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ABSTRACT

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Introductory Graduate Research Courses: An Examination of the Knowledge Base

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A paper presented at the American Educational Research Association Annual Meeting
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Abstract

This study addresses the question, "What should graduate students know about research and statistics after completing an initial course?" Individuals who teach such courses at various Carnegie classifications of institutions were surveyed about the specific characteristics of an introductory graduate research course at their own institution to see if a core of topics could be identified that was common to those courses. Seventeen topics were identified which appear to comprise a knowledge base for this course across institutions. These topics may be described as those which deal with one's ability to understand and utilize research results reported in the literature. This core includes topics such as the formulation of viable research problems and testable hypotheses, the scientific method, types of variables, types of research, null and alternative hypotheses, measures of center and dispersion, correlation coefficients, statistical significance, reliability and validity to name a few. Institutions differ, although not by much, on topics that do not comprise the common core. Mean ratings of importance for non-common core topics, most of which deal with technical aspects like inferential statistical procedures, were uniformly lower for masters institutions, and somewhat lower for research institutions, than for doctoral institutions. Where institutions seem to differ most is in the degree to which topics of a more technical nature are addressed within the course and the extent to which such topics may be left for inclusion in follow-up courses.

Introductory Graduate Research Courses:
An Examination of the Knowledge Base

Introduction

What should graduate students know about research and statistics? The answer to this question is quite obviously dependent on a number of variables, including, but not necessarily limited to, the degree which the graduate student is seeking, the type of institution in which the graduate student is enrolled, possibly the discipline in which the graduate student is majoring, and whether or not the student is required to produce some original research as part of those degree requirements. Clearly, we cannot provide a simple answer to this question that will apply to every graduate student in every situation.

If we limit our discussion, however, to what we expect a graduate student to know about research and statistics after having completed an introductory graduate level research course, then regardless of whether or not the graduate student is pursuing a master's degree or a doctoral degree, whether or not the graduate student will be required to write a thesis or dissertation, they must start the process with a first course. If we limit our focus to introductory graduate research courses, can we now answer the question posed above? That is, what should graduate students know about research and statistics after completing an initial graduate research course?

We attempted to answer this question by examining the introductory graduate research course to see if a core of topics could be identified that is common to most or all colleges and universities, regardless of whether or not the students are in a masters or doctoral program or whether they must write a thesis or dissertation or not. That is, the purpose of this study was to determine which topics and/or concepts, if any, in an introductory graduate research course comprise a common knowledge base. To accomplish this purpose, we surveyed a number of individuals who teach such courses at different types of institutions to obtain from them, the specific characteristics of an introductory graduate research course at their institution.

Background

At many, if not most, universities, all graduate students are required to complete at least one course whose content is devoted primarily to research and research-related topics. While one course is generally not sufficient, especially for those students who will be going beyond an M.S. Ed. Degree, students generally begin with an introductory course. The students enrolled in such a course have a variety of degree and career objectives, including students earning a non-thesis master's degree, master's students who will write a thesis, doctoral students who must write a dissertation but will be practitioners primarily, and doctoral students who will pursue careers as researchers. These groups of students have somewhat different needs in terms of what this first course offers them. For example, graduate students pursuing master's degrees may only be expected to develop skills that will enable them to critically read and evaluate research in their respective disciplines and to identify suitable research problems. If master's students are required to write a thesis, the expectations would be quite different, perhaps including the ability to design and conduct a study and to analyze and interpret their findings. Graduate students pursuing doctoral degrees would almost always be expected to conduct an entire research study from beginning to end.

This complete research process involves both technical skills, such as organizing literature searches and writing in a scholarly fashion, and critical thinking skills, such as proposing thoughtful and appropriate hypotheses based on and extending an existing knowledge base. According to Ary, Jacobs, and Razavieh (1996), desired competencies for beginning researchers include developing viable research problems; understanding the role of previous research and theory; using sampling procedures, statistics, and measurement that are appropriate for selected research problems; recognizing the advantages and disadvantages of differing approaches to research; interpreting research findings; and writing a scholarly report of those findings. Although all graduate students may not be required, in the end, to be proficient in all the same areas, many of these students will begin their journey into the world of research in the same place, enrolled in the same section of an introductory graduate research course.

