TRAINING INSTITUTIONAL RESEARCH PROFESSIONALS

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Training institutional research (IR) professionals in the use of statistics is a complex and challenging task. It is complicated by the need to develop a functional model of institutional research that includes its various roles. In addition, the specific statistical and analytical tools used to perform necessary tasks must be better understood. This is important due to the need for IR professionals to teach others to use and interpret statistical results. IR professionals have tended to use basic tools and have limited statistical sophistication. The specific tools or statistical methodologies that are important in IR should differ based on the situation of the individual and the academic background of the audience and should not be limited by lack of training in statistics. The work done by Terenzini (1993) further indicates that IR professionals need to broaden their approach to research by operating within three types of intelligence.

INTRODUCTION

John Lyons in his *Memorandum to a Newcomer to the Field of Institutional Research* (1976) begins his discussion with the observation that ""Logically, we should begin this discussion with some precise definition of what is meant by the term 'Institutional Research'. I can only say I wish we could" (p.1). This statement still reflects the reality faced by many institutional researchers when trying to define their work and what they do**.** Nevertheless, in order to train the Institutional Research professionals, we must start from the definition of Institutional Research (IR). Since no discipline in our colleges and universities defines Institutional Research as a profession, it is often difficult to set the training goals. This presentation will address this problem by providing a brief description of our professional, by examining the status of statistical procedures used by the IR professional, and by drawing conclusions that will facilitate better training of our professionals.

WHO ARE WE AND WHAT DO WE DO?

From the quote provided above, it is evident that developing a set of learning objectives for the practice of IR is difficult. Saupe and Montgomery noted that the work "…should be as objective, detached, thorough, and systematic as any other research. Problems should be as well-defined, methods as appropriate, analyses as logical, and conclusions as uninfluenced by pre-conceptions, as those of any scholar. Institutional research should use clear philosophy of higher education as a catalyst for its efforts." (1970, p 3) This is consistent with an early definition developed in1971 by Sidney Suslow in the first presidential speech to the Association for Institutional Research. He defined institutional research as "…. an attitude of critical appraisal of all aspects of higher education, which has as its primary purpose the assessment and evaluation of the expressed goals of the institution and the means used to achieve those goals, and that this assessment and evaluation are guided not by purposes higher than the goals themselves, but simply by the estimated efficiency of the processes and the probable utility of the results" (Suslow, 1971, p.1).

What are these tasks that we are to do with the rigorous and objective methodology? The IR function was described as a form of applied research that used the tools and techniques of other disciplines to address issues important to the institution. Key to the difficulty in precisely defining IR was the fact that each institutional research function tended to take on roles as defined by its institution's needs, desires, and the particular skills and interests of the institutional researcher. From its infancy, institutional researchers have used a broad range of methodologies from educational research, operations research, systems analysis, evaluation research, computer modeling, program budgeting, policy research, outcomes assessment, and planning models (Fincher, 1985). Stickler narrowed the focus when he indicated that the

research should be directed toward providing data that are useful or necessary "in the making of intelligent administrative decisions and/or for the successful operation, maintenance and/or improvement of a given institution of higher education." (1968, p3) He listed a number of tasks - appraising the environment or "setting" in which the institution operates, preparing the budget, planning for new buildings, assigning space in existing buildings, determining faculty loads, admitting students, individualizing instruction, planning the education program, and keeping abreast of student progress. This early inventory was subsequently categorized into the following Tracks by AIR to structured its annual meeting:

1. Enrollment management and student affairs: A focus on students as they select, enter, persist and graduate from education to include needs assessment, student profiles, and student financial aid.
2. Institutional effectiveness, student learning, and outcome assessment: Concerns of institutional effectiveness and outcomes of learning to include teaching and learning. Measurement issues and effective data collection are particular concerns.
3. Academic program and faculty issues: Addressing issues related to curriculum research, service, and scholarly activity, tenure policies, program review, faculty recruitment, personnel management, and other decision making about faculty programs.
4. Resource management and quality improvements: Involving resource allocation, budget and finance issues, quality improvement and cost containment initiatives, allocation of resources, and institutional advancement.
5. Policy analysis, planning, and governance: Including major governance and executive functions such as policy and management analyses, strategic tactical planning processes, mission development, and decision support.
6. Theory and practice: Looking at how we develop and apply our trade, what the tasks are, how we prepare, what limitations we face, and how we manage our functions.
7. Technology and Tools: Involving the use of the computer and other technology and the methodologies that we use in applying our functions such as statistics, operations research, mathematics, econometrics, biometrics, and psychometrics.

