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Abstract

As is true for virtually all of higher education, chemistry departments are often required to provide evidence of student learning at both course and curricular levels through evaluation and assessment. The ACS Exams Institute conducted a needs assessment survey of 1500 chemistry faculty members from across the country to investigate motivation, role, instrument use, and challenges associated with assessment efforts. For the more than 70% of participants who reported departmental efforts related to assessment, these findings emerged: motivations were primarily external factors related to accreditation and certification, ACS Exams and in-house exams were the most common instruments used, and time management associated with grading and reporting assessment results was the most frequently cited challenge. Summary results for each survey question related to these aspects of departmental assessment efforts are provided, along with logistic regression analyses of responses based on institution type. Logistic regression analyses were also used to identify differences among sex, years teaching, and chemistry subdiscipline for responses to departmental assessment efforts and instrument use.

Keywords

first-year undergraduate/general, second-year undergraduate, upper-division undergraduate, chemical education research, interdisciplinary/multidisciplinary, testing/assessment

Disciplines

Educational Assessment, Evaluation, and Research | Higher Education | Other Chemistry | Science and Mathematics Education

Comments

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Results from a National Needs Assessment Survey: A View of Assessment Efforts within Chemistry Departments

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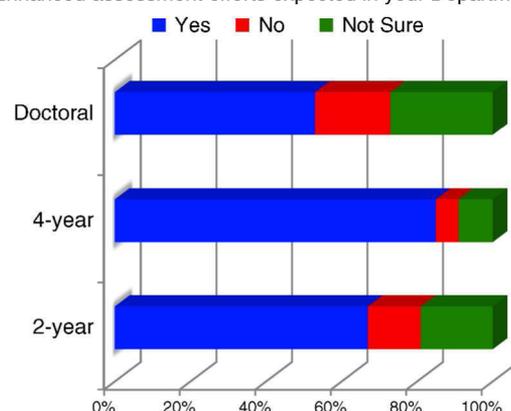
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Supporting Information

ABSTRACT: As is true for virtually all of higher education, chemistry departments are often required to provide evidence of student learning at both course and curricular levels through evaluation and assessment. The ACS Exams Institute conducted a needs assessment survey of 1500 chemistry faculty members from across the country to investigate motivation, role, instrument use, and challenges associated with assessment efforts. For the more than 70% of participants who reported departmental efforts related to assessment, these findings emerged: motivations were primarily external factors related to accreditation and certification, ACS Exams and in-house exams were the most common instruments used, and time management associated with grading and reporting assessment results was the most frequently cited challenge. Summary results for each survey question related to these aspects of departmental assessment efforts are provided, along with logistic regression analyses of responses based on institution type. Logistic regression analyses were also used to identify differences among sex, years teaching, and chemistry subdiscipline for responses to departmental assessment efforts and instrument use.

KEYWORDS: First-Year Undergraduate/General, Second-Year Undergraduate, Upper-Division Undergraduate, Interdisciplinary/Multidisciplinary, Testing/Assessment

Enhanced assessment efforts expected in your Department?



INTRODUCTION

For many different reasons, chemistry faculty members and chemistry departments are increasingly expected to undertake and report on assessment efforts regarding their students, their courses, and their curricula. One common reason for such assessment efforts is the desire for feedback on student learning and the effectiveness of teaching methods. In chemistry, this overall objective is often associated with the goal to obtain or maintain university accreditation or departmental certification.¹ Assessment is also playing a more important role in efforts by chemistry faculty member to acquire grant funding for the design, modification, and improvement of chemistry education activities, courses, and curricula.^{2,3}

Towns⁴ reported an analysis of assessment plans within chemistry departments and derived descriptions for how the development of learning objectives and assessment plans were carried out. This study suggested that assessment plans vary based on the number of students being assessed, the level of assessment (course-level and programmatic), and institutional resources. Furthermore, as Towns described: the “key facets of any assessment are ease of use, utility of the data, and leverage of current practices”.⁴ Assessment tools used among the four institutions in the analysis included student portfolios, student

self-assessments, clicker questions aligned to learning objectives, faculty developed gain-score tests, and American Chemical Society (ACS) Exams.

