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A Qualitative Assessment of Efforts to Integrate Data Analysis throughout the Sociology Curriculum: Feedback from Students, Faculty, and Alumni

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Abstract

Quantitative and computer literacy are increasingly recognized as core components of a liberal education in sociology. This study draws on student, faculty, and alumni questionnaires to identify the kinds of quantitative literacy skills that are perceived to be most critical for students enrolled in sociology courses. Respondents at Lehman College highlighted the need for proficiencies in a number of key areas, including (a) basic mathematical and statistical skills, such as measures of central tendency, ratios, and percentages; (b) the presentation and interpretation of quantitative data, including tables and charts; (c) the research process, such as developing hypotheses, sampling, and interpreting data; and (d) computer-based presentation and data analysis, including the use of software programs such as SPSS and Excel. Moreover, hands-on work in data analysis was highly valued by all respondents, particularly as a strategy for mastering these skills. This study suggests that effective education in quantitative literacy requires both (a) the removal of barriers to the incorporation of data analysis in sociology courses and (b) a well-sequenced sociology curriculum that pinpoints specific quantitative and computer literacy learning objectives at multiple course levels.

Keywords

active learning, integrating data analysis, numeracy, quantitative reasoning, statistics

Quantitative literacy is increasingly recognized as an essential skill for all college graduates. As the Association of American Colleges and Universities (2009:1) reports,

> Faculty are recognizing the steadily growing importance of Quantitative Literacy (QL) in an increasingly quantitative and data-dense world. [Concerns] about QL skills are shared by employers, who recognize that many of today's students will need a wide range of high level quantitative skills to complete their work responsibilities. And virtually all of today's students, regardless of career choice, will need basic QL skills like the ability to draw information from charts, graphs, and geometric figures, and the

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ability to accurately complete straightforward estimations and calculations.

Quantitative literacy, which is variously referred to as "numeracy" and "quantitative reasoning" (QR), may be defined as "the ability to understand and use numbers and data in everyday life" (Madison 2003:3). Quantitative literacy is not synonymous with mathematics or statistics, however, and it may be viewed more generally as "a practical, robust habit of mind anchored in data, nourished by computers, and employed in every aspect of an alert, informed life" (Steen 2004:4). Some of the key skills that make up QL include reading graphical displays, modeling real-world phenomena, solving practical problems through the use of data, justifying conclusions, and critiquing research designs (Johnson and Kaplan N.d.).

This study evaluates student, faculty, and alumni perceptions of efforts to infuse quantitative literacy into the sociology curriculum. In particular, it identifies the kinds of quantitative and computer skills that faculty and students feel are most important. The study also assesses the effectiveness of efforts to infuse data analysis into the sociology curriculum, particularly through the use of computers.

For two decades, the American Sociological Association (ASA) has stressed the importance of scientific literacy as a key learning outcome of the sociology curriculum (Howery 2001; Sweet and Strand 2006). As McKinney et al. (2004:8) report, "Education in sociology depends on empirical as well as theoretical analyses, and the sociological perspective grows from active learning experiences in both. Sociology, then, must be viewed as a 'lab science.'" According to Sweet and Strand (2006:1), sociology is "well-positioned to be a leading discipline in the cultivation of students' abilities to interpret statistical information and put those interpretations to meaningful use." In their view, it holds the promise of "[connecting] quantitative skills to effective civil engagement and to important questions about the social world" (Sweet and Strand 2006:1).

Unfortunately, present-day sociology programs fall short of this potential. In particular, "many students may perceive [statistics and methods courses] as inherently uninteresting, quite difficult and, like the immunization injections they received as children, a necessary but quite unpleasant aspect of growing older" (Bridges et al. 1998:15). Studies of efforts to promote QL instruction in sociology courses indicate that students' anxiety is a major barrier (Bridges et al. 1998). Markham (1991) suggests a potential solution, however, arguing that statistical and methodological content is most effectively taught in the context of substantive sociological issues and problems rather than in standalone methodology courses. Indeed, successful instruction in quantitative literacy demands what Cuban (2001:89) refers to as *progressive pedagogy*: "connecting content to real-life situations, lighter coverage of topics, an emphasis on understanding concepts rather than facts, integrating content across disciplinary boundaries." Students learn more when instructors use concrete examples and problems that are relevant to their lives (Bridges et al. 1998), and a growing body of research shows that incorporating quantitative reasoning skills (including the use of computers) into substantive sociology courses is associated with improvements in students' abilities to interpret and manipulate empirical data (Bridges et al. 1998; Wilder 2009).

An emphasis on quantitative literacy brings several benefits, especially when the quantitative work is presented as one component of a scientific approach to sociology. When theory and data analysis are combined through active learning, students often come to understand that quantitative reasoning skills are relevant to social issues. They learn how to accurately and objectively understand the social world and how to apply that knowledge (Clifton 1976; Frey and First N.d.; Himes and Caffrey 2003; Misra 1997; Scheel 2002; Sweet and Strand 2006). Moreover, since some students have the impression that descriptions of the social world are mostly "a matter of opinion," a quantitative approach to teaching sociology may attract students who might otherwise be "turned off" by the seemingly subjective orientation of the field (Fuller 1998:217). A quantitative approach is likely to attract students who are stronger in mathematics and to enhance the quantitative skills of students already working toward sociology degrees (Fuller 1998; Howery and Rodriguez 2006; Wolfe 1993). Many students, especially those with good math skills, report that quantitative learning exercises are useful in helping them learn the course material (Fuller 1998; Scheel 2002).

Extensive research has shown that students learn more rapidly, retain knowledge longer, and develop superior critical thinking skills when they are actively involved in the learning process (Fuller 1998; Himes and Caffrey 2003; Kain 1999; King 1994). Toward this end, the use of computers can help in the development of logical thinking and QL skills that are central to the research process (Fuller 1998; Markham 1991; Persell 1992; Raymondo 1996). Karp (1995:240) has shown that using SPSS in upper-division subject courses can stimulate students' interest in learning as they "move from being readers of social research to practitioners, capable not only of formulating ideas, but also of putting them to the test." Moreover, much of the knowledge acquired in computer-oriented courses can be transferred directly into the marketplace (Raymondo 1996). User-friendly, Web-based data analysis programs can help overcome some of the challenges associated with traditional statistical instruction, such as inadequate mathematical preparation and lack of familiarity with data analysis and software (Scheitle 2006).

The positive impact of active learning and using computers extends throughout the sociology curriculum. At the same time, this approach is especially important in introductory courses, which introduce students to the discipline, help to define the methods and materials of the social sciences, attract a broad range of students, and serve as feeder courses for the major. Previous research has shown that computer use in introductory sociology courses is associated with improved performance and attitudes (Reed-Sanders and Liebowitz 1991) and that computer-mediated communication, particularly online collaborative learning, enhances students' achievement (Wright and Lawson 2005).

