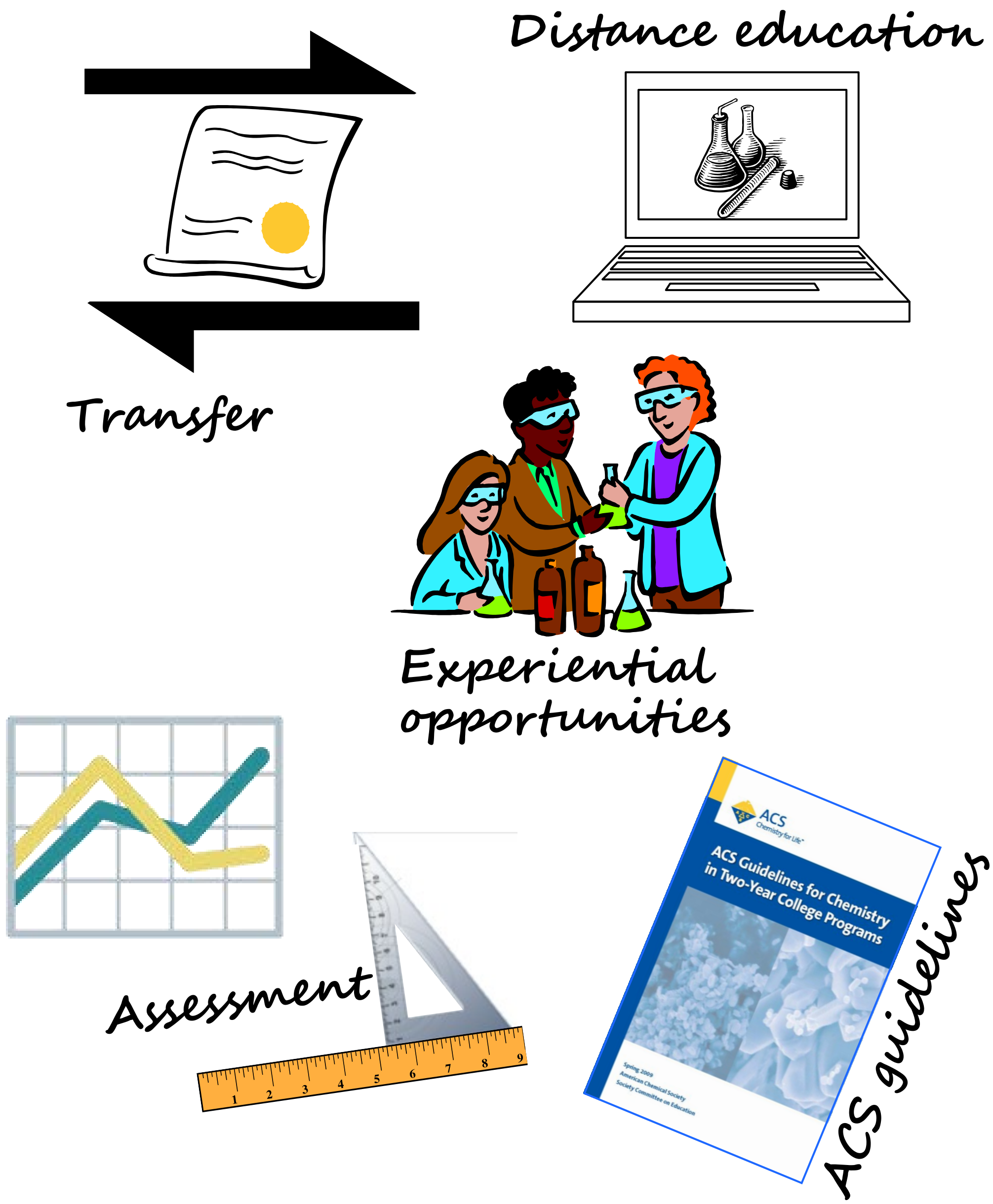
ACS Undergraduate Programs Office

Two-Year College Chemistry Landscape 2014

Faculty Responsibilities and Practices

Survey Data and Questionnaire

Fall 2014



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Two-Year College Chemistry Landscape 2014

Emerging trends and ACS policies Survey Data Tables

Fall 2014

In Spring 2014, ACS conducted the survey, *Two-Year College Chemistry Landscape 2014: Emerging trends and ACS policies* . The survey provided insight into such topics as distance education, assessments, experiential opportunities, and the impact of ACS policies. The results will be used to inform the revision of the *ACS Guidelines for Chemistry in Two-Year College Programs*, as well as develop resources for two-year colleges.

One chemistry faculty member or administrator was contacted at each of over 1,100 two-year college campuses, with a 36% response rate. Additional details on the demographics of the survey participants can be found on p. 11.

The following are the complete survey results and questions. Pages 1-4 feature information on transferability, distance education, and hands-on labs. The tools that two-year colleges use to assess courses and programs can be found on p. 5-6. Information on the incorporation of experiential opportunities into the curriculum can be found on p. 7. Pages 8-10 discuss the impact of the Guidelines on two-year colleges and resources that survey respondents felt would be helpful. Survey demographics can be found on p. 11, and the survey questionnaire can be found on p. 14-15.

