Research In Nursing Education: The Development Of A Computerized Information System

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RÉSUMÉ

L'école des sciences infirmières à l'université McMaster a élaboré un programme innovateur en ce qui concerne l'enseignement des sciences infirmières au niveau du B.Sc. Les stratégies pédagogiques, le procédé de sélection des étudiants et quelques méthodes d'évaluation sont uniques. Afin de permettre aux planificateurs des programmes d'études la possibilité d'évaluer sérieusement ces innovations, et de donner un reflet fidèle du programme afin d'assurer qu'il est en train d'attendre ses buts originaux, il est essential de recueillir de façon systématique des données pertinentes. Cet article décrit l'élaboration d'une base de données relative à l'enseignment qui documentera à quel point les buts du programme sont atteints avec le temps et qui aidera à évaluer les effets d'innovations ultérieures.

La Base de Données relative à l'Enseignement des Sciences Infirmières est un système interne d'information qui sera informatisé afin de traiter les données tirées des dossiers établis au cours de la formation de l'individu. Elle comportera des renseignements sur le réservoir de candidats, sur les attributs initiaux des étudiants admis au programme, sur la performance scolaire et clinique de l'étudiant, sur les résultats aux examens d'immatriculation professionnelle et sur sa carrière ultérieure. On pourra ainsi répondre aux questions qui concernent les facteurs qui permettent de prédire la performance de l'individu au cours de ses études, les facteurs relatifs au taux d'abandon des études, la validité actuelle et prédictive des formes d'évaluation et les effets de l'innovation en matière du programme d'études.

ABSTRACT

The B.Sc.N. Program at McMaster University, School of Nursing has developed an innovative program in undergraduate nursing education. The teaching strategies employed, the selection process for students and some of the evaluation measures are unique. In order for educational planners to responsibly evaluate these innovations, the systematic collection of meaningful data is essential to provide accurate feedback to ensure that the program remains on course and that the original goals are met. This paper describes the process of development of an educational data bank which will document the degree of goal attainment over time and help assess the effects of subsequent innovations.

The Nursing Educational Data Bank is an internal data system which will be computerized to handle data extracted from the records generated during the educational process. It will include information about the applicant pool, in-program students' admission characteristics, clinical and academic performance, licensing examination results, and postgraduate career data. Questions related to predictors of program performance, factors related to student attrition, concurrent and predictive validity of evaluation methods and the impact of curriculum innovation can be addressed.

Introduction

During the past decade, many nursing educational programs have introduced innovations in curriculum design and methods, but very few have evaluated the results of these changes (Ketefian, 1974). Of the evaluative studies reported, the majority employ one of the following three designs:

1. Self-report of opinions of students and teachers (White, 1976);
2. Comparative studies of employer ratings, student self-rating, and student school performance (Hayter, 1971 Dubs, 1975);
3. Comparison of student performance within individual programs over time (Meleis, 1974; Thomas, 1974; Stone, 1975), or between different programs (Bergman, 1973).

The dearth of well designed and routinely implemented evaluative studies of educational programs is understandable given the considerable ethical and methodological difficulties accompanying such endeavors. One of the major problems for evaluative research is the absence of reliable, relevant, and valid data that are necessary to answer the study questions. While most educational institutions have developed administrative data banks for particular operating purposes, these "banks" do not always provide data in a form that is easily retrieved or amenable to statistical manipulation for program evaluation. Hence, understanding of the relationships among various program components for evaluation of the educational program remains impossible.

The purpose of this paper is to describe the development of a computerized information system or data bank for an undergraduate nursing education program and the needs for which this system was designed. In general, the data will permit the assessment of the program's admissions policies and learning environment on program performance; factors related to student attrition; concurrent and predictive validity of evaluation methods; the impact of curriculum innovation; and postgraduate career data. Overall, the development and use of such a computerized information system should be considered an effort to provide a cost effective, unobtrusive data collection source to enhance and facilitate educational research and evaluation.

The Education Program Components

1. Teaching and Learning Methods

The B.Sc.N. program at McMaster University, School of Nursing is an undergraduate education program which departs from many of the traditions of nursing education. The teaching strategies employed, the selection process for students, and some of the evaluation methods are unique. The innovative learning environment includes small group tutorials, a problem-based learning format, individualized learning plans, a variety of evaluation strategies, a range of learning resources including simulated patients, and an interprofessional faculty of tutors. Learning is promoted through a variety of approaches, but emphasis is placed on clinical problem-solving. Skills, attitudes, and a sound knowledge base are acquired through concurrent classroom and clinical experiences. Students are expected to increase their educational independence and self-direction as they progress through the

four years. In all years of the program, monitoring of student progress in the nursing courses occurs throughout and is a shared responsibility of each student, his/her peers, and the faculty.