It is also true that some universities tend to train students who primarily come from one of these groups more than the others. For example, research and doctoral institutions may be more likely to enroll students who will be conducting original research of their own than would an institution that offered only master's degrees. And even in comparing research institutions with doctoral institutions, it is likely that the focus would be at least somewhat different. Because of the differences between different types of universities, it would be expected that the structure of such a course would vary, at least somewhat, from institution to institution. Those offering master's degrees only, may have only a single course devoted to research (Doak, 1982), whereas doctoral granting institutions frequently have a sequence of research and statistics courses that students are required to take. With the influx of emphasis on alternative methodologies and paradigms, some institutions have added additional courses devoted to these methodologies and paradigms (Lapan, 1995), while also calling for increased emphasis on the value of integrating science with educational practice in graduate research education (Martin, 1995). Although not necessarily advocating the need for a core curriculum that defines common training as the American Psychological Association developed in 1976 (Ellis, 1992), and re-asserted in their program accreditation guidelines (APA Committee on Accreditation, 1994), or a set of standards as developed by the National Council of the Teachers of Mathematics (1989), it may still be expected that a common core of topics and concepts would exist across all institutions, with other topics and concepts being more specific to the type of institution.

Method

In previous work, an initial list of topics and concepts was developed based upon past experiences in teaching introduction to graduate research courses (Young, Moore, Shaw, & Mundfrom, 1997). Several instructors of research, statistics, and measurement courses at two different universities compiled, examined, and revised the list. A questionnaire (see figure 1) was developed using this list of topics, so that the importance of each topic could be assessed, as well as the depth to which each topic was addressed. Respondents were also asked to identify any topics or concepts not included in the list which they deemed to be of importance to an introductory research course and the depth to which they would cover these topics in the course they taught. They were also asked to identify themselves as being associated with a research, doctoral, or master's institution, and to identify the types of students enrolled in their introductory research course.

The questionnaires were mailed to professors of educational research in numerous institutions across the United States and Canada. The colleges selected were limited to those that

Figure 1

For each of the following topics in an introductory graduate research methods course, indicate (1) how important you think each topic is to such a course, and (2) the depth to which you cover each topic when you teach such a course. Circle one number for **Importance** and one number for **Depth of Coverage** for each topic.

Topic	Importance (minimal … utmost)							Depth of Coverage (superficial … extensive)						
Research Process and Design														
Formulation of viable research problems	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Formulation of testable hypotheses	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Scientific method	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Literature sources and searching	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Types of variables	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Types of sampling	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Types of research	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Types of experimental designs	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Ethical and legal issues	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Internal and external validity	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Data Gathering														
Reliability estimates	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Validity estimates	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Standard error of measurement	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Conducting surveys	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Conducting interviews	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Rating scales	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Likert scales	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Descriptive Statistics														
Graphical and tabular displays	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Measures of center	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Measures of dispersion	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Standard scores	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Contingency tables	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Correlation coefficients	1	2	3	4	5	6	7	1	2	3	4	5	6	7
The Normal distribution	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Inferential Statistics														
Elements of probability	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Sampling distributions	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Sampling error	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Significance level	1	2	3	4	5	6	7	1	2	3	4	5	6	7
p-values	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Power	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Type I and Type II errors	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Null and alternative hypotheses	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Interpretation of results	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Statistical vs. practical significance	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Confidence intervals	1	2	3	4	5	6	7	1	2	3	4	5	6	7
t-tests	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Chi-square test of association	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Linear regression	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Analysis of variance	1	2	3	4	5	6	7	1	2	3	4	5	6	7

offered at least master's degrees. The professors were asked to evaluate each topic according to how important this topic was in the introductory course they taught and the depth to which it was covered in their introductory course.

Questionnaires were mailed to 335 individuals. Of these questionnaires, 33 were returned as undeliverable. Of the remaining 302 questionnaires, 80 were returned, with several of those accompanied by a comment similar to, "I was unable to complete this form because I no longer teach such a course." While the return rate is low (slightly over 26%), it is likely that a number of the non-returned forms would also fall into the category represented by the above comment. We realize that the data gathered do not necessarily constitute a representative sample of individuals who teach introductory graduate research courses, however, they do constitute a sample of individuals who were concerned enough about the teaching of graduate research courses to take a few moments to answer our questions and return the form to us.

