Computer Based Training in Quantitative Reasoning and Analysis

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ABSTRACT

The Sociology Quantitative Research Laboratory (SOCQRL), the Chicago Collar County Project (C3), and the Interactive Tutoring in Quantitative Reasoning and Analysis (ITQRA) projects combine to create an environment for undergraduate training in social science methodology. By incorporating more computer-based learning instead of lectures, the student is forced to become an active learner. The computer based, interactive tutors for QRA training transfer the presentation of material from lecture formats onto the computer with the added capability of tutoring feedback. The software emphasizes conceptual learning, interactive learning, individualizes the pace of instruction, and generates tutor-like feedback. The computer laboratory (SOCQRL) provides a physical and virtual site for focused QRA training (visit SOCQRL's homepage (www.socqrl.niu.edu). This paper discusses the QRA curriculum, describes the lab setting and functions, outlines some features of the interactive tutors being developed, describes how the Chicago Collar County Project is used, reviews the types of assignments given, and gives a preliminary, candid evaluation of successes, failures, and problems of instituting this pedagogical approach at N.I.U. The four course QRA curriculum taught by Cappell is built upon complementary elements of cognitive learning principles: contextual learning, conceptual mapping that leads to building schema, critical thinking, the integration of technique and conceptual learning, study-in-depth, and active learning.

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1. Overview

The computer lab and its server, dedicated exclusively to sociology students, has reorganized how I teach quantitative methods. Students spend far more time actively pursuing knowledge, declarative or content knowledge, as well as operational and procedural knowledge. Nearly all of the content delivered in each course is available in digital form: from preliminary lecture outlines, more fully developed lecture notes, to interactive software tutorials; from assignments to simulations, programs, and feedback on how to complete the exercises. The scheduling control we have over the use of lab means that courses can reserve the lab for a fixed period each week; currently about two-thirds of the instructor-student contact hours are in the lab environment. In the upper-level courses, even more time is allocated to lab based instruction. Staffing the lab with sociology graduate students and advanced undergraduates interested in methodology allows the lab to be staffed with personnel who are trained in the software as well as the pedagogical objectives and content of the courses. Students can visit the lab at any hour it is open and expect informed assistance from the lab staff. The courses are not designed as "distance learning" courses, although much of the simple, superficial transfer of information can occur electronically. The "active learning" is achieved mostly by students working at the computer as instructors and assistants guide their training as they work through the exercises. The interactive tutorials being developed will be distributed via CDROM, over the internet, as well as remaining available over the local area network.

2. Pedagogical Foundations

Before describing some of the concrete components of the courses in my QRA curriculum, I want to illustrate briefly how the pedagogical approach I have adopted in my training sequence rests upon several insights from cognitive learning theory and instructional design.

<u>Study-in-Depth</u>
Specialized training in any area must rest upon a core of general knowledge, must spiral toward a full understanding of the material at the conceptual as well as the practical levels. The proliferation and increasing sophistication of social science methodologies require more than a passing appreciation of the most elementary methods of data analysis. Social science disciplines, if they are to be more relevant than merely a component in the "general education" curriculum need to give their majors the opportunity to learn how to generate valid substantive knowledge in any field, and not just appreciate it when they see it.

The QRA curriculum is organized in a spiraling sequence through the modeling approach. The substantive spiral centers around the Chicago Collar County Project, an annual survey of the quality of social life in the Chicago suburbs which addresses a variety of mainstream research areas: sociology of work, family, community, well-being, political sociology. Introductory level methods courses use the survey results as examples and exercises; graduate level students write original theses based on questions they can add to the survey.

<u>Breadth-of-Study</u>
Specialized and technical knowledge is made more useful when it is connected to broader themes, issues, and substantive knowledge in the discipline. The formal qualities of methodological training need to be connected to important substantive issues. Connections need to be made so students can relate relevant information from different courses or learning settings.

The QRA curriculum is based upon problem issues across a range of major substantive concerns: crime, inequality, individualism, multiculturalism, for example.

<u>Critical Thinking</u>
In a world full of undifferentiated information, where one homepage appears as valid as the next, *critical thinking*—the ability to sift through the deluge of raw information and sort out the more

valid from the less valid pieces—has become crucial for one's civic as well as intellectual life. The foundation of critical thinking is the scientific method and logic.

The QRA curriculum begins with a general, liberal arts approach to critical thinking, and then through the modeling approach, emphasizes the increasingly complex development of testable, working models of social reality. The rubrics used in the modeling approach to learning research methods, “Conceptual Path Diagrams” and “Conceptual/Variable/Hypothetical Language” (CVHL) integrate nearly all of the general aspects of critical thinking and social research.

