

THE JOINT PROGRAM IN SURVEY METHODOLOGY: A GOVERNMENT PARTNERSHIP
FOR AN ACADEMIC PROGRAM

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The U.S. Federal statistical agencies have long faced the challenge of creating an expert, stable workforce with skills in census and survey methods relevant to the production of official statistics - interdisciplinary skills not available in a single academic department. Numerous statistical commissions identified this need, but no ameliorative action was taken until the fiscal year 1991 Boskin Initiative for Economic Statistics promoted funding. The Joint Program in Survey Methodology was selected through a process administered by the National Science Foundation. Funding now comes through a contract with participation from twelve statistical agencies. Present and future agency employees participate in academic and short courses and seminars and are enrolled in citation, certificate, and graduate degree programs. Survey problems are addressed in courses that allow transfer of knowledge between the work environment and the academic learning experience. This partnership has substantially enhanced the capabilities of the federal statistical workforce. The paper reviews challenges and successes through this partnership.

1. SURVEY RESEARCH - PRACTICE AND ACADEMIC PREPARATION

The survey research sector in the United States consists of activities of commercial organizations, academic/scientific organizations, and government agencies. The commercial sector is by far the largest, consisting of roughly 50,000-60,000 professional staff in over thousands of companies. The commercial sector generates annual revenues of \$7-8 billion. These revenues include those from audience/readership measurement firms (Nielsen, Arbitron, and Mediamark), health measurement (IMS Health), customer satisfaction measurement, opinion research, and a wide variety of market research. Some of these organizations have supported educational programs at the University of Wisconsin (Nielsen Foundation), the University of Nebraska (Gallup), and the University of Georgia (Coca Cola). However, for the large part, few commercial firms support educational activities.

The academic survey sector conducts surveys under support from grants and contracts from private foundations and government agencies. It consists of over 100 academic survey research organizations, most of which are small training and research units of social science departments at universities. Many of the surveys are launched to obtain basic descriptive data about social and economic problems facing the country, as well as collecting data used to test hypotheses about the causes of those phenomena. Some of these organizations are non-for-profit units, loosely connected to university campuses. Some of the units have established teaching arms, offering one or more courses at the undergraduate or graduate level to students on their campus.

The U.S. Federal statistical system consists of ten large agencies (e.g., Bureau of the Census, Bureau of Labor Statistics) that have statistical activities as their principle mission. There are another 60 agencies that carry out statistical activities in conjunction with other program missions, such as providing services or enforcing regulations (Statistical Programs of the US Government: FY 2001, 2000). These agencies collect the data underlying all major indicators of the U.S. government — economic; health and safety; social and demographic; natural resources, energy, and environment — and provide, through public use files, a major component of the data infrastructure of the social and behavioral sciences. In total, the agencies spent \$3.5 billion in FY 2001 (without the decennial census) on information collection and dissemination and have over 14,000 staff members.

For several decades the system has experienced a mismatch between the knowledge and skills needed by its professional staff members and those offered by graduates of university programs. Almost 20 years ago, a conference organized by the American Statistical Association (ASA) noted that “There is a growing lack of understanding between the applied statisticians in government or private endeavors, and those who are engaged in more academic pursuits. The supervisors of applied statistical work often complain that they must spend time retraining individuals with a good academic background. In the academic world, there is a growing subtle, but discernible, attitude that applied work is somehow of a lesser order of value and that the most competent people should not become deeply involved in it” (ASA, 1978). The conference urged consideration of Master’s level programs that meet the needs of government statistical offices (*ibid.*, p. 14). In 1982, another ASA committee recommended education programs blending theory and applications geared toward real problems faced by government professional staff (Eldridge, *et al.* 1982).

The problems identified by these committees stem from the way higher education is organized. U.S. universities produce graduates of computer science, economics, mathematics, psychology, sociology, statistics and other departments, each of which teaches components of knowledge needed in survey research. Their graduates are educated in theories and practices of those fields, but the statistical agencies need staff with knowledge that spans those departments. After hiring these graduates, the agencies generally spend several years giving them the knowledge needed to be effective professional staff for the agency. For example, most statistics master’s degree programs do not require students to take a sampling theory course (Groves 1996), and almost none offer courses on design of questionnaires, effects of modes of data collection, and reduction of nonsampling errors. Yet these areas are key to most statisticians in federal statistical agencies, whose work involves large scale survey and census design and estimation. Similarly, most graduates of economics departments have had little formal education in issues of research design, measurement procedures, and data collection, yet most economists in an agency like the Bureau of Labor Statistics are primarily involved in data collection and analysis (Plewes, 1995).

