Contemporary journal of Statistics and Applied Mathematics
Volume 1 Issue 1, February 2024
ISSN: pending...

NAVIGATING MATHEMATICAL EXCELLENCE: UNVEILING THE LANDSCAPE OF MODERN MASTER'S PROGRAMS IN THE UNITED STATES

Kimberly A. Mitchell, Jonathan R. Williams and Morgan C. Anderson
Eastern Kentucky University, USA

Abstract: In the inaugural issue of the "Contemporary Journal of Statistics and Applied Mathematics," this research aims to lay the groundwork for innovative statistical and mathematical inquiries. With a commitment to advancing knowledge in these fields, the study navigates the evolving landscape of modern applications, methodologies, and theoretical frameworks. This research provides a comprehensive exploration into diverse statistical and mathematical domains, offering insights into contemporary challenges and opportunities. The journal's pioneering volume addresses the pressing need for cutting-edge contributions in statistics and applied mathematics. By delving into an array of applications, ranging from theoretical constructs to practical implementations, the research endeavors to foster a deeper understanding of statistical methodologies and mathematical models. The study engages with the multifaceted nature of statistical and mathematical disciplines, providing a platform for scholars and practitioners to exchange ideas, methodologies, and advancements in the field. The introduction sets the stage by highlighting the dynamic nature of statistics and applied mathematics in the contemporary landscape. As the inaugural issue, the journal aims to carve a niche for itself by embracing a broad spectrum of topics, methodologies, and applications. It underscores the journal's commitment to facilitating interdisciplinary collaborations and promoting the integration of theoretical developments into practical solutions. As we embark on this academic journey, the "Contemporary Journal of Statistics and Applied Mathematics" seeks to become a pivotal platform for researchers, academicians, and practitioners to disseminate and access groundbreaking research in statistics and applied mathematics. By fostering a vibrant exchange of ideas and methodologies, the journal aspires to contribute significantly to the advancement of these fields, serving as a catalyst for innovation and progress.
Keywords: Statistics, Applied Mathematics, Contemporary Journal, Theoretical Frame works, Interdisciplinary Collaboration

INTRODUCTION

In 1902, a committee was appointed by the American Mathematical Society (AMS) to “Consider and report a scheme of requirements for candidates proceeding to their second degree, with mathematics as their major subject” (Waldo, Townsend, & Bolza, 1904). The committee surveyed the major U.S. institutions of the time and their results can be found in two reports from 1911 (Curtiss, Kasner, & Lunn, 1911; Bocher, Curtiss, Smith, & Van Vleck, 1911). These reports describe a degree which sounds very similar to the master’s in mathematics degree we think of today. However, there seem to have been no further in-depth studies of the master’s in mathematics degree since 1911. Annual reports on doctoral degrees (e.g., Cleary, Maxwell, & Rose, 2013) and

undergraduate education (e.g., Bressoud, 2014; Bressoud, Friedlander, & Levermore, 2014) are common, and a few cross-disciplinary (e.g., Conrad, Haworth, & Millar, 1993) and applied professional degree (e.g., Marano, Pedersen, Seshaiyer, & Slimowitz, 2003) articles have been published. This led to the present authors' survey of institutions across the United States in 2013. The goal was to follow up on the 1911 reports to get a glimpse of the procedures, requirements, and practices of modern master's degree in mathematics programs. The survey results have been broken up into two pieces: a study of the practices and characteristics for institutions whose highest degree offered is a master's degree in mathematics (Author 1, Author 2, & Author 3, 2014) and for institutions whose highest degree offered is a doctoral degree in mathematics (which is the content of this article).

Method

The authors used the Directory of Institutions maintained on the American Mathematical Society's website (http://www.ams.org/profession/dirinst/dirinst-index.html) to try to identify the population of American colleges and universities offering master's degrees in the mathematical sciences. Programs offering a master's degree were selected and divided into two groups, institutions offering a master's degree as their highest degree, and institutions with a PhD program. On April 10, 2013, the authors sent emails to program representatives from both groups. These e-mails included a link to an online survey created with Survey Monkey and a letter explaining the survey. After tracking which programs had completed the survey, opted out of the survey, or responded with updated contact information, the authors sent a second set of e-mail invitations to participate in the survey on August 5, 2013.From the 493 doctoral institutions who were contacted via e-mail, 118 programs consented to participate in the survey. This study examines only the responses from these institutions with doctoral programs. The results from 83 out of the 324 institutions offering a master's degree as their highest degree were summarized in "The Modern Mathematics Degree: A Survey of U.S. Programs"(Author 1, Author 2, & Author 3, 2014).