<u>Active Learning</u>

The objective of building higher-order thinking skills can be facilitated with the application of technology; hands-on or *active learning* is the most efficient mode of instruction (Bradstreet, 1996; Snee, 1993). Students can see the products of their understanding, properly constructed tables, well-designed surveys or coding forms used for analysis of extensive text.

The QRA curriculum shifts the instructional time (about two-thirds of the contact time in my classes) to the laboratory where students acquire concrete computer skills that embody the conceptual material being learned. The software for the course also requires the student to be a more active learner when simply acquiring content than does the traditional lecture format. But the lab exercises reinforce the conceptual learning by showing students how to use statistical software to achieve practical research results. From the very start, students learn how to do social research and not to just appreciate it.

<u>QRA Learning Objectives and Associated Hurdles</u>

The discipline of mathematics has identified four major cognitive transitions that lead to "mathematical reasoning":

1. The transition from arithmetic to algebra: culminating in the ability to think symbolically and to manipulate symbols to solve problems.
2. The transition between algebra and geometry: culminating in the ability to think logically. Logical proof replaces calculation.
3. The transition from technique to theory: culminating in the ability to create proofs. Thinking shifts from a focus on solving a problem to creation of proofs of a more general nature.
4. The creative transition culminating in the ability to pose new problems needing solution. (AAC, 1991: Ch. 5: Mathematics).

Jones et al. (1995) used the Delphi method to survey a panel of experts that identified a set performance skills comprising an independent dimension of statistical critical thinking. In their broad analysis of critical thinking abilities for liberal arts majors, a fifth factor emerged from their analysis, which they labeled: Statistical Argumentation Skills (presented below with their factor loadings in parenthesis):

> “Employ graphs, diagrams, hierarchical trees, matrices, and models (.77).
> Apply appropriate statistical inference techniques (.69).
> Assess statistical information used as evidence in an argument (.65).
> Use multiple strategies in solving problems (.55).
> Determine if a conclusion is based on an adequate/representative sample (.54).
> Determine how data might confirm or challenge a conclusion (.53).
> Assess how well an argument anticipates and responds to objections (.48)
> Determine and judge the strength of a causal reasoning argument (.41).”
> (Jones et al., 1995)

The parallel learning transitions (and associated hurdles) found in the quantitative/statistical thinking used in social science can be stated in equally general goal-oriented terms: What are the components of applied quantitative/statistical reasoning we want students to learn? I propose that contemporary treatment of undergraduate social science research methods should integrate the more general set of liberal arts critical thinking skills and QRA; to wit:

1. Critical Thinking Skills, the ability to think logically and to assess the quality of evidence. Identify logical fallacies and well-posed questions amenable to scientific inquiry. Assess the natural process, the sampling process, the measurement process that generate the data.
2. Formal, Symbolic Thinking Skills. Translate text and ideas into symbols, read algebra, create and manipulate symbolic models, concrete to formal reasoning.
3. Conceptual/Variable/Hypothetical Language (CVHL). Think in terms of hypothetical implications, scientific method, causality, use concepts of counterfactuals, sample space.
4. Stochastic Reasoning Skills. Understand probability, variation, uncertainty, sample space.
5. Statistical Modeling Skills. Create and evaluate statistical models representing a current condition or process. Apply useful statistical summary measures to descriptions and explanations: correlation and regression coefficients, conditional probabilities, odds, summary measures of association.
6. Inferential Reasoning. Think inferentially, to recognize the limits of generalization. The basic gamut of inferential statistics, sampling distributions, confidence intervals, p-values, hypothesis testing. (see also: AAC, Ch. 5, 1991; Browne, N., and Keeley, S., 2001; Chase, 2000; Jones, 1995; Mallows, 1998).

3. Sociology Quantitative Research Laboratory [SOCQRL]

The Quantitative Research Laboratory houses the quantitative analysis resources in the Department of Sociology. SOCQRL is a physical laboratory that contains 25 networked computers and a dedicated server that stores hundreds of data files and several statistical software applications. Anywhere from 6 to 8 graduate students are employed by SOCQRL to support the teaching of quantitative approaches and to support faculty and graduate student research. The lab is kept open for general access by sociology students when it is not reserved for instruction. A mobile projector system is used to display the instructors computer screen during sessions. The physical layout has a seminar table in the center of the room and hexagonal tables located around the periphery of the room.