As the structure of higher education has changed, so has the process by which IR professionals perform their job. Since the early days of IR, higher education has passed through three major phases that have had direct influences on the practice of institutional research. The first phase was the decentralized operations occurring, arguably, in the 50's and 60's. IR tasks were often completed using tally sheets, stand-alone databases that were not computerized, and Monroe calculators for calculations. Statistical analyses tended to be descriptive and correlational. The second phase began with the advent of mainframe computers. The centralized institutional research office came into being. Statistics were performed using the mainframe with BMP and SPSS and SAS supporting multivariate statistics, including factor analysis and MANOVA. The third phase began in the mid-to-late 80's when the function began to be distributed across the campus and a code of ethics was developed by AIR. Trends in the use of statistics advanced in two directions. In terms of sophisticated statistics, Bootstrapping, EDA, Simultaneous Equation Modeling, and Hierarchical Equation Modeling moved forward. As these techniques became more available, the horizontal expansion of statistics was even more impressive. SPSS, MINITAB, and SAS along with other software brought statistics to the point-and-click desktop of everyone, including most IR professionals and our customers, many of whom lacked training in statistics. At this point, IR became a complex organizational function driven both by technology and by the resulting impact of technology on the infrastructure of our colleges and universities. These and other aspects of the profession have been recently summarized in *Institutional Research: Decision Support in Higher Education* (Howard, 2001) and *What is Institutional Research All About: A Critical and Comprehensive Assessment of the Profession* (Volkwein, 1999).

WHAT STATISTICS DO WE USE?

In terms of our experience, studies have shown that IR professionals have a median of eight years of experience in the profession. This needs to be interpreted in terms of the fact that this experience is often in addition to previous academic and administrative experience. Many IR professionals transfer into the profession from other activities (Lindquist, 1999, Knight et.

al.1995). Almost half (48%) have terminal degrees and another 40% have Masters degrees. Our disciplines are divided between the social sciences (34%), education (31%) and either business (16%) or the sciences and mathematics (13%). Approximately 50% of IR professionals have taken three or more courses in quantitative methods and statistics. As a result, over half of them (61%) feel that they possessed quantitative research skills "to a large extent" or were "expert with respect to this knowledge or skill."

On the other end of the scale, one in three reported having one or fewer courses in quantitative methods (33%), and about the same proportion reported one or less courses in statistics (29%). Only 5 % reported that their research and statistical methodologies "are viewed as too complicated" and less (3%) reported that their "lack of familiarity with analytical methods" was a major obstacle or more in their effectiveness (Knight, 1995). While this lack of familiarity may not be viewed as a major problem, it is a recurring theme that points to two problems faced by IR professionals. First, there is the problem of data being too complex and the use of complicated statistical methods that are not understood by the executives. Second, there is the problem associated with the lack of opportunity and time for the IR professional to remain up-to-date with newer statistical methodologies.

If there are limitations in the ability of others to understand complicated statistics and a lack of time for us to upgrade our skills, what are we doing? In the review of some 115 papers presented at the three recent forums, almost one-third of the papers used no statistics (30.4%). These included the development of conceptual models, case studies, and the development of rubrics and other methods of content analysis. For those using statistics, one in four used percentages and means (22.6%). Other papers used simple comparative statistics such as t-tests, one-way ANOVA and Chi-Square Independence tests (13%). Correlation and regression, including logistic regression, were used in about one-fourth (28.7%). About the same number used more advanced methods such as Simultaneous Equation Modeling, MANOVA or mathematical statistical models (22.6%). Papers were categorized where they had multiple comparative, co-relational or advanced statistics, but being in the percentage and means group indicates that no other type of statistic was used. In other words, over half of the papers used nothing more complicated than means and percentages. In addition, the papers themselves were associated with the tracks noted above. Approximately half of the papers (46%) were in track 2 on learning and assessment, one in five (21.4%) were in Track 1 on enrollment management, and one in ten (12.2%) were in Track 3 on academic programs and faculty issues. Each of the remaining four tracks averaged approximately 5 %.

