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Foundation Coursework in Undergraduate Inorganic Chemistry: Results from a National Survey of Inorganic Chemistry Faculty

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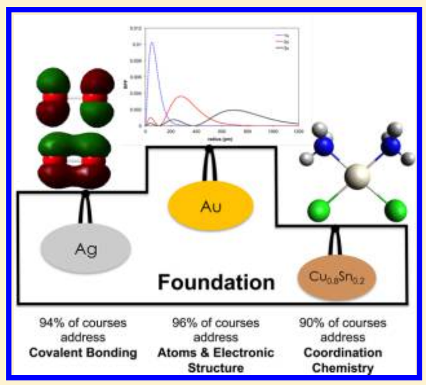
Supporting Information

ABSTRACT: A national survey of inorganic chemists explored the self-reported topics covered in foundation-level courses in inorganic chemistry at the postsecondary level; the American Chemical Society's Committee on Professional Training defines a foundation course as one at the conclusion of which, "a student should have mastered the vocabulary, concepts, and skills required to pursue in-depth study in that area." Anecdotal evidence suggested that more than one type of Inorganic Chemistry Foundation course was offered in the undergraduate chemistry curriculum. Cluster analysis confirmed this evidence, revealing four distinct foundation courses, each with unique profiles of topics covered. Faculty reported changes in content coverage over the past five years that mirror the evolving foci of inorganic chemistry research. These results potentially complicate how graduate programs evaluate incoming students' understanding of inorganic chemistry and the design of national assessments of undergraduate inorganic chemistry courses.



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INTRODUCTION

The breadth of topics covered in undergraduate inorganic chemistry courses is as diverse as the range of elements on which inorganic chemists focus their research. In contrast to the general, organic, and physical chemistry curricula, for example, the inorganic chemistry curriculum varies significantly by instructor and institution. This has resulted in the emergence of a wide array of inorganic course offerings. Faculty members customize the course based on their own expertise, interest areas, and comfort level.

The diversity in the undergraduate inorganic curriculum can be traced to the gradual removal of inorganic topics from the general chemistry course without universal development of a replacement course in inorganic chemistry.[1] Beginning in 1941, a recommendation was made to require a course in inorganic chemistry because the general chemistry course was no longer a course in inorganic chemistry. Furthermore, at the time, a specialized course in inorganic chemistry was not required by the "accrediting committee" of the American Chemical Society (ACS).[2] The "Symposium on the Place of Inorganic Chemistry in the Undergraduate-Curriculum" at the 116th Meeting of the American Chemical Society noted the deficiency of inorganic chemistry in the undergraduate curriculum and attempts to rectify the situation were subsequently made.[3] This discussion was presented as a series of pieces in this *Journal* in 1950, 27(8), pp 437−456.

The first formalized undergraduate inorganic chemistry curriculum was outlined in the *Journal of Chemical Education* in 1972 by the Inorganic Subcommittee of the Curriculum Committee of the Division of Chemical Education.[4] (Similar curricular statements were also published during the same time frame for general, analytical, organic, and physical chemistry

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courses.) Recommendations and updates to this curriculum have been described in this *Journal* and in the supplemental guidelines by the Committee on Professional Training (CPT).[5,6] Still, the nature of the undergraduate inorganic curriculum has always been a topic of discussion in the community and was the focus of a series of talks in a symposium published as commentary pieces in this *Journal* in 1980, 57(11), pp 761−778. Much of the discussion following this conference focused on the role of descriptive inorganic and its location in the curriculum.[7−11]

Over the past five years, there has been a renewed interest in exploring what is taught in the undergraduate chemistry curriculum in more formal ways; this work has included reviews of examination items and instructional materials,[12,13] surveys of chemistry faculty,[14−17] and development of consensus documents on content learning goals for the chemistry subdisciplines.[18−20] In addition, the Committee on Professional Training for the American Chemical Society has provided outlines of subdisciplinary topics for the various courses commonly offered at the undergraduate level.[21] The assumption of these statements is that there is a unique set of content and skills to be taught in each chemistry subdisciplinary course; although each statement does attempt to maintain a level of ambiguity to allow chemistry programs to customize their curriculum to fit their students' needs and program goals. The lack of diversity in curricular materials (i.e., textbooks) suggests that there is relatively little variation in the content of the general and organic chemistry courses.[12] However, with inorganic chemistry courses, such a unified curriculum is not as apparent. While the CPT provides an outline of topics that can be covered at the undergraduate level, these materials do not mandate what should be taught as the foundation of inorganic chemistry. The most recent opinions offered on the topic were those of textbook author Wulfsberg,[22] but there exists no snapshot of what is covered in the field since the CPT guidelines have been revised to require a foundation (or first) course in inorganic chemistry.