In general, in higher education, there is considerable interest in program assessment as a means for assuring quality of the educational experience. Program assessment for specific academic disciplines has been discussed in, for example, bioinformatics within life sciences,⁵ biology more broadly,⁶ geography,⁷ pharmacy,⁸ political science,⁹ and sociology.¹⁰ Key programmatic strategies include student assessment of their studies⁵ and combinations of assessment forms, including student peer assessment.¹¹ Goubeaud has argued that college biology instructors use a wider variety of assessment methods than either chemists or physicists.¹² Other studies have focused on how to best match assessment with specified learning outcomes.^{13,14} It is also worth noting that instructors’ understanding about the role of assessment in higher education has been studied more broadly, including the use of survey instruments to determine teachers’ conceptions of the role of assessment,^{15–17} and ultimately to compare the view of students and teachers about assessment.^{18,19} A key result of

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these latter studies is that faculty members tend to view assessment as a trustworthy process more than do students. Finally, recent trends suggest that assessment with a disciplinary focus, rather than a departmental focus, may improve faculty engagement in assessment practices.²⁰

To better understand the current state of assessment efforts within chemistry departments, the ACS Examinations Institute (ACS-EI) has conducted a needs assessment with a national sample of chemistry faculty.²¹ While this study investigated a wide range of topics related to assessment in chemistry education, the findings reported here will focus on the:

1. Degree to which departments are expected to conduct assessment efforts
2. Assessments used in these efforts
3. Motivation for, and faculty roles within, these efforts
4. Challenges faced by instructors resulting from these efforts.

The data analysis presented herein extends our previous report,²¹ primarily by providing detailed statistical analyses of difference among groups of participants. Ultimately, results from this needs assessment survey will inform efforts by the ACS-EI to design and develop interactive professional development resources related to assessment.

METHODOLOGY

Survey Design

Information gathered from five focus groups with chemistry faculty members served as the basis for the design of the pilot survey. These focus groups occurred at regional and national ACS meetings during the summer and fall of 2009. Approximately 40 faculty members participated in the focus groups. The first session included educators with expertise in assessment to determine appropriate goals for knowledge about assessment among chemistry faculty members. In subsequent groups, participants were asked to discuss their knowledge of, and prior experiences with, various forms of assessments (as identified by the initial panel) and different assessment techniques. The key themes that emerged from these focus groups included: confusion related to assessment terminology, variation in the level of engagement within departmental assessment activities, and frustration caused by departmental assessment requirements that lacked clear implementation strategies.

An online pilot survey was administered to 24 chemistry faculty members in the spring of 2010. For each survey item, participants had the opportunity to provide comments and suggestions on the clarity of the question and answer options. After revising the pilot survey, the full survey was administered online in the summer of 2010. An invitation to participate in the full survey was sent via e-mail to the approximately 14,000 faculty members in a database compiled by ACS-EI. The database of chemistry faculty members was populated using public information from the Web sites of colleges and universities within the United States. To compensate faculty members for their time, participants had the opportunity to enter into a random drawing to win an Apple iPad.

For the purposes of this survey, the term “faculty member” includes tenured, tenure-track, and nontenure-track professors and instructors at two-year and four-year colleges and universities. Within the database, faculty members were categorized into three groups based on the highest chemistry degree offered at their institution: *two-year* (associate’s degree),

four-year (bachelor’s or master’s degree), and *doctoral* (doctoral degree). Of the approximately 14,000 faculty members in the database, 42% were at doctoral institutions, 39% were at four-year institutions, and 19% were at two-year institutions. At the end of the survey, participants were able to provide additional demographic data, such as their sex, subdiscipline (analytical chemistry, organic chemistry, etc.), and number of years of teaching chemistry.

The response rate for the full survey was 14% for faculty members from four-year institutions and 7% for faculty members from two-year and doctoral institutions. Because the number of faculty members in the database from two-year institutions was less than half of the number of faculty members from doctoral institutions, the number of participants from two-year institutions was much smaller than for doctoral institutions. Consequently, faculty members affiliated with the 2-Year College Chemistry Consortium (2YCC)²² were invited to participate in the survey in the fall of 2011, which increased the number of participants from two-year institutions from 204 to 328.