A summary report of some selected findings can be downloaded at www.acs.org/2YColleges. For more information, please contact the ACS Undergraduate Programs Office (2YColleges@acs.org; 1-800-227-5558, ext. 6108.)

Transferability and distance education

	All responses	Transfer degree	Transfer, no degree	Chemistry-based technology degree	No chemistry program
Chemistry lecture sections	7	10	8	16	5
Chemistry lecture sections that transfer to a baccalaureate chemistry-based program	4	6	4	10	3
Transferrable chemistry sections that are distance education	0	0	0	0	0
Transferable distance education sections with hands-on lab experience	0	0	0	0	0
Transferable on-campus chemistry sections with hands-on lab experience	4	5	4	9	3
Total number of responses	***357***	***86***	***88***	***51***	***132***

Table 1. Median number of chemistry sections in Spring 2014 that fit the provided description, by type of program offered. (*Note*: "0" values indicate that more than 50% of respondents do not have the described sections.)

	All responses	<100 chemistry students	100-250 chemistry students	251-500 chemistry students	>500 chemistry students
Chemistry lecture sections	7	3	7	14	20
Chemistry lecture sections that transfer to a baccalaureate chemistry-based program	5	2	4	10	15
Transferrable chemistry sections that are distance education	0	0	0	0	0
Transferable distance education sections with hands-on lab experience	0	0	0	0	0
Transferable on-campus chemistry sections with hands-on lab experience	4	2	4	9	13
Total number of responses	***357***	***107***	***113***	***65***	***71***

Table 2. Median number of chemistry sections in Spring 2014 that fit the provided description, by number of chemistry students enrolled. (*Note*: "0" values indicate that more than 50% of respondents do not have the described sections.)

Survey participants were asked the number of chemistry sections being taught in Spring 2014 and how many of those sections were transferable to baccalaureate chemistry or chemistry-based technology programs. They were then asked how many of the transferable courses were considered distance education and how many incorporated hands-on laboratory work. (See survey questionnaire for exact wording.) The median responses are shown in Tables 1 and 2.

The percentages were calculated for each response (e.g., a respondent reporting 7 sections, 5 of which were transferable, would have 71% transferable sections). The distribution of those results is shown in Tables 3 and 4.

Each participant's response was analyzed to identify the percentage of transferable sections that were considered distance education. The responses were grouped and shown in Tables 5 and 6.

Percent of respondents who reported that…	All responses	Transfer degree	Transfer, no degree	Chemistry-based technology degree	No chemistry program
…all Spring 2014 chemistry sections transfer	40.1%	36.0%	38.6%	39.2%	43.9%
…most (75% to <100%) sections transfer	14.6%	10.5%	23.9%	15.7%	10.6%
…some (25% to <75%) sections transfer	38.7%	48.8%	27.3%	39.2%	39.4%
…few (>0% to <25%) sections transfer	3.4%	4.7%	5.7%	2.0%	1.5%
…no chemistry sections transfer	3.4%	0.0%	4.5%	3.9%	4.5%
Total number of responses	***357***	***86***	***88***	***51***	***132***

Table 3. Percent of respondents who reported whether chemistry sections taught in Spring 2014 transferred to a baccalaureate chemistry or chemistry-based technology program, by type of program offered.

Percent of respondents who reported that…	All responses	< 100 chemistry students	100-250 chemistry students	251-500 chemistry students	>500 chemistry students
…all Spring 2014 chemistry sections transfer	40.1%	53.3%	40.7%	27.7%	31.0%
…most (75% to <100%) sections transfer	14.6%	8.4%	8.0%	23.1%	26.8%
…some (25% to <75%) sections transfer	38.7%	29.9%	41.6%	43.1%	42.3%
…few (>0% to <25%) sections transfer	3.4%	0.9%	7.1%	4.6%	0.0%
…no chemistry sections transfer	3.4%	7.5%	2.7%	1.5%	0.0%
Total number of responses	***357***	***107***	***113***	***65***	***71***

Table 4. Percent of respondents who reported whether chemistry sections taught in Spring 2014 transferred to a baccalaureate chemistry or chemistry-based technology program, by number of chemistry students enrolled. (Because some participants did not report their number of chemistry students, total number of responses are not equal.)

Percent of respondents who reported that…	All responses	Transfer degree	Transfer, no degree	Chemistry-based technology degree	No chemistry program
…all Spring 2014 transferable chemistry sections are distance education	1.2%	0.0%	0.0%	0.0%	3.2%
…most (75% to <100%) transferable chemistry sections are distance education	0.0%	0.0%	0.0%	0.0%	0.0%
…some (25% to <75%) transferable chemistry sections are distance education	9.0%	8.1%	14.1%	2.0%	8.7%
…few (>0% to <25%) transferable chemistry sections are distance education	8.7%	11.6%	7.1%	14.3%	5.6%
…no transferable chemistry sections are distance education	81.2%	80.2%	78.8%	83.7%	82.5%
Total number of responses	***346***	***86***	***85***	***49***	***126***

Table 5. Percent of respondents who reported whether chemistry sections taught in Spring 2014 that could be transferred to a baccalaureate chemistry or chemistry-based technology program were considered distance education, by type of program offered.