Results of a national survey of inorganic chemistry faculty, as reported in this paper, are focused on the content of the foundation course in inorganic chemistry; a second paper will describe a similar analysis of the in-depth course in inorganic chemistry. The labels foundation and in-depth correlate with the American Chemical Society's description of undergraduate chemistry courses as outlined in the most recent (2008) guidelines for ACS approved bachelors degree programs.[6] According to the October 2014 draft version of the ACS CPT Guidelines, available for review online, "foundation experiences provide breadth of coverage across the traditional subdisciplines. Rigorous in-depth experiences build upon the foundation."[23] Foundation inorganic chemistry courses will be investigated through the lens of faculty reported content coverage of 14 broad inorganic chemistry topics. Cluster and subsequent categorical statistical analyses will be utilized as empirical evidence to support the hypothesis that more than one type of foundation course is offered by undergraduate chemistry degree programs. The following research questions will be answered: Is more than one type of foundation inorganic chemistry course offered in the undergraduate chemistry curriculum? If so, how are those courses characterized by topics covered?

■ METHODS

Members (n = 5551) of the Division of Inorganic Chemistry (DIC) of the American Chemical Society were asked to participate in a survey on the content of their undergraduate inorganic chemistry courses; to increase the response rate, members (n = 679) of the Virtual Inorganic Pedagogical Electronic Resource (VIPEr) community, a subset of the DIC community, were sent a reminder e-mail to participate. A total of 435 inorganic chemistry faculty responded; a response rate is unable to be accurately determined due to an inability to characterize the total population of inorganic chemistry faculty. At the time of the survey, approximately one-third of the membership of the DIC reported their primary job title as 'Professor/Instructor/Administrator'. This sampling strategy, likewise, does not ensure that all faculty who teach an undergraduate course in inorganic chemistry were sampled; it can be supposed that there are inorganic chemistry faculty who are not members of the American Chemical Society, specifically the Division of Inorganic Chemistry. Our analyses, however, suggests that a diverse set of foundation courses were reported and thus confirms the overarching hypothesis. (Such an analysis does not necessitate a representative sample population.) A nonrepresentative population allows for the different types of courses to be explored; however, the sample does not allow us to make conclusions about how prevalent the courses are in the curriculum. Implications of the results will be constrained to the finding that differing foundation courses in the inorganic chemistry curriculum exist.

Of the 453 respondents, 47.8% were from bachelors degree awarding institutions, 44.8% were from doctoral degree awarding institutions, and 7.4% were from masters degree awarding institutions.

Each respondent was asked whether they had taught a foundation inorganic chemistry course during the last three years; a foundation course was defined to the respondents in the survey as "the first course in inorganic chemistry builds on the introductory coursework typically taught in general chemistry and has a general chemistry pre-requisite." Only those respondents who had taught a foundation course were asked to characterize topics taught in the course.

The survey respondents reported topics covered for 317 foundation inorganic chemistry courses. Information gathered about these courses included the overarching topics and subtopics covered in the course and how the coverage of those topics has changed over the last five years. Survey questions were modified from an earlier survey of inorganic chemistry course content coverage.[24] The list of topics and subtopics were compiled by 4 inorganic chemistry education practitioners with extensive understanding of the state of inorganic chemistry education and with assistance from the 2014 Inorganic Chemistry ACS Exam Committee. During the development of the 2014 exam, the members of the exam committee were asked to independently identify the topics that students should know based on the topics in the Pesterfield and Henrickson[24] survey with an eye on changes that have happened and are happening in the field. Committee members shared these lists and common topics were used to identify additional categories that should be surveyed. The Leadership Council of the Interactive Online Network of Inorganic Chemists provided recommendations and review. These data were analyzed using descriptive statistics and cluster analysis. (Overviews of cluster

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analysis are reported elsewhere.[25−27] Salient methodological components will be noted as appropriate.)

RESULTS AND DISCUSSION

In 1972, the Inorganic Chemistry Subcommittee of the Curriculum Committee of the Division of Chemical Education presented a topical outline for the first and one-semester course in inorganic chemistry.[4] The Subcommittee identified the importance of each topic with the monikers: most important, important, and optional/dispensable (a summary is provided in Table 1). This curriculum places emphasis on the electronic structure of atoms, covalent bonding, and periodicity; all logical extensions of the introductory inorganic chemistry covered in general chemistry courses. Topics such as the metallic state (which includes metallic bonding, band theory, and semiconductors), bioinorganic chemistry, physical methods, and symmetry and group theory are treated as special topics with none of the subtopics having a "most important" rating.