Using logistic regression, only one statistically significant difference was identified between the two-year institution participants completing the survey in 2010 and 2011. The probability of a faculty member from a two-year institution identifying his or her subdiscipline as analytical chemistry was greater for the 2010 sample than for the 2011 sample (9.8 and 2.4%, respectively; $\beta = 1.47$, OR = 4.4, $p = 0.019$). We have combined these two samples for all data analysis because the samples were otherwise equivalent with respect to sex, years teaching chemistry, remaining subdisciplines, and answers to the questions related to departmental assessment efforts and campus workshops.

Data Analysis

Binary and multinomial logistic regression statistics^{23–25} were used to determine significant differences between or among responses for the different subgroups of participants (institution type, sex, subdiscipline, etc.). Logistic regression has been used in a number of studies reported in this *Journal* over the past decade;^{26–32} therefore, only concepts critical to the current analyses will be reviewed here.

Binary logistic regression (BLR) was used to analyze binary data (e.g., yes or no). For example, participants were asked: *What types of assessment does your department use in these efforts? (Check all that apply.)* Each assessment choice is an independent binary response, where 1 = use this assessment, and 0 = do not use this assessment. The choices indicated by any instructor may actually measure a latent (unobserved) variable, y^* , that would describe an underlying tendency for chemistry faculty members to use certain types of assessments. The tendency to use an assessment could be influenced by how easy it is to administer the assessment, the perceived credibility of the assessment, and the value associated with data collected from the assessment, to name a few factors. While the latent variable represents a distribution along a continuum, it is the observed variable, y (i.e., whether or not the assessment is used), that is measured. Ultimately, the cutoff of the binary observed variable occurs at some y^* value, τ (Figure 1). The probability of observing the outcome, $\Pr(y = 1|x)$, is equal to the proportion of the latent variable’s distribution above τ , and the probability of not observing the outcome, $\Pr(y = 0|x)$, is equal to the proportion of the latent variable’s distribution below τ .

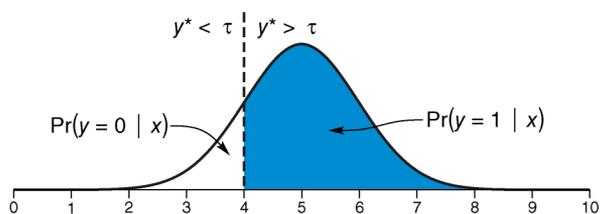


Figure 1. An example distribution of a latent (unobserved) variable y^* . The cutoff, τ (dashed line), creates the shaded region ($y^* > \tau$) that indicates the probability of observing the outcome.

The simple binary logit model that describes how the probability of an outcome depends on the latent variable can be described by

$$\Pr(y = 1|x) = \frac{\exp(\alpha + \beta x)}{1 + \exp(\alpha + \beta x)} \quad (1)$$

This equation results in an s-shaped logistic curve that represents the probability of an outcome.²³

Multinomial logistic regression (MLR) was used to analyze unordered categorical response data. For example, survey participants were asked: *What is your primary role in your departmental efforts? (Choose one.)* The response options included: *I am leading the effort; I collect or contribute data from my courses; I analyze data supplied by other instructors; or I (or my courses) do not contribute significantly to these efforts.* The MLR model is constructed similarly to the BLR model, except that an MLR model “can be thought of as simultaneously estimating binary logits for all comparisons among alternatives”.²⁵ In the case of participants’ primary role reported in the needs assessment survey, the MLR model determines the odds for six combinations, comparing these pairs:

Leading the effort to contributing data
Leading the effort to analyzing data
Leading the effort to not contributing
Contributing data to analyzing data
Contributing data to not contributing
Analyzing data to not contributing

The simultaneous comparisons take into consideration redundant comparisons such as those that would arise from merely changing the order of the comparison.