The prevalence of active learning in sociology courses falls short of the ASA recommendations, however. Evaluating a large number of syllabi in the ASA Teaching Resource Sample, Grauerholz and Gibson (2006) found that only 15 percent of sociology course syllabi mentioned data collection or analysis as course requirements. "It is very likely that a student could graduate with a major in sociology with very little experience with data analysis" (Grauerholz and Gibson 2006:17). Markham (1991:465) laments that the current situation

> is good neither for students nor for society. Knowledge of how science works is as crucial a component of a liberal education as is appreciation of art or literacy, and students need to know that research is just as central to social as natural science. . . . In addition, knowing how information about society and interpersonal relationships is gathered and analyzed is both a useful skill and a prerequisite for an informed, participating citizenry. Public officials, business managers, political activists, and citizens reading the daily newspaper need to be intelligent consumers of information from the Census, survey research, focus group sessions, and analyses of policy impact. Work roles in fields as diverse as personnel, city planning, marketing, and welfare administration require the ability to use research by others intelligently, to conduct simple research, and to collaborate with professional researchers. . . . Thus, failure to provide students with a foundation of basic research concepts and skills in the first course does them and society a disservice, whether or not they take more sociology courses.

Sweet and Strand (2006:2) echo this general assessment, reporting that "we require of our students a distressingly low level of engagement with quantitative data." Blalock (1989:457–58) contends that sociology is "not a high quality discipline," noting (among other things) that sociology majors fare poorly on standardized tests. He believes these problems can be traced to the fact that sociology curricula are horizontal rather than vertical (i.e., upper-level courses do not build on previously taught material) and that undergraduate statistics and methods courses are relatively basic compared to those in other disciplines. Indeed, sociology instructors are well aware of the "quantitative literacy gap" among students majoring in sociology (Howery and Rodriguez 2006:23).

BACKGROUND

Since 2003, the Sociology Department at Lehman College (prior to 2008, the Sociology Program) has been an active participant in the Integrating Data Analysis (IDA) project sponsored by the American Sociological Association and the

Social Science Data Analysis Network. The IDA project addresses the scientific literacy gap among undergraduate sociology students by incorporating data modules into substantive subject courses (i.e., courses other than research methods) (American Sociological Association 2005; Howery and Rodriguez 2006). By working with these data modules, students gain active experience with sociological methods and empirical evidence.

Faculty at Lehman College first became involved in the IDA project when the Sociology Program was selected to participate in a workshop at the University of Michigan in 2003. The modules developed as a result of that workshop (available at http://www.ssdan.net/datacounts/modules/) are a valuable resource for faculty working to integrate data analysis into the curriculum. A year later, sociology faculty from Lehman College received a competitive grant from the National Science Foundation (NSF) to strengthen efforts to infuse data analysis into the sociology curriculum. With support from NSF and a matching equipment grant from the Dormitory Authority of the State of New York, the Lehman College team developed several initiatives in support of the IDA project. In particular, project-related funds have been used to (1) purchase two mobile computer labs with 31 laptops each; (2) promote IDA participation among part-time faculty, who currently teach the majority of sociology classes at Lehman; (3) hold IDA dissemination workshops at Lehman; and (4) establish a teaching community in the Sociology Program whereby full-time and part-time faculty collaborate to explore new ways to promote scientific inquiry among students. Toward this end, a Lehman College IDA Web site (http://www.lehmanida.org/joomla) has been developed to promote communication among those involved in the project.

At Lehman, the faculty's efforts to integrate data analysis into the curriculum have taken a variety of forms, and the majority of full-time faculty as well as several long-term adjunct faculty have participated in the Lehman IDA initiative. There is considerable variation in the scope and degree to which faculty have mainstreamed data analysis into their classes. The efforts of the faculty range from a single assignment focusing on table reading to a collection of exercises that emphasize a wide variety of QL and computer literacy skills. By the end of the NSF funding period (2007), a collection of 56 data analysis exercises had been compiled. (Many of them are available at the Lehman College IDA Web site.) These modules are being used in approximately 10 different classes, many with multiple sections. While most of the assignments are used in non-methods courses (as per the goals of the original project), the emphasis on IDA in the sociology curriculum has led to the refinement of the exercises used in the two core methods classes, Sociological Analysis and Research Methods. (The Lehman Sociology Department does not offer a conventional statistics class.) It is also noteworthy that many part-time faculty have also participated in the IDA initiative, sometimes developing their own quantitative assignments.

Finally, the Department of Sociology has undertaken a multimethod assessment program to evaluate the effectiveness of our IDA efforts. The assessment program incorporates student focus groups, an external evaluation, an alumni survey, student assessment tests, and faculty questionnaires.

THE SETTING

Lehman College, part of the City University of New York, is a designated Hispanic-Serving Institution in the Bronx. The college's fall 2006 enrollment of 10,814 included 8,747 undergraduates and 2,067 graduate students. That semester, 48 percent of Lehman students self-identified as Hispanic, 33 percent as black or African American, 10 percent as white/non-Hispanic, 4 percent as Asian, and 5 percent as nonresident alien (Lehman College Office of Institutional Research, Planning and Assessment 2006). Of the students, 47 percent were 25 or older, and 72 percent were women. In addition, 38 percent were first-generation college students, and 30 percent reported living with children younger than 18. Altogether, 62 percent reported working outside the home for pay, and 21 percent worked 35 or more hours per week (City University of New York Office of Institutional Research and Advancement 2006). There were 469 undergraduate sociology majors in the fall 2006 semester (Lehman College Office of Institutional Research, Planning and Assessment 2006).

The nonresidential, working student that typifies Lehman College is becoming the norm in American higher education. In particular, nearly 40 percent of Lehman students arrive as transfers

from other schools, primarily community colleges (Lehman College Office of Institutional Research, Planning and Assessment 2008). Community college students comprise 46 percent of all American undergraduates, and many have the same socioeconomic and demographic characteristics as Lehman students. Their mean age is 29 (53 percent are 22 or older), 58 percent are women, 36 percent are minority, and 39 percent are first-generation students (American Association of Community Colleges 2009). Moreover, Lehman College is one of more than 200 Hispanic-Serving Institutions in the United States (Hispanic Association of Colleges and Universities 2009). Lehman students represent a significant and growing segment of the college and university population—a group of students who are older, chiefly female, ethnically diverse, and likely to be working or raising a family. Moreover, Lehman College is a particular kind of institution—public, urban, and nonresidential—that can be readily identified in university systems throughout the United States. The opinions of Lehman students and faculty regarding quantitative literacy may therefore be applicable far beyond the Lehman campus.

DATA AND METHODS

The data for this analysis were drawn from three sources: (1) questionnaires that solicited students' input on the Sociology Program's efforts to integrate data analysis into the curriculum, (2) questionnaires that solicited similar input from the faculty, and (3) a 2007 alumni survey that asked students about their post-graduation educational and career experiences as well as their reflections on the effectiveness of the instruction they had received.

Student Questionnaires

Each semester from fall 2004 through spring 2006, quantitative assessment tests were administered to students enrolled in sociology courses at Lehman College. These tests, administered on a voluntary basis during classes, included 18 questions that measured students' quantitative skills on a wide range of tasks. The results of the skills tests have been reported elsewhere (Wilder 2009). The present analysis focuses on a supplementary page of the spring 2006 assessment that asked students the following three questions:

1. What data analysis skills have you been taught in your sociology classes that you think will be helpful to you in the future?
2. Are there any kinds of data analysis skills that you wish you had been taught in your sociology class (or classes) and haven't been taught?
3. What has been your experience working with computers in sociology classes? (Please indicate both positive and negative aspects of this experience.)[1]

Altogether, 295 students completed the surveys in the spring of 2006. Although student participation was strictly voluntary, students were far more likely to complete the questionnaire when their instructors took the time to distribute the assessments in class. Consequently, efforts to maximize participation focused on the faculty and included repeated email messages, notices in faculty campus mailboxes, colorful signs posted throughout the main office of the Sociology Program (near the faculty mailboxes), and a plentiful supply of survey questionnaires (in a box in the main office).