SOCQRL delivers a variety of statistical software to the student: MICROCASE, EXCEL and ACCESS, SAS, SPSS, and various advanced specialized packages, e.g. LISREL, AMOS, HLM, and ARCVIEW. Some sections of Introductory Sociology require a research exercise where students examine a simple bivariate hypothesis; in these exercises students use MICROCASE. In the 300 level research courses, students also begin with MICROCASE and progress to EXCEL and some elementary SAS. Upper level courses rely on SAS and SPSS.

The physical facility is certainly the foundation of the QRA curriculum. N.I.U. permits additional student fees to be collected by specialized labs housed and managed by departments. This arrangement funds the entire operation. The lab is generally kept open until 10pm, and free workshops teaching the software available are offered to students throughout the term.

[Insert SOCQRL Picture]

4. Interactive Tutor Project

Cognitive Learning Rules

Recent research in cognitive science has produced several models of how complex symbolic material is learned. The Interactive Tutorials incorporate several learning strategies as part of the software design.

1. Attention Mobilization: Goal based learning motivates students by posing problems or arousing curiosity, providing a concrete substantive context to engage the learner. The tutorials try to motivate learning by grounding the training in substantively important and meaningful social science research topic (Context Learning);
2. Cognitive Mapping: Reasoning strategies are learned models built from linked concepts. A learned mode of reasoning invokes a cognitive map of related concepts. The tutorials aim for students to developing cognitive maps, literally, grow neural networks, that relate concepts to one another generating a schema for a fuller understanding of material (Relational Learning, creating Schema);
3. Review and Repetition: Material must be moved from working memory to long-term memory.
4. Transferred Learning: Context specific to general problem solving. Material must become part of the learner's active knowledge base, transferable. Generally involves Concrete to Formal Reasoning. Learning begins with the concrete, specific experiences and progresses to formal stages. Achieving generalized/transferred learning, i.e. an understanding that can be applied to novel problems and situations (Formal-Operational Learning, Transferred Learning) (Formal vs. Domain Specific Learning);
5. Chunking: Information needs to be presented in digestible amounts so it can be effectively processed and integrated in the learner's knowledge base;
6. Self-Paced Learning: the tutorials allow the student to move as slowly or as quickly as needed through the material;
7. Performance Learning: Linking conceptual learning to techniques (another aspect of Relational Learning, Performance Learning),
8. Self-Directed Learning: Involving the learner via interactivity and simulations;
9. Corrective Feedback: near immediate feedback that increases the probability that the material presented is placed in long-term memory (Interactive Tutoring);
10. Metacognitive Feedback: Learning is enhanced when learners become conscience of the learning strategies and styles that they are using. Corrective, directive, and evaluative feedback can increase the student's awareness of successful learning strategies used.

Some of these aspects of the interactive tutorial software being developed are discussed below. These programs are written using MACROMEDIA'S AUTHORWARE platform providing multimedia presentations, interactive tutorial feedback and evaluation, and tracking of student learning patterns and performance. MATHCAD, various statistical software packages – primarily SAS, ADOBE PHOTOSHOP, and MS OFFICE components are used to prepare content.

