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QUANTITATIVE ANALYSIS AND SKILL BUILDING IN PUBLIC ADMINISTRATION GRADUATE EDUCATION

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INTRODUCTION

The need for greater skill building in Master of Public Administration (MPA) curricula is increasingly finding expression in the literature as a result of the new emphasis on outcome assessment in academic programs.¹ Outcome assessment encourages a focus on the "ideal" or "expected" values and skills of the MPA graduate (the "product") as a means of designing curricula and assessing their success. To oversimplify somewhat, the focus of outcome assessment is on the knowledge and skills that students are generally expected to have when they complete their studies. As a terminal degree for public and nonprofit sector professionals, the MPA has generally been defined in terms of the professional values and practical knowledge and skills needed to survive and prosper in public and nonprofit agencies and to respond to the interests and needs of democratic societies.

In some measure, it is generally expected that MPA programs are providing students with the requisite skills in quantitative analysis to be successful and effective public administrators. The focus here is on the nature and sophistication of the specific skills in quantitative analysis that typically are taught in MPA curricula.

While many of the values, knowledge, and skills that should be acquired in an MPA program are articulated in the National Association for Schools of Public Affairs and Public Administration's curricular standards, there is still considerable debate within the

membership of NASPAA and within other professional and academic organizations. For example, the debate can be found in recent writings criticizing the lack of attention among MPA programs to basic communication skills (e.g., Manns and Waugh, 1990; Hambrick, 1990; Waugh and Manns, 1991), microcomputer and other information technology skills (e.g., Candle, 1990; Brudney, Hy, and Waugh, 1993), advanced research techniques (e.g., LaPlante, 1989; Waugh, Hy, and Brudney, 1991), and management science techniques (e.g., Garson, 1989).

Much the same kind of debate revolves around the question of what kinds of quantitative analysis skills should be taught in MPA curricula. To some extent, the central issues have been: what kinds of skills are in fact required in public and nonprofit sector employment and what kinds of skills are generally expected of MPA graduates? The skill needs of public and nonprofit sector administrators are still uncertain and certainly vary tremendously according to work responsibilities. There are discussions of appropriate skills for some occupational categories such as policy analysts (see, e.g., LaPlante, 1989; Schachter, 1985) and program evaluators (see, e.g., Hy and Brooks, 1984). But, the breadth of the field of public administration mitigates against the development of a single set of skill needs.

In terms of the skills acquired in MPA programs, earlier studies of MPA curricula (e.g., Hy, Nelson, and Waugh, 1981; Hy, Waugh, and Nelson, 1987) have inventoried the statistical and methodological techniques taught and questioned the level of sophistication in quantitative analysis expected of students. Little guidance has been offered by any of the studies concerning the requisite skills in mathematics, research methods, and other analysis-related coursework. Indeed, the Hy, Waugh, and Nelson (1987) analyses have commented on the difficulty of measuring the capacities of entering students for more advanced coursework on the basis of prior coursework, the uncertain value of strong mathematically-based statistical skills (relative to the value of more superficial "cookbook" type skills), and the unclear distinction between research and decision-making skills.

This analysis addresses two principal questions: (1) what kinds of basic and advanced quantitative analysis skills for research and public decision-making are students acquiring in MPA programs and (2) what do those skills suggest for the definition of "outcomes" in public administration education? The issue of whether MPA programs prepare students for doctoral education will be examined in a

limited manner.

MANDATE FOR QUANTITATIVE ANALYSIS SKILLS

First, to provide context for the discussion, one must understand the imperative to provide for such quantitative analysis skills in MPA programs. According to the curricular standards published and promoted by NASPAA, MPA degree programs are encouraged to "enhance the student's values, knowledge, and skills to act ethically and effectively" (Standard 3.21):

In the application of quantitative and qualitative techniques of analysis in:

- Policy and program formulation, implementation and evaluation
- Decision-making and problem-solving.

The Standards go on to say that no specific courses are prescribed, rather it is left to the programs to provide opportunities in their curricula for students to develop those skills. However, under "General competencies" (Standard 3.23), the programs are enjoined to "develop in students a demonstrated ability to:

- define and diagnose decision situations, collect relevant data, perform logical analyses, develop alternatives, implement an effective and ethical course of action, and evaluate results;
- organize and communicate information clearly to a variety of audiences through formats including oral presentations, written memoranda and technical reports, and statistical charts, graphs, and tables.