Action to address this mismatch was taken in 1991. At that time, the chair of the President’s Council of Economic Advisors, in collaboration with the chief statistician of the Office of Management and Budget (OMB) and the heads of major statistical agencies, designed a set of budget initiatives (referred to as the Boskin Initiative). Most focused on economic statistics and sought improvements in the short run; others were investments in the long run health of the statistical system.

One of the latter initiatives focused on “Preparing for Future Statistical Workforce Needs,” and was justified as follows: “For some time it has been extremely difficult for the federal statistical system to recruit and retain sufficient numbers of high quality statisticians. This seems to be due not only to the pay gap that exists between private and public sectors but also because universities have tended to de-emphasize training in the field of survey statistics in recent years” (Council of Economic Advisors, 1991). This initiative sought the establishment of a “Center for Survey Methods” in the Washington, D.C. area with the goals of providing advanced training and research in survey methods in the social, behavioral, economic, and statistical sciences; and graduate-level education and training for current and future employees of federal statistical agencies and for other individuals who will practice survey methods research at academic, public, and private institutions (National Science Foundation, 1992). The center was envisioned as a long-term investment of the federal government, designed to train the next generation of professional staff of the statistical system.

The problem being addressed is a worldwide one. Every developed country is facing a shortage of trained technical professionals with knowledge of social and economic statistics. In Britain there were early recognitions of the problem (Bishop, 1964; Bartholomew, 1973). Both France and Turkey chose to locate a university within their statistical systems (ENSAE, 1991); Canada has consultants from universities who develop and provide special courses to Statistics Canada staff; Sweden imports scholars from around the world to offer short courses; Eurostat offers a series of continuing education courses (Eurostat, 1995). The decision to place the U.S. educational unit in a

university setting was based on the belief that such a setting could bring together an interdisciplinary group of researchers/instructors actively pushing the field ahead.

In September 1991, a National Academy of Sciences/National Research Council workshop concluded that the center should have a) support among the agencies; b) balance and integrate the latest research with teaching; c) receive supplemental funding beyond that proposed in the initiative; d) utilize both permanent and short-term faculty; e) be actively involved with the statistical community; f) consider the needs and participation of federal agencies; g) address heterogeneous backgrounds of students; h) craft a curriculum with specialty courses to supplement core courses; i) use apprenticeship programs to provide real-world experience; j) use diverse teaching methods, including teletraining; k) innovate the curriculum as research developments occurred; l) offer a wide interdisciplinary variety of courses; m) promote a broad array of research topics; n) provide contributions to improving the federal work forces; and o) offer the potential to redesign the field of survey methodology (National Research Council, 1992).

A new unit, freed from constraints placed by a single department, appeared to be necessary for the freedom to build a truly interdisciplinary curriculum. A university base was judged desirable for synergy between educational and research activities. The National Science Foundation (NSF) appeared to be a natural agency to ensure the long run intellectual integrity of the center. OMB added the funds for the center to the FY 1993 NSF budget, on behalf of the federal statistical system.

2. SURVEY RESEARCH AND METHODOLOGY SKILL NEEDS IN THE FEDERAL GOVERNMENT SECTOR

2.1 Background on Federal Agency Efforts to Meet Workforce Skill Needs

Since the early 1940's federal agencies producing official statistics have had a need for staff skilled in statistics. Initially, those agencies hired the few trained statisticians being produced by academic programs. The staff learned skills on the job and innovated, developing the theory and applications for sampling in large scale surveys and censuses. As the number and scale of official statistical programs increased and as technology developed there was a need for staff skills in statistical computing, mathematics and operations research, and social science research applied to psychology, sociology, anthropology, economics, and demography. Academic programs began to produce more individuals with master's and doctoral degrees in statistics, computer science, and social science fields. However, there was little recognition within the academic community of the need for courses or interdisciplinary training that addressed the problems encountered in designing and conducting large scale censuses and surveys that cut across these academic disciplines.

In the late-1970's the American Statistical Association convened a committee that addressed some of the needs for statistical education of government statisticians (Eldridge *et al.*, 1982). However, the work of the committee did not motivate any focused progress on addressing the skill needs of mathematical statisticians and statisticians at the federal statistical agencies. The agencies were left to design their own programs with some assistance beginning in the 80's through short courses offered by the Washington Statistical Society and the American Statistical Association's Survey Research Methods Section.

Two agencies — the Census Bureau and the National Agricultural Statistics Service — developed in-house programs to enhance the knowledge of survey operations across a broad spectrum of agency staff. In 1985 the Census Bureau developed a 6-week survey practicum course that was required of all new professional staff, independent of their particular job assignment. This introduced staff to all components of a survey in a practical setting. However, no academic background was provided to educate participants in survey design and methodology. The National Agricultural Statistics Service developed in-house training that provided an operational perspective to agricultural surveys for its statisticians, mathematical statisticians, and computer programmers.