<u>Interactive Tutorial Architecture</u>

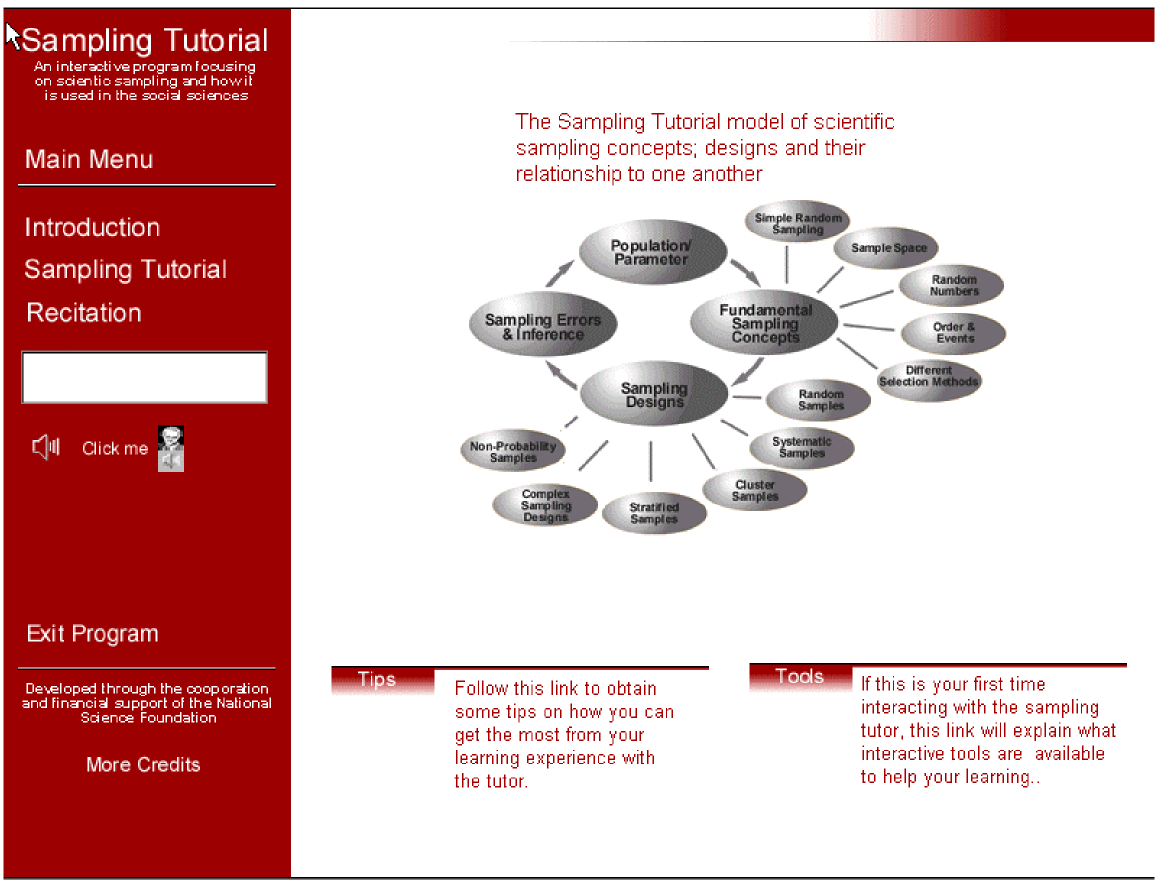
The Interactive Tutorials being developed try to implement several features of cognitive learning strategies. The graphic that serves as the navigation menu will be used to illustrate how a few of those outlined above are implemented as part of the tutorial's architecture.

The navigational menu used in the sampling tutorial emphasizes the relationship among the lessons.

Each lesson is designed to be a short to moderate length coherent chunk of material. A short interactive quiz that corrects misconceptions and allows the user to review the material appears at the end of each lesson.

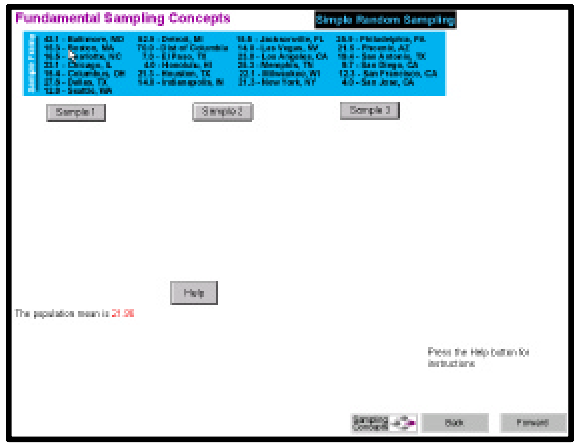
The tutorial uses interactivity, animation, simulations, some audio, but does not use video movies as part of the content. A glossary is always active, and key concepts are colored coded blue to indicate that a quick definition is available as a pop-up.

Note in the captured screen image below how these features are presented.

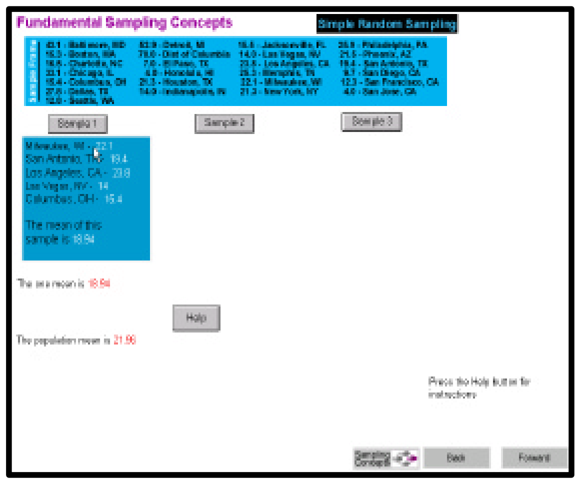


Random Sampling Simulation.