For most MPA programs, "quantitative analysis" has generally meant research methods, statistical analysis, and/or management science or problem solving skills.

It is frequently assumed that the teaching of quantitative methods and related skills and competencies is on the increase in public administration programs. For example, Josephine LaPlante (1989: 845) noted in an article:

Public administration and public policy programs have responded by increasing both the breadth and depth of course offerings and requirements in the areas of quantitative and qualitative research methodology, statistics, program evaluation, policy analysis techniques, and computing.

Earlier studies by Hy, Nelson, and Waugh, 1981, 1987) indicated increased teaching of quantitative methods and related computer skills between 1978 and 1984 as part of MPA core curricula. Their studies also indicated almost unanimity among MPA programs that students take at least one quantitative analysis course prior to completing their programs and growing use of the more sophisticated inferential and management science statistics (*Ibid*, 1987).

When Robert E. Cleary (1990) examined the master's degree-level curricula of the NASPAA member institutions in 1989, he also found that "research methods" were a major component of the core curricula of those programs. Moreover, the public policy- and economics-oriented programs tended to put a greater emphasis on research methods (*Ibid.*, 666).

In some measure those studies provide arguments for the content and rationale for quantitative methods courses as well as recognizing the differences among programs in their purposes and approaches. The importance of the issue may become more apparent as public administrative examiners examine the quality of scholarly research in the field, the utility of research for public sector practice, and the effectiveness of public sector decision-making itself.

In addition to providing an inventory of quantitative techniques taught in MPA programs and the skills that students bring into the programs, several expectations guided this analysis. Certainly the basic expectation was that the teaching of quantitative techniques in MPA programs has increased in recent years. That expectation was based on the more obvious changes in the field of public administration over the past years in terms of the growing number of doctoral programs in or offering specializations in public administration departments and schools. In short, it was deemed useful to understand why programs may have made the choices they did in determining which quantitative skills should be taught.

As has been suggested in the literature (Waugh and Hy, 1985), it is assumed generally that research-oriented programs and faculty will concentrate on social statistics and that the more applied programs and faculty will concentrate on management science techniques. Therefore, programs in institutional settings with doctoral programs and/or with close proximity to more traditional disciplines are more likely to be research skill-oriented than those located in separate public administration or public affairs units.

In more general terms, if admission standards and quantitative skill-related prerequisites can be presumed higher for doctoral

programs than for MPA programs, the level of sophistication of analytical techniques being taught may be assumed related to the proximity to a doctoral program.

HYPOTHESES

The first task was to determine just what research and management science skills are currently being taught in MPA programs and how the emphasis on those skills have changed over the past decade. In general, the expectations were that basic quantitative, research-oriented and management science or decision-oriented skills would be taught by a very large proportion of the NASPAA member programs and taught more extensively than in past years.

The second task was to examine the differences among MPA programs in terms of the kinds of quantitative skills being taught. Two expected determinants of research-orientation were identified. First, the MPA programs were categorized in terms of whether their institutions have doctoral-level public administration programs for which the MPA programs would likely generate students or act as "feedback" for the doctoral programs. It was expected that such programs would be more traditional, discipline-based, and would thus pay greater attention to basic research skills than those without doctoral programs.

Second, the programs were categorized according to institutional setting, *i.e.*, within a political science department, as a separate public administration department within a college of liberal arts and sciences or within a separate school or college of public affairs. The expectation was that the political science-based programs would be more traditionally research-oriented than those in separate departments or schools.

A somewhat greater emphasis on management science was also expected among those programs in separate public administration departments. While considerable institutional variation was expected in the third category, it was expected that these programs too would be more management science-oriented than those in political science departments.

In summary, the hypotheses that guided the analysis were:

H_1 = The teaching of quantitative analysis techniques in MPA programs has increased over the past six years.

H_2 = The public administration programs offering doctoral

degrees put greater emphasis on research skill building than those offering only MPA degrees.