Logistic comparison of survey data is not necessarily intuitive. Consequently, two other statistical measures are commonly computed. The odds of the outcome (Ω) is the

ratio of the probability of success for that outcome divided by the probability of failure for that outcome.

$$\Omega(x) = \frac{\Pr(y = 1|x)}{1 - \Pr(y = 1|x)} \quad (2)$$

The nonlinear regression equation can also be transformed into an odds ratio (OR), which is easier to interpret than the nonlinear relationship. The odds ratio can be calculated by

$$\text{OR} = e^{\beta} \quad (3)$$

The odds ratio describes the odds of success based on a one-unit increase in the variable. For example, a β coefficient of 0.528 ($p = 0.01$) produces an odds ratio of 1.7, which would be interpreted as: a one-unit increase in the dependent variable increases the odds of observing the outcome by 1.7 times. Because only two outcomes in binary logistic regression are possible, the statistic compares the probability of being in one category versus the probability of being in the other category. For the multiple outcomes in multinomial logistic regression, the statistic essentially estimates a separate binary logit for each pair of outcome categories while imposing constraints among the coefficients. For most statistical comparisons reported here, the β coefficient will be reported, followed by the OR and the p -value; for the remaining comparisons, statistical values are reported in the Supporting Information.

Demographic Characterization of the Respondent Sample

A summary of the participant demographics is provided in Table 1. Of the 98% of participants who provided information about their sex, 64% were men. Participants from doctoral institutions were more likely to be male than female compared to participants from two-year institutions ($\beta = 0.684$, OR = 2.0; $p < 0.001$) or four-year institutions ($\beta = 0.426$, OR = 1.5; $p = 0.001$). The distribution of survey participants across institution type was not statistically different from the distribution in the population. Participants reported an average of 15 years of teaching experience in chemistry, with participants from doctoral institutions reporting more years teaching chemistry than participants from two-year and four-year institutions ($p < 0.001$).

The distribution of participants over the different subdisciplines of chemistry is also provided in Table 1 as subsequent comparisons among subdisciplines rely on these categories. The subdiscipline “chemistry education” was intentionally used as a category that encompasses faculty members who identify as primarily chemistry educators and who identify as chemistry

Table 1. Demographics of Survey Participants, by Institution Type

Categories	Total (%, N = 1546)	Two-Year (%, N = 328)	Four-Year (%, N = 792)	Doctoral (%, N = 426)
Male	63	56	62	70
Female	35	43	37	27
Other, prefer not to say, or blank	2	2	1	3
Years Teaching Chemistry, Average	15	14.5	14.5	16.8
Analytical chemistry subdiscipline	13	7	14	14
Biochemistry subdiscipline	9	3	13	5
Chemistry education subdiscipline	10	20	5	9
Inorganic chemistry subdiscipline	18	22	16	20
Organic chemistry subdiscipline	28	27	28	28
Physical chemistry subdiscipline	17	9	19	19
Other subdiscipline or blank	6	13	4	4

Table 2. Departmental Assessment Efforts, by Institution Type

Response to the Question:	Total	Two-Year	Four-Year	Doctoral
<i>Is your department currently expected to enhance assessment efforts or prepare reports related to assessment?</i>	(%, N = 1546)	(%, N = 328)	(%, N = 792)	(%, N = 426)
Yes	72	67	85	53
No	12	14	6	20
Not sure	16	19	9	27

Table 3. Types of Assessments Used, by Institution Type

Answered "Yes" to Department Assessment Efforts:	Total	Two-Year ^b	Four-Year ^b	Doctoral ^b
<i>What types of assessment does your department use in these efforts? (Check all that apply.)^a</i>	(%, N = 1120)	(%, N = 218)	(%, N = 672)	(%, N = 230)
ACS Standardized Exam	66	49	74	61
Student performance on specific questions (or content) from in-house exams	38	56	35	29
Student research projects	37	6	45	40
Student performance overall on in-house exams	34	—	—	—
Student writing	25	14	31	20
Student surveys	25	15	27	29
Student laboratory notebooks	23	26	—	18
Major field test	17	2	25	8
Laboratory practical exams	17	—	—	—
Student performance on homework	14	—	—	—
Student portfolios	8	—	—	—
Other (please specify)	15	—	17	9

^aResponses are ordered by frequency of reported use, not by the order presented in the survey. ^bResponses are provided for individual institution types only when there is a statistically significant difference among the types of institutions ($p < 0.05$). Italicized numbers indicate no statistical difference between the two italicized values.

education researchers. This group could be subdivided based on activity (paper publication or conference presentations) in chemistry education research, but the sample size of such a group is too small to allow later statistical comparisons. The percentage of faculty members from doctoral institutions identifying biochemistry as their subdiscipline is lower than one might expect. This low percentage is likely because of the fact that biochemists are not always part of chemistry departments at doctoral institutions.