The authors further restricted the study to programs whose representative responded to the question "Which of the following terms best fits the degree you are describing?" with Mathematics, Mathematical Sciences, or Applied Mathematics. Programs which failed to respond to the question or answered the question as Mathematics Education, Statistics, Computer Science, or Financial Mathematics were excluded. A total of 54 programs met the criteria for inclusion in this study. The survey responses for these programs were summarized using the statistical software program SAS. Additionally, eight institutions that offer a PhD did not complete the survey but indicated that they do not offer an M.S. degree, and one institution said, "MA awarded on way to PhD and by request only."

Results

After some programs were excluded according to the criteria described in the Method section, there were 54 programs in mathematical sciences offering a PhD who responded to the survey; it appears that three institutions may have included multiple programs in their responses. A majority of these (31 or 57%) indicated that they are in a department of mathematics. Fourteen respondents (26%) said they are housed in departments of mathematical sciences; five (9%) in departments of mathematics and statistics; two (4%) in departments of mathematics and computer science; one (2%) in a department of computational science, engineering and mathematics; and one (2%) in a department of computational and applied mathematics. A strong majority (41 or 76%) of the programs indicated that they offer the M.S. (Master of Science) degree, while 11 (20%) said they offer the M.A. (Master of Arts) degree. Two respondents (4%) selected "Other" for type of degree: one of them said they offer an MM degree ("special degree program for high school or community college teachers"); the other one listed M.S., M.A.,

and MAT ("Masters of Arts for Teachers"). Table 1 summarizes the responses to the question regarding degree name.

Table 1: Degree Names

Degree Name	No. Programs (% of Programs, n = 54)
Applied Mathematics	7 (12.96%)
Mathematical Sciences	11 (20.37%)
Mathematics	36 (66.67%)

Almost all (52 out of 53, or 98%) of those who answered the question regarding the type of term structure used at their institutions indicated that they operate on semesters, while only one (2%) reported that they have quarters. As Table 2 illustrates, a clear majority of respondents said that the average time to degree for their programs is three to four semesters (four to six quarters).

Table 2: Average Times to Degree

Average Time to Degree	No. Programs (% of Programs, n = 54)
2 semesters or less (3 quarters or less)	1 (1.85%)
3 to 4 semesters (4 to 6 quarters)	39 (72.22%)
5 to 6 semesters (7 to 9 quarters)	14 (25.93%)

Only one program reported average completion times of two or fewer semesters, and there were no responses of "8 or more semesters (10 or more quarters)."Compared to the master's only respondents (Author 1, Author 2, &Author 3, 2014), the programs represented in this study reported a shorter typical time to completion. A majority of program representatives indicated that their programs require at least 30 semester credit hours, while quite a few indicated that their credit-hour requirement is variable or depends on some available options. Table 3 describes the responses for credit hour requirements.

Table 3: Credit Hour Requirements

No. Credit Hours	No. Programs (% of Programs, n = 53)
24	1 (1.89%)
30	25 (47.17%)
31	2 (3.77%)
32	3 (5.66%)
33	2 (3.77%)
36	5 (9.43%)
37	2 (3.77%)
Variable	11 (20.75%)
Other	2 (3.77%)