In 1960, the National Agricultural Statistics Service initiated a program to provide its statisticians with support for pre-requisite mathematics and statistics courses and enrollment in a graduate statistics program at specified universities. Selected individuals were supported at full salary for one year of academic course-work — usually not sufficient to receive a master's degree. Occasionally, individuals were retained at the location where they were studying to complete the degree while working full-time. In 1982 this program was made available to individuals interested in studying computer science; in 1985 a few individuals were selected to participate in the University of Michigan's master's degree program in social research for a 15 month period.

In the early 90's there was a broader recognition of the need for more academic based training of staff producing federal statistics. At the National Academy of Science Workshop and under the direction of the Interagency Council on Statistical Policy chaired by OMB, OMB proposed an initiative to provide graduate level academic training in the field of survey methodology and research. This was supported by the fourteen statistical agencies represented on the Interagency Council of Statistical Policy. The program objective was to provide academic training both for current federal statistical agency employees who needed to update their skills, and for individuals enrolled in the program who might later become federal employees. The initiative was set up through the NSF as a grant with one year of start-up funding and five years of program funding.

2.2 Establishment of the Joint Program in Survey Methodology

The Joint Program in Survey Methodology (JPSM), a consortium of the University of Maryland, the University of Michigan, and Westat, was awarded the initial NSF grant. The NSF intent was that, once established, the program would either be self-funding through the collaborating universities or be supported by the beneficiary organizations. The program addressed the needs of the official statistical agencies to have a work force trained in survey and statistical methodology applicable to official statistics. The program initially focused on graduate course work in two concentration areas — statistical science and social statistics — with core courses in survey methodology. The JPSM academic courses began in the fall of 1993. In addition, JPSM also offered a number of short courses on survey and statistical methodology topics each year. Federal statistical agency employees enrolled in academic courses who were supported by their respective agencies paid in-state tuition and fees to the University of Maryland. Individual fees were charged for short courses.

2.3 Interagency Collaboration with the JPSM

The initial funding for the JPSM extended through September of 1998. During the 1997 - 1998 academic year the JPSM submitted a proposal to NSF to extend the funding for five additional years. The NSF agreed to continue funding of the program over the next three years (through September of 2001), providing two-thirds of the requested funds, and stipulating that no additional funds would be forthcoming. At that time the federal statistical agencies committed to providing the additional funds required for the program to continue for this three year period.

During the summer of 1998, the administrators of the federal statistical agencies discussed how they would collectively fund and receive benefits from the JPSM. The agencies varied tremendously in their budget, size, workforce composition, and consequently, in their expected benefits from the program. However, the agencies identified six common benefits:

- The JPSM sponsors a two semester Practicum Survey course using an agency proposal to suggest research topics. Agencies whose proposal is selected receive a direct benefit from this course.
- Agencies present survey topics for methodological study in the two semester Survey Design Seminar. This is a unique way for an agency to receive consultative assistance from the professor and the students.

- In 1998, the JPSM initiated a highly competitive summer undergraduate intern program in Washington, D.C. (JPSM Junior Fellowship Program) placing participants at one of the participating federal statistical agencies. The individuals in the program receive salary from the hiring agency, and housing and seminar instruction through JPSM.
- Many JPSM students are agency employees, but among those who are not, agencies may hire students for part-time work or have opportunities to recruit them as they complete their program. The JPSM may be more effective at recruiting highly qualified individuals into the survey field than federal agencies are.
- The agency management could benefit from the opportunity to periodically review an academic program and direct it to employee development needs as was envisioned with JPSM.

Twelve of the federal statistical agencies represented on the Interagency Council on Statistical Policy entered into a memorandum of understanding with agencies participating in the cost of the program proportional to their expected potential benefits. The Census Bureau paid half the cost because of its substantial expected benefit; it also agreed to find a funding vehicle to support the program. A five-year contract was signed in August of 2000 with the potential for extending the contract each year. The Census Bureau administers the contract and receives funding from the other participating agencies through memorandums of understanding.