Percent of respondents who reported that…	All responses	< 100 chemistry students	100-250 chemistry students	251-500 chemistry students	>500 chemistry students
…all Spring 2014 transferable chemistry sections are distance education	1.2%	3.0%	0.0%	0.0%	1.4%
…most (75% to <100%) transferable chemistry sections are distance education	0.0%	0.0%	0.0%	0.0%	0.0%
…some (25% to <75%) transferable chemistry sections are distance education	9.0%	14.1%	7.3%	4.7%	8.5%
…few (>0% to <25%) transferable chemistry sections are distance education	8.7%	4.0%	3.6%	12.5%	19.7%
…no transferable chemistry sections are distance education	81.2%	78.8%	89.1%	82.8%	70.4%
Total number of responses	***346***	***99***	***110***	***64***	***71***

Table 6. Percent of respondents who reported whether chemistry sections taught in Spring 2014 that could be transferred to a baccalaureate chemistry or chemistry-based technology program were considered distance education, by number of chemistry students enrolled. (Because some participants did not report their number of chemistry students, total number of responses are not equal.)

Hands-on laboratory experiences

Participants were asked how many of the chemistry sections that were transferable to a baccalaureate chemistry or chemistry-based technology program included hands-on laboratory experiences. The aggregate results are in Tables 7-10. Because so few transferrable distance education sections were reported, responses were grouped only by whether all, any, or none included hands-on labs.

Percent of respondents who reported that…	All responses	Transfer degree	Transfer, no degree	Chemistry-based technology degree	No chemistry program
…all transferable on-campus sections include hands-on labs	93.3%	94.2%	92.9%	91.8%	93.4%
…most (75%-<100%) transferable on-campus sections include hands-on labs	2.9%	2.3%	2.4%	6.1%	2.5%
…some (25%-<75%) transferable on-campus sections include hands-on labs	1.8%	1.2%	2.4%	0.0%	2.5%
…few (>0%-<25%) transferable on-campus sections include hands-on labs	0.0%	0.0%	0.0%	0.0%	0.0%
…no transferable on-campus sections include hands-on labs	2.0%	2.3%	2.4%	2.0%	1.6%
Total number of responses	***342***	***86***	***85***	***49***	***122***

Table 7. Percent of respondents who reported whether transferable, on-campus chemistry sections taught in Spring 2014 included hands-on laboratory experiences, by type of program offered.

Percent of respondents who reported that…	All responses	< 100 chemistry students	100-250 chemistry students	251-500 chemistry students	>500 chemistry students
…all transferable on-campus sections include hands-on labs	93.3%	94.8%	98.2%	90.6%	85.7%
…most (75%-<100%) transferable on-campus sections include hands-on labs	2.9%	0.0%	0.0%	4.7%	10.0%
…some (25%-<75%) transferable on-campus sections include hands-on labs	1.8%	4.2%	0.0%	3.1%	0.0%
…few (>0%-<25%) transferable on-campus sections include hands-on labs	0.0%	0.0%	0.0%	0.0%	0.0%
…no transferable on-campus sections include hands-on labs	2.0%	1.0%	1.8%	1.6%	4.3%
Total number of responses	***342***	***96***	***110***	***64***	***70***

Table 8. Percent of respondents who reported whether transferable, on-campus chemistry sections taught in Spring 2014 included hands-on laboratory experiences, by number of chemistry students enrolled. (Because some participants did not report their number of chemistry students, total number of responses are not equal.)

Percent of respondents who reported that…	All responses	Transfer degree	Transfer, no degree	Chemistry-based technology degree	No chemistry program
…all transferable distance education sections include hands-on labs	78.5%	82.4%	72.2%	100.0%	72.7%
…any, but not all, transferable distance education sections include hands-on labs	7.7%	11.8%	11.1%	0.0%	4.5%
…no transferable distance education sections include hands-on labs	13.8%	5.9%	16.7%	0.0%	22.7%
Total number of responses	***65***	***17***	***18***	***8***	***22***

Table 9. Percent of respondents who reported whether transferable, distance education chemistry sections taught in Spring 2014 included hands-on laboratory experiences, by type of program offered.

Percent of respondents who reported that…	All responses	< 100 chemistry students	100-250 chemistry students	251-500 chemistry students	>500 chemistry students
…all transferable distance education sections include hands-on labs	78.5%	76.2%	83.3%	81.8%	76.2%
…any, but not all, transferable distance education sections include hands-on labs	7.7%	0.0%	8.3%	9.1%	14.3%
…no transferable distance education sections include hands-on labs	13.8%	23.8%	8.3%	9.1%	9.5%
Total number of responses	***65***	***21***	***12***	***11***	***21***

Table 10. Percent of respondents who reported whether transferable, distance education chemistry sections taught in Spring 2014 included hands-on laboratory experiences, by number of chemistry students enrolled.

Assessment of courses and programs

Participants were asked what assessment tools were used to assess individual courses and programs. (In cases where there were no dedicated chemistry programs, participants were asked about chemistry education as a whole.) Participants' responses reflected a view of assessment as a continuum, rather than a series of discreet steps. For example, ACS Exams were used to assess both courses and programs.

