DOCUMENT RESUME

ED 475 485 SE 067 773

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TITLE	The Status of Chemistry in Two-Year Colleges: Results from a Survey of Chemistry Departments.
INSTITUTION	American Chemical Society, Washington, DC.
PUB DATE	2003-00-00
NOTE	19p.
AVAILABLE FROM	American Chemical Society, 1155 16th Street NW, Washington, DC 20036; tel: 800-227-558, ext. 4587.
PUB TYPE	Reports - Descriptive (141) -- Reports - Research (143)
EDRS PRICE	EDRS Price MF01/PC01 Plus Postage.
DESCRIPTORS	*Chemistry; Curriculum Development; Higher Education; *Science Instruction; Science Teachers; *Two Year Colleges

ABSTRACT

In the fall of 2001, the American Chemical Society (ACS) conducted a survey of two-year college chemistry departments to obtain basic data on chemistry faculty and chemistry courses taught at college. A questionnaire sent to appropriate representatives (department chairs, program heads, or deans) from 1195 campuses generated a 77% response rate. The survey results indicate that chemistry is taught in departments that vary widely in size but that 28% of two-year college campuses offering chemistry have only one chemistry instructor. Overall, 59% of faculty hold full-time positions and 41% have part-time status. The retention of full-time chemistry faculty, 96% of whom are tenured or tenure-track, is fairly high. The representation of women overall is 32%, with the distribution of female faculty among the various ranks closely corresponding to that of the male faculty. Most of the chemistry courses taught are traditional courses such as General Chemistry (41%), Introductory Chemistry for Allied Health majors (29%), General Organic Chemistry(11%), and Chemistry in Society or a similar course (6%). This project, modeled after a similar project by the American Institute of Physics (AIP) that focused on physics in two-year colleges, was conducted in collaboration with AIP. (Author/KHR)

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The Status of Chemistry in Two-Year Colleges: Results from a Survey of Chemistry Departments

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Summary

In the fall of 2001, the American Chemical Society (ACS) conducted a survey of two-year college chemistry departments to obtain basic data on chemistry faculty and chemistry courses taught at the colleges. A questionnaire sent to appropriate representatives (department chairs, program heads, or deans) on 1195 campuses generated a 77% response rate. The survey results indicate that chemistry is taught in departments that vary widely in size but that 28% of two-year college campuses offering chemistry have only one chemistry instructor. Overall, 59% of faculty hold full-time positions and 41% have part-time status. The retention of full-time chemistry faculty, 96% of whom are tenured or tenure-track, is fairly high. The representation of women overall is 32%, with the distribution of female faculty among the various ranks closely corresponding to that of the male faculty. Most of the chemistry courses taught are traditional courses: General Chemistry (41%), Introductory Chemistry for Allied Health majors (29%), General Organic Chemistry (11%), and Chemistry in Society or a similar course (6%). If funding is obtained for a second, more extensive survey, the results from this initial survey will be used as the basis for gathering detailed data from faculty. This project, being modeled after a similar project by the American Institute of Physics (AIP) that focused on physics in two-year colleges (*1*), was conducted in collaboration with AIP.

Introduction

Two-year colleges represent an important component within the U.S. higher education system. Since their establishment in the early 1900s (*2*), two-year colleges have evolved to fulfill a number of needs. Currently, science programs at two-year colleges prepare students to transfer to four-year institutions, establish careers as technicians, and become scientifically literate citizens. With their open admissions policies, low tuition, and convenient locations, two-year colleges are accessible to many minorities, women, and returning students (*2, 3*). Given the fact that nearly 45% of students pursuing higher education attend two-year colleges and that 58% of these students are women and 26% are underrepresented minorities (*4*), these educational institutions have been highlighted as ideal venues for expanding the science, engineering, and technology (SET) workforce. The Congressional Commission on the Advancement of Women and Minorities in Science, Engineering, and Technology Development recommended "comprehensive and systemic institutional changes to strengthen SET education at two-year colleges and to facilitate transition of SET students from two-year colleges into four-year colleges" (*5*).

Information about the status of chemical education at two-year colleges is essential for initiating and assessing such institutional changes. Yet, for all the data on science education gathered in recent years, there has never been any systematic or comprehensive effort to map the scope and substance of chemistry instruction at the nation's almost 2000 two-year college campuses. Apart from anecdotal reports, little is known about the demographics, background, and professional activities of the thousands of two-year college chemistry faculty. Equally little is known about the types of courses that are taught, the instructional practices utilized, faculty perceptions of students, and the connections that faculty have established with other colleagues in industry and academe.