3. THE ORGANIZATION AND FUNCTIONS OF THE JOINT PROGRAM IN SURVEY METHODOLOGY

The needs of the survey research sector in the early 1990's for education for the next generation of professionals coincided with a set of conceptual developments in the field. For example, in 1951 Stanley Payne wrote the first serious text on survey question wording, a compendium of his experience with questionnaire development. By 1996 there were scientific research findings that identified the cognitive and communicative principles underlying the role of question wording in survey measurement error (e.g., Sudman, Bradburn, and Schwarz; 1996). In 1953 Hansen, Hurwitz, and Madow, published a theory of sampling devoted to estimating means and totals. By 1989 the theory and practice had been extended to complex analytic statistics, including regression models, multi-level models, and a variety of models on discrete data (Skinner, Holt, and Smith, 1989). By 1990 there were full texts reviewing both social science behavioral principles underlying survey participation, survey design features to reduce nonresponse, and statistical techniques of imputation and weighting to compensate for missing data (Goyder, 1987; Dillman, 1978; Rubin, 1987).

The field of survey methodology has imported some concepts and theories wholesale from other disciplines, enriched and adapted others, and developed its own specific approaches. Survey methodology draws on sociology, for the interaction of social groups with dominant institutions and how that interaction shapes access to measurement. It depends on social psychology, for principles of compliance with requests, notions of civic duty, altruism, interpersonal influence, and theories of attitude change. It has incorporated and adapted theories from cognitive psychology, for conceptual models of comprehension, memory encoding, cuing for retrieval, and judgment under uncertainty. It utilizes a specialized subfield of classical statistics, for finite population sampling theory, and has imported empirical Bayesian and other non-frequentist perspectives for model-based inference in special circumstances. Similarly, the field utilizes many of the error models common to econometrics and psychometrics, and has adapted principles of human-computer interaction and of large scale data structures from computer science. However, the unique intellectual contributions of the field of survey methodology are the blending of these conceptual structures to identify and quantify human behaviors that affect statistical error properties of measurements. This rich combination of conceptual components has arisen only in the last 15 years through the emergence of the total survey error paradigm, a conceptual structure that is now guiding major advances in the field.

Despite these advances the development of integrated theory in the field is constrained by the

fact that scholars are separated by boundaries of academic departments in universities. The absence of university departments devoted to survey methodology has meant that the field is at the margins of every academic discipline. Even now, most survey methodological developments have not been integrated into graduate education in the very departments of the scholars who invented the theories or methods. Thus, in 1991, there were no programs that attempted an interdisciplinary integration of this knowledge. Nor was there much hope of increased educational attention to research design and measurement, as several disciplines moved more away from measurement and toward theory development. This has been deplored within academia in statistics (Hartley, 1980; Kish, 1978) and economics (Griliches, 1994) as well as by individuals outside academia (Duncan, 1994; Triplett, 1990). It is viewed as impeding innovation within government statistical agencies (see Dillman, 1994), and statistical agencies continue to suffer its penalties (Clark and Schuchardt, 1995).

3.1 Educational Packages at the Joint Program in Survey Methodology

To fulfill the diverse educational needs of the Federal statistical agencies, activities focused on the first JPSM skills of existing professional and administrative staff within the consortium and the participating agencies. The educational “packages” now offered by the JPSM include 2-day continuing professional education short courses, citation programs, certificate programs, masters degree and doctoral degree programs. These are described below.

Short Courses. The 1991 NAS/NRC workshop concurred that current statistical agency staff needed continuing education opportunities. As a result, JPSM has sponsored over 75 non-credit short courses, with over 4,000 participants. Each year JPSM offers 10-12 short courses ranging from introductory courses (e.g., Introduction to Survey Sampling) to advanced courses (e.g., Regression Analysis with Complex Data). These use a world-wide group of researchers as faculty. Several of the courses were created in direct response to the Reinventing Government Initiative, to train federal staff in the design and conduct of customer satisfaction surveys.

Citation in Introductory Survey Methodology. The Citation in Introductory Survey Methodology is designed for professional staff who want to learn current principles and practices of complex surveys but do not have the time to devote to graduate level courses of the certificate program. The program assumes no previous formal training in survey methodology. The student first completes the semester-length credit-bearing course, Fundamentals in Survey Methodology. Then the student completes eight different one or two-day short courses, of which four must be from the core courses — Questionnaire Design, Introduction to Survey Sampling, Survey Management, and Introduction to Survey Estimation. After completing the courses, the student takes a written examination covering the content of the Fundamentals in Survey Methodology course and the four required short courses.

Certificate in Intermediate Survey Methodology. The Certificate in Intermediate Survey Methodology is designed for the working professional whose education omitted courses in the newly developing field of survey statistics and methodology. The program provides a comprehensive treatment of the field at the intermediate level, consisting of five required courses and one elective. The program is taught at the graduate level but is less intensive than the JPSM masters degree program. The five required courses are: Fundamentals of Survey Methodology, Introduction to Statistical Methods Using Computers, Data Collection Methods in Survey Methodology, Applied Sampling, and Questionnaire Design.