Table 1. Topics for the First and One-Semester Course in Inorganic Chemistry[4]

Overarching Topic	Number of Subtopics	% of Subtopics: Most Important	% of Subtopics: Important	% of Subtopics: Optional
Electronic Structure of Atoms	6	66.6	33.3	0.0
Ionic Bonding	8	37.5	50.0	12.5
Covalent Bonding	10	70.0	30.0	0.0
Acid−Base Chemistry & Nonaqueous Solvents	5	40.0	60.0	0.0
Coordination Chemistry	11	27.3	72.7	0.0
Organometallic Chemistry	8	25.0	25.0	50.0
Other Chemistry of Metals	7	14.3	42.9	42.9
Periodicity	4	75.0	25.0	0.0
Nonmetal Chemistry	10	20.0	50.0	30.0
The Metallic State	4	0.0	100.0	0.0
Bioinorganic Chemistry	6	0.0	66.6	33.3
Physical Methods	17	0.0	35.3	64.7
Symmetry & Group Theory	2	0.0	50.0	50.0

In 2001, Pesterfield and Henrickson reported on a national survey of 200 randomly selected inorganic chemistry professors from both public and private institutions.[24] Seventy-three topics were rated as covered in detail, covered briefly, or not covered. The results showed a strong consensus among faculty regarding the importance of several topic areas (e.g., covalent bonding, symmetry and transition metal complexes) in the curriculum with greater than 60% of respondents indicating detailed coverage. A lack of detailed coverage was also indicated in the topical areas of bioinorganic, materials, oxidation/reduction, and general descriptive chemistry. While the survey revealed some broad trends in topical coverage, the diversity in inorganic programs at the undergraduate level was clearly evident.

Topical Coverage of Foundation Inorganic Chemistry Courses

The study reported herein sought to replicate and expand the focus of Pesterfield and Henrickson's work on characterizing the foundation course in inorganic chemistry. Respondents were asked to report whether they teach a foundational course in inorganic chemistry and to select which of 14 broad topics are covered in that course; in all, 317 respondents reported teaching such a course. (Note: The term "foundational" instead of foundation was used throughout the survey; the term "foundation" is used throughout this paper to standardize language with the CPT guidelines.) The percentages of respondents covering each topic are reported in Table 2.

Table 2. Percent of Respondents Covering Each Topic in a Foundation Inorganic Chemistry Course

Topic	Percentage Covering (n = 317)
Atoms & Electronic Structure	96.2
Covalent Bonding & Molecular Orbital Theory	94.3
Transition Metal Complexes & Coordination Chemistry	89.6
Acids, Bases, & Solvents	77.0
Symmetry & Group Theory	75.4
Solids & Solid State Chemistry	75.1
Redox Chemistry	61.5
Main Group & Descriptive Chemistry	54.6
Organometallic Chemistry	45.1
Bioinorganic Chemistry	32.8
Materials Chemistry & Nanoscience	21.8
Analytical Techniques	18.0
Nuclear Chemistry	17.0
Green Chemistry	2.8

There is a noted overlap between the topics reported as covered by the largest percentage of respondents, those suggested by the 1972 report,[4] and those found by Pesterfield and Henrickson[24] suggesting that little has changed in the intended focus of the first course in inorganic chemistry. This is valuable in light of changes in the ACS CPT guidelines over the last two decades and shifts in research emphases in inorganic chemistry. However, the hypothesis we intended to test is built on anecdotal evidence collected by the authors that suggested a single foundation course in inorganic chemistry does not exist.

Identification of Four Distinct Courses

To test this hypothesis and answer our research questions, a hierarchical cluster analysis was conducted using Ward's linkage[28] and a matching similarity matrix for binary data.[29] Visual inspection of the resultant dendrogram (see Supporting Information) and application of Duda and Hart stopping rules[30] led us to determine that a four-cluster solution best represented the data; Je(2)/Je(1) = 0.8238 and pseudo-T^2 = 18.39. Duda and Hart stopping rules consider "the sum of squared errors (of the similarity measure) to devise a quantitative measure for choosing appropriate clusters... A cluster solution should have a large ratio of the sum of squared errors in the two resulting groups, i.e., Je(2), versus the sum of squared errors within the groups, i.e., Je(1), and a small pseudo-T-squared value."[16,29,30] The percentage of respondents covering each topic by cluster are reported in Table 3. Fisher exact tests aided in determining cluster distinctness; eight topic areas showed association between coverage and the cluster groupings.