Not unlike the master's only respondents (Author 1, Author 2, &Author 3, 2014), almost half of the 53 respondents (24 or 45%) indicated that their programs require 30 credit hours. Almost all of the 54 respondents (53 or 98%) indicated that they offer daytime on-campus classes for their programs, 16 (30%) indicated that they offer evening/weekend on-campus classes for their programs, and 6 (11%) indicated that they offer online classes for their programs. The master's only respondents described in Author 1, Author 2, and Author 3 (2014) had a

lower percentage for daytime on-campus classes (75%), but higher percentages for evening/weekend on-campus classes (75%)and online classes (18%).Most respondents(46 or 87%) of the 53 who answered the relevant question said that the majority of their program's classes are daytime on-campus classes, while only 6(11%) said the majority of their classes are evening/weekend on-campus classes and 1 (2%) said online classes comprise the majority of offerings. This is in contrast to the results from the master's only respondents (Author 1, Author 2, &Author 3, 2014); over half of those indicated that the majority of their program's classes are evening/weekend on-campus classes. The survey also gathered information about program admission requirements. Fifty-four representatives responded to a question regarding whether the GRE is required; Table 4 summarizes the responses.

Table 4: Requirement of GRE for Admission

GRE Required?	No. Programs (% of Programs, n = 54)
No	18 (33.33%)
Yes, both general and subject exams	7 (12.96%)
Yes, general only	28 (51.85%)
Yes, subject only	1 (1.85%)

Thirty-six programs (67%) reported requiring the subject exam, the general exam, or both. In comparison, less than half of the master's only respondents (Author 1, Author 2, &Author 3, 2014) indicated that their programs require at least one of the two exams for admission. The survey included a question regarding the minimum background a student would be expected to have prior to admission. Respondents were asked to mark all courses that apply. Table 5 displays the responses to this question.

Table 5: Minimum Background Needed for Admission

Course	No. Programs (% of Programs, n = 53)
Single Variable Calculus	45 (84.91%)
Multivariable Calculus	45 (84.91%)
Introduction to Proof	36 (67.92%)
Linear Algebra	49 (92.45%)
Abstract Algebra	27 (50.94%)
Real Analysis/Advanced Calculus	34 (64.15%)
Differential Equations	36 (67.92%)
Discrete Mathematics	5 (9.43%)
Statistics	10 (18.87%)
Other	6 (11.32%)

As with the master's only programs who responded to the survey (Author 1, Author 2, &Author 3, 2014), single variable calculus, multivariable calculus, and linear algebra are expected by most programs at institutions that offer a PhD. Introduction to proof, abstract algebra, real analysis/advanced calculus, and differential equations are also commonly regarded as essential components of a student's background.

Program Requirements

The survey asked participants questions regarding program requirements, including core courses, whether non-mathematics courses could count toward the degree, comprehensive examinations, theses, presentations, foreign languages, and other requirements. Figure 1 displays requirement status for comprehensive exams, theses, and presentations.

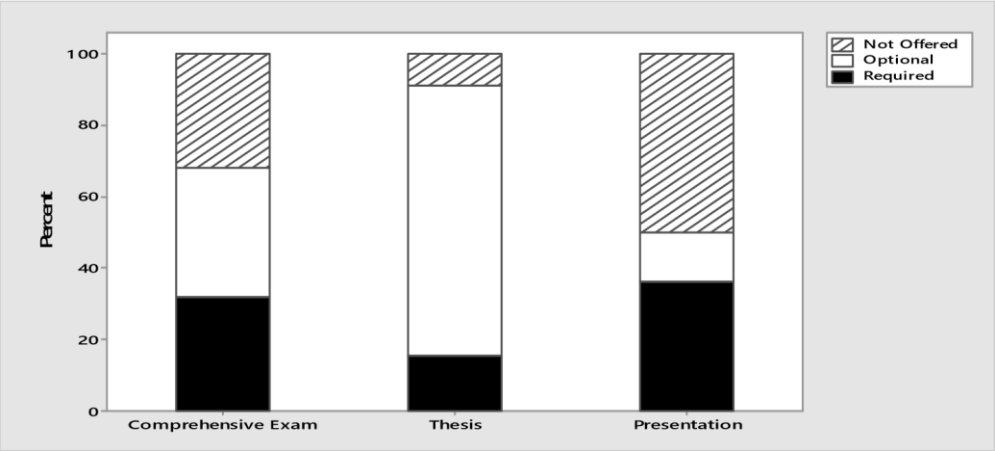

Figure 1: Program Requirements—Comprehensive Examinations, Theses, and Presentations.