Certificate in Survey Statistics. The Certificate in Survey Statistics offers training in sample design and estimation for individuals who have previously completed graduate-level coursework in statistics but desire specific knowledge and training in the theories and application of survey sampling

and estimation. The certificate program consists of four required courses and two electives in survey methodology. The four required courses are: Sampling Theory, Applied Sampling, Inference from Complex Surveys, and Topics in Sampling.

M.S. in Survey Methodology. There are two areas of concentration in the M.S. curriculum — statistical science and social science — each requiring successful completion of 46 credit hours. The curriculum is not a collection of previously existing courses; instead, completely new courses were constructed to achieve the interdisciplinary goals of JPSM. This was the first evidence in support of the findings of the National Academy of Sciences workshop. Most of the new courses have no texts; the course readings consist of classic and recent research articles. The curriculum melds theoretical and applied content, statistical and nonstatistical concepts. For example, key concepts in cognitive and social psychology are taught but only when they inform survey measurement design and data collection. Similarly, properties of alternative variance estimators from complex samples are derived but mathematical statistical theory unrelated to surveys is omitted from the curriculum.

The statistical and social science areas of concentration share a common core — Survey Practicum I and II, Data Collection, Applied Sampling, Randomized/Nonrandomized Design, Total Survey Error, and two seminars — Introduction to Federal Statistical System I and II, and Survey Design Seminar I and II. These courses provide exposure to real world problems facing survey methodologists and statisticians within a theoretical foundation. The social science area adds courses in statistical analysis, questionnaire design, social and cognitive foundations of survey measurement, the analysis of complex survey data, and survey management. The statistical science area adds courses in probability, mathematical statistics, statistical analysis, sampling theory, inference from complex surveys, and topics in sampling. Its goal is to produce well-trained survey statisticians, who are broadly trained in statistical aspects of both sampling and nonsampling errors in complex surveys.

The curriculum is cumulative in both theory and applications. For example, the survey practicum is deliberately scheduled early in the program of study to expose the student to the practical problems of constructing measures of an underlying concept, to pretesting questionnaires through awareness of the comprehension and judgment problems of real respondents, designing and implementing a probability sample, interviewing sample persons, processing unclean data, and analyzing real data to answer real questions. With first-hand experience of interviewing and analysis, students can connect theoretical principles introduced in later classes to survey practice.

A key prerequisite course for both areas is Applied Sampling, teaching the student how sampling frame problems affect coverage error, how to implement stratification and clustering, how to assess the variance impacts of disproportionate allocation, and how to estimate variances for data from complex survey designs. This practically oriented course provides the foundation for more advanced courses in theory and practice of statistics. Another prerequisite course is Questionnaire Design teaching the state of the art of measurement construction; this is followed by a theory course — Social and Cognitive Foundations of Survey Measurement.

Ph.D. in Survey Methodology. In the fall of 2000, the first applicants began preparation for doctoral studies, with 3 Ph.D. students entering in the fall of 2001. The Ph.D. program is envisioned to train the next generation of academics. The program attracts students with masters degrees in diverse fields, but whose desire is to investigate new methods of design, collection, and estimation in surveys. The program has a qualifying examination to test the students' knowledge of social science and statistical principles. After successful completion of that examination, the student forms a course-of-study committee. After the completion of coursework and comprehensive examinations, dissertation research begins.

3.2 Ingredients of a Successful Academic Partnership with Federal Agencies.

To achieve the mission of training the next generation of survey professionals for the federal statistical system and improving the skills of the academic staff, the JPSM has formed several partnerships with staff within the system.

First, JPSM has involved federal system researchers in the graduate teaching of the program. Every year, the chief statistician of OMB and heads of statistical agencies lecture to the entering cohort, describing the work of their agency and how the inputs and outputs of the organization depend on other agencies in the system. This two term seminar, Introduction to the Federal Statistical System, introduces the student to the complexity of a dispersed government statistical system and to issues of budget and program management. It also provides a student with knowledge of the professional background of current agency heads, as potential role models for the students. An example of collaboration with federal staff in teaching was a one credit mini-course taught in June, 1996, on the redesigned Current Population Survey (CPS). This course involved staff at the Bureau of Labor Statistics and Bureau of the Census, giving detailed description of the CPS sample, questionnaire, and methodology, as well as hands-on access to the CPS public use data.

Second, federal staff have been clients of the Survey Design Seminar. This course is an applied one in which students attempt to solve design issues presented by clients. Federal staff (as clients), outline the problem for which they were seeking solutions within their agencies. They return to the seminar several weeks later to listen to group presentations by students recommending alternative solutions, based on reviews of the relevant literature, analysis of data, and group discussions.