For more than a decade, the chemical education community has sought the reliable information such a survey would provide. *Partners in Progress*, a 1992 report of a National Science Foundation (NSF) workshop on the role of professional societies in science, technology, engineering, and mathematics education in two-year colleges, included the following in its recommendations: "The American Chemical Society should conduct baseline studies on science, technology, engineering, and mathematics issues at two-year colleges including curricula, faculty, definition of scholarship, and facilities and resources" (*6*). This charge mirrored a call to all disciplines for baseline information. Members of ACS's Division of Chemical Education and ACS staff concurred that a survey of chemistry in the two-year colleges would provide valuable information. Plans for such a study were put into place, and ACS resources for the first phase of the project became available in 2001. The survey data reported in this study represent an initial effort to gather basic information in response to these needs.

ACS Involvement in Two-Year College Chemistry

ACS's involvement in two-year colleges dates back to the 1960s, when nationwide programs for two-year colleges and the Committee on Technician Activities, as it was then called, began. Since then, ACS has played a leadership role by compiling guidelines for two-year colleges (*7*), providing outreach and consulting programs (*8–11*), and facilitating the establishment of chemical technology programs (*12–20*). As part of its commitment to technicians and technical education, ACS also established a Chemical Technicians Division in 1991.

The ACS document *Guidelines for Chemistry and Chemical Technology Programs in the Two-Year Colleges* (*7a*) was first published in 1970. In 1984, the ACS Task Force for the Study of Chemistry Education in the United States published a report entitled *Tomorrow* (*8*) that recommended revising the guidelines (*7b*) and establishing an ACS approval service for chemical technology programs (*12*). To set the framework for implementing these recommendations, ACS held an invitational conference in 1985 on Critical Issues in Two-Year College Chemistry, producing a report by the same name (*9*). Several years later, also in response to *Tomorrow*, another invitational conference was held to discuss issues and make recommendations related to two-year/four-year college articulation in chemistry (*10*).

ACS efforts in the area of chemical technology programs have been leveraged with federal funding. In the mid-1990s, with financial support from the U.S. Department of Education (*13*), ACS developed the Voluntary Industry Standards (*14*), which codified the skills industry sought in chemical technicians. With support from NSF, a two-year high school science technology program, Science in a Technical World (*15*), and educational materials for two-year programs were developed (*16*). Currently, ACS is using NSF funding to support and enhance chemical technician education at the national level (*17*). Grant activities include the development of a national clearinghouse of information and resources related to chemical-based technician education (*18*), an online database of updated Voluntary Industry Standards (*19*), materials to assist with the professional development of chemistry faculty (*20*), and outreach materials for two-year colleges with chemical technology programs (*18*).

Overall Plan for the Study

To build on its past involvement with two-year college chemistry and address the need for more information in this important area of chemical education, ACS planned a nationwide survey of two-year colleges. ACS was aware that in 1996 AIP had carried out an extensive NSF-funded survey of physics in two-year colleges (*1*). Because of AIP's experience on this earlier project, ACS sought to collaborate with AIP on a parallel study of two-year college chemistry. It was clear that AIP's Statistical Research Center could be an effective partner for ACS, supplementing the expertise and resources available at ACS while offering models for data collection. AIP also wished to update its data on physics in the two-year colleges and planned to do this simultaneously with the ACS study.

ACS adapted the two-phase model successfully used by AIP for its 1996 study of physics. The plan was to first conduct a survey of chemistry department chairs or other appropriate representatives in all two-year colleges that offer chemistry courses. This survey, funded by ACS and AIP, would make it possible to gather some basic data on both faculty and programs. It would also lay the groundwork for the second phase—an in-depth survey of individual faculty. The faculty survey, for which funding is being sought, would ask for detailed information on academic and work experience, instructional practices, resources for instruction and professional development, opinions about the adequacy of resources, and descriptions of students' characteristics.

The departmental survey form, a one-page questionnaire (see Appendix A), was designed to elicit data on

- the number of chemistry faculty at each college,
- full-time or part-time status,
- the number of sections taught per term,
- the highest degree earned,
- tenured/permanent or temporary status,
- gender,
- the longevity of appointments,
- faculty turnover, and
- the types of chemistry courses taught in each department in the fall term.

A group of two-year college chemistry leaders reviewed the questionnaire and provided feedback about whether it requested appropriate information and whether the questions clearly conveyed the type of information needed (*21*).

In planning the study, care was taken to develop a complete list of two-year campuses. According to the American Association of Community Colleges, 1163 two-year colleges existed in the United States in 2001. This list, however, refers to school systems, which can include several campuses. To fully capture the differences that often exist between campuses in the same system, the list used for the survey was expanded so that each campus was assessed separately.

The list of campuses surveyed was developed and updated from that used in the AIP 1996 Survey of Two-Year College Physics Programs. Of the 1785 two-year college campuses on the initial list, 93 had since closed or merged. This decrease was largely offset by 81 campuses that had opened. Of the 1773 campuses currently in existence, 1195 (approximately two-thirds) offered chemistry. In comparison, 1072 campuses offered physics (*22*).