Students were instructed not to complete the questionnaires a second time if they had already done so in another course. Since we do not have data on the total number of students enrolled in sociology classes at Lehman (we have data only on full-time enrollments, and many students were enrolled in multiple classes), it is not possible to calculate a response rate for the student assessment questionnaires. The spring 2006 survey results should therefore be seen as illustrative rather than conclusive.

Faculty Questionnaires

Faculty questionnaires were administered on a voluntary basis at the end of the fall 2004 and spring 2006 semesters. Faculty were instructed to fill out a separate questionnaire for every course (not every section) they taught. In addition to asking about the kinds of data skills that faculty had incorporated into their classroom instruction, the questionnaires included the following two questions:[2]

1. What quantitative skills do you think are most important for Lehman students to acquire before graduation?

2. What do you think are the greatest challenges you face in integrating data analysis into the curriculum?

In the fall of 2004, 18 faculty questionnaires were completed, representing 28 of the 61 sociology classes/sections taught that semester. In the spring of 2006, 22 faculty questionnaires were completed, representing 32 of the 54 sociology classes/sections taught that semester. In the fall 2004 semester, 10 faculty provided responses to one or both of the open-ended questions specified previously. In the spring 2006 semester, 16 did. (Of course, many of the same faculty replied to both rounds of the assessments. However, because the questionnaires were anonymous, there is no way to determine the number of repeat responders.)

A number of strategies were used to maximize faculty participation. All faculty were sent email notifications encouraging them to complete the questionnaires, and several follow-up messages were sent. Each faculty member received a note in his or her departmental mailbox along with a copy of the questionnaire, and additional copies of the survey were made available in the main Sociology office near the faculty mailboxes. Colorful signs were posted in the main office encouraging faculty to complete the questionnaires. Since no identifying information was gathered, it is impossible to know who responded. Although slightly more than half of the sociology courses at Lehman are taught by part-time faculty, full-time faculty presumably have a greater interest in the department's curricular initiatives. At the same time, several long-standing adjunct faculty were actively involved in the IDA project.

Alumni Survey

During the summer of 2007, a four-page survey was mailed to 522 Sociology alumni who had graduated from January 2001 to May 2007. All completed surveys were mailed back by early 2008. (The survey asked alumni to respond within two weeks. Most of the surveys were returned by fall 2007, but a few came back as late as early 2008.) The survey solicited information on a wide range of topics ranging from students' educational and career trajectories to their experiences in sociology courses at Lehman. The alumni survey also gathered data on respondents' demographic characteristics, including sex, race/ethnicity, and country of origin (foreign-born vs. native). Most of the questions were multiple choice, although some allowed alumni to write in their answers. Altogether, 114 completed surveys were returned (22 percent) and 48 surveys (9 percent) were returned unopened due to incorrect addresses.[3]

FINDINGS

Students' Reflections on Efforts to Integrate Data Analysis into the Curriculum

Skills that will be most useful in the future. Table 1 shows the frequency with which various skills were mentioned in response to the question, "What data analysis skills have you been taught in your sociology classes that you think will be helpful to you in the future?" Altogether, 189 students (64 percent of assessment respondents) answered this question, and several mentioned multiple skills (e.g., interpreting charts and working with Excel). The responses have been grouped into five broad categories: (1) general data analysis skills (including "how to analyze data" and similar responses); (2) tables, charts, and graphs; (3) software and data sets; (4) statistical skills; and (5) research methods and skills. There is considerable overlap among the skills listed in Table 1, and the categories are not mutually exclusive.

As Table 1 shows, student respondents mentioned charts and graphs more frequently than any other data analysis skills. In fact, 38 students (20 percent of those providing written comments) selected that response. One senior sociology major remarked, "The data analysis [skill] that will help me in the future is the graph reading." Likewise, another wrote, "In the course I am taking now I have learned how to correctly read a graph and how to make one using Excel."

Along with charts and graphs, understanding how to prepare and interpret tables was widely mentioned. As one sophomore sociology major noted, "I am finally learning how to read the data on tables that appear [in] different articles from the NYT newspaper dealing with polls, surveys, etc. I usually would skip them."

Many students identified a variety of software programs and data sources they felt would be

Table 1. Student Responses to the Question "What Data Analysis Skills Have You Been Taught in Your Sociology Classes that You Think Will Be Helpful to You in the Future?"

Skill	Frequency
General data analysis skills	
Analyzing and interpreting data	31
Tables, charts, and graphs	
Charts and graphs	38
Tables	20
Software and data sets	
U.S. Census	19
Microsoft Excel	11
General Social Survey	3
Microsoft Word	3
SPSS	3
Blackboard	2
Computers	1
Library databases	1
Survey Documentation Analysis (SDA)	1
WebChip	1
Statistical skills	
Percentages	18
Understanding statistics	9
Rates	8
Ratios	8
Proportions	4
Mean, median, and mode	2
Crosstabs	1
Standard deviation	1
What it means to control for a variable	1
Research methods and skills	
Independent and dependent variables	11
Research	11
Finding data	10
Qualitative data analysis and research	10
Quantitative data analysis and research	10
Surveys	6
Hypothesis testing/theories	3
Sampling	3
Ethics	2
Inputting data	2
Interviews	2
Experimental design	1
Measurement	1
Variables	1

Note: Sample includes 189 respondents.
Source: Lehman College Student Assessment, fall 2006.

especially helpful to them in their future activities. The U.S. Census was singled out as being especially useful, perhaps because it is widely used by the faculty at Lehman, and approximately 10 percent of students specifically mentioned the Census. As one junior enrolled in Sociological Analysis and Religion and Society courses wrote, "I learned how to access and research data on the Census Bureau website and that could come in handy if I ever have to look up information on a specific population." Another student, a sophomore with no declared major, noted that the most useful data analysis skill he/she had learned was "to go to the census and find information regarding my community." Similarly, a senior enrolled in Sociology of the Family reported that she had learned quite a lot by examining data on the number of female-headed households. A few students mentioned other surveys they had worked with, such as the General Social Survey (GSS). As one senior wrote, "The use of GSS seemed to be very helpful and in the future I can determine peoples' view through this data site."

Many students who worked with Excel felt that spreadsheet skills would be especially valuable. In response to the question about the most useful data analysis skills, one student wrote, "Excel (hooray). Not in depth, but extremely helpful introduction." Likewise, a junior sociology major wrote, "I learned how to construct tables using Excel with data from American factfinder/American Census. I also learned how to use databases (electronic) to do my papers."