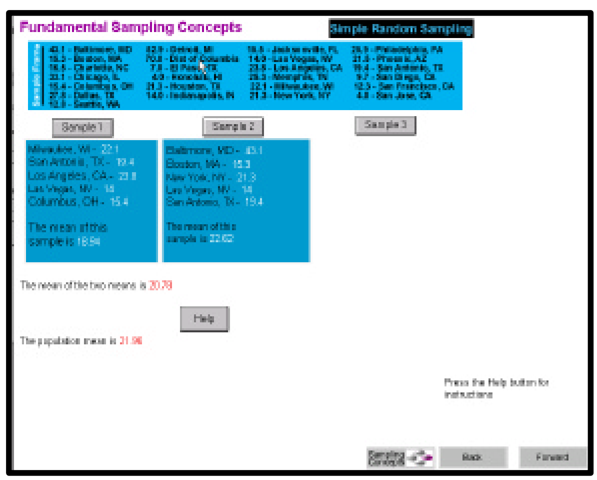
The interactive simulation built into the Sampling Tutor demonstrates to the student how a single sample is just one realization from the full set of possible samples that comprise the Sample Space.



The student can repeat the draw. Three sample draws are displayed on the screen as they are made; the student can compare the results of each sample estimate of the mean to each other and the population mean.

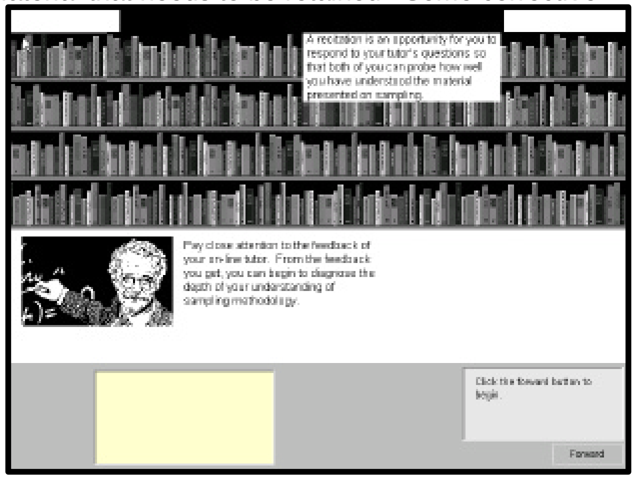


This is just one of several presentations that emphasize the idea of sample space, one of the most fundamental concepts needed by students to understand not only sampling variability, but inferences made from samples. The inference module is presented to students after the sampling module and begins with the concept of sample space.

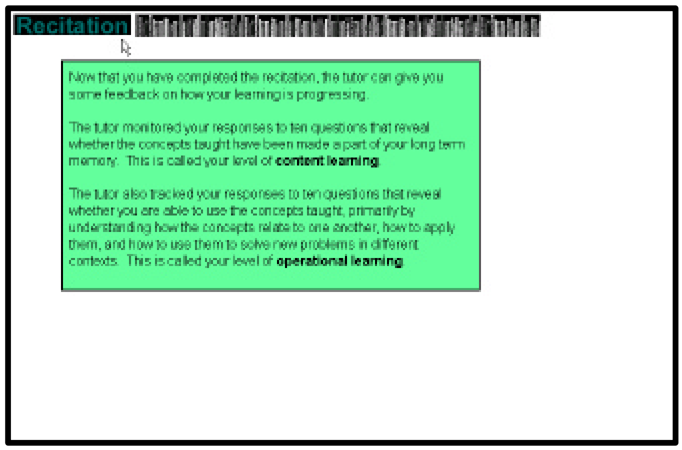


The Recitation

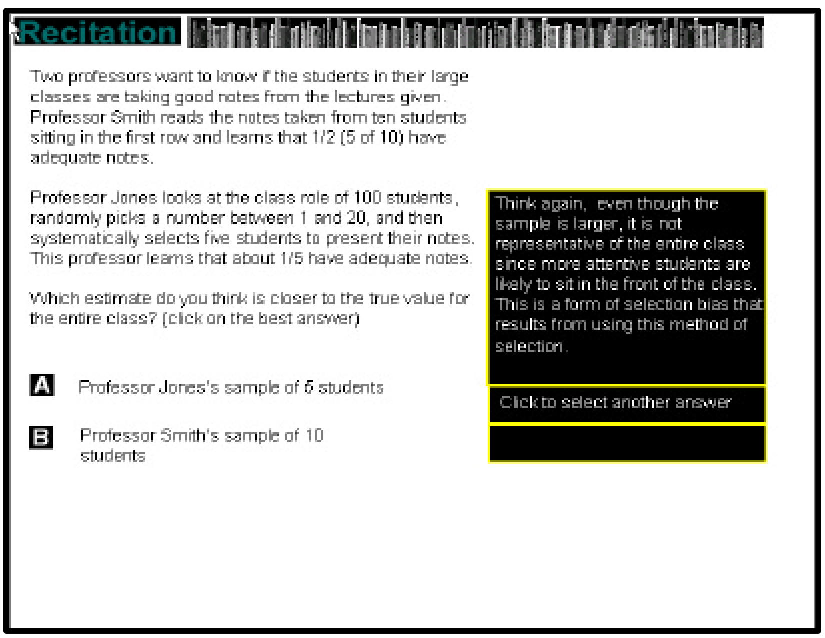
The tutor architecture being developed includes at the end of each section a short quiz that helps the student to review the most important material that needs to be retained. Some corrective information is provided about their responses. At the end of the entire module, a longer recitation section is included; currently in the sampling tutorial, a randomized set of 25 questions is provided. The randomization allows the student to repeat the recitation several times.