Responses noted in the "Other" category for both questions included capstone courses, evaluation of student learning outcomes, embedded exam questions, observations of students, full program reviews, student presentations, and surveys of former students.

Tables 11 through 14 show the types of assessments respondents reported using.

	All responses	Transfer degree	Transfer, no degree	Chemistry-based technology degree	No chemistry program
Student retention in current class	64.9%	66.3%	63.2%	73.1%	62.2%
Student evaluation of courses	81.4%	78.3%	78.9%	84.6%	83.9%
Observation of classroom/laboratory sections	71.2%	71.7%	71.6%	80.8%	67.1%
Student performance on exams, course work, and/or lab work in current course	89.5%	92.4%	87.4%	90.4%	88.8%
Student performance on year-end or exit exams	49.5%	59.8%	46.3%	51.9%	44.1%
Student performance in subsequent classes	44.2%	45.7%	49.5%	50.0%	37.8%
Graduate performance at transfer institutions and/or workplace	19.9%	15.2%	23.2%	30.8%	16.8%
Other	6.3%	7.6%	4.2%	9.6%	5.6%
We do not assess individual courses.	2.1%	3.3%	3.2%	1.9%	0.7%
Total number of responses:	***382***	***92***	***95***	***52***	***143***

Table 11. Percent of respondents who reported using the listed tools to assess chemistry or chemistry-based technology courses, by type of program offered.

	All responses	< 100 chemistry students	100-250 chemistry students	251-500 chemistry students	>500 chemistry students
Student retention in current class	64.9%	62.3%	66.4%	63.1%	67.1%
Student evaluation of courses	81.4%	84.2%	80.3%	80.0%	79.7%
Observation of classroom/laboratory sections	71.2%	69.3%	67.2%	69.2%	81.0%
Student performance on exams, course work, and/or lab work in current course	89.5%	91.2%	91.8%	86.2%	88.6%
Student performance on year-end or exit exams	49.5%	41.2%	54.9%	50.8%	51.9%
Student performance in subsequent classes	44.2%	36.0%	44.3%	52.3%	50.6%
Graduate performance at transfer institutions and/or workplace	19.9%	21.9%	19.7%	20.0%	17.7%
Other	6.3%	3.5%	6.6%	4.6%	11.4%
We do not assess individual courses.	2.1%	0.9%	1.6%	4.6%	2.5%
Total number of responses:	***382***	***114***	***122***	***65***	***79***

Table 12. Percent of respondents who reported using the listed tools to assess chemistry or chemistry-based technology courses, by number o f chemistry students enrolled.

	All responses	Transfer degree	Transfer, no degree	Chemistry-based technology degree	No chemistry program
Course (in-house) assessments	79.2%	80.2%	85.1%	78.8%	74.8%
ACS Exams or other external course assessments	37.1%	48.4%	34.0%	40.4%	30.8%
Departmental or institutional (in-house) assessments	45.0%	44.0%	45.7%	57.7%	40.6%
County, state, or federal tools	1.6%	1.1%	2.1%	0.0%	2.1%
ACS Assessment Tool for Chemistry in Two-Year Colleges	4.7%	8.8%	3.2%	5.8%	2.8%
Accreditation agency assessment tools	7.6%	11.0%	9.6%	5.8%	4.9%
No formal tools are used.	8.2%	4.4%	7.4%	7.7%	11.2%
Other	2.6%	5.5%	2.1%	1.9%	1.4%
Total number of responses:	***380***	***91***	***94***	***52***	***143***

Table 13. Percent of respondents who reported using the listed tools to assess chemistry or chemistry-based technology programs or education as a whole, by type of program offered.

	All responses	< 100 chemistry students	100-250 chemistry students	251-500 chemistry students	>500 chemistry students
Course (in-house) assessments	79.2%	81.3%	78.7%	76.9%	79.7%
ACS Exams or other external course assessments	37.1%	25.0%	38.5%	43.1%	46.8%
Departmental or institutional (in-house) assessments	45.0%	34.8%	46.7%	44.6%	58.2%
County, state, or federal tools	1.6%	3.6%	0.8%	0.0%	1.3%
ACS Assessment Tool for Chemistry in Two-Year Colleges	4.7%	5.4%	1.6%	4.6%	8.9%
Accreditation agency assessment tools	7.6%	7.1%	7.4%	4.6%	10.1%
No formal tools are used.	8.2%	11.6%	5.7%	9.2%	6.3%
Other	2.6%	0.9%	2.5%	3.1%	5.1
Total number of responses:	***380***	***112***	***122***	***65***	***79***

Table 14. Percent of respondents who reported using the listed tools to assess chemistry or chemistry-based technology programs or education as a whole, by number of chemistry students enrolled.

Experiential opportunities

Participants were asked what experiential opportunities were available to students at their institutions. Those with dedicated chemistry or chemistry-based technology programs were also asked if participation in an experiential opportunity was a required part of the program (see Table 15). All others were asked if it was required for degree attainment (see Table 16).

The results from all dedicated chemistry and chemistry-based technology programs were combined, due to small sample size; however, there was no significant difference in the distribution of results by type of program offered.