A substantial number of students felt that the research skills they had acquired in the classroom would be useful to them. Nearly 10 percent of students specifically mentioned "research" in their responses to this question, and others wrote about particular skills or methods. For example, 11 students mentioned independent and dependent variables. As one junior majoring in social work noted, "I have learned about independent and dependent variables, as well as units of analysis and how they are applied towards research." A junior majoring in sociology wrote, "I have learned the difference between [a] longitudinal study, content analysis, [and questionnaires]. I do think that it will be helpful because I conduct surveys for my job." Among the specific research skills that students singled out were finding data, developing surveys, testing hypotheses, and sampling.

Skills that students wish they'd been taught. Students were asked, "Are there any kinds of data analysis skills you wish you had been taught in your sociology class (or classes) and haven't been taught?" Altogether, 54 students (18 percent) provided responses to this question. Among those who provided written feedback, approximately 65 percent identified specific skills, 25 percent said there were no skills they wish they had been taught, and 10 percent said they didn't know.

Among those who mentioned particular skills, several indicated that they would like more research experience, a better understanding of various data analysis/statistical software programs, and stronger basic quantitative skills. One senior sociology major distilled the sentiments of many students when he/she wrote, "definitely data research and application of data in research." A few students singled out Excel ($n = 4$) and SPSS ($n = 2$) as data analysis tools that they wanted to learn more about. One senior sociology major wrote, "Yes. SPSS. We could not concentrate on it much because of the heavy workload in [Methods of Social Research]." In addition, a few students indicated a desire to be taught more about fundamental data analysis skills such as charts ($n = 3$), tables ($n = 2$), percentages ($n = 2$), rates ($n = 1$), and ratios ($n = 1$).

Several respondents expressed a desire for a better understanding of the kinds of data resources that are available. For example, a senior sociology major wrote, "Perhaps more classes should teach or at least inform the students where to go to find statistics and more information about the society." A junior majoring in social work noted, "I would have to find out what all the different types of analysis are in order to know what I haven't been taught or what I would like to be taught." Similarly, a sophomore majoring in sociology remarked, "Hopefully before I leave Lehman I'll be able to learn all the different kinds of data analysis that exist." Three students also stressed the importance of gaining information literacy skills that can be applied to data analysis. For example, one sophomore expressed a desire to learn "how to effectively use the Internet."

Students' Experiences Working with Computers in Sociology Classes

The student questionnaire also asked, "What has been your experience working with computers in sociology classes? (Please indicate both positive and negative aspects of this experience.)" Altogether, 184 students (62 percent of respondents) provided written responses to this question. Among those who provided feedback, the majority (68 percent) mentioned only positive aspects of their computer use. In all, 22 students (12 percent) stressed positive aspects but mentioned negative points as well, while 13 (7 percent) provided neutral comments or emphasized both the pros and cons of their computer use. Only 8 students (4 percent) focused exclusively on the negative aspects of their experience. Another 15 students (8 percent) indicated that the question was not applicable to them (e.g., they had not used computers in any sociology courses). Overall, 80 percent of the responses could be categorized as favorable. Dozens of students provided either single- or two-word answers to this question, writing comments such as "great," "excellent," "positive," or "good." For example, a senior majoring in sociology wrote that his/her experience with computers was "most definitely positive. Mostly a fun experience."

Several students stressed that the active learning component of their computer work enhanced their experience and helped them to better understand the course material. For example, a senior majoring in health sciences wrote, "It [computer work] has a positive outcome. We have the ability to learn more when the data is in front of our face while we are learning as oppose[d] to trying to remember what the professor told us before we left the class." A sophomore majoring in sociology wrote, "Work is easier to understand when you are able to graph or chart it and actually see it," and a senior sociology major stated, "I like working with computers because it gave me a better and clearer view of the class." A senior psychology major had very favorable comments as well: "I enjoyed looking up data on my own as opposed to just having it handed out to me. Sometimes, however information that I tried to retrieve on the web was difficult to access."

Several students stressed that their computer use had provided them with important quantitative, research, and technological skills that would be useful well beyond their educational careers at Lehman. As one sociology major wrote: "I felt I was gaining knowledge that I would definitely need in the workplace again."

These kinds of sentiments were repeated by quite a few students, sometimes with reference

to the specific skills they had acquired. For example, a senior majoring in health sciences wrote, "It's been good because I was taught how to interpret ratios, percentages and proportions among information such as diseases, races, etc." Two sophomores who had not yet chosen their majors provided similar feedback. One of them wrote, "It [working with computers] is a positive experience because we learn [Web] sites and ways to understand the material." A senior sociology major agreed: "Computers are essential for sociology classes because these provide students update[d] information about the data that a sociology student should and must know."

Several students reported that the use of computers had increased their technological proficiency. As one respondent wrote, "[Computer work in sociology classes is] very pos. it has made me (an old lady) more computer literate—THANK you MUCH." Likewise, another wrote, "It has been positive because I was once illiterate on the computer, but my skills are now getting better."

The relatively few students who provided negative comments focused overwhelmingly on the technical problems associated with using computers in the classroom. For example, one sociology major pointed to the technical glitches that would sometimes arise. He/she wrote: "Positive: having the tools available without leaving class, enough computers for every student, including the projector which is used to assist the whole class at once. Negative: time consuming (problems logging on), the Internet signal would occasionally fail." Another sociology major wrote, "Sometimes the computer don't work so it is hard to complete the work," and a social work major reflected, "My computers rarely worked, I did 99% of the work at home." A few students noted that the computers could lead them to distraction because of the temptation to check email, surf the Web, and so on.

Meanwhile, a small minority of students expressed dissatisfaction with computer use in the classroom because they felt that the computers made things too difficult or too challenging for them. A few wrote that they needed additional tutoring, better guidance from professors, or more class time in order to complete the computer assignments. As one sophomore majoring in sociology wrote, "I find it a bit confusing. I wish I was better at being able to get data from the census website." Another sociology major stated, "If you can't make it to class due to an emergency, you can't make up the work." Of course individual professors may have different policies with regard to making up computer labs, but clearly those students who miss the labs are likely to be at a disadvantage.

Faculty Comments on Efforts to Integrate Data Analysis into the Curriculum

As noted earlier, Sociology faculty were asked "What quantitative skills do you think are most important for Lehman students to acquire before graduation?" Respondents stressed the importance of the research process, basic mathematical/statistical skills, and spreadsheet and statistical programs such as Excel and SPSS. Comments on these three topics were widespread in both the fall 2004 and spring 2006 rounds of the faculty assessment.

With regard to the research process, one faculty member (2004) distilled the sentiments of many when he/she described the wide range of skills that students ought to acquire: "Many—computer literacy, using spreadsheets for data entry, calculations, graphing and chart building, database research skills, writing about and interpreting tables." Likewise, another faculty member (2004) wrote: "I think students should have a clear understanding of the research process and steps. They should be exposed to it not only in 'Research Methods' courses, but in other courses as well. By the time of graduation, they should be able to think scientifically about gathering data, analysis and interpretation."

Several faculty mentioned students' need for better mathematical skills. One (2006) wrote, "Many seem to be lacking basic skills: percentages, dealing with decimals, etc. These skills are critical in today's world, and no one should obtain a college degree without them. Basic numeracy is as important as literacy." Similarly, another faculty member (2006) wrote that students need "fundamental quantitative skills including (but not limited to): percentages, rates, ratios, measures of central tendency, understanding graphs and tables, relationships among variables (e.g., correlation, indep. vs. dep. variables), and the ability to clearly and critically think and write about data." Another (2006) stressed the need for students to be able to "translate data into words and words into data. Ability to construct and de-construct variables. Inductive and deductive reasoning."