Response to the Survey

The appropriate program heads, chairs, or deans on the 1195 two-year college campuses that offered chemistry received the survey questionnaire during the fall 2001 semester. The response rate was 77%, with direct responses obtained from 916 campuses (455 responded to the paper survey, 145 responded to telephone follow-up, and 316 submitted data online in response to e-mail queries). To ensure that these data were representative of the entire list of campuses offering chemistry, partial information on 208 other campuses (17%) was obtained from their websites. Since this information was not from official responses, it was not included in the formal data analysis. However, the information was consistent in almost every respect with the findings from the campuses that returned the surveys. So while the official response rate was only 77%, the results accurately reflect the main characteristics of at least 94% of the two-year college chemistry programs nationwide.

Survey Results

Findings on faculty, program size, retirements and other turnover, and chemistry courses offered at two-year colleges in fall 2001 are presented below. In some cases, data from the parallel physics survey conducted by AIP are mentioned for comparison purposes (*22*).

Findings on Faculty

Number of faculty

A total of 3364 faculty teach chemistry at the 916 campuses that responded to the survey. Adding in the data collected from the websites of 208 non-responding departments and generalizing to the 6% of schools for which no data on department size was available, the number of chemistry faculty in the nation's two-year colleges in fall 2001 is estimated to be 4300. A similar analysis from the physics survey, carried out during the same semester, indicated that 2600 faculty taught that discipline at two-year colleges (*22*).

Of the approximately 4300 chemistry faculty, an estimated 59% (2540) had full-time appointments. The remaining 41% (1760) were teaching part time.

Course loads

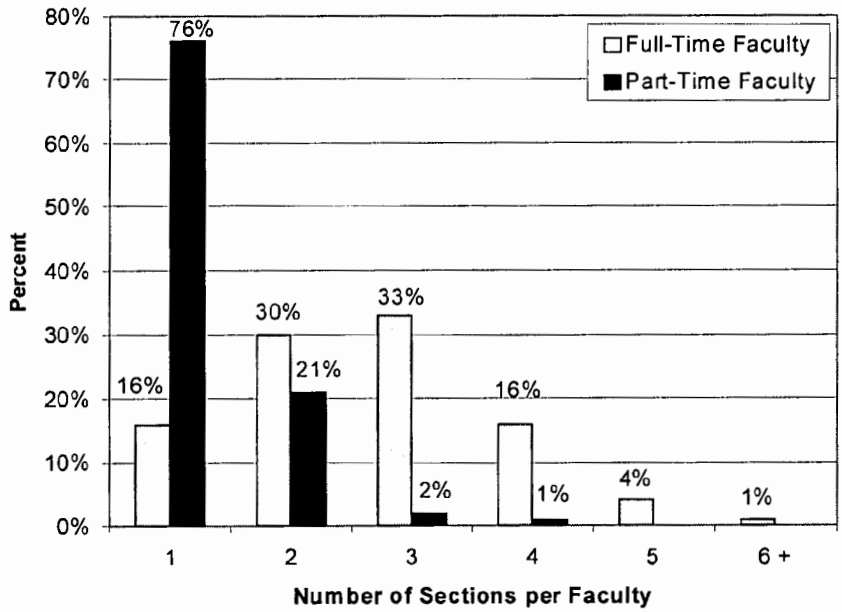
The survey requested the number of chemistry sections taught per faculty in the fall 2001 semester, excluding laboratory sections. Figure 1 shows the distribution for full- and part-time faculty. The overall mean for all two-year college chemistry faculty was 2.1 non-laboratory sections per semester. Table 1 includes data showing that the mean number of sections for full-time faculty was 2.7; for part-time faculty, the mean was 1.3.

Although the data on number of chemistry sections taught per semester do not reflect the high teaching loads at two-year colleges (*23*), several factors must be considered. For one thing, laboratory sections, which may constitute a significant portion of teaching loads for science faculty, were intentionally excluded. A more detailed survey (such as the planned faculty survey) would be needed to accurately capture data on laboratory courses. This is because departments and faculty themselves count and handle laboratories differently. In some cases, laboratories are

listed as separate companion courses to lecture classes; in other cases, they are not. On some campuses, several labs are associated with one lecture section, and on others, several smaller classes may come together to share one lab time. Given the range of possibilities, the one-page questionnaire to departments in this survey requested only the number of non-laboratory courses, which could be identified without ambiguity.

Also, because of the way in which the information was gathered, reported course loads do not include any courses taught outside the discipline of chemistry and do not reflect any time spent on administrative duties. The fact that 7% of the campuses only offered one chemistry section in the fall while 4% had only a single part-time instructor suggests that chemistry faculty are teaching courses in other areas, perhaps math or physics. Once again, the survey planned for the second phase of the project will shed more light on the full breadth of faculty teaching assignments and administrative responsibilities.

Figure 1. The number of chemistry sections taught per faculty member in the fall 2001 semester, excluding laboratory sections, comparing full- and part-time faculty.



Note: One percent of part-time faculty taught four or more courses.