	Required	Available with credit	Available without credit	Not available	*Total number of responses*
Original research	3	22	14	109	***148***
Independent or collaborative long-term laboratory project	9	30	19	91	***149***
Interdisciplinary long-term laboratory project	0	18	7	118	***143***
Internships	3	24	18	101	***146***
Co-operative learning or similar experience	9	15	18	102	***144***
Job shadowing	1	2	12	122	***137***
Other	3	0	0	0	***3***

Table 15. Number of respondents with a chemistry-based technology or chemistry transfer program (with or without a degree) that has the described experiential opportunity available to students.

	Required	Available with credit	Available without credit	Not available	*Total number of responses*
Original research	3	18	13	105	***139***
Independent or collaborative long-term laboratory project	5	21	10	102	***138***
Interdisciplinary long-term laboratory project	0	17	3	117	***137***
Internships	1	12	14	108	***135***
Co-operative learning or similar experience	4	10	14	105	***133***
Job shadowing	0	1	12	120	***133***
Other	1	2	1	34	***38***

Table 16. Number of respondents whose institutions had no dedicated chemistry program that has the described experiential opportunity available to students.

ACS Guidelines

The *ACS Guidelines for Chemistry in Two-Year College Programs* are being revised to keep current with changes in the two-year college landscape and ACS policies. To better inform the revision of the Guidelines and support their implementation in the community, participants were asked about their successes and challenges with the Guidelines.

Just over 75% (out of 378) survey participants were familiar with the Guidelines. Their successes and challenges are reported in Tables 17 and 18. Suggested resources to support implementation are reported in Table 19.

Hired additional faculty or staff	12.6%
Increased our budget	6.3%
Decreased our budget	0.4%
Performed program assessment	23.7%
Limited our teaching loads or class enrollments	17.4%
Acquired new equipment	21.9%
Improved our support resources for students	15.2%
Altered our curriculum or course requirements	17.0%
Implemented new pedagogies	15.6%
The Guidelines have had no effect on our campus	43.3%
Other impact	8.9%
Total number of respondents	***270***

"Other impact" responses include:

- Improving laboratory safety
- Acquiring safety equipment
- Supporting retention of hands-on laboratories over computer simulations
- Developing a research program

Table 17. Percent of respondents who reported the listed impacts of the Guidelines on their campus.

My administration does not support use of the Guidelines	21.3%
Other faculty do not support use of the Guidelines	2.6%
I am not sure how to use the Guidelines	6.4%
Guidelines do not address topics applicable to my campus	7.9%
Guidelines are not specific enough to apply to my campus	7.1%
I have not had enough time to consider use of the Guidelines	26.2%
I have not encountered any barriers	34.1%
Other barrier (please specify):	15.7%
Total number of respondents	***267***

"Other barrier" responses include:

- Faculty had not approached administration
- Lack of resources, personnel, and/or funding
- Guidelines were difficult to use
- Disconnects between the Guidelines and institutional goals or state requirements

Table 18. Percent of respondents who reported the listed challenges to implementation of the Guidelines on their campus.

Workshops on the use of the Guidelines	27.7%
Examples of how the Guidelines have been implemented	51.8%
Assessment tools based on the Guidelines	52.9%
Effective practices for topics addressed in the Guidelines	40.1%
Samples of documents, such as chemical hygiene plans	48.9%
Facilitated discussions with faculty and administration	23.4%
No additional resources are needed	19.0%
Other resources	5.1%
Total number of respondents	***274***

"Other resources" responses include:

- Promoting the Guidelines directly to administrators
- Providing funding to support implementation

Table 19. Percent of respondents who reported the listed resources would support implementation of the Guidelines on their campus.

Curriculum development	53.4%
Student transfer	44.0%
Graduate job placement	14.4%
Support for students majoring in fields other than chemistry or chemistry-based technology	39.9%
Partnerships	23.3%
Distance education	27.6%
Student skills (e.g., teamwork, leadership, use of chemical literature, etc.)	42.8%
Experiential opportunities (e.g., research, internships, co-operative learning, job shadowing, long-term projects, etc.)	40.8%
Current ACS recommendations and guidelines are fine without modification	15.5%
Other (please specify):	3.4%
Total number of responses	***348***

Other responses include:

- Grant-writing
- Equipment acquisition
- Online/distance education
- Learning outcomes
- Benchmarked assessment tools, aside from ACS Exams
- Importance of hands-on laboratory experiences (*versus* computer simulations)
- Lab/lecture equivalence in teaching assignments

Table 20. Percent of respondents who would like to see the listed topics addressed in ACS guidelines and policies.

All participants, regardless of whether they were familiar with the Guidelines, were asked to select topics they would like to see addressed or expanded in ACS guidelines and policies (see Table 20). They were then given an opportunity to elaborate on their response.

Topics that participants were particularly interested in included the following:

- Specific details on any of the topics in Table 20 (e.g., sample student learning outcomes, course curricula, safety plans, etc.)
- Development and implementation of internships, research, and other experiential opportunities
- Stronger language regarding the value of hands-on laboratories, teaching assignments, innovative teaching techniques, and alignment with baccalaureate programs
- Interconnectivity of chemistry and allied fields
- Detailed effective practices for all sections of the Guidelines

Participants also expressed interest in the following:

- Recommendations and examples for implementing the Guidelines, especially in small, geographically isolated colleges
- Advice on communicating needs to administrations
- Advice on engaging four-year institutions, fellow faculty, potential industry partners
- Data on what other two-year colleges are doing
- Information on graduate opportunities, developing student skills, affordable access to chemical literature, successful teaching methods, research and project ideas, and effective practices in distance education.