Several respondents stressed the importance of applying quantitative skills to real-world issues. For example, one faculty member (2004) indicated that students should have "the ability to assess claims made by politicians and advertisers, poll results and research presented in the popular media—the difference between means and medians, %s, absolute numbers, correlation and causation, etc."

A number of respondents emphasized the importance of research skills and facility with quantitative software programs. For example, one respondent (2004) wrote, "I think it is important for the students to be comfortable reading and interpreting bivariate and univariate tables. Simple descriptive statistics are crucial for students to be familiar with. I also think by the time they graduate they must be familiar with Excel, SPSS, PowerPoint, and library search engines."

While there is a strong commitment among Lehman faculty to provide students with important quantitative skills, several challenges hinder these efforts. When asked about the barriers they faced in their efforts to integrate data analysis into the curriculum, faculty stressed students' lack of basic quantitative abilities. One faculty member (2004) noted that one of the greatest challenges lay in "students who do not have very basic math skills." Others said that efforts to infuse data analysis into course instruction were hindered by "student background" (2006) and that "not many students are quantitatively oriented; these skills need to be stressed more" (2004).

Quite a few faculty also pointed to high levels of math anxiety as well as antagonism toward quantitative instruction in sociology classes. As one respondent (2006) wrote, "Many [students] seem fearful of this [data analysis]." Another (2004) wrote that "negative attitudes" hindered efforts to incorporate data analysis into the curriculum. Interestingly, several faculty also stressed that by the time Lehman students graduate, they should have a high degree of comfort and patience in working with data. A few respondents expressed the view that many Lehman students are not motivated to engage in data analysis. For example, one (2006) said that students would prefer to be "spoonfed information rather than to analyze problems on one's own." Another (2006) indicated that students' poor attendance, sporadic class participation, and reluctance to learn presented the greatest challenges.

Variation in the students' preparation and experience was also identified as a major barrier. One faculty member (2006) wrote, "The department does not have a structured curriculum that ensures that students learn different quantitative skills at different levels—every faculty member approaches IDA differently so the skills of students vary tremendously." Another reported (2006) that "inconsistency in early classes" was a problem, while another (2006) pointed to "differences among students in their math abilities and computer experience."

Technology was also a barrier to the success of the program. Several faculty reported that before the Sociology Program purchased two mobile computer labs in 2005, inadequate access to computer technology hindered their efforts to promote active learning. As one wrote (2004), "The greatest challenge facing me is limited access to computer rooms. I could do a lot more if I had better and easier access to computer labs." Indeed, technical barriers associated with the computer labs were identified by many faculty as significant obstacles. Even after the purchase of the labs, problems remained. One respondent (2006) stressed that "computer labs need to be easier to access," and another (2006) identified the "reliability of hardware and software" as a significant problem.

Although many faculty are taking advantage of the new mobile computer labs, institutional barriers work against the effective use of this technology. As one faculty member (2006) stated, "Using the laptop computers in the classroom takes a lot of time and preparation and this approach to teaching isn't necessarily rewarded, so it is easier for faculty to do other things that are more likely to be positively received and lead to better [student] teaching evaluations (show movies, have classroom discussions)." This sentiment is consistent with Conklin's (1978) research showing that academic change is frequently impeded by deeply held prestige factors that seem to hinder new methods of instruction. Moreover, faculty who engage students in active learning may find that such an approach requires a strong individual commitment, since it is often not fully understood or supported at the institutional level (Conklin 1978).

Class size was another problem noted by the faculty. As one respondent (2006) wrote, "Class size is . . . too large and teaching loads are too heavy to invest adequate time to teach students necessary skills." Others reported that their classes were too large to use the computer labs. (The labs can accommodate 30 students, but many sociology classes at Lehman College are larger than that.)

Responses to the Alumni Survey

Experiences in the Sociology program. As noted earlier, 114 former students responded to the alumni survey. Of these, 36 alumni graduated before efforts to mainstream data analysis had been implemented, and 69 graduated after these efforts had begun. (Nine alumni did not indicate their year of graduation.) The demographics of the alumni respondents mirror those of the current Lehman students.

Sociology alumni almost universally stressed the importance of computer use and data analysis in both their educational careers and their post-graduation employment. More than 96 percent of alumni felt that analyzing data was either very important (78 percent) or somewhat important (19 percent) within the field of sociology. Among working respondents (85 percent of the alumni), 89 percent indicated that the use of computers was either very important (77 percent) or somewhat important (12 percent) in their work. Likewise, 71 percent of employed sociology alumni reported that working with data was either very important (47 percent) or somewhat important (23 percent) in their work. While alumni respondents felt strongly that data-related skills are important, a substantial minority were not wholly satisfied with the preparation they had received in college. Nearly 29 percent of alumni reported that the Sociology Program used computers "too little," and 25 percent reported that the Program incorporated too little statistical work and data analysis.

Respondents who graduated after the start of the IDA program are different from earlier graduates in several important respects, however.[4] For one thing, alumni who graduated in 2006 or 2007 were more likely to have used computers (78 percent vs. 71 percent), read graphs or tables (77 percent vs. 67 percent), and analyzed data (61 percent vs. 54 percent) in their sociology courses (see Table 2). Likewise, those who graduated after the initiation of the IDA project were more likely to report that their sociology courses incorporated "about the right amount" of computer use (73 percent vs. 66 percent) and statistical/data analysis (75 percent vs. 61 percent).

Confidence in abilities. Perhaps not surprisingly, students who graduated in 2006 or 2007 also indicated higher levels of confidence in using computers, interpreting tables and graphs, and analyzing data. Moreover, alumni who had used computers in sociology courses (aside from the required methods course) were more likely to report that the sociology curriculum made use of computers to an appropriate extent and more likely to feel confident using computers. In much the same way, students who had experience reading tables or graphs in non-methods sociology courses were more likely to feel confident in their ability to interpret tables and graphs. Finally, students who had experience analyzing data were more likely to feel confident in their ability to analyze data (see Table 2).

The alumni survey did not gather information on the intensity of exposure to data analysis in sociology courses. (That is, the questionnaire asked only whether *any* data analysis had been incorporated into the students' courses.) It is likely, however, that recent graduates had more frequent data analysis assignments as well as exposure to a broader array of data analysis activities.

Suggestions for Improving the Teaching of Quantitative Concepts and Skills.