H₃ = The MPA programs housed in more traditional discipline-defined (political science) departments put greater emphasis on research skill building than those housed in separate public administration units.

H₄ = The MPA programs housed in separate, more autonomous schools of public administration put greater emphasis on management science skill building than those housed in more traditional units.

METHODS

Replicating many of the questions used by Hy, Nelson, and Waugh in their 1978 and 1984 studies of research methods in MPA programs (Hy, Nelson, and Waugh, 1981; Waugh and Hy, 1985; Hy, Waugh, and Nelson 1987), a survey was conducted during 1990. Questionnaires were mailed to all of the NASPAA member institutions indicating in the Association directory that they offer masters degrees in public administration. Institutions offering only undergraduate or doctoral degrees and those offering masters degrees clearly designated as public policy or general public affairs were not surveyed.

The principal representatives contacted were asked to pass the questionnaire onto the quantitative methods and computing instructors in their MPA programs. It is important to note that the expectation was and is that the data collected represent the impressions or best estimations of the respondents, rather than thorough analyses of curricula, syllabi, and student records.

Second and third waves of questionnaires were mailed to nonresponding programs. All programs identifying themselves as being something other than MPA programs were eliminated from the study during the survey itself. One hundred, thirty nine or 73.5 percent of the 189 MPA programs with membership in NASPAA eventually responded.

Analysis of the nonrespondents did not indicate a pattern reflective of any of the program categories examined here. That is, the mix of political science-based and other kinds of programs was essentially the same as that noted in NASPAA's most recent analyses of its membership. The percentages of larger and smaller programs were consistent with those analyses as well. There were also no discernible

TABLE 1
ANALYTICAL SKILLS OF ENTERING
MPA STUDENTS
(in percentages)

Prior Coursework	1978	1984	1989
Research Methods	22	23	34
Data Processing	10	9	20
Basic Statistics	36	45	51
Advanced Mathematics	*	*	11
Calculus	6	5	*
Matrix Algebra	7	4	*
Vector Analysis	0	1	*
Differential Equations	1	1	*
Computer Programming	6	5	14
Philosophy of Science	*	2	8
Management Information Systems	*	*	9
Operations Research	*	*	6
Microcomputer usage	*	*	36

Sources of 1978 and 1984 data: Hy, Nelson, and Waugh (1981) and Hy, Waugh, and Nelson (1987). * denotes items not included in that survey.

TABLE 2
 TYPES OF QUANTITATIVE TECHNIQUES
 TAUGHT IN MPA PROGRAMS
 (in percentages)

Techniques	1978	1984	1990
<u>Basic Statistics</u>			
Measures of Association	91	95	97
Measures of Dispersion	93	95	95
Tabular Statistics	84	92	96
Linear Statistics	89	92	97
<u>Advanced Statistics</u>			
Partial Correlation	58	63	70
Linear Regression	83	91	93
Nonlinear Regression	21	37	36
Factor Analysis	15	33	27
Nonparametric Statistics	27	44	61
Analysis of Variance	57	73	70
<u>Management Science Statistics</u>			
Time Series Analysis	38	47	49
Inventory Analysis	16	16	13
Queuing	28	34	18
PERT/CPM	41	50	44

Sources of 1978 & 1984 data were Hy, Nelson, and Waugh (1981) and Hy, Waugh, and Nelson (1987).

patterns in the geographic distribution of nonrespondents; consequently the results are reflective of MPA programs nationally

FINDINGS

As Table 1 indicates, the students entering MPA programs increasingly have prior coursework in basic statistics, research methods, data processing, computer programming, advanced mathematics, and the philosophy of science. While the percentages are still relatively low for most of those skills, it is clear that students are receiving at least some foundation in statistics and research methods as part of their undergraduate programs and/or are being required to take such coursework as prerequisites for the public administration studies.

Without comparative data it is impossible to gauge change in the students' backgrounds in management information systems and operations research, although it is evident that few entering students have been exposed to those skills. Similarly changes cannot be gauged in terms of microcomputer skills but it is noteworthy that over one-third have some experience with microcomputers. Rather than asking about specific prior coursework in calculus, matrix algebra, vector analysis, the survey asked more generally about students' background in advanced mathematics.