Compared to the data in Table 2, Atoms & Electronic Structure, and Covalent Bonding & Molecular Orbital Theory are topics covered in a large percentage of all courses; however,

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Table 3. Percent of Courses Covering Each Topic in Foundation Inorganic Chemistry Courses by Cluster Grouping

n_{total} = 317	Descriptive Chemistry	Fundamentals and Selected Topics	Foundation Survey: Fundamentals	Foundation Survey: Comprehensive	Fisher Exact Test[a]
n =	88	42	107	80	
Percentage of Total Respondents	28%	13%	43%	25%	
Atoms & Electronic Structure	93.2	97.6	99.1	95.0	$p < 0.0001$
Covalent Bonding & Molecular Orbital Theory	88.6	100.0	97.2	93.8	
Transition Metal Complexes & Coordination Chemistry	69.3	95.2	99.1	96.3	
Acids, Bases, & Solvents	80.7	7.1	95.3	85.0	$p < 0.0001$
Symmetry & Group Theory	50.0	92.9	88.8	76.3	$p < 0.0007$
Solids & Solid State Chemistry	76.1	85.7	70.1	75.0	$p < 0.0007$
Redox Chemistry	60.2	7.1	64.5	87.5	
Main Group & Descriptive Chemistry	89.8	35.7	10.3	85.0	$p < 0.0036$
Organometallic Chemistry	11.4	76.2	44.9	66.3	$p < 0.0001$
Bioinorganic Chemistry	2.3	57.1	16.8	75.0	$p < 0.0001$
Materials Chemistry & Nanoscience	9.1	42.9	16.8	31.3	
Analytical Techniques	13.6	31.0	16.8	17.5	$p < 0.0007$
Nuclear Chemistry	20.5	4.8	8.4	31.3	
Green Chemistry	2.3	4.8	0.0	6.3	

[a]Adjusted for 14 simultaneous tests ($p < 0.0036$, $p < 0.0007$, $p < 0.0001$).

topics beyond these two are covered at varying levels making it difficult to suggest an overall categorization of topics into levels such as major or minor.

Discussion among the authors and review of the Fisher exact test results led to an assignment of an illustrative title for each of the cluster groups: *Descriptive Chemistry*, *Fundamentals & Selected Topics*, *Foundation Survey: Fundamentals*, and *Foundation Survey: Comprehensive*. Each cluster group represented a distinguishable set of content coverage that identifies with inorganic chemistry courses taught by or known to the authors.

A course from the Descriptive Chemistry cluster is marked by a high level of inclusion of Atoms & Electronic Structure, Covalent Bonding & Molecular Orbital Theory, and Main Group & Descriptive Chemistry topic areas. The content for such a course is typically centered on a set of organizing ideas. For example, Rayner-Canham and Overton, in *Descriptive Inorganic Chemistry*,[31] use fundamental principles to discuss the periodic table in a systematic way. Other texts that use similar organizing principles and content coverage include: Wulfsberg's *Inorganic Chemistry*,[32] Rodgers' *Descriptive Inorganic, Coordination, and Solid State Chemistry*,[33] House and House's *Descriptive Inorganic Chemistry*,[34] and Cotton, Wilkinson, and Gaus' *Basic Inorganic Chemistry*.[35] (These texts are provided to the reader *only* as a reference for conceptualizing the course characterized by this and subsequent cluster groupings. These are exemplars that represent textbooks most likely used by the survey respondents, although this question was not directly asked of the respondents.)

A course from the *Fundamentals & Selected Topics* cluster is marked by a lower coverage of Acids, Bases, and Solvents; Redox Chemistry; and Main Group & Descriptive Chemistry. In addition, this course has an emphasis on transition metal related topics, including Transition Metal Complexes & Coordination Chemistry, Organometallic Chemistry, Bioinorganic Chemistry, and Materials Chemistry & Nanoscience. The authors hypothesize that instructor interest, time constraints in the number of inorganic chemistry courses, and content overlap with other courses may drive the focus of this course. The organization and content of Miessler, Fischer, and Tarr's *Inorganic Chemistry*[36] and Shriver, Weller, Overton, Rourke, and Armstrong's *Inorganic Chemistry*[37] are similar to this cluster. Several other textbooks could be used to teach this course by emphasizing select chapters.