Results

The principal objective of this study was to determine if a common core of topics exists within the introductory graduate research course which could be considered as a common knowledge base that transcends different types of institutions. The responses we received appear to bear this out. The overall pattern of responses from all individuals is presented in Table 1. Two primary points appear from these data. First, the individual topics which are perceived to be of the greatest importance (high percentages in response categories 6 and 7) are ones which are essential for an individual to understand if they are going to be an informed consumer of research. This group includes most of the topics listed under Research Process and Design, along with topics under other headings that are also related to one's ability to understand and utilize the research of others, such as interpretation of results, null and alternative hypotheses, statistical vs. practical significance, measures of center and dispersion, correlation coefficients, reliability and validity. Second, overall, topics tended to be rated higher under importance than they were under depth of coverage. The depth of coverage ratings were generally more diverse, with greater percentages being in the lower response categories almost uniformly across the board.

The relative importance of individual topics is somewhat easier to see by examining a table of means than through the response patterns. The mean ratings for topics along with their standard deviations are presented in Table 2. The topics that are considered to be of the greatest importance by the respondents are: the formulation of viable research problems; types of research; formulation of testable hypotheses; the scientific method; internal and external validity; and types of variables. The next highest rated group of topics in terms of perceived importance (based on overall mean rating) consisted of: interpreting results (of inferential tests); literature sources and searching; null and alternative hypotheses; statistical vs. practical significance; types of experimental designs; measures of center; measures of dispersion; correlation coefficients; types of sampling; reliability; and validity. It is these two groups of topics, the highest rated topics, that appear to constitute a common knowledge base. As stated above, it would seem that a somewhat common thread that ties these topics together, is their close connection with one's ability to understand and utilize the research results reported in the literature.

The remaining topics were all rated somewhat lesser in terms of perceived importance. We divided these topics into two more groups, based on their mean ratings. The third group consisted of: ethical and legal issues; significance level; p-values; type I and type II errors;

Table 1
Percentage of all individuals responding in each category
(n=80)

Topic	Importance: minimal 1	2	3	4	5	6	utmost 7	Depth of Coverage: superficial 1	2	3	4	5	6	extensive 7
Research Process and Design														
Formulation of viable research problems		2	3	6	21	18	50		8	2	13	26	21	31
Formulation of testable hypotheses	2		5	8	19	24	42	2	8	10	3	21	27	29
Scientific method			7	13	26	19	34	3	11	10	16	26	8	24
Literature sources and searching	2	2	8	13	26	21	27	3	15	8	15	24	8	26
Types of variables		2	3	16	18	34	26		5	10	19	31	13	21
Types of sampling	2	2	7	16	31	23	21	2	5	10	34	27	8	13
Types of research		2	2	11	15	36	34	2		8	8	34	23	24
Types of experimental designs	2	3	8	18	23	32	15	2	8	18	18	26	19	8
Ethical and legal issues	3	7	13	15	21	18	24	6	14	18	23	23	8	8
Internal and external validity			3	3	16	36	42		2	11	8	16	27	36
Data Gathering														
Reliability estimates	2	2	11	11	34	24	15	3	7	21	18	32	10	7
Validity estimates	2	2	10	16	24	23	19	3	15	19	21	21	10	7
Standard error of measurement	2	15	7	21	24	11	16	7	18	18	15	16	7	11
Conducting surveys		7	15	16	27	22	11	3	11	21	24	15	16	7
Conducting interviews	2	11	18	19	26	11	10	7	26	18	21	13	10	3
Rating scales		2	16	29	31	13	8	2	13	36	18	15	11	3
Likert scales		5	11	29	31	13	10	3	16	24	23	11	15	5
Descriptive Statistics														
Graphical and tabular displays	7	3	15	19	21	23	13	11	2	19	21	18	21	8
Measures of center	7	3	7	13	15	32	24	11	2	11	19	16	24	15
Measures of dispersion	7	3	8	16	13	31	23	11	3	13	15	21	24	13
Standard scores	10	8	8	19	23	18	11	15	7	10	24	23	16	7
Contingency tables	11	10	10	19	24	16	8	16	18	18	13	19	10	5
Correlation coefficients	7	3	5	10	15	34	23	11	2	10	24	15	23	13
The Normal distribution	13	8	5	10	24	16	24	14	10	14	18	15	16	13
Inferential Statistics														
Elements of probability	19	13	8	21	15	11	10	31	16	15	18	10	7	2
Sampling distributions	15	13	10	18	11	23	10	26	8	15	21	16	11	2
Sampling error	11	7	13	23	15	21	8	19	5	26	19	10	15	3
Significance level	10	3	8	16	21	19	21	13	2	19	29	15	11	11
p-values	10	7	11	16	13	18	26	13	8	19	26	8	13	13
Power	15	13	8	16	16	23	7	23	21	16	11	10	11	5
Type I and Type II errors	11	3	7	16	23	16	24	11	8	16	21	16	15	13
Null and alternative hypotheses	10	2	3	11	19	24	31	10	7	8	18	23	16	19
Interpretation of results	10	2	2	10	16	27	34	11		8	16	19	29	16
Statistical vs. practical significance	10	2	7	8	23	26	26	11	2	13	15	32	16	11
Confidence intervals	21	13	8	16	15	13	15	31	19	8	16	10	11	5
t-tests	11	15	7	18	16	24	10	19	15	13	16	13	16	7
Chi-square test of association	16	15	11	16	16	18	8	29	15	15	19	7	11	5
Linear regression	19	21	8	13	13	16	10	39	10	8	11	11	13	7
Analysis of variance	15	16	11	13	15	19	11	32	13	15	11	13	10	5