Consistent with those earlier findings, the small percentage (11%) of students entering with strong backgrounds in advanced mathematics suggests that MPA curricula may have to address those deficiencies before strengthening their quantitative skill courses or choose "cookbook" approaches to quantitative analysis that do not require theoretical background on the techniques being used.

The data in Table 2 indicate that the overwhelming majority of the MPA programs require their students to learn basic descriptive statistics. While the categories of "basic statistics" and "advanced statistics" are admittedly awkward and are only utilized to offer a very general means of comparison, the responses do provide useful information. The percentages of programs requiring students to learn "basic" skills have increases since 1978 and 1984 and are approaching 100 percent.

Clearly the first hypothesis concerning increased emphases on quantitative techniques is supported. However, the percentages of programs requiring students to learn more sophisticated techniques are leveling off and, in some cases, decreasing. For example, the

TABLE 3
 TYPES OF QUANTITATIVE TECHNIQUES
 TAUGHT IN MPA PROGRAMS
 BY HIGHEST PROGRAM DEGREE
 (in percentages)

Technique	Degree	
	PhD	MPA
<u>Basic Statistics</u>		
Measures of Association	100	96
Measures of Dispersion	98	94
Tabular Statistics	95	96
Linear Statistics	100	96
<u>Advanced Statistics</u>		
Partial Correlation	73	69
Linear Regression	98	90
Nonlinear Regression	24	41
Factor Analysis	22	29
Nonparametric Statistics	63	60
Analysis of Variance	71	69
<u>Management Science Statistics</u>		
Time Series Analysis	46	50
Inventory Analysis	12	13
Queuing	28	17
PERT/CPM	39	47
Other	22	10*
N =	41	94

* $p < .05$

TABLE 4
 TYPES OF QUANTITATIVE TECHNIQUES
 TAUGHT IN MPA PROGRAMS
 BY INSTITUTIONAL SETTING
 (in percentages)

Technique	Setting		
	Poli Sci Dept	PA Dept	School/ College Other
<u>Basic Statistics</u>			
Measures of Association	95	91	100
Measures of Dispersion	95	91	100
Tabular Statistics	96	96	94
Linear Statistics	96	96	100
<u>Advanced Statistics</u>			
Partial Correlation	71	68	71
Linear Regression	93	94	94
Nonlinear Regression	34	43	32
Factor Analysis	27	28	26
Nonparametric Statistics	54	72	58
Analysis of Variance	61	72	81

TABLE 4 (cont.)

TABLE 4 (Continued)
TYPES OF QUANTITATIVE TECHNIQUES
TAUGHT IN MPA PROGRAMS,
BY INSTITUTIONAL SETTING
(in percentages)

Technique	Setting		
	Poli Sci Dept	PA Dept	School/ College Other
<u>Management Science Statistics</u>			
Time Series			
Analysis	46	47	55
Inventory			
Analysis	11	15	13
Queuing	9	17	35*
PERT/CPM	38	47	55
Other	18	11	10
	N = 56	47	31

* $p < .01$

teaching of linear regression and time series analysis techniques increased only slightly while the teaching of nonlinear regression, queuing, and PERT/CPM techniques has decreased (in some cases dramatically). The increased percentage of programs teaching nonparametric statistics, from 44 to 61 percent, is the only suggestion of greater sophistication in the repertoire of quantitative techniques that MPA students are acquiring. Indeed, there is ample evidence of a decline in the teaching of management science techniques in MPA programs.

Table 3 permits an examination of the quantitative techniques broken down by the level of degree offered by the public administration unit. Not surprisingly, the units offering doctoral degrees in public administration are more likely to require their students to become familiar with the basic research techniques than those units offering MPA degrees as their highest degree.

Interestingly, the highest percentages of programs requiring students to acquire skills in nonlinear regression and factor analysis are those without doctoral programs. The two groups were roughly similar in terms of the teaching of nonparametric statistics, analysis of variance, time series analysis, and inventory analysis. And, while the MPA-only programs clearly put a greater emphasis on the teaching of PERT/CPM, the programs with doctoral degrees were more likely to teach students queuing techniques.