An optional thesis is very common among these programs; none of these program features are required by more than about 36% of respondents. Compared to the master's only programs who responded to the survey (Author 1, Author 2, & Author 3, 2014), lower percentages of responding programs indicated that they require these components. More details will be provided later in this paper. Of the 54 responding programs, 44(81%) have either a list of core courses that students are required to take or a list of courses from which students must choose? The survey respondents who reported having a core or a list of choices were also asked about the kinds of courses that are in that core, and 39 program representatives provided a list of courses (one institution that listed only courses for its statistics program was omitted). One of the authors categorized the responses; Table 6 displays the frequencies for all core areas that were given in responses by the program representatives.

Table 6: Core Courses

Core Course Area	No. Programs Requiring One Course in Area (% of Programs, n = 39)	No. Programs Requiring a Second Course in Area (% of Programs, n = 39)
Real Analysis	31 (79.49%)	12 (30.77%)
Algebra	24 (61.54%)	14 (35.90%)
Complex Analysis	15 (38.46%)	1 (2.56%)
Topology	15 (38.46%)	6 (15.38%)
Linear Algebra/Matrix Theory	14 (35.90%)	1 (2.56%)
Numerical Analysis	12 (30.77%)	5 (12.82%)
Applied Mathematics	10 (25.64%)	5 (12.82%)
Differential Equations	10 (25.64%)	2 (5.13%)
Computing and Computer Science	8 (20.51%)	0 (0.00%)
Statistics	6 (15.38%)	1 (2.56%)
Functional Analysis	5 (12.82%)	0 (0.00%)
Advanced Calculus	4 (10.26%)	3 (7.69%)
Discrete Mathematics/Graph Theory	4 (10.26%)	0 (0.00%)
Thesis/Project	4 (10.26%)	1 (2.56%)
Linear Analysis and Programming	3 (7.69%)	0 (0.00%)

Probability	3 (7.69%)	0 (0.00%)
Differential Topology and Geometry	2 (5.13%)	0 (0.00%)
Mathematical Modeling	1 (2.56%)	1 (2.56%)
Number Theory	1 (2.56%)	0 (0.00%)
Seminar	1 (2.56%)	1 (2.56%)
Other	2 (5.13%)	0 (0.00%)

Real analysis and algebra are very popular core requirements; complex analysis, topology, linear algebra/matrix theory, and numerical analysis are also commonly required. Quite a few respondents also reported requiring a second semester of real analysis or a second semester of algebra. While slightly lower percentages of programs at PhD institutions indicated that they require a first course in real analysis or algebra than the master's only programs who responded to the survey (Author 1, Author 2, &Author 3, 2014), higher percentages of respondents reported requirements of a second course in real analysis, a second course in algebra, and various other courses. Of the forty-three survey participants who responded to a question about non-mathematics courses, 35 (81%) indicated that students can count non-mathematics courses toward their degrees. In particular, the most common courses counted toward the degree are computer science (29 responses), statistics (27), physics (27), economics (17), and mathematics education (14). A few programs listed other areas of science and engineering, with other programs indicating they are very flexible in what they would count. Thirty-five survey respondents answered a question regarding how many hours outside of mathematics can be counted toward the degree. Table 7 provides a summary of the responses to this question.

Table 7: Maximum Number of Hours Outside of Mathematics That Can Be Applied to Degree

No. Credit Hours	No. Programs (% of Programs, n = 35)
6	11 (31.43%)
7	1 (2.86%)
8	1 (2.86%)
9	9 (25.71%)
10	1 (2.86%)
12	7 (20.00%)
16	1 (2.86%)
18a	1 (2.86%)
Variable	3 (8.57%)

One program said they allowed students to count up to 18 credit hours outside of mathematics "for a minor." The most common response to the question regarding the maximum number of hours outside of mathematics that can be applied was six, with nine being the second most common response. Of the 45 program representatives who responded to a question about comprehensive examinations, 14 (31%) said comprehensive exams are required, 15 (33%) said they are not offered, and 16 (36%) said they are optional. Relative to the master's only respondents (Author 1, Author 2, & Author 3, 2014), a much greater proportion of these respondents said that comprehensive exams are optional. Respondents with programs that have comprehensive exams were asked to mark all answers that apply to a question about exam format. (Note that one respondent chose "Not offered" for the question

regarding whether comprehensive exams are offered/required but proceeded to answer the questions about comprehensive exam details. That program was not included in the summary of responses to the question regarding whether comprehensive exams are offered/required, but the program's subsequent responses about exams were retained.)Table 8 summarizes these results.

