears that the schools have adequate instrumentation to teach modern chemistry programs.

Only one third of the schools had current grants and less than half of these were for research. This indicates that undergraduates in these institutions are not exposed to research and the current developments in the various fields. The operating budgets exclusive of salaries indicate that one third of the schools have an operating budget of less than \$5,000 a year and 75% of the schools operate with a budget under \$15,000 a year. The highest budget reported was \$32,000 a year. Budgets over \$5,000 would be adequate for schools of this size to permit replacement of equipment and faculty travel.

The chemistry departments of the schools had an average of 22 majors at the time of the survey; however, this average is not very meaningful as the number of majors ranged from 0 to as many as 80 with a median of 13. In any case, it can be seen that large numbers of students are majoring in chemistry in these schools. The number apparently has increased over the past five years. In fact, some schools have two or three times as many chemistry majors now as they had in the past five years. Of course, one important factor is the number of current

Table III. Chemistry Faculty Salaries for an Academic Year at 87 Predominantly Black Colleges and Universities

Rank	Salary Range	Median Salary	Average Salary	NSF 1968 Median Salary
Instructor	\$5,250-\$8,700	\$7,500	\$5,252	\$8,000
Assistant Professor	6,600-10,800	9,025	8,736	9,900
Associate Professor	7,650-13,600	10,200	10,223	11,700
Professor	8,500-16,900	11,400	12,029	14,700

Table IV. Fifteen Principal Chemistry-Related Journal Holdings of 87 Predominantly Black Colleges and Universities

	% Schools Having Journal ± Standard Error
Journal of Chemical Education	100 ±
Chemical Abstracts	90 ± 6
Journal of the American Chemical Society	83 ± 8
Science	83 ± 8
Journal of Organic Chemistry	78 ± 9
Analytical Chemistry	72 ± 9
Chemical Reviews	72 ± 9
Journal of Physical Chemistry	72 ± 9
Inorganic Chemistry	61 ± 10
Journal of Chemical Physics	56 ± 10
Journal of the Chemical Society	56 ± 10
Nature	50 ± 11
Journal of Inorganic and Nuclear Chemistry	44 ± 10
Quarterly Reviews	33 ± 10
Journal of Scientific Instruments	28 ± 9

chemistry majors who will actually graduate. Experience shows that about one out of four of these students actually finish.

Faculty. There was a 45% response from the individual faculty members. The response came from a cross section of the

schools and gives a good picture of the type of chemistry teachers in the predominantly Black institutions.

From Table V it can be seen that almost all of the faculty members have a Doctor's or Master's degree, two-thirds of them having a doctoral degree. All but 3% of the faculty members have an area of specialization in chemistry, over half of them being in organic or biochemistry as is typical of most college chemistry teachers. In fact, the distribution of areas of specialization nationally shows a predominance of biochemistry. This high concentration of biochemistry is probably due to strong biology programs at the institutions.

Table V. Characteristics of Chemistry Faculty in 87 Predominantly Black Schools

Area of Specialization	Highest Degree Earned (% Obtained \pm Standard Error)		% of Faculty in Area \pm Standard Error	% of Chemists in Area Nationally
	Doctoral 66 \pm 4	Master's 31 \pm 4		
Analytical Chemistry	10	\pm 3	13.2	
Biochemistry	17	\pm 3	5.8	
General Chemistry	6	\pm 2	—	
Inorganic Chemistry	6	\pm 2	5.5	
Organic Chemistry	42	\pm 5	41.0	
Physical Chemistry	16	\pm 3	12.0	
Biology	3	\pm 1	—	

With regard to faculty development the survey shows that 48% of the faculty members attend some scientific meetings, 13% are currently working on an advanced degree and 17% plan to work on an advanced degree. Because 34% of the faculty members do not have doctoral degrees, these data indicate that most of them were either working on or planning to work on an advanced degree.

Participation in professional meetings and publications are revealing. Thirty-seven percent of the faculty members did not indicate that they had attended any scientific meetings in the past year, though one indicated he had attended as many as nine scientific meetings in the same period. Thirty-nine percent of the faculty members did not indicate that they had ever published anything, though 17% have published more than 10 scientific articles and one has published 65.

Ninety-two percent of these chemistry teachers are members of the American Chemical Society and thus are receiving current literature in the field of chemistry. Forty-eight percent are members of Sigma Xi, a national scientific research honor society, and 19% are members of Beta Kappa Chi, which represents the highest distinction in the field of science in Black colleges and universities. However, only 8% of these faculty members are members of their state academies of science.

Use of teaching aids is also very significant. Ninety-two percent of the faculty members use models and 55% use movies; 14% use programmed texts. As most of the recent programs do require such tools, these findings indicate that most of the schools are using an up-to-date instructional approach. The faculty members also indicated that they would be interested in some type of cooperative teaching or testing

program. Less than 10% indicated that they had no interest in this type of approach and approximately 30% indicated that they were currently working with some type of cooperative program.

CONCLUSIONS AND COMMENTS

This study indicates many improvements in the chemistry departments of predominantly Black institutions since previous studies were made.

The predominantly Black institutions have generally a higher percentage of female students than other institutions. Because fewer females than males go into the field of chemistry, this could be one reason there is a smaller percentage of Black chemists being trained. The increase in male students may explain the apparent increase in chemistry majors over the last few years in these schools.

The schools apparently are offering the more modern chemistry curriculum and are using the teaching tools necessary to these courses. However, all of the departments should continually look very closely at curriculum to assure that it meets current needs. The American Chemical Society offers a consultative service in curriculum which could be utilized by any of these schools. An area of curriculum that should be looked at closely is the development of interdisciplinary courses, particularly with input from biology, business and the environment areas. Interdisciplinary training of this type could involve interinstitutional resources because many of the schools are in areas where there are other small institutions, each having different strengths and programs. An interinstitutional program would allow all the schools to benefit by upgrading their course offerings and making maximum utilization of their facilities and faculty members. This might also prove to be a method of reducing teaching loads.

One of the major problems with the schools appears to be the heavy teaching load of most of the faculty members. This heavy teaching load does not allow faculty members sufficient time to counsel and work with students individually and to develop new ideas in curriculum. It also does not permit faculty members to do research and keep informed about the current developments.

The fact that over 30% of the faculty members of these institutions have not attended any scientific meetings in the past year and have not published anything indicates that they are not keeping abreast with their fields.

Most of the schools are well equipped to teach chemistry. The same equipment can be used to develop undergraduate research programs. Only 28% of the schools have undergraduate research programs.

In conclusion, it can be said that the predominantly Black institutions offer a modern chemistry curriculum, utilizing the current teaching techniques. The handicap of small size can be overcome partly by development of interdisciplinary courses with particular emphasis on biology, business and environment sciences. Such training would open new fields to the students and allow the institutions to make maximum utilization of their facilities and faculty members.

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