In a free-response question, participants were asked what resources ACS could provide that would help them provide the highest-quality chemistry education for their students. A number of respondents felt ACS already did a good job providing support and asked only to be alerted when new resources become available.

However, a number of suggestions were submitted for ways ACS could support two-year colleges. Responses covered a broad range and included the topics in the following subsections:

Recognition of effective practices and excellence

Many participants reported challenges convincing their administrations of the value in ACS recommendations. Course transfer was also a concern; four-year institutions, graduate schools, and medical schools sometimes refuse to accept two-year college course credits. Respondents sought ways to document and demonstrate the value of their courses, as well as the need for critical improvements.

Some respondents suggested that ACS might provide some types of recognition of excellence. Some simply asked that ACS intercede with administrations and four-year institutions. One respondent proposed that all two– and four-year programs use ACS exams for assessment, as an objective measure of course quality.

Most respondents who commented on recognition proposed using the Guidelines to establish a checklist of criteria for colleges to meet; however, one participant commented that the flexibility of two-year colleges was a strength that should be recognized.

Curriculum and infrastructure resources

Many respondents sought help with curriculum development. Student learning outcomes were a particular concern, as were recommendations for minimum course content that would ensure transferability. A number of participants were also interested in supporting students in non-chemistry majors and those with weak educational backgrounds.

Laboratories were another area of interest, with respondents asking for help with laboratory and chemical storeroom design. Some asked for resources on incorporating green chemistry into the labs, as well as improving safety education and practices.

There were many requests for effective practices and case studies demonstrating the uses of the Guidelines. Additionally, participants were interested in recommendations for study tools, electronic books, and apps.

Faculty professional development
Respondents sought a variety of professional development opportunities. Workshops and resources on the following topics were of particular interest:

- Grant-writing
- Funding opportunities
- Development, implementation, and analysis of new teaching methods
- Fostering partnerships
- Effective distance education
- Handling hazardous materials
- Supporting students with extensive commitments outside of the classroom

Because two-year college faculty often have little funding for professional development, local and inexpensive workshops and meetings were of particular interest. Respondents were also interested in finding more research on chemistry education.

Support for students
Many respondents were interested in learning effective techniques for engaging students and identifying their skill levels. Resources for transfer students and assistance acquiring qualified tutors were also requested. Several respondents sought inexpensive journal access, noting that their college's library budget could not accommodate ACS subscriptions.

Assistance with starting or establishing research and internships opportunities was also of interest, especially at small and/or geographically isolated institutions. One respondent sought help addressing the extremely high member turnover and funding challenges often faced by ACS student chapters at two-year colleges.

Advocacy
Some respondents asked that ACS advocate on a variety of topics. These included NSF and NIH grants for two-year colleges, administrative support of the Guidelines, industrial internships, articulation and transfer support from four-year institutions, state government and accrediting agency support of the Guidelines, and teaching opportunities for industrial chemists.

Other concerns

Participants were asked for any other concerns they wanted to share with ACS. These comments were combined with the Guidelines feedback and shared with relevant ACS staff and governance units. All feedback from this survey is being use to help ACS policies and resources for two-year colleges.

Again, many respondents were complimentary about the resources and support provided by ACS. However, a number of suggestions were also submitted. Some of these respondents' concerns are described below.

Costs of professional development
Many participants received little or no financial support from their institutions for professional development. This challenged their ability to pay for ACS membership and travel to conferences. They also wrestled with the timing of conferences, which often conflicted with their teaching schedules. Similarly, library budgets at two-year colleges were sometimes too small to include ACS journals.

Supporting students
Many two-year college students do not have strong backgrounds in science and math. Some respondents were looking for ways to get these students up to speed quickly, before they became too frustrated to continue studying chemistry.

Additionally, the classes tend to be a mix of traditional students, first-generation college attendees, and non-traditional students. Many have part– or full-time jobs, families, and a plethora of living expenses. Survey responses indicated an interest in resources that would help faculty engage their diverse student bodies.

Communication with administration
Many respondents reported challenges conveying the importance of the Guidelines recommendations to their administrations. Faculty reported overloaded teaching schedules, lack of sufficient faculty and staff, increasing pressure to replace hands-on labs with computer simulations, and insufficient time to incorporate innovative teaching methods into their courses. These respondents were looking for help convincing their administrations to support efforts to implement the Guidelines.

Other concerns
Most participants who commented on distance learning were primarily concerned with how to provide hands-on lab experiences for their students. Some were also seeking ways to develop curricula as engaging and informative as face-to-face courses.

A few respondents felt the Guidelines were too restrictive or idealistic to be useful to them.

Faculty at small and/or geographically isolated institutions were interested in ways to network and grow their programs. They also sought guidance on how to comply with ACS guidelines with resources available to support their efforts.