Table 8: Comprehensive Exam Format

Format	No. Programs (% of Programs, n = 31)
Oral, one exam/session	5 (16.13%)
Oral, multiple exams/sessions	2 (6.45%)
Written, one exam	5 (16.13%)
Written, multiple exams/components	23 (74.19%)

As with the master's only respondents (Author 1, Author 2, &Author 3, 2014), a clear majority indicated that their programs' comprehensive exams include multiple written exams/components. Only two respondents reported that their programs utilize multiple oral exams/sessions. Thirty-one respondents answered a question regarding comprehensive exam content; 27 (87%) reported that their comprehensive exams are drawn from a fixed list of subject areas. Program representatives were also asked about the subjects that are covered on their programs' comprehensive exams, and 28 survey respondents listed the relevant subjects (it is unclear why one representative listed subject areas after indicating that the program's exams are not drawn from a fixed list of areas). One of the authors collapsed the responses into categories. Table 9 summarizes the results.

Table 9: Comprehensive Exam Areas

Comprehensive Exam Area	No. Programs[a] (% of Programs, n = 28)
Analysis/Real Analysis	24 (85.71%)
Algebra	20 (71.43%)
Topology and/or Geometry	14 (50.00%)
Linear Algebra	8 (28.57%)
Applied Mathematics	7 (25.00%)
Differential Equations	6 (21.43%)
Statistics	5 (17.86%)
Numerical Analysis	5 (17.86%)
Probability/Probability and Statistics	4 (14.29%)
Complex Analysis	3 (10.71%)
Multivariate/Advanced Calculus	2 (7.14%)
Algebraic Topology	2 (7.14%)
Discrete Mathematics	2 (7.14%)
Education	1 (3.57%)
Other	2 (7.14%)

[a]One program also indicated that they include a second semester of real analysis, one listed a second semester of abstract algebra, two listed three areas in statistics, two listed two applied mathematics areas, and two listed two areas in differential equations. Each program was counted once in each of these categories.

Given the emphasis on real analysis and algebra seen in the core courses, the popularity of these areas on comprehensive examinations seems logical. This is quite similar to what was seen in the master's only responses (Author 1, Author 2, &Author 3, 2014).

Twenty-seven program representatives responded to a question regarding how many topics are included on comprehensive examinations. The results are summarized in Table 10.

Table 10: Number of Comprehensive Exam Subject Areas

No. Areas	No. Programs (% of Programs, n = 27)
1	1 (3.70%)
2	13 (48.15%)
3	9 (33.33%)
4	2 (7.41%)
All	1 (3.70%)
Variable	1 (3.70%)

Here a strong majority of respondents reported having two or three areas on comprehensive exams; this is similar to the results from the master's only data (Author 1, Author 2, &Author 3, 2014). Survey respondents also answered a question about the time limit for comprehensive exam completion. Table 11 displays the results.

Table 11: Total Amount of Time Allotted for Students to Complete All Comprehensive Examination Parts

Amount of Time	No. Programs (% of Programs, n = 28)
1 hour to 2 hours	2 (7.14%)
2 hours to 3 hours	5 (17.86%)
3 hours to 4 hours	7 (25.00%)
4 hours to 5 hours	1 (3.57%)
5 hours to 6 hours	8 (28.57%)
Over 6 hours	5 (17.86%)

The most commonly reported amount of time allotted for comprehensive exams was five to six hours with 8 programs (29%), and the second most common response was three to four hours with 7 programs (25%). There were no responses of "1 hour or less." Five respondents (18%) reported two to three hours, and five respondents (18%) reported over 6 hours. Here five to six hours was a much more common response than it was for the master's only respondents (Author 1, Author 2, &Author 3, 2014). The survey asked program representatives to provide an approximate first-attempt pass rate for comprehensive exam requirements. The results are given in Table 12.