A course from the *Foundation Survey: Fundamentals* cluster is marked by high coverage of most of the topics. This course differs from the *Descriptive Chemistry* course in that Transition Metal Complexes & Coordination Chemistry and Organometallic Chemistry are more emphasized and Main Group & Descriptive Chemistry is less emphasized.

Finally, a course from the *Foundation Survey: Comprehensive* cluster is marked by a large emphasis on every topic compared to the other three courses. There are a number of textbooks that could be used for this course: Housecroft and Sharpe's *Inorganic Chemistry*;[38] Shriver, Weller, Overton, Rourke, and Armstrong's *Inorganic Chemistry*;[37] and Hugheey, Keiter, and Keiter's *Inorganic Chemistry: Principles of Structure and Reactivity*.[39]

The resultant cluster analysis and characterization of the cluster solutions suggest confirmation of the proposed hypothesis of more than one type of foundation course in inorganic chemistry. Our sampling method is unable to determine how prevalent each course is nationally; however, the existence of these courses offered at a minimum of 42 institutions (the lowest number of respondents for a cluster; i.e., *Fundamentals & Selected Topics*) should be considered in national discussions of the undergraduate inorganic chemistry curriculum.

Changes in Content Coverage

In addition to asking respondents to note topics covered in their course, respondents were asked to rate changes in the content covered over the last five years: increased, stayed the same, decreased, or not applicable. Table 4 summarizes the content coverage change for all respondents. Apparent movements toward increased or decreased coverage can be noted through visual inspection of the results: Topics such as Solids & Solid State Chemistry, Transition Metal Complexes, and Bioinorganic Chemistry appear to be increasing overall. Topics such as Acids & Bases and Main Group & Descriptive

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Table 4. Distribution of Responses to Changes in Content Coverage in Foundation Inorganic Chemistry Courses Over the Last 5 Years

n_{total} = 317	% Increased	% Stayed the Same	% Decreased	% Not Applicable
Atoms & Electronic Structure	6.4	76.1	11.2	6.4
Symmetry & Group Theory	18.3	53.3	7.2	21.2
Covalent Bonding & Molecular Orbital Theory	18.5	67.8	6.4	7.3
Solids & Solid State Chemistry	22.9	50.3	8.3	18.5
Acids, Bases, & Solvents	6.8	57.5	18.2	17.5
Redox Chemistry	9.7	51.5	11.4	27.4
Transition Metal Complexes & Coordination Chemistry	20.7	63.6	5.3	10.5
Main Group & Descriptive Chemistry	8.6	39.1	22.4	29.9
Bioinorganic Chemistry	18.2	21.0	9.1	51.7
Organometallic Chemistry	14.3	31.3	9.5	44.9
Materials Chemistry & Nanoscience	17.3	16.6	3.1	63.0
Nuclear Chemistry	2.1	20.5	6.9	70.5
Analytical Techniques	5.6	18.5	4.5	71.4

Chemistry appear to be decreasing overall. (Note that movements in topics covered are interpreted in reference to those who did not select "not applicable" as their response. Therefore, of those respondents covering the topics, increased and decreased coverage was observed for the topics noted above.)

Our overarching hypothesis of multiple foundation inorganic chemistry courses was confirmed by the four-cluster solution. Thus, it is important to consider how respondents in each of the cluster groupings perceived changes in content coverage over the past five years. Table 5 reports the average content coverage change for each topic area by cluster grouping; responses of increasing coverage were coded as 1, coverage stayed the same were coded as 0, and decreasing coverage were coded as −1, not applicable responses were removed from the analysis. An average change around 1 suggests that respondents in the cluster grouping all reported the coverage increasing, an average of 0 suggests coverage staying the same, and an average of −1 suggests coverage decreasing.

Two observations should be made about Table 5. First, there is great flux in content coverage for the *Fundamentals & Selected Topics* course; there is an increasing emphasis on Solids & Solid State Chemistry as well as Materials Chemistry & Nanoscience with subsequent removal of content on Acids, Bases, & Solvents and Main Group & Descriptive Chemistry. Second, respondents in all cluster groupings report increasing coverage of Materials Chemistry & Nanoscience; this suggests a movement toward incorporating more recent advances in the inorganic chemistry field.