Table 2
Means and Standard Deviations
For Topics – All Respondents (n= 80)

Topic	Importance		Depth of Coverage	
	Mean	Std. Dev.	Mean	Std. Dev.
Internal and external validity	6.09	1.00	5.63	1.41
Formulation of viable research problems	6.00	1.24	5.42	1.48
Types of research	5.85	1.17	5.41	1.32
Formulation of testable hypotheses	5.84	1.33	5.32	1.66
Scientific method	5.62	1.27	4.74	1.77
Types of variables	5.59	1.23	5.02	1.43
Interpreting results (of inferential tests)	5.39	1.84	4.87	1.80
Literature sources and searching	5.36	1.45	4.72	1.85
Correlation coefficients	5.25	1.73	4.53	1.80
Types of sampling	5.24	1.36	4.59	1.38
Null and alternative hypotheses	5.24	1.84	4.63	1.86
Measures of center	5.19	1.73	4.60	1.83
Validity estimates	5.15	1.41	4.02	1.54
Statistical vs. practical significance	5.13	1.83	4.48	1.73
Types of experimental designs	5.11	1.40	4.51	1.49
Reliability estimates	5.08	1.35	4.28	1.43
Measures of dispersion	5.08	1.79	4.55	1.83
Ethical and legal issues	4.93	1.72	3.97	1.62
Type I and Type II errors	4.81	1.91	4.18	1.85
Significance level	4.80	1.85	4.10	1.75
Conducting surveys	4.80	1.42	4.13	1.55
p-values	4.72	1.98	3.98	1.86
The Normal distribution	4.69	2.04	4.08	1.96
Likert scales	4.65	1.28	3.88	1.55
Graphical and tabular displays	4.64	1.66	4.27	1.72
Rating scales	4.62	1.20	3.80	1.39
Standard error of measurement	4.58	1.67	3.89	1.80
Standard scores	4.40	1.79	4.08	1.77
Conducting interviews	4.33	1.54	3.52	1.57
t-tests	4.24	1.91	3.64	1.94
Sampling error	4.22	1.79	3.53	1.76
Contingency tables	4.18	1.78	3.51	1.79
Sampling distributions	4.06	1.98	3.34	1.79
Power	4.03	1.93	3.18	1.88
Analysis of variance	4.00	2.02	3.08	1.95
Chi-square test of association	3.87	1.94	3.13	1.89
Confidence intervals	3.87	2.12	3.08	1.95
Elements of probability	3.73	1.98	2.85	1.70
Linear regression	3.66	2.06	3.11	2.12

conducting surveys; rating scales; Likert scales; the Normal distribution; standard scores; and graphical and tabular displays. Group four, the lowest rated topics, consisted of: conducting interviews; contingency tables; elements of probability; sampling distributions; sampling error; power; confidence intervals; t-tests; analysis of variance; Chi-square test of association; and linear regression. These last two groups consist of topics which are either more specialized statistical procedures, more closely related to conducting research, or both. It seems that these two groups consist of topics which are not part of a common core of topics which exist across various types of institutions, but rather are more specialized topics that would be included in an introductory course by some individuals and not by others, depending perhaps, on the types of students enrolled in the course.

Also presented in Table 2 are the mean ratings regarding depth of coverage for each topic. As mentioned previously, the depth of coverage responses were uniformly less than the perceived importance responses. This same trend is evident in the mean ratings. For the most important topics, the ones which were identified as part of a common core, the depth of coverage ratings ranged about .4 to .6 points below their corresponding importance rating. For the other topics, the depth of coverage ratings were even lower, ranging from .6 to 1.2 points below the corresponding importance ratings.