Table 12: Estimated First-Attempt Pass Rates for Comprehensive Exams

Pass Rate	**No. Programs (% of Programs, n = 28)**
0% to 20%	2 (7.14%)
21% to 40%	6 (21.43%)
41% to 60%	7 (25.00%)
61% to 80%	4 (14.29%)
81% to 100%	9 (32.14%)

A majority (71%) of programs reported estimated first-attempt pass rates of over 40%. Pass rates are slightly lower than for the master's only responses (Author 1, Author 2, &Author 3, 2014). Of the 45 program

representatives who responded to a question regarding theses, 34 (76%) indicated theses are optional, 4 (9%) indicated they are not offered, and 7 (16%) indicated they are required. These results are not much different from those found in the master's only data set (Author 1, Author 2, &Author 3, 2014).Respondents with degree programs that offer or require theses were further asked to determine the category that best describes the theses defended in the past three years. Table 13 summarizes the responses to this question.

Table 13: Types of Theses Defended in Past Three Years

Category	No. Programs (% of Programs, n = 35)
Original work only	8 (22.86%)
Original work is expected but detailed expository work is sufficient	14 (40.00%)
Nearly 100% are expository	11 (31.43%)
The majority of these are nontraditional (computer programs, modeling, etc.)	2 (5.71%)

The most common response was that, while original work is expected, detailed expository work is sufficient. However, this percentage is much lower than that reported by the master's only respondents (Author 1, Author 2, & Author 3, 2014). Program representatives were asked whether presentations are required (not as part of a course or comprehensive exam or thesis). Of the 44 respondents, 16 (36%) said presentations are required, 22 (50%) said they are not offered, and 6 (14%) said they are optional. This is in contrast to the master's only survey in which only 28% of survey participants indicated that presentations are not offered (Author 1, Author 2, &Author 3, 2014). Survey participants who indicated that presentations are required were also asked to select all applicable ways in which presentations are delivered. The results are summarized in Table 14.

Table 14: Delivery of Presentations

Presentation Format	No. Programs (% of Programs, n = 22)
At a regional or national professional meeting or conference	1 (4.55%)
As part of a university or department colloquium or seminar	13 (59.09%)
Poster or expository paper	1 (4.55%)
Other[a]	9 (40.91%)

Awhile the first question about whether a presentation is required referred to presentations that are "not as part of a course or comprehensive exam or thesis," five of the nine respondents who selected "Other" clearly indicated that the presentation is related to the thesis or part of a defense and another said that the presentation is made before a committee. Program representatives were further asked how the presentations are assessed. Like the master's only responses (Author 1, Author 2, &Author 3, 2014), most of the responses indicated that a committee assesses the presentation. Of the 44 program representatives who answered a question about whether a foreign language is required, only one indicated that a foreign language is required for degree completion. Of the 43 respondents who answered a question about whether competency in technology that is not part of a course must be demonstrated, 37 indicated that it is not required. Program representatives were asked whether their programs have any other degree requirements that are not part of a course. Responses included mentions of "A Creative Component (effectively a minor, minor thesis) with a corresponding presentation," a project, and certain courses.

Survey respondents who indicated that their programs have at least one possible degree requirement (comprehensive examination, thesis, or presentation) that is optional were asked to characterize how such a requirement could be used (e.g., a thesis could be used to replace a comprehensive examination).There were various responses, but several respondents indicated that students could choose between a comprehensive examination and a thesis, and some said that a thesis could replace a comprehensive examination and/or so many hours of coursework. Three respondents suggested that the comprehensive examinations are primarily for students who plan to pursue doctoral degrees. Eighteen of 43 program representatives (42%) reported that students can complete their programs with coursework only.