The recitation also provides some metacognitive feedback regarding the level of understanding the student has achieved at the conclusion. The questions embedded in the tutorial are classified according to the type of cognitive operation required to answer, simple recall of conceptual definitions, relational learning that shows appropriate links have been made among concepts, operational learning which indicates students can apply the knowledge learned to specific problem-solving demands.



As the student makes a choice, immediate corrective information is provided, and the student is prompted to select another choice. In the recitation section, the student is not navigated back to the sections of the lesson where the information needed to answer the question was presented. However, in the regular portion of the tutorial, when a student misses a review quiz question, the student is given the option of revisiting the portion of the lesson that is being examined.



5. Chicago Collar County Project

PURPOSE

The objectives of the Chicago Collar County Project (C3 Project) are first to create a hands on, professional quality research experience to undergraduate and graduate students as part of their training in social science research methods. Secondly, the project creates a useful knowledge base about the quality of life in the Chicago suburban ring, provides the public and interested private organizations, newspapers, and governmental agencies with up-to-date information regarding specific opinions and preferences of Collar County residents, and monitors social changes in the collar county area.

The project is primarily designed to integrate undergraduate and graduate instruction in research methods with substantive sociological research questions and expose students to a professional survey research operation (N.I.U.'s Public Opinion Laboratory) utilizing computer aided telephoning survey technology.

The information collected and analyzed is of two primary types. A community based database has been established and is updated annually. This database contains basic demographic and other interesting social and political information for each of the 308 communities located within the 10 county suburban and satellite city region surrounding Chicago, the project's definition of the area comprising the collar counties.

Each spring a survey of approximately 500 residents representing the inner collar county area is conducted using the computerized telephone interviewing facility at the Public Opinion Laboratory, Northern Illinois University.

Previous community based and national surveys inspired the 1991 and 1992 C-3 Surveys. Questions tap the broad domains of political, community, family, and occupational life. These first two C-3 Surveys collected information on local policy preferences and evaluations of community services, funding priorities, questions about household criminal victimization, family quality of life indicators, as well as work experiences and satisfaction. [See http://www.socqrl.niu.edu]

EDUCATIONAL COMPONENT

The C3 project has a strong educational component. The actual survey is run in conjunction with SOCI476A: Survey Methods. Students in this course help design the survey, learn some features of Computer Aided Questionnaire Design and interviewing, and write a preliminary report describing a section of the survey they worked on. The data are extensively analyzed by students in SOCI476D: Quantitative Analysis. More detailed and complex reports are written. Graduate students are invited to participate; to date 3 original M.A. theses have been written from the C3 Project, and dozens of senior level capstone papers were written before the requirement was abandoned by the department. The integration of a high quality scientific survey as a training vehicle for N.I.U. students improves the quality of undergraduate education in survey research and statistical analysis, provides students with a set of very practical research tools sought after by employers, and demonstrates the link between information taught in classes, obtained in research settings, and used by policy makers and businesses.

During the spring of 1991, the first prototype 1991 C3 Survey (n=321) was conducted by 15 students taking Sociology 476A: Survey Methods. The 1992 C3 Survey (n=545) was conducted by 28 students in two combined sections of Sociology 476A. The Spring 1999 C3 survey interviewed 478 respondents; and the Spring 2000 survey interviewed 545 respondents. Student interviewers used the Computer Aided Telephone Interviewing [CATI] system at the Public Opinion Laboratory. Each student authored an individual research report covering some aspect of the survey. In addition, codebooks tabulating the responses to each of the questions and synopsis reports were prepared by the project director and graduate assistants.

Students in other courses make use of the survey data; the data are made available in different formats: MICROCASE, which allows the data to be used in lower level courses to illustrate substantively interesting themes with a local flare; SPSS, and SAS. The data are used to demonstrate many statistical applications in SOCI377B: Introduction to Quantitative Analysis, and SOCI476D: Quantitative Analysis. Since the vast majority of N.I.U. students attended high school in the Collar Counties, they have a deeper interest in the survey and its results. A better learning environment is generated when students can examine hypotheses about social life in their own communities.