A secondary question that can be addressed with these data deals with the extent to which these ratings varied from one type of institution to another. Respondents were asked to identify the Carnegie classification of the institution with which they are affiliated: Research I or II, Doctoral I or II, or Masters I or II. The ratings for each of these classifications were compiled and examined and it was decided to combine these into three categories: research institutions, doctoral institutions, and masters institutions because the differences between the respective I and II classifications were either minimal or non-existent. The mean ratings in terms of the importance of each topic for the three different types of institutions are presented in Table 3. (Note: corresponding tables of response patterns for each type of institution, similar to Table 1, are presented in the appendix as Tables 4, 5, and 6.) It is not hard to see that some differences exist across these different types of institutions, and that the differences are primarily for the topics that do not comprise the common core.

In general, the mean ratings of importance for the non-common core topics dealing with inferential statistics were uniformly lower for masters institutions than for doctoral institutions, and also were somewhat lower in the masters institutions than for the research institutions, but not by as much. This result is consistent with our initial conjecture that once we identified a common core of topics, the different types of institutions would differ on how they perceived the importance of other research and statistics topics.

In terms of comparisons among institutions that enroll education majors versus psychology majors or other social/behavioral science majors, the comparison of the mean ratings revealed no real differences among these groups or any readily apparent trends in the responses. This same lack of differences or apparent trends was also evident when comparisons were made among institutions that enrolled students pursuing different types of degrees. The comparisons of perceived importance of topics across individuals who taught MS thesis students, MS non-thesis students, Ph.D. researchers, and Ph.D. practitioners revealed no obvious differences or trends.

The final question addressed by the respondents was whether any topics were omitted that should have been included in this list. There were no responses to this question that were

Table 3
Means for Topics by
Carnegie Institution Type

Topic	Masters I & II	Doctoral I & II	Research I & II
Internal and external validity	5.83	6.18	6.22
Formulation of viable research problems	6.17	5.81	6.00
Types of research	5.36	6.12	5.87
Formulation of testable hypotheses	6.17	6.12	5.64
Scientific method	5.33	5.62	5.63
Types of variables	5.63	5.43	5.67
Interpreting results (of inferential tests)	5.00	5.43	5.35
Literature sources and searching	4.91	5.50	5.36
Correlation coefficients	5.25	5.53	5.12
Types of sampling	5.00	5.43	5.09
Null and alternative hypotheses	5.17	5.43	5.12
Measures of center	4.75	5.37	5.25
Validity estimates	5.36	4.93	5.16
Statistical vs. practical significance	4.67	5.18	5.25
Types of experimental designs	4.33	4.93	5.48
Reliability estimates	5.27	4.75	5.16
Measures of dispersion	4.67	5.25	5.12
Ethical and legal issues	4.91	5.56	4.51
Type I and Type II errors	4.50	5.12	4.64
Significance level	4.42	5.31	4.60
Conducting surveys	4.82	4.81	4.67
p-values	4.17	5.18	4.64
The Normal distribution	4.67	4.87	4.54
Likert scales	4.75	4.68	4.63
Graphical and tabular displays	4.33	4.37	4.87
Rating scales	4.58	4.75	4.60
Standard error of measurement	4.18	4.13	4.86
Standard scores	4.25	4.53	4.43
Conducting interviews	4.00	4.18	4.41
t-tests	4.00	4.50	4.06
Sampling error	3.90	4.40	4.09
Contingency tables	4.09	3.81	4.32
Sampling distributions	3.83	4.66	3.74
Power	3.17	4.35	4.06
Analysis of variance	3.50	4.37	3.80
Chi-square test of association	3.50	4.00	3.70
Confidence intervals	3.58	3.50	4.06
Elements of probability	3.81	4.40	3.35
Linear regression	3.25	3.50	3.77

consistently made by all or even a majority of the respondents. The comments that were most frequently given dealt with the realm of qualitative research or with specific aspects of qualitative methodology. These comments ranged from needing an introduction to qualitative research, to qualitative research should be half of the course, to there should be a parallel course devoted to qualitative methodology.

Other comments that were made by more than a single respondent focused on writing, such as emphasizing APA style or proposal and report writing; measurement, evaluation, and assessment, such as emphasizing dimensions of measurement, formative evaluation, or authentic assessment; the use of technology, such as using computers for data collection or for data and literature searches. There were a variety of comments, each provided by a single individual, that didn't fit any specific categories, such as provide an overview of research, do a course on meta-analysis, emphasize teacher research, and one even calling for more statistical theory.