Unique Features and Strengths of Programs

Survey respondents were asked what they thought was unique about their programs, and 29 of them provided responses. Five respondents indicated that their programs are flexible, five mentioned options/areas of specialization they offer (one respondent referred to both flexibility and options, so they are counted among the five "flexible" responses and the five who touted their options), and one said that they offer a "partially custom-made curriculum." Three referred to the interdisciplinary nature of their programs. Four acknowledged the applied nature of at least parts of their programs, and one said that "Math and Stat can be creatively blended in plans of study." A couple of respondents described the depth and breadth of their programs, and one said that their program is "rigorous." Two indicated that their students gain teaching experience. Two program representatives noted that students typically earn the master's degree along the way toward a doctoral degree or as they leave the doctoral program, while one respondent specifically said that their program does not accept terminal master's students. Some survey respondents noted specific areas, and some mentioned the individual attention students receive. One program representative remarked that their program allows working teachers to get an M.S. degree in mathematics instead of a master's degree in education. Several individuals who did not complete the survey e-mailed one of the authors and said that their students earn a master's degree en route to earning a PhD, while some e-mailed to say that they have only a doctoral program with no master's. Program representatives were asked what they think their degree programs do best, and 32of them answered the question. As with the master's only survey, many programs used some variation of the word "prepare," while others used other words that still pointed to preparation of some sort. Ten programs indicated that they prepare students for further graduate study, with one of these and seven others making references to the background or foundation in mathematics (e.g., "theoretical math at the first-year graduate level," "serious mathematics," and "high level mathematics") that they provide their students. Six institutions made reference to the preparation they provide for current or future teachers. Eight respondents indicated that their programs prepare students for the workplace (not necessarily teaching), while two more generally referred to the preparation in their fields that students receive. Three programs said they are good at mentoring graduate students, and three mentioned research. There were also comments related to teaching experience, completion rate, student and faculty interactions, and program flexibility and requirements.

Discussion

Although the results presented here may not be representative of all master's programs in the mathematical sciences whose institutions also offer doctorates in mathematics, the survey described here points toward some of the variety and commonalities that can be seen in today's master's programs in the mathematical sciences in the United States. This rich data set provides information regarding various aspects of these programs, including requirements, courses offered, and potential paths for students. Not unlike the master's only respondents (Author 1, Author 2, &Author 3, 2014), the vast majority of responding programs operate on semesters and indicated that

the average time to degree for their programs is three to six semesters (four to nine quarters).Just under half of responding programs require 30 semester credit hours for degree completion, while over a quarter of the programs have a variable number of credit hours required. Daytime on-campus classes seem to be the norm for the surveyed programs, with some offering evening/weekend on-campus classes or online classes. While some programs reported requiring comprehensive examinations, many do not require them and some do not even offer them. The areas of analysis and algebra are common among both core courses and comprehensive exam topics. For those programs reporting the use of comprehensive exams, multiple-part written exams are fairly standard; a nontrivial proportion of these exams typically last five hours or more. As with the master's only respondents (Author 1, Author 2, &Author 3, 2014), many responding programs offer optional theses. Quite a few responding programs have required or optional presentations. A foreign language requirement was reported by only one program.

REFERENCES

Bocher, M., Curtiss,D. R., Smith, P.F., &Van Vleck, E.B. (1911). Graduate work in mathematics in universities and in other institutions of like grade in the United States. Bulletin of the American Mathematical Society, 34, 122-137.

Bressoud, D.(2014). STEM-oriented societies call for collective action. MAA Focus, 34(2), 10-11.

Bressoud, D., Friedlander, E. M., & Levermore, C. D. (2014). Meeting the challenges of improved postsecondary education in the mathematical sciences. MAA Focus, 34(1), 15-16.

Cleary, R., Maxwell, J. W., & Rose, C. (2013).Report on the 2011-2012 new doctoral recipients. Notices of the American Mathematical Society, 60, 874-884.

Conrad, C. F., Haworth, J. G.,& Millar, S. B. (1993).A silent success: Master's education in the United States. Baltimore and London: The Johns Hopkins University Press.

Curtiss, D.R.,Kasner, E., & Lunn, A.C. (1911). University courses in mathematics and the master's degree. Bulletin of the American Mathematical Society, 17, 230-249.

Marano, L. E., Pedersen, K., Seshaiyer, P., & Slimowitz, J. (2003). The professional master's degree. Math Horizons, 10(3), 14-18.

Author 1, Author 2, & Author 3 (2014). The modern mathematics master's degree. American Review of Mathematics and Statistics, 2(2), 27-42.

Waldo, C.A.,Townsend, E.J., & Bolza, O.(1904). Report on the requirements for the master's degree. Bulletin of the American Mathematical Society, 10, 380-385.