RESULTS AND DISCUSSION

A number of key results emerged from the analysis of this survey data. Several of those with the broadest effects are discussed here; additional, more fine-grained results are included in the Supporting Information.

Departmental Assessment Efforts

The distribution of participants who answered *yes*, *no*, or *not sure* to the question: *Is your department currently expected to enhance assessment efforts or prepare reports related to assessment?* is provided in Table 2. While 72% of the participants were aware of assessment efforts within their departments, there was statistically significant variation in this awareness among the faculty members from different institution types. If awareness of assessment is considered to be positive for answering *yes* and negative for answering *no* or *not sure*, faculty members from four-year institutions were more likely to report awareness than faculty members from two-year and doctoral institutions ($\beta = 1.09$, OR = 2.9, $p < 0.001$, and $\beta = 1.62$, OR = 5.0, $p < 0.001$, respectively), and faculty members from two-year institutions were more likely to report awareness than faculty members from doctoral institutions ($\beta = 0.538$, OR = 1.7, $p = 0.010$).

Responses to departmental assessment efforts were also investigated for differences based on sex, number of years teaching chemistry, and chemistry discipline. Female partic-

ipants were 1.5 times more likely than male participants to report *yes* versus *no* in response to this question about enhancing assessment efforts ($\beta = 0.376$, $p = 0.034$). When considering experience, for every one year increase in the number of years teaching, the likelihood of reporting *yes* versus *not sure* was 1.05 times greater ($\beta = 0.0475$, $p < 0.001$) and the likelihood of choosing *no* over *not sure* was 1.06 times greater ($\beta = 0.0607$, $p < 0.001$). Interestingly, this would indicate that with greater teaching experience, participants were more likely to be aware of assessment efforts (or lack thereof) in their department; however, the effect sizes (i.e., odds ratios) are quite small. No statistically significant differences based on chemistry discipline were observed among faculty members who answered *yes* to departmental assessment efforts rather than *no* or *not sure*.

Assessment Used

For the participants who reported awareness of departmental assessment efforts, a series of additional questions were asked using the branching feature of online surveys in order to provide information about the nature of these efforts. The first question in this series asked participants: *What types of assessment does your department use in these efforts? (Check all that apply.)* Responses are reported in Table 3 for the entire subsample. The percentages reported for individual institution types are presented only when a statistically significant difference ($p < 0.05$) among the different institution types was observed; responses in italics indicate that two institution types are not statistically significantly different from each other, but that they are both statistically significantly different from the third institution type.

For the faculty members sampled, the top three assessments used in departmental assessment efforts were: *ACS Standardized Exams* (66%), *student performance on specific questions (or content) from in-house exams* (38%), and *student research*

Table 4. Primary Motivation for Departmental Assessment Efforts, by Institution Type

Answered "Yes" to Department Assessment Efforts: <i>What was the primary motivation for these departmental efforts? (Choose one.)</i> ^a	Total (%, N = 1120)	Two-Year (%, N = 218)	Four-Year (%, N = 672)	Doctoral (%, N = 230)
The college as part of an external accreditation	57	70	55	52
The college as part of an internal decision	19	19	18	23
The department wishes to maintain ACS certification	11	1	13	16
The faculty thought it was important	7	8	7	6
The department wishes to obtain ACS certification	2	1	3	0
Other (please specify)	3	1	4	2

^aResponses are ordered by frequency of reported use, not by the order presented in the survey.