On the whole, the programs with doctoral level students do seem to be slightly more quantitatively oriented, as suggested by the second hypothesis but the difference is certainly not great. Similarly, the MPA-only programs may be very slightly more management science-oriented.

In terms of the impact of institutional settings on the teaching of quantitative techniques, the data in Table 4 suggest that those programs located in public administration/public affairs schools or colleges are more likely to require basic statistical skills and management science skills. Those programs housed in political science departments, too, require more basic skills of their students than those programs in separate public administration departments although the latter do appear more demanding of the sophisticated quantitative skills, including management science skills.

The impact of institutional setting on the kinds of techniques taught is important. The data support the conclusion that MPA programs housed in public administration/public affairs schools or colleges are more likely to teach the kinds of techniques that are

assumed to be most useful to practitioners, *i.e.*, basic statistics and management science techniques.

It is also noteworthy that the separate public administration departments, while slightly less likely to require students to learn the more basic statistical techniques, are more likely to require them to learn the more sophisticated research-oriented analytical techniques. Thus, the third and fourth hypotheses concerning the relationship between institutional setting and program emphases are not consistently supported. Chi-square analysis, moreover, indicated unacceptably low levels of significance in most of the relationships between variables (except where noted).

CONCLUSIONS

In general terms, the data support the expectations and are generally consistent with the common wisdom. The teaching of quantitative methods in MPA programs is almost universal but the level of sophistication is generally not high among most of the programs. The question of whether the more practitioner-oriented programs would emphasize management science over sophisticated research techniques was also answered generally in the affirmative with some qualifications that will be addressed below. The data also raise important questions concerning the content of MPA curricula.

First, the data here do provide some foundation for programs evaluating their curricular requirements relative to quantitative analysis and seeking benchmarks for the repertoire of skills to be required of MPA students. The data also raise questions concerning the kinds of techniques that should be required of MPA students. Given the finding that over one-half of the entering students have some background in basic statistics, the data in Table 2 are all the more interesting. It may be understandable that public administration departments put less emphasis on basic skills when more and more of their students already have such skills upon beginning their programs of study.

By the same token, the emphasis placed on basic skills generally may be misplaced. In short, we may be duplicating undergraduate coursework for increasing numbers of the students in our MPA programs. We may also want to examine whether the "cookbook" approach to quantitative analysis, while practical and perhaps necessitated by MPA students' generally poor mathematical backgrounds, limits the sophistication of the techniques with which they can deal.

The 36 percent of the programs that indicated that most of their students already have microcomputer skills when beginning their MPA studies also suggests that more attention should be paid to the assessment of such skills, the avoidance of unnecessary duplication, and the integration of more advanced applications in appropriate courses.

The inventory of techniques, however, should not be taken as a guide for what an MPA curriculum should include. To the extent that programs have different purposes, skill needs may differ among graduates. For example, programs that enroll more preservice students should perhaps consider requiring more of the sophisticated analytical techniques to prepare graduates for the kinds of entry-level program, policy or budget analysis positions that they typically may find. More senior, executive-level students may need a "literacy" level of knowledge about data analysis and decision-making, *i.e.*, a working knowledge of the techniques that subordinates and technical personnel may be using rather than a more advanced level.

The quantitative skill building necessarily should be appropriate to the needs of the students and the expected outcomes of the MPA program. The relevance of the skills, in terms of both usefulness and use in the public sector positions filled by MPA program graduates, is critical in assessing program outcomes (Faerman and Jablonka, 1990:271-272).

Quantitative analysis courses and course components can also serve a number of purposes, only some relating to the skill needs of program graduates. Unfortunately, quantitative analysis requirements have frequently been used as gatekeeping mechanisms (sometimes along with one or more economics courses) in MPA programs. Perhaps more frequently, the sequencing of courses does not encourage the integration of quantitative analysis skills into substantive courses. In such cases, quantitative analysis skills become a hurdle rather than a tool for students.

The leveling off or decline in the sophistication of the quantitative analysis and decision-making techniques taught may be a reflection of the increased number of MPA programs and presumably broader student clientele base or an indication of some disillusionment with the utility of the more sophisticated quantitative analysis techniques. Or, the numbers may simply mean that programs are reaching the appropriate levels of emphases and differences among programs and reflect the diversity of MPA curricula. As one practitioner-oriented teacher of quantitative methods commented in

response to a survey item: "Why would an MPA program even want its students to understand, let alone use, factor analysis?"