Comparison of full- and part-time faculty

As noted above, 59% of chemistry faculty at two-year colleges held full-time positions, and 41% were employed part time. This is quite different from the situation for academic chemists overall. According to a special report on the academic chemists surveyed in the ACS ChemCensus 2000, 87.7% were employed full time and only 4.3% were part time, 6.2% were postdoctoral fellows, and the remainder were unemployed (*24*). Two-year college chemistry faculty, however, are more fortunate in this regard than their colleagues in other disciplines. Overall, only 35% of all faculty at public two-year colleges held full-time positions in the fall of 1999 (*25*).

The high percentage of part-time chemistry faculty at two-year colleges raises concerns about the climate in which courses are taught and chemistry departments operate. Yet when the fact that 76% (approximately 1340) of the part-time faculty only taught one non-laboratory chemistry course (see Figure 1) is taken into account, it does not appear that reliance on part-time faculty is excessive overall. The situation must be examined on a departmental basis, however, to determine whether a campus is hiring a large number of part-time faculty to teach one course each, rather than consolidating the teaching load. The more comprehensive survey planned for the second part of this project will investigate whether many of these part-time faculty teach a large number of laboratory or non-chemistry courses or hold other full-time positions and only want to teach one course.

A Ph.D. or Ed.D. degree had been obtained by 53% of the tenured/permanent chemistry faculty, 59% of the tenure-track faculty, and 43% of the temporary faculty at two-year colleges. As shown in Table 1, a higher percentage of the full-time chemistry faculty (54%) had earned Ph.D.s or Ed.D.s, compared to the part-time chemistry faculty (42%). About 1% of the part-time chemistry faculty had not yet earned a graduate degree. These numbers differ from those obtained in ChemCensus 2000, where 60.8% of all chemistry faculty at AA-granting institutions had Ph.D.s, but the difference may be due to the smaller sample size of 803 faculty in the ChemCensus study (*24*).

Table 1 also compares the employment status of full- and part-time two-year college chemistry faculty. Almost all full-time faculty had long-term employment options; 78% were tenured/permanent, and 18% were tenure-track. Only 4% were temporary. Among part-time faculty, virtually all (96%) were temporary; 3% were tenured, and 1% were tenure-track.

The percentage of two-year college chemistry faculty who held tenured positions in fall 2001 (78%) is slightly higher than that reported for all two-year college faculty in 1998–99 (71.7%) and much higher than at four-year institutions (62.3%) (*26*). The fact that 96% of the full-time chemistry faculty are tenured, permanent, or tenure-track suggests that two-year colleges are committed to maintaining quality chemistry faculty. A more comprehensive survey will make it possible to identify what steps institutions are taking, beyond offering job security, to recruit and retain chemistry faculty.

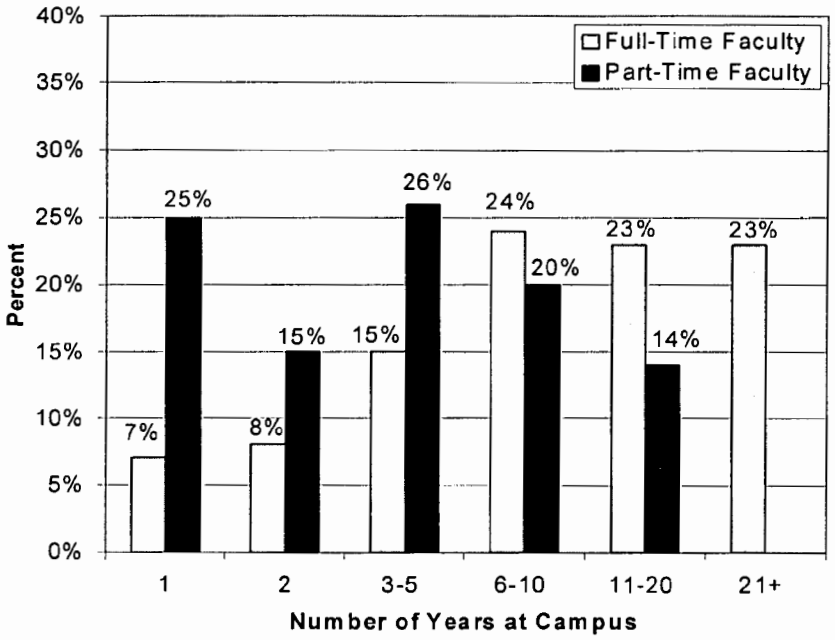
Table 1. Comparison of full- and part-time chemistry faculty in two-year colleges during the fall 2001 semester.

	Course load [a] (mean)	Ph.D. or Ed.D. [c]	Tenured/ Permanent [c]	Tenure-track [c]	Temporary [c]	Years working at campus	
						median	mean
Full time	2.7 [b]	54%	78%	18%	4%	10	12.6
Part time	1.3 [b]	42%	3%	1%	96%	4	6.2

[a] Chemistry sections excluding laboratory sections.
[b] Overall mean for faculty (full time and part time) = 2.1 non-laboratory courses.
[c] Percentages are based on the number of faculty of the specified gender.