There did not seem to be any specific topics or concepts mentioned frequently enough in response to this open-ended question that warranted their inclusion in the common core of topics identified earlier. The responses were quite varied, indicating, perhaps, that after covering the basics, different individuals find different topics that they consider to be important enough to devote time to in an introductory course.

Discussion

Our objective of identifying a common core of topics in an introductory graduate research course seems to have been realized. A list of 17 common topics emerged from our analyses, with each of the identified topics having a clear connection to the realm of understanding and utilizing published research reports. These appear to be skills that are required of all graduate students, regardless of the type of institution or the degree to which the student is aspiring. Even within this core of 17 topics, the highest rated topics are those dealing directly with the research process such as forming viable problems and hypotheses, the scientific method, types of research and variables, and internal and external validity. The remaining topics in this list of 17 are more technical in nature and deal with the ability to understand the results as they would be presented in a typical research article, such as, measures of center and variation, reliability and validity, types of sampling, types of designs, and statistical vs. practical significance.

Secondarily, we found some differences across different types of institutions, although these differences were, in general, not large, and not uniformly present. The most prominent differences were among the non-common core topics, particularly those dealing with more technical aspects like inferential statistical procedures. These topics were most highly rated in doctoral institutions, and least highly rated in masters institutions. One possible explanation for these difference patterns may be that in a masters institution, these topics are just not considered that important, in research institutions they are often covered in great depth in other courses, whereas in doctoral institutions, more importance is placed on these topics as many students may not take much in the way of additional coursework in quantitative methodology.

The comments made in response to the question regarding additional topics had their largest focus on the realm of qualitative research. Admittedly, qualitative research and its associated methodology were not represented in the initial list of topics that was used to construct our questionnaire. Whereas this may appear to be an oversight or a shortcoming, it was actually a conscious decision to leave these topics out. That decision was based partly on our experiences in teaching this course where qualitative research is introduced but not covered in

depth, and our desire to keep the questionnaire as short as it was. Including qualitative research as a single topic in our list did not seem to do it justice and including an extensive list of related topics would have made the list so long that it may have precluded even the individuals who did respond from doing so. We fully expected to get the kinds of responses we got in regard to qualitative research, and part of what we were interested in was how broad-reaching those responses would be. It would appear that qualitative methodology does not differ much from quantitative methodology in regard to its inclusion in an introductory research course--some people want a lot, some want a little, some want none at all.

We realize that these data and our analyses do not represent a definitive work in regard to what constitutes a knowledge base of common topics for an introductory graduate research course. Our sample was not large, may not have been representative, and our initial list of topics may not have included all relevant topics. Consequently, our conclusions should not be viewed as THE answer to the question of what topics comprise a common knowledge base for an introductory graduate course in research. We do believe, however, that these results can be used to aid in the identification of what is typically done in introductory courses, and can also help individuals who may be organizing or revising the graduate research curriculum to include new or different topics, or when more than one course is offered, to help differentiate between topics which should be included in an initial course and topics that can be left to follow-up courses.

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Table 4
Master's Institutions I & II
Percentage of individuals responding in each category