RESEARCH COMPONENTS OF THE C-3 PROJECT

Annual Survey

A survey is conducted in the early spring of each year. A self-weighting sample frame, stratified by county, using random digit telephone dialing, has been established. From this sample, the project attempts to complete 800 interviews. The sample, stratified by county, guarantees that respondents will represent a cross-section of residents from all six suburban counties and satellite cities surrounding Chicago: the inner ring - Suburban Cook, Dupage, Lake, Kane, McHenry and Will; the outer ring and satellite cities – Boone, Winnebago, DeKalb, and Kendall can be sampled as well, although a larger sample size is required.

Questions are designed to query suburban households about current issues as well as topics of long standing sociological interest. The survey will collect basic background and demographic information on households in the Chicago Collar County area, including such items as: household composition, occupations of adults in the household, levels of education, income, age, race, and gender. In addition, several question modules for the C3 Surveys are asked on a rotating basis:

1. Quality of community life including evaluations of the performance of local agencies, spending levels, and existing or pending problems as well as quality of environment;
2. Assessments of individual well-being and health (stress);
3. Experiences with crime;
4. Work experiences and satisfaction;
5. Quality of family life;
6. Quality of social interactions and networks;
7. Multicultural and ethnic relations;
8. Opinions regarding relevant and current policy issues.

[Copies of the C391, C392, C399, and C32000 Codebooks are available at http://www.socqrl.niu.edu]

Some of the year to year content of future questionnaire will depend upon the interests of faculty and students. Most generally, the survey is designed to address important issues in the sociology of suburban life and to respond to the needs of organizations and agencies concerned with maintaining and improving the quality of suburban life.

Community Database

The Sociology Quantitative Research Laboratory [SOCQRL] is the site housing a Collar County community level database. This database contains a variety of census data, crime data, and other useful social indicators. These data have been compiled with the collaboration of the Social Science Research Institute [SSRI] at Northern Illinois University. Within SSRI, the Governmental Studies [G.S.] unit manages a census database used by regional planners and private businesses to aid in their decision making and policy evaluations. Currently, this database contains information about the population of the cities, including 1980 and 1990 information from the STF3 Census tapes. City crime rates for the seven major crimes reported in the Uniform Crime Reports are also included. Several hundred variables are available for analysis. A separate census database at the zipcode level is also maintained.

Contextual Analysis

Combining information collected at the zipcode level and at the individual level (survey respondents are asked their zipcode) offers a unique opportunity to investigate the contextual effects community characteristics have on individual responses. For example, in their separate theses, graduate students Mike Sobzcak and Jun Xu were able to test the effects of racial composition in the respondents zipcode on individual level attitudes towards Hispanics and Blacks. One can investigate whether community crime rates or individual criminal victimization rates are more important in explaining fear of crime; or whether recent community population growth has affected attitudes about suburban quality of life indicators. We can also see the effects of changing community population composition on attitudes toward minority groups. We address these types of questions by adding to each individual's responses some pertinent information about the community in which they live.

C3 PROJECT PRODUCTS

The first and most immediate product resulting from the C3 project is the improved educational experiences of undergraduate students who pursue quantitative training. The use of a common data source across a set of spiraling courses: SOCI377B, SOCI476A, SOCI476D, and graduate level work allows the student to participate and learn the research enterprise at increasingly levels of sophistication. In upper level courses, each student produces an independent report analyzing some aspect of social life in the suburban ring. Graduate students have the opportunity to write master's theses based on these data, and serve as assistant project directors learning techniques of file construction, etc.

Secondly, several useful substantive reports are generated from the survey for public dissemination. The codebooks are published on the Collar County web site and contain the basic survey information from all of the questions asked. Topical reports are prepared as time and resources permit, some based upon graduate student seminar, independent study, and theses work. Third, the project generates news releases, and the summary reports are posted on the C3 web site. Fourth, the survey and community based data are available to all undergraduate and graduate students in sociology and related disciplines, as well as to the research staff at S.S.R.I. and N.I.U. faculty. A web site maintained N.I.U.'s Sociology Quantitative Research Laboratory contains project results. [see http://www.socqrl.niu.edu]

6. Instructional Example: Using Correlation Analysis to Asses Measurement Validity

A problem addressed in the assigned laboratory work is introduced in the first part of the session. The general methodological topic is framed with a concrete substantive social science research problem: e.g. how do we measure an abstract concept like individualism?