■ IMPLICATIONS

This paper does not offer a prescription for a foundation course in inorganic chemistry, nor for how many inorganic-specific courses a curriculum should have. While the data show that there are a number of shared topics, there is diversity in the field with four distinct clusters. This diversity reflects the historical development of the inorganic chemistry course; the curriculum was developed from the bottom up at an individual institutional level rather than from a top down mandate requiring a unified inorganic curriculum. From its inception as a distinct discipline, it was recognized that positioning the inorganic chemistry course(s) in the undergraduate curriculum required compromise and integration with the other courses and depended on institutional constraints.[40] The flexibility with which inorganic topics can be integrated throughout the curriculum leads to the diversity we see in the curriculum today. Just as the Committee on Professional Training does in its guidelines,[6] the authors celebrate the diversity of the field by

Table 5. Mean Change in Content Coverage in Foundation Inorganic Chemistry Courses Over the Last 5 years[a]

	Descriptive Chemistry	Fundamentals & Selected Topics	Foundation Survey: Fundamentals	Foundation Survey: Comprehensive	*n*
Atoms & Electronic Structure	-0.02	-0.08	-0.07	-0.04	*294*
Symmetry & Group Theory	0.08	0.18	0.20	0.09	*241*
Covalent Bonding & Molecular Orbital Theory	0.13	0.17	0.14	0.10	*291*
Solids & Solid State Chemistry	0.16	0.44	0.20	0.04	*246*
Acids, Bases, and Solvents	-0.01	-0.56	-0.22	-0.05	*254*
Redox Chemistry	0.02	-0.20	-0.13	0.09	*217*
Transition Metal Complexes & Coordination Chemistry	0.13	0.03	0.22	0.21	*273*
Main Group & Descriptive Chemistry	-0.06	-0.33	-0.37	-0.20	*213*
Bioinorganic Chemistry	-0.13	0.04	0.00	0.44	*143*
Organometallic Chemistry	-0.05	0.04	0.13	0.11	*162*
Materials Chemistry & Nanoscience	0.44	0.68	0.45	0.15	*107*
Nuclear Chemistry	-0.12	-0.50	-0.17	-0.13	*85*
Analytical Techniques	-0.05	0.25	0.08	-0.04	*82*

[a]Responses were coded 1 = increasing, 0 = stayed the same, −1 = decreasing. Cells shaded green have mean values greater than 0.25; cells shaded red have mean values less than −0.25.

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not writing a manifesto on what the foundation inorganic chemistry course should include.

The data described in this paper does provide a reference for faculty wishing to make iterative changes in their courses; and for new faculty, this data provides a good starting point for designing a first syllabus. Those who have an established course in inorganic chemistry can compare their course to what colleagues across the field are teaching and may wish to emphasize or de-emphasize topics accordingly. Topic coverage may also be distributed to other subdisciplines depending on the interest and expertise of personnel. It is not as important that inorganic chemists get ownership of these topics as it is important that all chemistry majors get exposed to these topics at some point in their education. In fact, the fluidity of the curriculum should allow inorganic chemists to adapt their courses to cover emerging topics more readily.

The finding that a single foundation course in inorganic chemistry does not exist has potential implications for several aspects of undergraduate and graduate chemistry education. First, many graduate-level chemistry programs require proficiency in the subdisciplines of chemistry prior to advancement to candidacy. Uniform evaluation of student understanding of inorganic chemistry with the knowledge that students could have taken any of up to four different foundation inorganic chemistry courses is difficult. Second, and related, the design of national assessments, such as those offered by the ACS Examinations Institute, for the foundation course in inorganic chemistry should consider the possibility of disparate topic coverage. The 2016 Foundations of Inorganic Chemistry ACS Examination Committee (Chaired by author Reisner) is considering the results of this work as it determines content coverage during examination development.

■ CONCLUSION

A national survey of inorganic chemists was conducted in which topics covered in 317 foundation inorganic chemistry courses were reported. Four distinct courses were found via cluster analysis: *Descriptive Chemistry*, *Fundamentals & Selected Topics*, *Foundation Survey: Fundamentals*, and *Foundation Survey: Comprehensive*. Respondents in each course grouping reported variations as to how each topic area is increasing, decreasing, or staying the same in coverage with the largest flux of topics in the *Fundamentals & Selected Topics* course. The results of this work suggest that means of evaluating undergraduate student learning of inorganic chemistry beyond a single institution must consider the possibility of disparate emphasis of topics.

■ ASSOCIATED CONTENT

Supporting Information

The dendrograms for the 4 and 10 cluster solutions and relevant items from the Survey Instrument are provided. 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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