Third, federal staff might be temporarily detailed to the JPSM offices to work in partnership with JPSM faculty and students. One example of this was the construction of the Customer Satisfaction Survey Manual and a set of five professional education short courses on customer survey design taught in 1994. For this work, staff from the National Agricultural Statistics Service and the Bureau of the Census worked at the JPSM offices to prepare materials and oversee the course operations. Currently, JPSM is collaborating with the OMB Office of Statistical Policy to develop a best practices guide for contracting of Federal government surveys. JPSM applied for and received a small grant from the Alfred P. Sloan Foundation to bring private sector survey researchers, contract officers, and project officers to identify problems and solutions in contracting for surveys.

Fourth, federal staff at five agencies (Energy Information Administration, Census Bureau, Bureau of Labor Statistics, National Agricultural Statistics Service, and the Center for Disease Control) have collaborated with JPSM faculty and students on seven survey practica. This has included meeting with the practicum students to review the conceptual framework of the survey, to define the information needs of the survey, and to describe how the data would be used by decision-makers. In some years, it included active collaboration in teaching some of the classes in the practicum.

Fifth, the partnership with Federal agencies includes many supervisors of working students in the program who have offered work context support for the student's original empirical analysis paper for the Total Survey Error course. The papers investigate the magnitude of survey error sources, or examine the effect of alternative designs on survey quality. Some of the papers result in direct benefits for the decisions regarding alteration of methods used in ongoing federal government surveys.

3.3 Future Prospects

The challenge of training the next generation of survey statisticians for the field has not been fulfilled. There are a variety of new activities that could help fulfill the goal:

- development of a national consortium of universities that have graduate programs in survey statistics, sharing curricula and teaching resources;
- development of more diverse academic-industry ties with the commercial sector to share the costs of graduate education with that sector;

- development of new courses and ties with other academic departments, to enlarge the breadth of the survey curriculum (e.g., economic measurement, data structure design, human-computer interaction).

4. FEDERAL AGENCY PARTICIPATION IN JPSM

The federal statistical agencies represented on the Interagency Council on Statistical Policy have chosen to participate in the JPSM in different ways. The National Agricultural Statistics Service now provides employees the opportunity to be competitively selected for full time participation in JPSM for three semesters and one summer. Other agencies support employees in the program on an individual basis.

Since 1993, the Census Bureau has supported employees in the JPSM for a half-time academic workload while working half-time; up to six individuals are competitively selected each year. This program was designed so individuals gain the maximum benefit from the combination of their work experience and their academic training; participating individuals are placed in a job that facilitates the interchange of knowledge between the two environments. The Census Bureau support has been critical to the success of the JPSM as over forty percent of the students in the program are sponsored by the Census Bureau. The Census Bureau has benefitted greatly from the education that its employees have received through JPSM.

4.1 Census Bureau Training Needs Assessment

In FY 1997 the Census Bureau completed an in-depth assessment of its training needs in relation to its workforce profile. A comparison with other agencies participating in the JPSM Practicum Survey of Organizational Health demonstrated that Census Bureau employees' perception of the training that they received (necessary to do their jobs, to keep up with new technologies, to be supported in learning experiences outside work, and of the priority given to training) was lower than that for any of the other agencies. Focus groups were conducted among the mathematical statistician employees to learn about employee perceptions of training and development opportunities. An important finding was that employees did not recognize the need for continual learning even though several important efforts to provide training opportunities had been made available to this group of employees, including participation in the JPSM.

Based on these findings the Census Bureau recognized that it would need to provide greater support for training and career development to more effectively promote opportunities for graduate study through JPSM, and to provide work incentives for employees to enhance their skills. The Census Bureau reviewed workforce profiles and assessed the needs of its workforce. These needs were identified, in part, by defining competencies required to be fully successful as a statistician or survey methodologist:

- statistical concepts and tools, survey activity, computer usage, research skills, other program specific knowledge and skills;
- Communication — oral and written; formal presentation
- Analytical Thinking — analysis/problem assessment, judgment/problem solving, innovation;
- Initiative/Leadership — teamwork/ collaboration, initiating action, managing work, influencing/gaining commitment;
- Customer Service — building trust, customer service orientation, organizational knowledge;
- Managing Change — adaptability, continuous learning.

4.2 Census Corporate University

Based on the identified needs and competencies required for success in work activities, the

Census Bureau reviewed academic and other professional courses to determine which best met the requirements of its workforce. As a result, it was determined to provide opportunities for those employees among its support staff and professionals who did not have a formal degree through an undergraduate degree in business at the University of Maryland; for its “statisticians” and employees in administrative positions, through the Project Management Certificate Program offered by George Washington University; for its managers, through a graduate degree in Public Administration at the University of Maryland; and for its professional statisticians and mathematical statisticians, through the Joint Program in Survey Methodology at the University of Maryland. These programs would all become part of Census Corporate University (CCU) — an umbrella academic program for Census Bureau employees. Career development counseling and course counseling would be an integral part of the CCU program.