On average, full-time faculty had been at their current campus for 12.6 years, just over twice as long as part-time faculty (6.2 years). A more detailed breakdown of the data is provided in Figure 2.

Figure 2. Number of years that two-year college chemistry faculty have been working at their campuses.



Note: 14% of the part-time faculty have taught 11 or more years at their campuses.

Gender

Female faculty members accounted for 32% of chemistry faculty at reporting departments. This proportion is comparable to the percentage of women faculty at AA degree-granting institutions in the ACS ChemCensus 2000 (34.4%) (*27*). It is higher than the percentage of female two-year college physics faculty (14%) (*22*) but lower than the percentage of women among all two-year college faculty (49.0%) (*28*).

As shown in Table 2, crossing gender with other variables showed no significant differences for male and female faculty course loads, full-time vs part-time status, and tenure status. Although a slightly higher percentage of male faculty were already tenured (52% of male vs 48% of female faculty), a higher percentage of women were in the tenure-track positions (10% of male vs 14% of female faculty).

However, there was a significant difference with respect to highest degree held: 55% of men vs 40% of women held a Ph.D. or Ed.D. On average, male faculty had been employed on their campus for eight years, while women had been employed on theirs for only six.

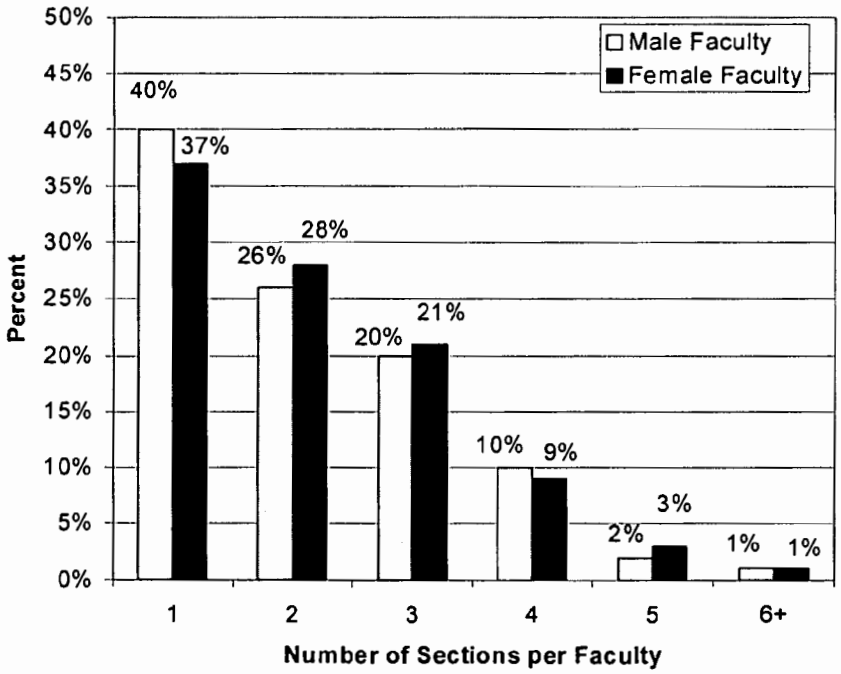
Table 2. Comparison of male and female chemistry faculty at two-year colleges during the fall 2001 semester.

	% of all faculty	Course load [b] (mean)	Ph.D. or Ed.D. [c]	Tenured/ permanent [c]	Tenure-track [c]	Temporary [c]	Years working at campus (median)
Male faculty	68%	2.1	55%	52%	10%	38%	8
Female faculty[a]	32%	2.1	40%	48%	14%	38%	6

[a] 40% of the campuses had no women on the chemistry faculty; 34% had only one woman.
[b] Chemistry sections excluding laboratory sections.
[c] Percentages are based on the number of faculty of the specified gender.

The fact that 38% of both the female and male faculty hold temporary positions indicates that women are not being disproportionately relied on to fill what is often seen as an undesirable position. They are also being assigned to comparable numbers of non-laboratory chemistry sections (see Figure 3).

Figure 3. The number of chemistry sections taught per faculty member (male vs female) at two-year colleges in the fall 2001 semester, excluding laboratory sections.



Findings on Chemistry Programs

Survey responses also allowed comparisons between chemistry programs on different campuses, indicating the range of situations in which chemistry is taught.

Program size: Faculty

Of the two-year college campuses offering chemistry, 28% had only one chemistry faculty member, including 24% with one full-time instructor and 4% with only a single part-time instructor. This is of concern since, in such situations, a faculty member can feel quite isolated and may bear a disproportionate amount of the administrative tasks.

On the other end of the distribution, four campuses each had 19 chemistry faculty. Overall, campuses had a median of 3 and a mean of 3.7 chemistry faculty.