Respondent demographics

	Number of responses	Percentage
Certificate or associate's degree in chemistry	119	29.2%
Certificate or associate's degree in a chemistry-based technology (e.g., chemical technology, process technology, biotechnology, etc.)	55	13.5%
Certificate or associate's degree in natural sciences, physical sciences, and/or a chemistry-related field	181	44.4%
Transfer programs (without degrees) in chemistry or chemistry-based technology	198	48.5%
General degree program that can be transferred to a four-year program in chemistry or chemistry-based technology	273	66.9%
None of the above	25	6.1%
Total responses:	***408***	

Table 21. Number and percentage of respondents who reported their institutions offered the above courses.

Survey respondents were asked what types of programs were offered by their institutions; the responses are shown in Table 17. Respondents were allowed to indicate more than one type of program offered by their institution. In order to assemble non-overlapping data groups, responses were separated into the following categories:

- ***Chemistry transfer degrees:*** certificate or associate's degree in chemistry, excluding chemistry-based technology degree programs
- ***Transfer chemistry programs without degrees:*** transfer programs (without degrees), excluding chemistry transfer degrees and chemistry-based technology degree programs
- ***Chemistry-based technology degree programs:*** certificate or associate's degree in a chemistry-based technology
- ***No dedicated chemistry program:*** all responses that did not fit in the above categories

When separated into the categories described, the distribution shown in Table 18 was achieved.

Table 19 shows the distribution of responses by number of chemistry students at the respondents' institutions. To maintain consistency with previous Landscape surveys, responses from all institutions with more than 500 chemistry students were grouped together.

	Number of responses	Percent distribution
Chemistry transfer degrees	98	24.0%
Transfer chemistry programs without degrees	102	25.0%
Chemistry-based technology degree programs	54	13.2%
No dedicated chemistry program	154	37.7%
Total responses:	***408***	

Table 22. Number and percentage distribution of respondents by type of program offered at their institution.

	Number of responses	Percent distribution
< 100 students	116	28.9%
100-250 students	130	32.4%
251-500 students	71	17.7%
501-1,000 students	45	11.2%
1,001-1,500 students	11	2.7%
1,501-2,500 students	13	3.2%
> 2,500 students	15	3.7%
Total responses:	***401***	

Table 23. Number and percent distribution of respondents, by number of chemistry students enrolled at their institution.

Two-Year College Chemistry Landscape 2014
Emerging trends and ACS policies
Survey Questionnaire

1. **Which of the following are offered on your campus? Check all that apply.**
   a. Certificate or associate's degree in chemistry
   b. Certificate or associate's degree in a chemistry-based technology (e.g., chemical technology, process technology, biotechnology, etc.)
   c. Certificate or associate's degree in natural sciences, physical sciences, and/or a chemistry-related field
   d. Transfer programs (without degrees) in chemistry or chemistry-based technology
   e. General degree program that can be transferred to a four-year program in chemistry or chemistry-based technology
   f. None of the above

2. **What is the *current* total student enrollment for all chemistry courses on your campus?**
   a. < 100 students
   b. 100-250 students
   c. 251-500 students
   d. 501-1,000 students
   e. 1,001-1,500 students
   f. 1,501-2,500 students
   g. > 2,500 students

3. **Is your campus offering any lecture sections for chemistry and chemistry-based technology courses in the current term?**
   a. Yes
   b. No *[went to question 15]*

4. **What is the total number of lecture sections for chemistry and chemistry-based technology courses offered in the current term?**
   [Participants selected answer from 1 through "more than 60." Two participants selected "more than 60," which were entered as "61" in the calculations.]

5. **Are any of the lecture sections offered in the current term accepted by the baccalaureate chemistry or chemistry-based technology programs into which your students most commonly transfer?**
   a. Yes
   b. No *[went to question 10]*

6. **Of the lecture sections offered in the current term, how many are accepted by the baccalaureate chemistry or chemistry-based technology programs into which your students most commonly transfer?**
   [Participants selected answer from 1 through "more than 60." Two participants selected "more than 60," which were entered as "61" in the calculations.]

7. **Of the transferable lecture sections offered in the current term, how many are considered distance education courses?**
   a. None, all transferable lecture sections are taught on-campus *[went to question 10]*
   b. All of our transferable lecture sections are distance education courses
   c. Some, the number of transferable lecture sections that are distance education courses is: *[Participants selected answer from 1 through 60.]*

8. **Of the distance education sections offered in the current term, how many have a corresponding hands-on laboratory component, either on-campus or off-campus?**
   a. None, transferable distance education sections either have no hands-on laboratory components or rely on computer-simulated laboratory components
   b. All transferable distance education sections have a hands-on laboratory component
   c. Some, the number of transferable distance education sections that have a hands-on laboratory component is: [*Participants selected answer from 1 through 60.]*

9. **Do the on-campus lecture sections offered in the current term have a corresponding hands-on laboratory component?**
   a. No, transferable lecture sections on-campus either have no hands-on laboratory components or rely on computer-simulated laboratory components
   b. Yes, all transferable lecture sections taught on-campus have a hands-on laboratory component
   c. Yes, some do. The number of transferable lecture sections taught on-campus that have a hands-on laboratory component is: [*Participants selected answer from 1 through 60.]*