Efforts to expand JPSM opportunities were developed to support the CCU initiatives, and in collaboration, with other statistical agencies. This effort led to the development of the course “Fundamentals in Survey Methodology” designed to introduce employees to the field of survey research and, later, to the citation and certificate programs. Through this course, employees become aware of the value of broadening their academic preparation in statistics and survey methodology, enticing them to consider participation in further academic courses. The course became the prerequisite for the Citation in Introductory Survey Methodology and for the Certificate in Intermediate Survey Methodology. It is used as a screener to identify the qualifications of participants for potential enrollment in JPSM certificate and degree programs.

The Census Bureau developed courses on-site and an on-site video-conferencing classroom in the spring of 1999. This allows employees to participate in some JPSM courses on site. This has expanded the number of employees exposed to the academic courses offered by JPSM. Additionally, staff continue to participate in the JPSM short courses.

4.3 Impact of JPSM on Census Bureau Workforce

The Census Bureau currently has as employees 27 of the 61 graduates of the JPSM master’s degree program; these graduates consisted of individuals in each of the concentrations — social science and statistical science. Five of these employees were hired by the Census Bureau after graduation from JPSM. The remaining 22 were supported by the Census Bureau. Only one Census Bureau employee supported in JPSM has left the Census Bureau since graduation. Five Census Bureau employees left the Census Bureau while in the program; four of those are working in federal agencies with the other individual in the private sector.

Census Bureau employees that are graduates of the program are highly sought out to fill critical survey management and research positions at the Census Bureau. The agency finds that these individuals have skills that make them highly qualified for a number of agency positions — as researchers, as methodologists and statisticians, and as technical managers. Among the 27 graduates since 1996 there are six managers — one at the GS-15 level, five at the GS-14 level — twenty-one mathematical statisticians or survey statisticians — fifteen at the GS-13 level, and six at the GS-12 level. Because of the relevant training that they received through the JPSM program these individuals have their choice of work assignments. Additionally, the Census Bureau is supporting twenty-seven individuals in the JPSM who are expected to complete the program in 2002 - 2004. These individuals, too, are sought after for positions. Two of these individuals already hold GS-13 positions. Although the certificate and citation programs have just been in place for two years, a Census Bureau employee received the Certificate in Intermediate Survey Methodology; another Census Bureau employee received the Citation in Introductory Survey Methodology. Additionally, sixteen Census Bureau employees are enrolled in one of these nondegree programs.

5. *Attracting New People to the Profession*

For sometime the U. S. Census Bureau has recognized that it faces a particular challenge in ensuring that it has sufficient mathematical statistician employees with an educational background adequate to carry out its programs. The agency seeks to hire individuals with a master's or doctoral degree in statistics or its equivalent with experience or course-work in sampling and survey methodology. The latter requirement is almost never met. Because of difficulties in hiring the sought after workforce, the Census Bureau hires a number of individuals with a bachelor's degree in mathematics or statistics who need additional academic preparation to be successful in the agency. An analysis of the mathematical statistician workforce has revealed that the entry level employees hired annually represent almost an equal number of bachelors and masters degree recipients, with a much smaller number of doctoral recipients. Of a total of 216 entry level employees hired from October 1995¹ through July 2001, there were approximately 32% (69) who had a bachelor's degree in mathematics or statistics; 53% (114) had a master's degree; 15% (33) had a doctoral degree. Only individuals with a bachelor's degree who indicate a willingness to seek master's level training in statistics have recently been offered employment.

The Census Bureau program for support of individuals in the JPSM program has become a successful recruiting tool. The agency has attracted more highly qualified individuals with bachelor's degrees for employment due to the opportunity for on the job training through JPSM.

More recently the Census Bureau has been successful in attracting individuals who participated in the JPSM Junior Fellowship Program to employment with the agency and subsequently to participation in the JPSM. The Census Bureau has been particularly aggressive in providing good internship opportunities during the fellowship term, and introducing the interns to broader opportunities at the Census Bureau. The very interesting technical problems that the agency is required to solve for its programs continues to attract individuals. Also, students are having positive experiences working for government, not something that the students initially expected. Over the three past years of the intern program, the Census Bureau has now hired five interns (one who has now enrolled in the JPSM) and attracted two more into graduate programs in survey research (at the University of Michigan and the University of Wisconsin, respectively). This program is beginning to attract individuals into the profession with the qualifications the Census Bureau and other federal statistical agencies are seeking for employment. These individuals also have the skills needed by private survey organizations.