Topic	Importance							Depth of Coverage						
	minimal						utmost	superficial						extensive
Research Process and Design	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Formulation of viable research problems				8	17	25	50				25	17	25	33
Formulation of testable hypotheses				8	17	25	50		8		17	8	33	33
Scientific method			8	17	33	17	25			8	50	25		17
Literature sources and searching		8	25	8	8	25	25	8	17	8	17		25	25
Types of variables			9	18	18	9	46		9		36	9	9	36
Types of sampling			8	33	25	17	17			8	50	25	8	8
Types of research				36	18	18	27				27	46	9	18
Types of experimental designs		8	17	42	8	17	8		8	33	33	17		8
Ethical and legal issues	8	8	8	8	25	8	33	8	17		17	25	8	25
Internal and external validity				8	25	42	25			16	16	16	25	25
Data Gathering														
Reliability estimates			9	18	27	27	18			36	9	36		18
Validity estimates			9	9	36	27	18		18	36	9	9	9	18
Standard error of measurement	9	9	9	27	27	9	9		20	20	10	20	10	20
Conducting surveys		9	18	9	27	18	18			30	30	10	10	20
Conducting interviews	10	10	10	30	30		10		20	30	30	10		10
Rating scales			17	33	33	8	8			46	9	18	18	9
Likert scales			17	33	25	8	17	9		36	9	9	18	18
Descriptive Statistics														
Graphical and tabular displays	8	8	17	17	17	25	8	25		8	17	25	25	
Measures of center	8	8	8	17	8	33	17	25			17	25	25	8
Measures of dispersion	8	8	8	17	17	25	17	25			17	33	8	17
Standard scores	8	8	8	25	25	25		25			25	33	17	
Contingency tables	9	9	9	27	27	18		27	9	9	9	27	18	
Correlation coefficients	8		8	8	8	50	17	25			8	17	33	17
The Normal distribution	17			25	17	25	17	17	8	8	8	25	8	25
Inferential Statistics														
Elements of probability	18	9		36	18	18		27	18	18	9	9	18	
Sampling distributions	17	8	8	33	17	8	8	17	17	17	33	8	8	
Sampling error	18	9	9	27	18		18	18	9	27	18	18		9
Significance level	17			25	33	17	8	17		17	33	8	17	8
p-values	17	8	8	17	17	25	8	17	8	17	33		17	8
Power	16	16	16	25	25			18	27	27	18		9	
Type I and Type II errors	16			16	42	16	8	17		8	25	25	17	8
Null and alternative hypotheses	17				25	33	25	17		8	17	8	33	17
Interpretation of results	17				33	33	17	17		17		33	17	17
Statistical vs. practical significance	17		8		33	33	8	17		17		42	17	8
Confidence intervals	25			50	17	8		33	17	25	8	8	8	
t-tests	25			17	42	17		18	9	9	9	36	18	
Chi-square test of association	25	8	8	25	17	17		25	16	16	16	8	16	
Linear regression	25	25		16	16	16		36	9	9	18	9	18	
Analysis of variance	25	8	17	17	8	25		36	27		18		18	

Table 5
Doctoral Institutions I & II
Percentage of individuals responding in each category

Topic	Importance: minimal 1	2	3	4	5	6	utmost 7	Depth of Coverage: superficial 1	2	3	4	5	6	extensive 7
Research Process and Design														
Formulation of viable research problems		7		13	19	13	50		19		6	13	31	31
Formulation of testable hypotheses				12	12	25	50		6	13		6	38	38
Scientific method			7	13	25	25	31	6	12	6	13	19	13	31
Literature sources and searching			7	13	25	38	19		25		19	25		31
Types of variables				19	25	50	6		6	13	6	38	25	12
Types of sampling				13	44	31	13			13	40	33	7	7
Types of research				6	6	56	31			12		44	31	13
Types of experimental designs				19	19	12	50		12	19	19	13	37	
Ethical and legal issues			6	13	19	43	19			31	25	25	13	6
Internal and external validity					25	31	44			6	6	25	31	31
Data Gathering														
Reliability estimates		6	19	6	44	13	13	6	6	20	20	40		6
Validity estimates	6	7	7	13	27	13	27	13	7	13	20	27	13	7
Standard error of measurement		20	7	40	20		13	7	21	36	21	7		7
Conducting surveys			19	19	31	25	6		12	31	19	25	13	
Conducting interviews		13	19	25	31	6	6	6	31	19	19	25		
Rating scales			13	31	31	19	6		12	38	25	19	6	
Likert scales			13	31	38	12	6		12	38	25	12	12	
Descriptive Statistics														
Graphical and tabular displays	6		25	25	13	25	6	6	6	25	31	6	13	13
Measures of center	6		6	13	13	38	25	6		6	31	12	31	12
Measures of dispersion	6		6	13	19	38	19	6		12	19	19	37	6
Standard scores	7	13	7	13	27	20	13	6	12	12	19	19	25	6
Contingency tables	19	13	13	6	31	12	6	19	31	13	6	19	6	6
Correlation coefficients	7	8			8	46	31	7	7		29	14	29	14
The Normal distribution	13	6	6		31	19	25	13	6	18	13	13	31	6
Inferential Statistics														
Elements of probability	20		20	13	7	7	33	33	13	20	20		7	7
Sampling distributions	13		13	20		40	13	20	7	7	26	26	13	
Sampling error	7		20	27	20	20	6	13	7	33	27		20	
Significance level	6		6	19	19	12	38	6		18	25	18	18	13
p-values	6		12	19	13	12	38	6	6	19	25	19	13	13
Power	14	7		29	14	29	7	27	27		20	6	6	13
Type I and Type II errors	6	6		25	19	6	38	6	12	6	38	12	12	12
Null and alternative hypotheses	6		6	12	19	19	38	6	6	13	6	31	13	25
Interpretation of results	6			19	19	25	31	6		12	19	31	19	12
Statistical vs. practical significance	6			19	38	12	25	6	6		38	25	19	6
Confidence intervals	31	6	12	13	13	19	6	38	25		19	6	12	
t-tests	6	6	13	31	6	25	13	6	25	19	19	12	12	6
Chi-square test of association	19		13	25	25	13	6	25	12	19	25	6	12	
Linear regression	31	6	6	25	13	6	13	44	12	6	13	6	13	6
Analysis of variance	12	6	12	19	13	25	13	19	12	31	6	19	12	