It has also been suggested that the answer is that faculty tend to teach what they use themselves (Hy, Waugh, and Nelson, 1987). But, the recent debate in *Public Administration Review* over the quality of research would seem to indicate otherwise because faculty are not using the more sophisticated techniques themselves (e.g., McCurdy and Cleary, 1984; Perry and Kraemer, 1986; Houston and Delevan, 1990).

An obvious response to that conclusion is that MPA programs are not expected to be research-oriented, therefore the issue of whether public administration scholarly research is of low quality is not relevant to professional education except to the extent that it reflects the scholarship of public administration faculty. Indeed, the evidence shows that few of the quantitative skills thus acquired are actually used in public sector employment (Hy and Brooks, 1984; LaPlante, 1989).

The need for research-oriented skills, however, is manifest. Hindy Lauer Schachter (1985:1-3), for example, does find that the kinds of analytical techniques taught have an impact on policy-making and argues for greater attention to social science-oriented analytical techniques to balance the use of economic analysis techniques that have come to dominate policy analyses in government agencies.

To a lesser extent, concerns have been expressed concerning the negative impact of management science techniques, most frequently grounded on economic assumptions and values and perhaps insensitive to other social and political values, on public management practice. Interestingly, the development of decision-making skills among students in public administration masters degree programs, as evidenced by the teaching of management science techniques, has shown some decline in recent years according to at least one study (Waugh and Hy, 1985).

It is not argued that quantitative analysis techniques are unimportant to public administration education, rather that some attention needs to be paid to the kinds of techniques being taught and their uses. Indeed, while research-oriented techniques are perhaps less useful in practitioner settings, there is a need for MPA students to understand and be able both to use and to conduct applied research. The basic analytical techniques are the same although there may be important differences in terms of the level of sophistication

in the techniques being applied.

Notwithstanding that observation, there is also a real danger that, as the field develops and academic programs proliferate, more and more students will be moving from MPA programs into doctoral programs and will lack the kinds of methods and analytical skills that students generally acquire in more traditional, academic masters degree programs. Just as the distinction between practice-oriented Doctor of Public Administration (DPA) programs and research-oriented Doctor of Philosophy (Ph.D.) programs has become blurred, the fundamental differences between professional and academic or discipline-based programs are also being overlooked (Waugh, Hy, and Brudney, 1991). In short, while the practice-orientation of MPA and other professional programs is fundamental, public administrationists should be concerned about the research skills that students acquire because we want those students to be able to use our scholarly research as well as to conduct their own applied research.

The most important issue raised may be that concerning the academic preparation of students for entry into doctoral programs. To the extent that increased experience with management science techniques usually means a concomitant decrease in experience with research-oriented techniques, recruiting doctoral students from MPA programs may necessitate building strong social statistics and research design components into the curriculum as prerequisite to the more substantive coursework and research.

Notwithstanding the finding that MPA programs housed in separate public administration departments are more likely to require students to learn more sophisticated techniques than those programs housed in political science departments, the nature of the orientation may still be critical. As noted by Waugh, Hy, and Brudney (1991), there are problems when students enter doctoral programs without some experience in the design and logistics of intensive and large-scale research projects, let alone without knowledge of the appropriate research designs and methods. The practitioner-oriented programs typically do not require the same kinds of academic exercises as the more traditional research-oriented programs, nor should they necessarily.

The solution may be greater attention to the skill needs of doctoral students in public administration, focusing on both quantitative analysis skills and research methods, rather than on any adjustment of public administration masters degree curricula to put greater

emphasis on research skills. Certainly, the relationships between MPA and public administration doctoral curricula should be clarified in terms of skill content.

That is not to say, however, that building the analytical skills of MPA students should be overlooked. Program faculty should ask just how important management science or decision-making techniques are to their students and what skills they are intended to develop. In some measure that is a crucial question concerning the definition of MPA programs and the Master of Public Administration degree itself. It is perhaps the basic question in defining our expected (or hoped for) outcomes.

NOTES

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