Table 5. Primary Role in Departmental Assessment Efforts, by Institution Type

Answered "Yes" to Department Assessment Efforts: <i>What is your primary role in your departmental efforts? (Choose one.)</i> ^a	Total (%, N = 1120)	Two-Year (%, N = 218)	Four-Year (%, N = 672)	Doctoral (%, N = 230)
I collect and contribute data from my classes	59	55	62	56
I am leading the effort	19	28	18	16
I (or my courses) do not contribute significantly to these efforts	9	6	8	16
I analyze data supplied from other instructors	5	4	5	5
Other (please specify)	7	7	7	7

^aResponses are ordered by frequency of reported use, not by the order presented in the survey.

projects (37%). However, these assessment types were not used uniformly across the different institution types. Participants from four-year institutions were more likely to use ACS *Standardized Exams* than participants from doctoral institutions, who, in turn were more likely to use ACS *Standardized Exams* than participants from two-year institutions. Participants from two-year institutions were more likely to use *student performance on specific exam questions (or content) from in-house exams*, and less likely to use *student research projects* and *student surveys*, than participants from both four-year and doctoral institutions. For both *student writing* and the *major field test (MFT)*, participants from four-year institutions were more likely to report using these assessments than participants from doctoral institutions, who were, in turn, more likely to report using these assessments than participants from two-year institutions. The use of *student laboratory notebooks* was reported more frequently from participants from two-year institutions than from participants at doctoral institutions. The reported departmental use for the remaining types of assessments—*student performance overall on in-house exams* (34%), *laboratory practical exams* (17%), *student performance on homework* (14%), and *student portfolios* (8%)—did not differ among faculty from different institution types.

It is interesting that faculty members from four-year institutions report higher usage for the *major field test* as compared to faculty members from doctoral institutions, a trend that is similar to the use of ACS *Standardized Exams*. One hypothesis for this difference might be that because doctoral schools stake less of their institutional identity on undergraduate student learning outcomes than four-year schools, their faculty are less likely to seek assessments that offer comparative information about their success in this aspect of their program. *Student research projects* are likely also used as assessment of accumulated knowledge for students in upper-level courses. The percentages and statistical comparisons of reported use between sexes, based on number of years teaching, and among the disciplines are reported in the Supporting Information.

Motivations and Faculty Roles

Participants who reported awareness of departmental assessment efforts were also asked about their department's primary motivation for these efforts (Table 4), as well as their primary role in these efforts (Table 5). Overall, nearly 90% of the faculty members cited an external factor as the primary motivation for their department's assessment efforts. Only 7% reported that *the faculty thought it was important*. Of these external factors, motivations related to the department (i.e., *obtaining ACS certification*, 2%, or *maintaining ACS certification*, 11%) were less prevalent than motivations related to the college (i.e., *internal decision*, 19%, or *external accreditation* (57%).

In addition to the aggregated data on motivation by institution type (Table 4), it is also possible to consider responses from groups of faculty members from the same school. There were 76 institutions from which more than three participants completed the survey, and it appears that the faculty within the same department may not always be aware of, or agree upon, the primary motivation of their department's assessment efforts. Analyzing the responses from each institution uncovered complete agreement on departmental assessment efforts *and* the primary motivation for these efforts among the individual faculty members at only 10 institutions (13%). For another 18 institutions (24%), the individual faculty members agreed that their department was undergoing assessment efforts; however, they did not agree on the primary motivations for these efforts. Faculty members at the remaining 49 institutions (64%) did not agree that their department was undergoing assessment efforts (and, consequently, not all participants were asked about the primary motivation).

There are several possible explanations as to why members from a single department differ on their impressions about motivation for assessment efforts. We have noted that there are, in fact, different driving factors for assessment, so individuals may be more aware of one or another of these motivations. Alternatively, it is possible that these motivations actually have changed over time and differences reflect this. Perhaps more worrisome, however, is the possibility that these differences reflect confusion about the motivation for assessment. Such

confusion could contribute to frustration among instructors with the departmental assessment efforts.