Table 6
Research Institutions I & II
Percentage of individuals responding in each category

Topic	Importance minimal 1	2	3	4	5	6	utmost 7	Depth of Coverage superficial 1	2	3	4	5	6	extensive 7
Research Process and Design														
Formulation of viable research problems			7	3	23	19	48		6		13	36	16	29
Formulation of testable hypotheses	3		6	6	23	26	36	3	9	6		36	19	26
Scientific method			7	13	26	17	37	3	17	10	7	27	10	27
Literature sources and searching	3		3	17	33	13	30	3	10	10	13	33	7	23
Types of variables		3		16	16	36	29		3	7	23	39	9	19
Types of sampling	3	3	9	13	29	19	23	3	9	7	29	29	9	13
Types of research		3	3	7	16	32	39	3		7	7	26	23	36
Types of experimental designs	3	3		7	32	32	23	3	7	10	10	37	20	13
Ethical and legal issues	3	10	19	16	23	10	19	9	23	16	23	23	6	
Internal and external validity			3	3	9	36	48		3	6	6	13	29	42
Data Gathering														
Reliability estimates	3		10	13	29	29	16	3	6	19	23	26	19	3
Validity estimates			13	23	17	27	20		17	20	30	20	10	3
Standard error of measurement		16	7	10	27	20	20	10	17	14	17	21	10	10
Conducting surveys		9	13	19	26	23	9	6	13	16	29	13	23	
Conducting interviews		13	19	16	26	16	10	10	26	16	23	6	19	
Rating scales		3	13	30	33	13	7	3	17	33	20	13	13	
Likert scales		10	3	30	33	17	7	3	23	13	30	13	17	
Descriptive Statistics														
Graphical and tabular displays	7	3	7	19	29	16	19	10		19	19	23	19	10
Measures of center	7	3	7	10	19	26	29	10	3	17	13	17	23	17
Measures of dispersion	7	3	10	16	10	26	29	10	6	16	10	19	26	13
Standard scores	13	7	7	20	20	16	16	16	6	10	26	19	13	10
Contingency tables	9	9	9	23	19	16	13	13	16	23	16	19	10	3
Correlation coefficients	6	3	6	13	23	23	26	10		16	29	13	19	13
The Normal distribution	13	13	3	9	26	9	26	16	13	9	26	13	13	10
Inferential Statistics														
Elements of probability	19	23	7	23	16	10	3	32	19	13	23	9	3	
Sampling distributions	16	23	9	10	13	23	6	35	6	16	16	13	13	
Sampling error	13	9	13	23	9	26	6	26	3	23	19	10	16	3
Significance level	10	7	13	10	20	23	17	16	3	19	29	16	6	10
p-values	9	9	9	16	13	16	26	16	10	16	26	6	13	13
Power	16	16	6	13	13	26	9	26	19	19	3	13	16	3
Type I and Type II errors	13	3	13	13	16	19	22	13	10	23	12	12	16	12
Null and alternative hypotheses	9	3	3	16	16	19	32	10	10	6	23	19	12	19
Interpretation of results	9	3	3	10	10	29	36	13		3	19	10	42	13
Statistical vs. practical significance	10	3	6	7	13	29	32	13		13	9	35	16	13
Confidence intervals	16	19	10	7	16	10	23	29	16	6	19	9	13	6
t-tests	10	26	6	13	9	22	13	29	13	9	16	6	16	10
Chi-square test of association	13	26	13	10	12	16	9	36	16	13	16	6	6	6
Linear regression	12	26	13	6	13	19	9	39	9	9	10	16	10	6
Analysis of variance	12	26	9	10	16	12	13	42	10	13	9	13	6	6

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