The week's exercise is then presented; student attention increases when the material to be presented is linked to a performance goal. The tasks assigned are as meaningful and are as much a part of the "real world of social research" as possible: research questions pertinent to major questions in social science are framed, real data are used, and the thinking skills and techniques learned can be transferred to other tasks performed by analysts in the "real" workplace.

The exercise below anchors the section taught on correlation analysis. Correlation is first introduced as a measure used to assess measurement validity. It is also discussed as a measure of explanatory association in the tutorial, but the emphasis in the main exercise is on using it to assess the usefulness of multiple indicators of a latent concept, such as individualism.

The assignment anchoring the section on measurement and correlation:

Week 6: Assessing Measurement and Conceptual Validity
(updated Feb. 7, 2000)

In an earlier exercise, you had to develop a measurement model with several indicators for the very abstract concept "individualism" used in various sociological theories. This exercise will show how correlations can be used to test measurement models. We will generate a correlation matrix of different measures of individualism in lab this week using the Chicago Collar County 1999 survey. We will assess a two dimensional model of individualism. The data are available in the MICROCASE system. Use this correlation matrix to calculate:

1. an estimate of the convergent validity of the indicators for each dimension;
2. an estimate of the discriminant validity of the indicators across the three dimensions;
3. an assessment of a single dimension model with all of the indicators using Cronbach's alpha;
4. an assessment of each of the two dimension's internal consistency using Cronbach's alpha.

Hand in a discussion of why the estimate you used reflects the type of validity estimate along with detailed calculations showing each step of your work.

Relevant Handouts and Readings:
C31999 Codebook via the C3 Homepage on the SOCQRL site.
Cappell: Correlation Coefficient; Correlation Analysis; Model.doc; Validity.doc
Interactive Tutor: Correlation
Simulations: SOCQRL WEB site: Link to Online Statistical Training, Correlation links.

7. Evaluation

Several evaluations of the Interactive Tutor component of the QRA project are underway. A dissertation is being written by Tom Haapoja in the Instructional Design Program, N.I.U.'s College of Education. This thesis will consolidate several subjective and objective evaluations. At the conclusion of each test version of the Sampling Tutorial, a subjective evaluation form was completed by each student assessing the tutorial. Here is a brief summary of how these evaluations guided our development of the architecture.

Subjective Student Evaluations

After the initial version, several students appealed for more review quizzes at the end of each sub-lesson. In the next version, we included more such quizzes and implemented the larger scale Recitation section with metacognitive feedback.

Students wanted more interactions and simulations, so we have begun to increase those. In the last version tested, we incorporated audio at selective locations, and the feedback was positive, so more audio will be introduced in the next version.

While the tutorials are not being designed to replace all other forms of instruction, classroom and lab, about half of the students thought that the tutorials could replace lectures. In response to our evaluation question on this topic, the last wave of students commented:

Do you think this computer program could substitute for lectures when learning sampling?

ð Yes
ð No → *IF NO… Why do you think it will not?*

Nine of 16 students replied "yes". One commented that "it was a welcome change!" from lectures. Another believed this computer program could substitute for lectures only "for disciplined students who take notes throughout the tutorial and then review". Seven students did not think that it could substitute for lectures. Their comments were as follows:

"Some portions of the tutorial need clarification by an instructor."
"It does not bring it to life like a teacher could, It's not interactive, which in my opinion is the best way to learn."
"I learn better in lectures where I can ask questions, but it is a good aid on the side or to look at during a lecture as a reinforcement."
"Further clarification of the confusing parts is more helpful and sometimes you just need to HEAR it from someone and see examples drawn out."
"I would say no because this computer program cannot answer any questions that the student may have."
"It is beneficial, but best if also supplemented by interpretation by a teacher (introduces the subject in more than one format helps to enhance learning at least with me."
"No. It needs to complement a lecture. This tutorial cannot simply replace the section."

These evaluations reinforce the pedagogical approach implemented: a three integrated learning approaches: software enhanced conceptual learning, hands-on active learning in a laboratory setting, and didactic classroom activities.

<u>Student Testimonials</u>

Another indicator of the impact made by the SOCQRL/QRA project on the training of students is the success in placing our students in top flight sociology graduate programs and in research positions in the private sector. While anecdotal, it is safe to say that the impact has been profound; a growing list of students have registered testimonials regarding how the training they have received in the SOCQRL environment has contributed to their subsequent success (some examples: graduate assistantship offers from Berkeley, U. of Penn., Wisconsin-Madison, Indiana, Iowa, and research analysts positions at NORC, A.C. Nielson, Information Resources).

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