Comparable data in physics show that 43% of the campuses had only one physics instructor; the median for physics faculty was 2, and the mean was 2.5 (*22*).

It is likely that female faculty feel isolated, given that only 32% of the chemistry faculty overall are female and that 34% of departments have only one woman on the faculty. A related concern is that 40% of chemistry departments have no women faculty at all, and students on these campuses lack female role models in chemistry.

Questions about faculty ethnicity were not included in this brief departmental survey but will be part of the detailed faculty survey planned for the next phase of the project.

Program size: Course sections

Seven percent of the campuses taught only one chemistry section, and 30% taught three or fewer. The median number of chemistry sections (excluding laboratory sections) taught in a department during the fall 2001 semester was 6, and the mean was 7.8. Data on physics showed that 15% of the campuses taught only one section of physics, and 49% taught three or fewer sections. The median number of physics sections taught per semester was 4, and the mean was 4.9 (*22*).

Retirements and other turnover

In the past two years, 16% of the campuses had seen retirements among full-time permanent chemistry faculty, although in 88% of the cases it was just one person. In addition, 10% of the campuses also had full-time chemistry faculty leave prior to retirement. Among the campuses teaching physics, the percentages were similar (*22*).

On the flip side, 9% of the campuses were currently recruiting chemistry faculty. Another 13% anticipated recruiting in the next year. Among the campuses teaching physics, the percentages were 6% and 8%, respectively (*22*).

Based on the turnover, retirement, and recruitment data, it does not appear that the overall number of two-year college full-time chemistry faculty will change dramatically in the near future. Along with the 120 chemistry faculty that left their campuses, an estimated 225 faculty retired in the last two years. During that same time, 380 faculty assumed full-time positions (Figure 2). Although it is nearly impossible to project future retirements and turnovers, the recruiting efforts that were currently under way at 9% of the campuses and anticipated the following year at 13% of the campuses were estimated to involve approximately 120 and 180 positions, respectively.

Findings on Courses

Multiplying the reported mean of 2.1 non-laboratory chemistry sections by 4300 instructors yields an estimate of 9000 chemistry course sections offered in the fall of 2001. Table 3 indicates the distribution of the various kinds of courses offered by chemistry departments. An additional 44 campuses reported that some chemistry or chemical technology courses were offered through another department on their campus.

The data show that general chemistry courses for science majors were the most common; they were offered by nearly all campuses (93%) and comprised 41% of the total number of chemistry sections offered overall. Introductory chemistry courses for allied health and related majors were next in frequency; they were offered by 73% of the campuses and comprised 29% of the chemistry sections offered overall. General organic chemistry courses were the third most common; they were offered by 59% of the campuses and comprised 11% of the sections offered overall. Many of the courses mentioned in the "Other" category referred to basic introductory chemistry such as Fundamentals of Chemistry or Preparatory Chemistry, or various kinds of applied chemistry.

Given the increasing need for chemical technicians and the flexibility that many campuses have to respond to that need, it is surprising that less than 5% of the courses offered overall in chemistry departments focus on applied chemistry in fields outside of allied health. Chemical technology courses comprised a mere 1%. Some of the courses listed under "Other" did correspond to applied chemistry, but still a very small portion overall.

Table 3. Distribution of the types of chemistry courses offered at two-year college campuses in the fall 2001 semester.

Course name	% of campuses offering this course	% of all chemistry courses offered
Gen. Chemistry for Science Majors	93	41
Intro. Chemistry for Allied Health, etc.	73	29
Gen. Organic Chemistry	59	11
Chemistry in Context, etc.	23	6
Analytical Chemistry	4	1
Chem. or Phys. Science for Educ. Majors	5	1
Other Physical Science	6	2
Chemical Technology	3	1
Other[a]	26	8

[a] Courses reported in the "Other" category included Fundamentals of Chemistry or Preparatory Chemistry (and similar courses of a basic, introductory nature), as well as various specialty courses.

Approximate number of students in chemistry courses
Based on the estimated 9000 sections taught and the assumption that approximately 20 students enrolled per section (the average enrollment in two-year college physics courses found in the 1996 AIP survey), approximately 180,000 students took chemistry in the fall term of 2001. In the 1996 physics study, about one-sixth of the students were enrolled in one-semester stand-alone courses, which were often offered every term (*1*). If the same holds true for chemistry, this would suggest that somewhere around 210,000 students take a chemistry course in U.S. two-year colleges each year.

Conclusions

The survey of two-year college chemistry departments, with its 77% return rate, has been quite successful, providing representative information on the two-year college campuses that teach chemistry. It confirms that chemistry is taught in departments that vary widely in size, but it raises concerns about those that are very small. The retention of full-time faculty suggests that conditions are at least adequate, but questions remain about the actual teaching load, including laboratory and non-chemistry courses. More information is needed about the role of part-time faculty, who comprise 41% of the faculty. The representation of women among two-year college chemistry faculty (32%), as well as their distribution across campuses, should be increased, but it is better than the percentages for B.S.-granting institutions (29.0%), M.S.-granting institutions (25.2%), and Ph.D.-granting institutions (20.2%) (*27*). Consideration of the chemistry courses taught, most of which are traditional courses for students pursuing allied health or planning to attend four-year institutions, points to opportunities for new courses and programs.