The final question on the alumni survey (and the only one that allowed respondents to provide open-ended feedback) asked, "In this last space, we invite you to give us any comments about your experiences at Lehman or since you left Lehman. Do you have any ideas that would help us to improve the sociology program?" In all, 57 alumni answered this question. The alumni respondents' suggestions for improvement support three main recommendations: (1) provide more opportunities for students to engage in active learning and equip them with practical skills—especially quantitative and computer skills, (2) establish a stronger link between the classroom and the workforce by offering internships and by sponsoring guest speakers with sociology degrees, and (3) expand course offerings, especially for evening and weekend students. Of course, the first and second recommendations are grounded in the sociology curriculum, while the third is at least partially an

Table 2. Alumni Responses to Quantitative Literacy Questions[a] (%)

Experience with data analysis, by year of graduation	2001–2003[b]	2004–2007[c]	All Years
Used computers in sociology class(es)	71.4	77.5	72.3
Read graphs/tables in sociology class(es)	66.7	76.9	73.6
Analyzed data in sociology class(es)	54.3	61.2	59.1
Do you feel that the Lehman Sociology Program uses computers . . .	**Too little**	**About the right amount**	**Too much**
Graduated 2001–2005	30.6	66.1	3.2
Graduated 2006–2007	27.5	72.5	0.0
Used computers in sociology class(es)	25.0	72.5	2.5
Didn't use computers in sociology class(es)	38.7	61.3	0.0
All respondents	28.8	69.4	1.8
Do you feel that the Lehman Sociology Program incorporates statistics and data analysis . . .	**Too little**	**About the right amount**	**Too much**
Graduated 2001–2003	33.3	61.1	5.6
Graduated 2004–2007	20.6	75.0	4.4
Analyzed data in sociology class(es)	24.6	70.8	4.6
Didn't analyze data in sociology class(es)	26.7	68.9	4.4
All respondents	24.8	69.9	5.3
How confident do you feel about your ability to use a computer?	**Very confident**	**Somewhat confident**	**Not very confident**
Graduated 2001–2005	75.9	20.7	3.4
Graduated 2006–2007	78.9	21.1	0.0
Used computers in sociology class(es)	82.2	16.4	1.4
Didn't use computers in sociology class(es)	70.0	26.7	3.3
All respondents	78.1	20.0	1.9
How confident do you feel about your ability to interpret tables and graphs in newspapers and magazines?	**Very confident**	**Somewhat confident**	**Not very confident**
Graduated 2001–2003	50.0	41.7	8.3
Graduated 2004–2007	59.4	36.2	4.3

(continued)

Table 2. (continued)

How confident do you feel about your ability to interpret tables and graphs in newspapers and magazines?	Very confident	Somewhat confident	Not very confident
Read tables or graphs in sociology class(es)	58.0	38.3	3.7
Didn't read tables or graphs in sociology class(es)	48.3	37.9	13.8
All respondents	55.3	38.6	6.1
How confident do you feel about your ability to analyze data, such as calculating a mean or percentage?	**Very confident**	**Somewhat confident**	**Not very confident**
Graduated 2001–2003	36.1	44.4	19.4
Graduated 2004–2007	42.0	52.2	5.8
Analyzed data in sociology class(es)	40.0	55.4	4.6
Didn't analyze data in sociology classes	40.0	42.2	17.8
All respondents	40.4	50.0	9.6

Note: Questions about reading graphs/tables, using computers, and analyzing data refer to whether students had these experiences *outside* the core methods courses (Sociological Analysis and Research Methods).
a. The computer-related questions compare alumni who graduated before the installation of the computer lab (2001–2005, $n = 63$) with those who graduated afterward (2006–2007, $n = 42$). All other questions compare alumni who graduated before the initiation of the Integrating Data Analysis (IDA) program (2001–2003, $n = 36$) with those who graduated afterward (2004–2006, $n = 69$). Nine respondents did not indicate their year of graduation.
b. 2001–2005, for the computer use question.
c. 2006–2007, for the computer use question.
Source: 2007 Lehman College Sociology Alumni Survey.

administrative recommendation. For the present analysis, we focus on the alumni comments that addressed quantitative reasoning skills.

Nearly a third of the written comments addressed the need for active learning opportunities and quantitative/computer skills. This need was expressed most strongly by students who had graduated prior to the initiation of the IDA project (2001 to 2003) and/or prior to the installation of the two computer labs in 2005. As one 2003 graduate wrote, "I think every sociology course should have lab time. I believe that incorporating computers in the beginning is vital to the students." Similarly, a group home manager and 2001 graduate recommended, "Implement more use of the computer. In today's technological age, computer is being utilized in most aspects of the work force." An entitlement coordinator who had graduated in 2002 suggested that the sociology curriculum should "incorporate more programs on the computers using the latest programs such as Excel, PowerPoint. . . . These programs are in great demand." Finally, a manager and 2002 graduate reflected, "The courses I took in the later years were very relevant to work, however, more computer related classes would be a plus." Likewise, a teacher from Bangladesh who had graduated in 2001 remarked, "Yes, please teach the students hands on experience not just theories on the book. Have full time professor to teach who had first hand experiences."

Alumni who had graduated after the implementation of the IDA project expressed similar needs, although recent graduates were generally more satisfied. For example, a 2007 graduate enrolled in

a master's program in education wrote, "I would have to say that the sociology program is well structured but there should be more computer usage to explore society's statistics and other material that relates to the class." Similarly, a foreign-born legal secretary who had graduated in 2006 wrote, "I have had a great experience in majoring in Sociology at Lehman. [It's] given me an insight to the varied fields that I could go into. However, in regards to making calculations such as percentages, I wish I had more confidence and practice during my college years." Likewise, a caseworker who had graduated in 2006 wrote, "I think that the use of more computers will enhance the sociology program," and an African American graduate working as a lead teacher suggested that the sociology curriculum could be improved through "more hands on and real life activities bring in companies representatives have them demonstrate business graphs and data analysis." A handful of alumni lamented that they had experienced some difficulty finding jobs after graduation. Several indicated that more internships and greater opportunities for active learning (including computer use) would have better prepared them for the job market.

DISCUSSION AND CONCLUSIONS

In spring 2009, the Association of American Colleges and Universities (AAC&U) developed a quantitative literacy rubric that includes six skill areas and four levels of competency. (See the first six rows of Table 3.) This rubric does not link the four levels of competency to the four years of college. Rather, the levels are constructed on a scale in which level 4 indicates exemplary skills, 3 indicates strong skills, 2 indicates limited skills, and 1 indicates very weak skills. Although the QL rubric developed by the AAC&U is not specific to sociology, the kinds of skills that students and faculty identified as important overlap closely with the areas of quantitative literacy enumerated by the AAC&U. Three additional key areas—the ability to identify/generate data, computer literacy, and research design—were identified as central to our QL efforts. Consequently, those three additional areas have been incorporated into the expanded QL rubric shown in Table 3.

Table 3 provides a useful starting point for sociology departments interested in improving the teaching of quantitative skills and quantitative reasoning in the undergraduate major. As shown in the rubric, QL is multifaceted and includes several distinct dimensions. In strengthening students' QL skills, the more advanced sociology courses should be working toward a sophisticated understanding of each of the areas identified in Table 3. Of course, successful QL instruction requires that departmental faculty work together to ensure that courses provide complementary QL skills and that upper-division courses reinforce and expand upon material taught in the lower-level classes. For example, an introductory sociology class might teach students how to calculate the average income, age, etc, of the population, and a more advanced class on social stratification might teach students how to track down relevant data and analyze variations by age, gender, and race. Markham (1991), asserting that quantitative literacy should be a central component of introductory courses in sociology, suggests a number of specific techniques that may be helpful: (1) be willing to devote a significant portion of the course to teaching about methods of research; (2) use high-quality materials; (3) homework is essential; (4) take it slow; (5) integrate frequent discussion of methodological topics and issues in substantive discussions; (6) a few extended examples of research studies are better than a great many mentioned in passing; and (7) use computer exercises judiciously. If faculty embrace active learning approaches to quantitative literacy, students should achieve a level of versatility that ensures personal and professional success by the time they complete their undergraduate experience.