THE CHALLENGE OF STATISTICAL TRAINING

If one considers the above findings, we can be described are moderately mature professionals that have some statistical training. We use mostly basic statistics, and we are concerned but not greatly so about our need for more statistics. Interestingly, the desire for statistical training has been in the top six categories of desired training in membership surveys since 1981 (Lindquist, 1999). The following section utilizes a classic work to identify strategies for providing training within the context of the skills or “Intelligence” we need to be effective in IR. Terenzini (1993) identified three tiers of intelligence needed by the IR professional to add value to his or her college or university: technical intelligence, issues intelligence, and contextual intelligence.

Technical Intelligence. Technical intelligence is the ability to work with the basic building blocks of our profession. These include methodological skills and the ability to use tools like statistics, cost-benefit analyses, planning models, computers, and strategic management tools. This set of skills is similar to those that are frequently needed for entry-level IR positions. They are also the abilities that are needed to complete institutional research projects and the day-to-day operations of an IR office or function. In developing statistical ability in this level, one would need to have an understanding of the primary statistical tools such as the basic inferential and descriptive techniques noted above. What do they do, what are their assumptions, what is their interpretation? This would be the type of learning that responds to "Use the following data to compute a correlation. Some of the specific challenges include:

1. Training in how to use power test for various techniques. Our customers in general want to have statements in terms of the probability that they are wrong given they have a positive belief. While this may involve us learning to quantify the belief for the computation of the power of the test, it is still often a desirable alternative to the Type I type conclusions.
2. Training in use of confidence limits either through simulation or formulae. For example, the traditional methodology for enrollment projection is a variation of a Markov model with transition probabilities. We all know that the entering vector and the transition state probabilities are point estimates with error and that there should be some type of confidence limit on the answer, but most still produce a point enrollment estimate.
3. Training in development of simple models that integrate cross-sectional and longitudinal data. For example, we use two methodologies to examine student success and to try to deal with issues of causality. One examines success over time for a set of students with variable ability. The other examines the correlation of ability and cumulative performance at a point in time, or a cross-sectional study. IR professionals must know how to integrate the results of these different studies in order to facilitate good decision making

Issues Intelligence. Issues intelligence involves use of methodologies to address the traditional factors and issues of higher education. This includes understanding the reasons for managerial activities and understanding decision-making processes. It also includes general organizational skills, communication skills, and the more advanced skill of being able to apply what is known from various disciplines in tasks such as shaping an inquiry or studying complex issues. The issues for us include the various tracks discussed above such as student retention, faculty concerns, learning outcomes, budget expectancies or program evaluation. The skills are also heavily related to how we collect data -- such as surveying, focus groups, and archived academic data. Knowledge of statistics at this level involves knowing methodology. When does one use a specific statistics and how do statistics group together in a discovery strategy? Some of the specific challenges include:

1. Training in use of “best practices”. We need skills in the “best practices” application of non-parametric statistics and the use of techniques such as those in Tukey’s EDA. Many of our processes do not produce the data appropriate for the statistics listed above. Data sets are small, populations are not normal, and samples are not random. Even more problematic are the lack of independent errors in many of our studies of change over time. Nevertheless we use the basic statistics that we learned in our first three statistics courses.
2. Training in use of Bayesian or Bayesian-type techniques. We need skills in techniques that are appropriate for some of the situations where previous research and/or knowledgeable individuals have additional information that can contribute to the understanding. One example is the use of regression equations each year to anticipate the proportion of freshmen that will persist to being sophomores. At some point we probably should look at Empirical Bayes regression.
3. Training in how to integrate multiple studies. There needs to be some type of confidence that can be created when we integrate multiple studies into one larger methodology. Such an example is in meta-analysis. Another example is in embedded case studies where multiple studies may combine to bring different probabilities to one general conclusion. This includes the problematic issue of integrating the results of focus groups with survey data and performance comparisons, even assuming that the focus group is the unit of analysis.