Future Work: Plans for a Comprehensive Survey of Faculty

ACS is currently seeking funding for a more detailed survey of faculty in two-year college chemistry departments. If the project is funded, ACS will again collaborate with AIP in the implementation of the survey. An advisory committee of two-year college chemistry leaders will be formed to provide input and direction to the project, and the survey will be mailed in the fall of 2003. Information from this survey, coupled with the physics data, would enhance our understanding of the status of physical science in the two-year system—potentially a very powerful resource.

The final report for the earlier AIP physics survey provides a sense of the kind of information yielded by such surveys (*1*). That survey provided, for the first time ever, accurate answers to questions such as how many two-year colleges offer physics, how many physics faculty teach on these campuses, how many students take physics courses, the gender and racial distributions of students and faculty, the kinds of physics courses that are offered, and the textbooks and other instructional media that are used. Information was also obtained about the use of part-time faculty; the academic and employment background of all faculty; their administrative responsibilities; their sense of isolation and other problems; their assessment of the available facilities, resources, and administrative support; and their involvement in professional activities and organizations.

The overall results from both the departmental and faculty surveys will lead to a better understanding of the status of chemistry in two-year colleges. Once the project is completed, it will help identify strengths and weaknesses in this part of the educational system. It will also provide a baseline for comparison for two-year colleges that are trying new approaches to education and establishing innovative programs.

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Acknowledgments

Special thanks to Mark McFarling at the Statistical Research Center of AIP for his work with the data collection and analysis and to Colette Mosley at the ACS Education and International Activities Division for preparation of the figures and tables.

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8) *Tomorrow,* American Chemical Society: Washington, DC, 1984.

9) *Critical Issues in Two-Year College Chemistry,* American Chemical Society: Washington, DC, 1986.

10) *Addressing Articulation Issues,* American Chemical Society: Washington, DC, 1995; http://www.chemistry.org/education/2year.html.

11) Information about the College Chemistry Consultant Service is available at http://www.chemistry.org/education/institutional/c3s.html.

12) *Chemical Technology Program Approval Service: Guidelines for Development and Evaluation of Chemistry-Based Technician Programs,* American Chemical Society: Washington, DC, 1997.

13) U.S. Department of Education, Office of Vocational and Adult Education, Business and Education Standards program, agreement number V244B30007, CFDA #84.244.

14) *Foundations for Excellence in the Chemical Process Industries: Voluntary Industry Standards for Chemical Process Industries Technical Workers,* Robert Hofstader and Kenneth Chapman, Eds., American Chemical Society: Washington, DC, Nov 1997.

15) a) NSF-DUE 9454564 (Science Technology: Knowledge and Skills) and NSF-DUE 9752102 (Science Technology: Knowledge and Skills—Phase II.)
b) *Science in a Technical World: Making Semiconductors,* W.H. Freeman and Co.: New York, 2002.
c) *Science in a Technical World: Medical Laboratory Technology,* W.H. Freeman and Co.: New York, 2002.
d) *Science in a Technical World: Refining Petroleum,* W.H. Freeman and Co.: New York, 2002.
e) *Science in a Technical World: Food Safety,* W.H. Freeman and Co.: New York, 2002.
f) *Science in a Technical World: The Carbonated Beverage Industry,* W.H. Freeman and Co.: New York, 2000.
g) *Science in a Technical World: Polymer Research and Development,* W.H. Freeman and Co.: New York, 2000.
h) *Science in a Technical World: Teacher's Edition,* W.H. Freeman and Co.: New York, 2002.

16) NSF-DUE 9850247, Chemical Technology Contextual Learning Curriculum Development Project.

17) NSF-DUE 0053250, Project to Support Chemistry-Based Technician Education.

18) The web address for the center is http://www.ChemTechLinks.org

19) The online Voluntary Industry Standards can be found at http://www.acs.org/vis.

20) Reed, John H. *A Guide to Classroom Instruction for Adjunct Faculty,* American Chemical Society: Washington, DC, 2002.

21) Reviewers of the questionnaire for the departmental survey included Clarita Bhat, Shoreline Community College, Shoreline, WA; Rick Bolesta, Mt. Hood Community College, Gresham, OR; Ann Cartwright, San Jacinto College, Pasadena, TX; Frank Koch, Bismarck State College, ND; and Doug Sawyer, Scottsdale Community College, AZ.

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22) Neuschatz, Michael and Mark McFarling, *Profile of Physics Programs and the Academic Workforce in Two-Year Colleges* (forthcoming, 2003), American Institute of Physics: College Park, MD.