10. Which of the following do you use to assess the quality of chemistry and chemistry-based technology course on your campus? (Select all that apply)

a. Student retention in current class
b. Student evaluation of courses
c. Observation of classroom/laboratory sections
d. Student performance on exams, course work, and/or lab work in current course
e. Student performance on year-end or exit exams
f. Student performance in subsequent classes
g. Graduate performance at transfer institutions and/or workplace
h. Other (please specify):
i. We do not assess individual courses

12. Which of the following do you use to assess the overall quality of chemistry and chemistry-based education on your campus?

a. Course (in-house) assessments
b. ACS Exams or other external course assessments
c. Departmental or institutional (in-house) assessments
d. County, state, or federal tools
e. ACS Assessment Tool for Chemistry in Two-Year Colleges
f. Accreditation agency assessment tools
g. No formal tools are used
h. Other (please specify):

13. [Question 13 was shown only to those who selected responses a, b, or d in question 1.] Indicate which of the following experiences are available and/or required for students in your campus's chemistry or chemistry-based technology program. (Experience can be available on- or off-campus.)

	Required	Available with credit	Available without credit	Not available
Original research				
Independent or collaborative long-term laboratory project				
Interdisciplinary long-term laboratory project				
Internships				
Co-operative learning or similar experience				
Job shadowing				
Other				

14. **[Question 14 was shown only to those who did *not* see question 13.] Indicate which of the following experiences are available to students in chemistry courses and whether they are required for degree completion. (Experience can be available on- or off-campus.)**

	Required	Available with credit	Available without credit	Not available
Original research				
Independent or collaborative long-term laboratory project				
Interdisciplinary long-term laboratory project				
Internships				
Co-operative learning or similar experience				
Job shadowing				
Other				

15. Are you familiar with *ACS Guidelines for Chemistry in Two-Year Colleges*?

a. Yes
b. No *[went to question 18]*

16. How have the Guidelines impacted chemistry or chemistry-based education on your campus? (Select all that apply)

a. Hired additional faculty or staff
b. Increased our budget
c. Decreased our budget
d. Performed program assessment
e. Limited our teaching loads or class enrollments
f. Acquired new equipment
g. Improved our support resources for students
h. Altered our curriculum or course requirements
i. Implemented new pedagogies
j. The Guidelines have had no effect on our campus.
k. Other impact (please specify):

17. **Which of the following barriers have challenged or impeded efforts to implement the Guidelines on your campus? (Select all that apply)**
    a. My administration does not support use of the Guidelines
    b. Other faculty do not support use of the Guidelines
    c. I am not sure how to use the Guidelines
    d. Guidelines do not address topics applicable to my campus
    e. Guidelines are not specific enough to apply to my campus
    f. I have not had enough time to consider use of the Guidelines
    g. I have not encountered any barriers.
    h. Other barrier (please specify):

18. **Which of the following resources would help you implement the Guidelines on your campus? (Select all that apply)**
    a. Workshops on the use of the Guidelines
    b. Examples of how the Guidelines have been implemented
    c. Assessment tools based on the Guidelines
    d. Effective practices for topics addressed in the Guidelines (e.g. recruitment and retention, writing lesson plans, curriculum development for non-majors' course)
    e. Samples of documents, such as chemical hygiene plans
    f. Facilitated discussions with faculty and administration
    g. No additional resources are needed.
    h. Other resources (please specify):

18. **Which of the following topics, if addressed or expanded in ACS recommendations and guidelines, would best help support the goals of the chemistry-based education on your campus? (Select all that apply)**
    a. Curriculum development
    b. Student transfer
    c. Graduate job placement
    d. Support for students majoring in fields other than chemistry or chemistry-based technology
    e. Partnerships
    f. Distance education
    g. Student skills (e.g., teamwork, leadership, use of chemical literature, etc.)
    h. Experiential opportunities (e.g., research, internships, co-operative learning, job shadowing, long-term projects, etc.)
    i. Current ACS recommendations and guidelines are fine without modification.
    j. Other (please specify):

19. **What aspect of these topics would you like to see addressed in the Guidelines?**
    [free response]

20. **How can ACS help your campus provide the highest-quality chemistry education experience for your students?**
    [free response]

21. **What other information or comments would you like to share with ACS?**
    [free response]

Acknowledgements

The Office of Two-Year Colleges gratefully acknowledges the insights of the Survey Review Team in the development of the survey and reporting of the results:

- Tamika Duplessis, Delgado Community College, LA
- Candice Campbell, Georgia Perimeter College--Dunwoody, GA
- Kathleen Carrigan, Portland Community College, OR
- Ron Darbeau, McNeese State University, LA
- Michael Davis, Wilbur Wright College, IL
- Julie Ellefson-Kuehn, Harper College, IL
- Donna Friedman, St. Louis Community College at Florissant Valley, MO
- James C. Schmidt, Ashland Community & Technical College, KY

The office also acknowledges the Statistical Research Center at the American Institute of Physics, which supported the development and administration of the survey, and the ACS Society Committee of Education's Task Force on the Revision of the *ACS Guidelines for Chemistry in Two-Year College Programs* (2015), which provided input on the survey.