6. SUMMARY

The JPSM has emerged as a good example of interagency collaboration meant to enhance survey and statistical training for the workforce of the federal statistical agencies. It is particularly effective when these agencies have a formal program to support employee participation in JPSM. It is a program that might well be adopted by other universities to meet the needs of both government and private survey organizations. The JPSM has discussed possibilities for extending its collaboration beyond the organizations currently participating, thereby involving other universities and survey organizations in the discipline of survey methodology research. The program does not address all technical training needs of the agencies, it can, nevertheless, provide a strong foundation for the training needs of "statisticians." Agency collaboration has been beneficial in accomplishing more through collaborative efforts. The JPSM model for collaboration is an initial step in meeting multiple agency needs through an academic training program.

¹The U. S. Census Bureau had a hiring freeze from October 1991 through October 1995. Thus, the mathematical statistician workforce had severely declined.

REFERENCES

- American Statistical Association (1978), "Conference on Transfer of Methodology Between Academic and Government Statisticians," Washington, D.C.
- Bishop, H. E. (1964), "The Training of Government Statisticians," *Journal of the Royal Statistical Society*, Vol. 127: 211-215.
- Clark, C., and Schuchardt, R. (1995), "Technical Academic Training for Employees of Survey Organizations," in *American Statistical Association Proceedings of the Section on Government Statistics*.
- Cochran, W. (1953), *Sampling Techniques*, New York: John Wiley.
- Council of Economic Advisors (1991), "FY 1992 Economic Statistics Initiative Improving the Quality of Economic Statistics," Executive Office of the President.
- Dillman, D. (1994), "Why Innovation is Difficult in Government Surveys," in *U.S. Census Bureau Proceedings of the Annual Research Conference and CASIC Technologies Interchange*, Washington, DC:, pp. 213-226.
- Dillman, D. (1978) *Mail and Telephone Surveys*, New York: John Wiley.
- Duncan, J. W. (1994), "NABE Presidential Address: Building Improved Official Statistics for Decision Making," *Business Economics*, pp. 12-19.
- Ecole Nationale de la Statistique et de l'Administration Economique (ENSAE) (1991), Programme des Enseignements: Division de Cadres de Gestion Statistique et Attaches, Paris: Institut National de la Statistique et des Etudes Economiques.
- Eldridge, M., Wallman, K., Wulfsberg, R., Bailar, B., Bishop, Y., Kibler, W., Orleans, B., Rice, D., Schaible, W., Selig, S., and Sirken, M. (1982), "Preparing Statisticians for Careers in the Federal Government: Report of the ASA Section on Statistical Education Committee on Training of Statisticians for Government," *The American Statistician*, Vol. 36(2): 69-89.
- Eurostat (1995), *Training of European Statisticians*, TES Secretariat, Senningerberg, Luxembourg.
- Goyder, J. (1987), *The Silent Minority*, Boulder, CO: Westview.
- Griliches, Z. (1994), "Productivity, R&D, and the Data Constraint," *American Economic Review*. Vol. 84: 1-23
- Groves, R. (1996), "The Educational Infrastructure of the Survey Research Profession," *Public Opinion Quarterly*.
- Hartley, H. O. (1980), "Statistics as Science and As a Profession," *Journal of the American Statistical Association*, 75 (369): 1-7.
- Kish, L. (1978), "Chance, Statistics, and Statisticians," *Journal of the American Statistical Association*, 73:361, pp. 1-6.
- Madow, W. G., Nisselson, H., and Olkin, I. (1983), *Incomplete Data in Sample Surveys, Vol.1, Report and Case Studies*, New York: Academic Press.
- Madow, W. G., Olkin, I., and Rubin, D. B. (1983), *Incomplete Data in Sample Surveys, Vol. 2, Theory and Bibliographies*, New York: Academic Press.
- Madow, W. G. and Olkin, I. (1983), *Incomplete Data in Sample Survey, Vol.3, Proceedings of the Symposium*, New York: Academic Press.
- National Research Council (1992), *Center for Survey Methods*, Committee on National Statistics, Commission on Behavioral and Social Sciences and Education, Washington: National Academy Press.
- National Science Foundation (1992), "Center for Survey Methods: Solicitation for a Special Competition." Directorate for Social, Behavioral, and Economic Sciences.
- Office of Management and Budget (2001), "Statistical Programs of the United States Government," Washington, DC: Office of Information and Regulatory Affairs, Office of Management and Budget.
- Plewes, T. (1995), Presentation at the NSF/JPSM Economic Statistics Workshop, Ballston, VA.