At the same time, there are numerous obstacles to adopting or expanding a QL approach. Faculty resistance is one of the most significant barriers. This is often related to insufficient resources, lack of comfort with QL instruction, or insufficient support (material and otherwise) for such efforts. In order for sociology majors to graduate with a full range of QL skills, faculty need to work together to ensure that particular skills are emphasized and reinforced at each level of the curriculum. In many sociology departments—especially those that have many adjunct faculty and high faculty turnover—this kind of curriculum is hard to implement and sustain. Many faculty are familiar with students' aversion to quantitatively oriented instruction, and at least one faculty respondent admitted that it is generally more cost-effective to employ other teaching approaches that are less

Table 3. Quantitative Literacy Rubric

	4 (Exemplary skills)	3 (Strong skills)	2 (Limited skills)	1 (Very weak skills)
Interpretation: Ability to explain information presented in a mathematical *form* (e.g., equations, graphs, diagrams, tables, words).	Provides sophisticated explanations of information presented in mathematical form.	Provides accurate explanations of information presented in mathematical form.	Provides somewhat accurate explanations of information presented in mathematical form, but makes minor errors.	Attempts to explain information presented in mathematical form, but makes major errors.
Representation: Ability to convert relevant information into various mathematical forms (e.g., equations, graphs, diagrams, tables, words).	Skillfully converts relevant information into a *mathematical form* appropriate for the task at hand.	Competently converts relevant information into a mathematical form that is usually appropriate for the task at hand.	Is developing the ability to convert relevant information into mathematical form, as appropriate.	Displays difficulty in converting relevant information into appropriate mathematical form.
Calculation	Attempts and successfully completes all appropriate calculations for the task at hand.	Successfully completes appropriate calculations attempted.	Appropriate calculations for the task at hand are not attempted or are not completed uniformly and successfully.	Appropriate calculations for the task at hand are unsuccessful and/or not attempted.
Application/analysis: Ability to make judgments and draw appropriate conclusions based on the quantitative analysis of data, while recognizing the limits of this analysis.	Engages in a process that uses the quantitative analysis of data as the basis for sophisticated judgments, drawing insightful *conclusions from this work.*	Engages in a process that uses the quantitative analysis of data as the basis for competent judgments, drawing reasonable conclusions from this work.	Is developing the ability to engage in a process that uses the quantitative analysis of data as the basis for judgments, drawing plausible conclusions from this work.	Attempts to engage in a process that uses the quantitative analysis of data as the basis for judgments, attempting to draw conclusions from this work.
Assumptions: Ability to make and evaluate important assumptions in estimation, modeling, and data analysis.	Explicitly describes assumptions and provides compelling rationale for why each assumption is appropriate. Shows awareness that confidence in final conclusions is limited by the accuracy of the assumptions.	Explicitly describes assumptions and provides compelling rationale for why each assumption is appropriate.	Explicitly describes assumptions.	Attempts to describe assumptions.

(continued)

Table 3. continued

	4 (Exemplary skills)	3 (Strong skills)	2 (Limited skills)	1 (Very weak skills)
Communication: Expressing quantitative evidence in support of the argument or purpose of the work (in terms of what evidence is used and how it is formatted, presented, and contextualized).	Use of quantitative information markedly enhances the argument or purpose of the work.	Use of quantitative information enhances the argument or purpose of the work.	Use of quantitative information supports the argument or purpose of the work.	Use of quantitative information weakly supports the argument or purpose of the work.
Identify/generate data: Ability to identify or generate appropriate information to answer questions or identify problems.	Clearly understands and identifies what data resources are needed to answer social science questions.	Can usually track down or generate data that are appropriate to answer the question at hand.	Can track down or generate data that may be generalized, but are often not appropriate for question at hand.	Attempts to answer research questions based on personal or anecdotal information.
Computer literacy: Ability to track down and analyze data using a variety of Internet and software tools.	Can easily find data and analyze it using multivariate techniques with a variety of Internet and software programs (e.g., SPSS, Excel, etc.).	Can undertake more complex computer tasks, but does not fully understand the range of computer resources available or how to use them.	Can use computers and software programs to obtain data and undertake simple data manipulations.	Is familiar with how to use a computer, but uncertain how to track down data or use any software programs to analyze data.
Research design: Understanding of the fundamental elements of the research process (generate hypotheses, collect data, operationalize variables, specify models, analyze data, interpret results, and draw conclusions).[a]	Understands how to engage in and critique quantitative social scientific research studies at a very sophisticated level.	Clearly understands the key elements of research design, but makes minor methodological or logical errors in undertaking and critiquing research studies.	Can identify the key stages of the research process, but does not understand how to most effectively go about undertaking or critiquing research.	Does not understand or recognize the fundamental elements of research design.

Note: The quantitative literacy (QL) dimensions represented in this rubric are consistent with the skills that Lehman faculty and students identified as being important for students enrolled in sociology courses. Rows 1 through 6 are taken from the Association of American Colleges and Universities (AAC&U) rubric (AAC&U 2009). This table also draws on a similar rubric developed by Alter et al. (2009).

a. Although research design combines elements of many of the QL skills previously outlined, it is treated as a separate category here since it represents a synthesis of many different skills.

cumbersome and more certain to result in positive teaching evaluations.

Research shows that the mainstreaming of QL throughout the sociology curriculum has a positive impact on students' interest in data analysis as well as their preparedness for postgraduate education and careers (see e.g., Wilder 2009). Ultimately, however, even plans that are well supported by evidence require a strong institutional commitment that is accompanied by adequate resources and pedagogical training. In short, faculty need to work together to develop a successful curriculum, and the barriers that discourage QL instruction must be removed. Among other things, an administrative commitment to reliable technology and user support must be established. The departmental or institutional I.T. infrastructure should include well-trained technical support staff who respond to problems (including software, hardware, and Internet connectivity issues) promptly and effectively. Moreover, faculty must be rewarded for developing QL assignments and successfully teaching students how to think quantitatively, and teaching loads and class sizes must be conducive to active learning. Further research will need to assess the importance of each of these variables in contributing to the success of QL initiatives and to evaluate whether their impact varies by institutional characteristics (public vs. private, etc.). It would also be helpful to know whether faculty and student attitudes toward QL vary systematically at different kinds of colleges and universities.

One barrier to computer-enhanced instruction is the high initial cost (Raymondo 1996). Once purchased, computer installations require significant administrative and technical support. Indeed, "the line between empowering computer users and unleashing their creative potential on the one hand, and utter chaos on the other, is a fine one" (Bills and Stanley 2001:161). This study suggests that the line can be crossed in both directions—that at Lehman College, the use of computers has empowered students and faculty but has also generated considerable frustration due to technical problems.