Contextual Intelligence. Contextual intelligence represents knowledge of the culture of higher education, both at the institutional level and in general. It includes an understanding of how business is done at a specific institution, the key issues facing the institution, and how to most appropriately effect change. This level of intelligence makes the application of methodology to locally meaningful issues possible. It requires that we understand the rules of evidence and the process of decision making of specific individuals. Not only must we understand these processes, we then need to know how to select, apply, and interpret the results of our methodologies in a manner to reduce key uncertainties and to support decision making.

Classroom learning and reading will be of almost no value for learning at this level. Some of the specific challenges include:

1. Developing a set of methodologies that produce an anticipated distribution of outcomes. What will be the expected value of these outcomes and what would be the distribution? This type of reportable results would then allow us to use the distribution of outcomes, to give the probability associated with various outcomes.
2. Developing a set of cases to use in learning statistics that reflect the situations that the IR professional is going to face when they begin to apply statistics as part of a rational decision process. Based on a taxonomy presented in Naumes and Naumes, (1999) technical intelligence could be enhanced by developing concepts and clustering facts to highlight causality. Issues intelligence could be addressed by requiring analysis of higher education and business problems. Contextual intelligence could be used to permit the addition of a broader range of facts, increased complexity, and conflicting perspectives, all of which influence the choice of statistical tools.
3. Developing a partnership to create a strategic process that links together research methodology and decision support. When sequential studies are done, studies treated as independent events should be integrated. Statistical procedures and research methodologies should provide a foundation for linking studies with decision making. There need to be conversations that look at how grounded theory, embedded case studies, and similar methodologies can extend the discovery process.

SUMMARY AND DISCUSSION

Our Code of Ethics and Professional Practice requires that IR professionals develop a level of competency where we work within our skills and not overstate them. We are required to develop the ability of our subordinates and ourselves to use the appropriate statistical tools. In other words, we must develop technical intelligence. In addition, we must execute our skills by working within the boundaries of our methodologies and the issues of our host employer – education, thus developing issues intelligence. This drives the need for us to use appropriate standards of practice and various analytical statistical techniques in identifying assumptions, values and limitations. Conceptual intelligence then aids us in developing a community of discovery. We need to work with processes that support openness, participation, equity and diversity we are to help interpret internal and external requests to prevent misunderstanding.

We need to be better prepared to select strategies for analyzing complex situations. We need training in how to look at decision-oriented cases and in articulating strategies as projects or as sets of projects. This would include being given research problems that involve the multiple tools and techniques. It also involves partnering between those who teach research methodologies and those who teach statistics. It also involves more involvement in fieldwork, internship experiences, and mentoring.

IR professionals also need to train others. This is a challenge shared with those who train us in statistics. When statisticians train us, they are training the trainer. Furthermore, under the distributed model of IR and the presence of statistical software and databases on the desktops of many of our managers in higher education, we are going to be increasingly called upon to help our colleagues select, apply, and interpret statistics.

You can help us in our role as trainers by engaging us in the appropriate pedagogy. Chickering and Gamson (1987) identified seven research-based principles of effective undergraduate education: (1) encourages contacts between students and faculty, (2) develops reciprocity and cooperation among students, (3) uses active learning techniques, (4) provides prompt feedback, (5) emphasizes time on task, (6) communicates high expectations, and (7) respects diverse talents and ways of learning. We propose that if statistics are taught by these principles and if we as IR practitioners emphasis these principles, our members are more likely to be effective in training others in how to use and interpret statistics. With you help, we can develop an “enthusiasm for proposals made by others for new methods and new utilization, but a vigilant skepticism for partisan, mediocre, or reputedly consummate solutions; willingness to assume a spectrum of responsibilities and request to provide assistance to academic and administrative functions of the institution.” (Suslow, 1972, p17)

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