23) In the fall of 1998, 51.6% of the full-time faculty at public two-year institutions taught five or more credit courses. Overall for all academic institutions, only 25.4% of the full-time faculty teaching undergraduate courses taught five or more credit courses. These statistics were obtained from the U.S. Department of Education, *2001 Digest of Education Statistics,* available at http://nces.ed.gov/pubs2002/digest2001 (Table 233).

24) *Academic Chemists 2000: A Decade of Change,* American Chemical Society: Washington, DC, 2001, pp 9, 17.

25) In the fall of 1999, a higher proportion of the faculty at public four-year colleges were employed full time (73%) than at private four-year colleges (59%) or public two-year colleges (35%). These statistics were obtained from the U.S. Department of Education, *2001 Digest of Education Statistics,* available at http://nces.ed.gov/pubs2002/digest2001.

26) The percentage of two-year college faculty with tenure at each rank are professor, 92.9%; associate professor, 83.8%; assistant professor, 52.6%; instructor, 21.6%. These statistics were obtained from the U.S. Department of Education, *2001 Digest of Education Statistics,* available at http://nces.ed.gov/pubs2002/digest2001 (Table 243).

27) *Women Chemists 2000,* American Chemical Society: Washington, DC, 2001, p 36.

28) Of the 296,239 faculty at public two-year institutions, 49.2% are women. Of the 17,768 faculty at private two-year institutions, 46.3% are women. These statistics were obtained from the U.S. Department of Education, *2001 Digest of Education Statistics,* available at http://nces.ed.gov/pubs2002/digest2001 (Table 226).

Appendix A. ACS 2001 Survey of Two-Year College Chemistry Programs

link: http://www.aip.org/statistics/pdf/chemfinal.pdf

American Chemical Society
2001 Survey of Two-Year College Chemistry Programs

If you would like to receive a summary of the results from this survey when it becomes available, please check here ☐.

THIS FORM WAS COMPLETED BY:

Name _____

Job Title _____

Department _____

Division _____

Campus _____

Chemistry Department Chair or Program Head (if different from above) _____

PLEASE UPDATE ANY INCORRECT INFORMATION ABOVE

If your school does not offer a chemistry course **this term** please check here ☐.

***PLEASE NOTE:** In filling out this questionnaire, please include, in addition to regular chemistry courses, any course in which **at least half** of the content covered is chemistry, even if it is not explicitly called a chemistry course.

1. Please list the names of all faculty members who are teaching at least one chemistry course in your department/division **this term**. Include both full-time and part-time faculty who teach these courses. Remember to include yourself if applicable. Use an attached sheet if necessary. *Please note:* faculty members are considered "full-time" if they are employed full-time at your institution, regardless of how many chemistry courses they teach.

	FACULTY NAME	Full-Time or Part-Time (circle)	Gender (circle)	Number of chemistry sections **this term** (No Labs)	Highest Degree Earned (circle)	Check One: Tenured or Permanent	Tenure Track	Temporary	Approximately How Many Years Working at This School
a.	_____	FT PT	M F	_____	MS/MA PhD/EDD	☐	☐	☐	_____ yrs
b.	_____	FT PT	M F	_____	MS/MA PhD/EDD	☐	☐	☐	_____ yrs
c.	_____	FT PT	M F	_____	MS/MA PhD/EDD	☐	☐	☐	_____ yrs
d.	_____	FT PT	M F	_____	MS/MA PhD/EDD	☐	☐	☐	_____ yrs
e.	_____	FT PT	M F	_____	MS/MA PhD/EDD	☐	☐	☐	_____ yrs

Total chemistry sections taught in your department/ division this term (sum a through e): _____

2. In the past two years, did any **full-time permanent** faculty members who taught chemistry in your department/division:

   a.) retire or die? ☐no ☐yes→How many? _____ b.) leave prior to retirement? ☐no ☐yes→How many? _____

3. Is your department/division **currently** recruiting *full-time* teachers of chemistry? ☐no ☐yes→How many? _____

4. Does your department/division anticipate recruiting *additional* full-time teachers of chemistry **next year**? ☐no ☐yes→How many? _____

5. How many sections of each type of chemistry course are offered in your department/division **this term**? (Total should equal the sum you entered in the box under question 1.)

   _____ a. General Chemistry (2 semester sequence for science majors)

   _____ b. Introductory Chemistry Courses for Allied Health and Related Majors

   _____ c. Chemistry in Context, Chemistry in Society or Similar Course

   _____ d. Analytical Chemistry

   _____ e. General Organic Chemistry (full-year)

   _____ f. Chemistry or Physical Science for Education Majors

   _____ g. Other Physical Science (at least half chemistry)

   _____ h. Chemical Technology

   _____ i. Other Chemistry (specify:_____)

6. Is Chemistry or Chemical Technology taught in any other department or division on your campus? ☐no ☐yes

   If yes, what is the name of the department/division? _____

   Who is the chair or contact person in that department/division? _____

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