It is worth emphasizing that negative perceptions about students' resistance to quantitative data analysis may sometimes be misplaced. While individual students may be resistant to QL instruction, those who participated in this study expressed overwhelming support for active learning and quantitative course instruction, particularly if it involved the use of computers. In fact, when asked about their experiences working with computers in sociology courses, at least 80 percent of respondents who provided written feedback expressed positive sentiments. Sociology alumni were remarkably consistent in their recommendations to provide more opportunities for active learning and to equip students with better quantitative and computer skills.

Some faculty may have good reason to employ pedagogical strategies that focus on non-quantitative skills such as textual analysis and public speaking. Of course, these skills are vital components of the sociology curriculum.[5] We should also note, however, that an emphasis on quantitative literacy can be used to strengthen students' understanding of the course materials. The teaching of quantitative software, for example, is not an end in itself, but a way to encourage students to think about the world. For instance, when presenting raw data in which each row (each case) is an individual or household, we might discuss whether other groups, corporate bodies, geographical areas, or events might be more appropriate as units of analysis.

Finally, there is considerable variability in students' backgrounds and preparedness for quantitative work. It is therefore not surprising that there remains a strong quantitative literacy gap among students enrolled in sociology courses (Wilder 2009). As Steen (2004:1–2) reports, "Most U.S. students leave high school with quantitative skills far below what they need to live well in today's society." This is a significant challenge, since the focus on QL in the sociology curriculum should not be on teaching remedial mathematics, but on using quantitative techniques to understand social phenomena. At Lehman College, the recognition that some students have very weak quantitative backgrounds has led to interdisciplinary efforts to institute a QL requirement within the General Education curriculum.[6] Sociology has been recognized as a key discipline in which the QL requirement may be met.

Other approaches may also be valid. For example, strict requirements for remedial work may help avoid the difficulties associated with teaching students who are mathematically disadvantaged. At Wellesley College, for example, all first-year students are required to take a QL placement test. If their scores do not meet minimum standards, they must enroll in a remedial course. At the same time, however, the impact of remedial math courses on subsequent

performance remains inconclusive (Lagerlöf and Seltzer 2008; Pozo and Stull 2006). Further research should assess the effectiveness of remedial math courses on students' performance in the sociology curriculum, particularly in programs where there is a strong emphasis on quantitative literacy. In the absence of a numeracy requirement for incoming students (and appropriate remedial courses), there are quite a few freely available resources that may be used to improve students' mathematical skills.[7]

Both faculty and students recognize the importance of providing sociology students with fundamental quantitative and computer skills. Moreover, the overwhelming majority of students enrolled in sociology courses are passionate about active, computer-based learning and sincerely want to acquire fundamental quantitative and research skills before they graduate. Sociology programs wishing to develop their QL programs may be well advised to follow the ASA's guidance concerning "a well-considered, sequenced mastery of skills and knowledge" (McKinney et al. 2004:i) based on the rubric shown in Table 3. That is, further efforts should be devoted to the development of a well-sequenced sociology curriculum that clearly specifies the quantitative literacy outcomes expected of students at each course level.

NOTES

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1. A fourth question, "Do you have any suggestions for strengthening the Sociology program's approach to teaching students how to work with data?," has been excluded from this discussion since it was felt to be too specific to Lehman College.
2. Each faculty member was given one questionnaire that included these two attitudinal questions. (That is, one questionnaire with the attitudinal questions was placed in the departmental mailbox of each instructor.) At the same time, faculty were instructed to fill out a separate questionnaire for every class they taught, although the additional questionnaires (placed below the faculty mailboxes) did not include the two attitudinal questions. The first page of each faculty questionnaire included a list of every sociology course and section taught that semester. Faculty were instructed to check off the course(s) and section(s) for which they were answering the questionnaire. (If an instructor taught multiple sections of the same course, he or she was instructed to complete only one questionnaire, but to indicate all the sections taught.)
3. Several strategies were employed in an attempt to maximize response rates. For example, the surveys were accompanied by a friendly cover letter signed by four faculty in the department. (The letter indicated that Lehman faculty wanted to know what the alumni were doing and what they thought, and that regardless of whether they participated in the study, we hoped they were doing well and would stay in touch with the Sociology Program.) The surveys were mailed using first-class postage, the questionnaires were accompanied by return envelopes with pre-applied stamps, and a follow-up postcard was sent to respondents three weeks after the mailing of the original survey. Many of these strategies, including university sponsorship, first-class outgoing postage, postcard follow-up, and stamped return postage (rather than business reply mail), have been shown to significantly increase survey response rates (Díaz De Rada 2005; Fox, Crask, and Kim 1988; Nederhof 1983; Ziegler 2006). Some information that might have increased response rates (e.g., telephone numbers and email addresses) was not available at the time of the survey, and budgetary constraints limited our ability to expand our efforts. At the same time, it is noteworthy that strategies such as monetary incentives are likely to elicit favorable (biased) survey responses (James and Bolstein 1990).

   Díaz De Rada (2005) reports that researchers can typically expect a response rate of 25 percent from an initial mailing, and it is unclear what accounts for our relatively low response rate. At the same time, the response rate for our alumni questionnaire is roughly equivalent to that of other CUNY mail-in surveys that were carried out during the same time period. For example, the 2006 CUNY Student Experience Survey yielded a response rate of 26 percent. That survey, mailed in April 2006, included a postcard reminder, a second copy of the survey, and an additional postcard reminder (City University of New York Office of Institutional Research and Assessment 2006). It is possible that the demographic characteristics of the CUNY student population do not lend themselves to high survey response rates, since many students and alumni lead extremely busy lives.

4. As previously noted, efforts to mainstream data analysis into the sociology curriculum began at Lehman in the fall of 2004, following a 2003 summer Integrating Data Analysis (IDA) workshop at the University of Michigan. The two new computer labs were not purchased until the summer of 2005, and several faculty started mainstreaming computer use in their elective classes during the 2005–2006 academic year. Questions relating specifically to computer use are therefore disaggregated by whether the respondent graduated during the 2001–2005 or 2006–2007 period.
5. An ASA task force recommended that students majoring in sociology should be required to study, review, and demonstrate understanding of (1) the discipline of sociology and its role in contributing to our understanding of social reality, (2) the role of theory in sociology, (3) the role of evidence and qualitative and quantitative methods in sociology, (4) the technical skills involved in retrieving information and data from the Internet and using computers appropriately for data analysis, (5) basic concepts in sociology and their fundamental theoretical interrelations, (6) how culture and social structure operate, (7) reciprocal relationships between individuals and society, (8) the macro/micro distinction, (9) an in-depth understanding of at least two specialty areas within sociology, and (10) the internal diversity of American society and its place in the international context (McKinney et al. 2004).
6. Students enrolled in associate and baccalaureate programs at CUNY are required to pass a proficiency examination that tests skills in two areas: (1) analytic reading and writing and (2) analyzing and integrating material from text and graphs. At Lehman, approximately 27 percent of test-takers failed the CUNY Proficiency Examination (CPE) in 2008. The overwhelming majority of those who failed did poorly on the second part of the examination.
7. See, for example, Math.com (http://www.math.com/homeworkhelp/EverydayMath.html) and the pre-algebra tutorials offered by the Visual Math Learning Web site (http://www.visualmathlearning.com/). The Webmath site (www.webmath.com) enables users to solve math problems in real time and explains how to arrive at the answers.

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BIO

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