Over half of the participants (59%) reported *I collect and contribute data from my classes* as their primary role in their departmental assessment efforts (Table 5). The next most prevalent response (19%) was *I am leading the effort*. Participants from four-year institutions and from doctoral institutions were more likely to report *I collect and contribute data* rather than *I am leading the effort* than participants from two-year institutions ($\beta = 0.536$, OR = 1.7, $p < 0.01$ and $\beta = 0.551$, OR = 1.7, $p = 0.025$, respectively). Furthermore, participants from doctoral institutions were more likely to report *I or my courses do not contribute significantly to these efforts* rather than *I am leading the effort* or *I collect and contribute data* than participants from two-year and four-year institutions ($\beta = 0.636$, OR = 1.02, $p = 0.01$ and $\beta = 0.835$, OR = 2.3, $p = 0.016$, respectively). These inferences about statistical significance are again made using multinomial logistic regression, and the item is not structured in a way that allows for determination of significance for a single response across institution types (essentially across a row of the table).

Challenges

The last question related to departmental assessment asked participants about the challenges individual instructors face with respect to their departmental assessment efforts (Table 6).

Table 6. Challenges to Departmental Assessment Efforts

Answered "Yes" to Department Assessment Efforts: <i>What challenges do the individual instructors in your department feel in terms of meeting the expectations of departmental assessment? (Choose one.)</i> ^a	Total (%, N = 1120)
Reporting data for the departmental efforts takes extra time	58
Not all instructors participate as fully as they should	43
These efforts rarely result in any action	43
Departmental assessment efforts take extra time to grade	29
Some instructors "teach to the test" so their students will look good in the assessment reports	16
Department assessment efforts do not match the course material well	15
Other	43

^aResponses are ordered by frequency of reported use, not by the order presented in the survey.

Over half of the participants (58%) identified with the challenge that *reporting data takes extra time*. Nearly half (43%) also reported the challenge that *not all instructors participate as fully as they should* and *these efforts rarely result in any action*. In addition, the statement *department assessment efforts take extra time to grade* was reported for over one-quarter of the participants (29%).

The two remaining choices of possible challenges, some instructors "teach to the tests" so their students will look good in the assessment reports and department assessment efforts do not match the course material well, were selected by 16 and 15% of the participants, respectively. While none of the top four responses differed significantly among participants from different institution types, the challenge that some instructors "teach to the tests" was more likely to be selected by participants from two-year institutions (23%) than from participants at four-year institutions (13%; $\beta = 0.764$, OR = 2.1, $p < 0.001$). Participants were also able to provide their own

challenges in the other category. These responses were organized into four general categories:

1. General issues of time requirements (designing and managing assessments, maintaining records, reporting findings)
2. The concern that the results from these assessments will impact faculty members' evaluation, tenure, and promotion
3. Lack of awareness or apathetic attitudes toward assessment efforts
4. Claims that departmental assessment efforts infringe on instructors' "academic freedom"

CONCLUSIONS

The recent report by Towns⁴ provided case studies of four chemistry departments' assessment plans. The current results further suggest that a large number of chemistry faculty members are part of departmental assessment efforts and could potentially be interested in additional resources related to assessment efforts. Moreover, because 70% of these participants cited reasons related to accreditation or certification as the primary motivations for their departmental assessment efforts, it seems likely that these incentives will continue to encourage faculty members and departments to assess their students, courses, and curricula.

There is little reason to believe that any decrease in emphasis on assessment is on the horizon for higher education. As a result of this fact and the reality that college instruction typically falls under the umbrella of some form of faculty governance, it is reasonable to predict that an increased number of chemistry instructors will incorporate new or additional assessment efforts in the foreseeable future. The results from this needs assessment can be useful not only to faculty leaders who are assigned the task of marshaling assessment efforts, but also to developers of educational tools for college faculty members. For example, because a majority of faculty members reported challenges related to the time requirements associated with assessment efforts, systems that help minimize the time requirements for collecting, managing, and reporting data would appear to be a helpful development. Designing a system that helps lessen the burden for reporting data may also help address the frustration that *not all instructors participate as fully as they should*. Finally, providing interactive resources about assessment techniques and terminology may help chemistry faculty members and departments in their efforts to use the results of their assessment efforts to suggest relevant and meaningful changes to their courses, programs, and curricula such that faculty members do not feel frustrated by the fact that *these efforts rarely result in any action*.

ASSOCIATED CONTENT

Supporting Information

Additional data and statistical analyses. This material is available via the Internet at <http://pubs.acs.org>.

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Notes

The authors declare no competing financial interest.

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