2. Student Background

Applicants to the program are selected through a variety of methods according to the classification of the applicant. Two-thirds of the year one students are high school graduates who are selected on the basis of grades alone; the remaining one-third of the class is comprised of transfer and mature applicants who are selected on the basis of their academic backgrounds and personal qualities which are assessed through a team interview and autobiographical letter. An additional 25 students per year are accepted into the post-diploma RN stream of the program, also on the basis of academic background and personal qualities.

Data Bank Development

Similar to most other educational endeavors, we have routinely obtained and stored demographic and student performance data. Given the variety of data entry points, e.g., at application, admission and in course, these data were stored in different areas, in different formats, and mostly in paper files. There were overlaps in data gathering, inconsistencies in data available from year to year, and gaps in data available for use. The difficulty in retrieval of these data and their availability for statistical treatment have limited the possibility of evaluating the educational program.

As educators in an innovative program, we have the responsibility to evaluate our innovations. Accurate feedback is required to insure that the program remains on course and that the program objectives are met. The systematic collection of meaningful data is an essential ingredient in the evaluation enterprise. To accomplish this task, we required an internal data system that would be computerized to handle data extracted from records generated during the educational process.

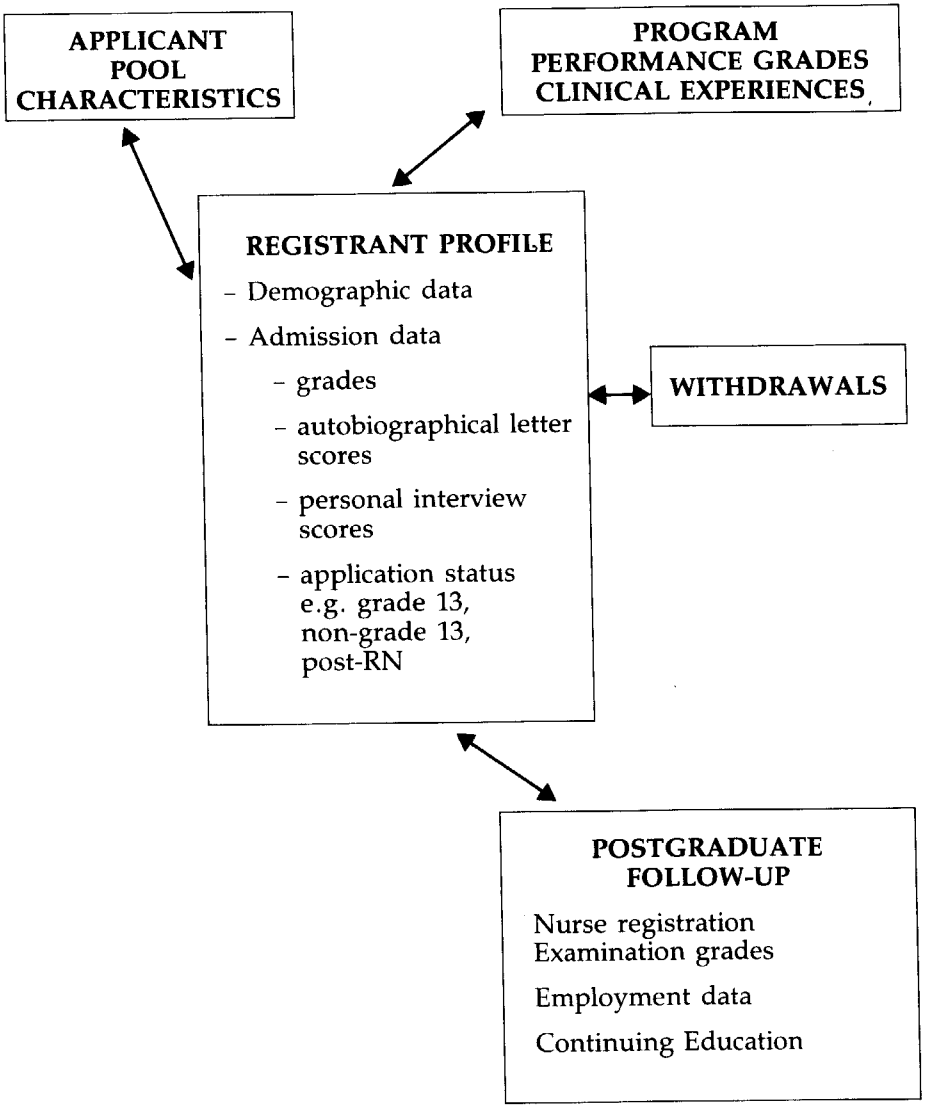
A "Data Bank Committee" was established which included members of the nursing faculty interested in curriculum design and educational research, a computer analyst and research assistant, and a program administrative assistant. Consultation with data bank managers and evaluation experts internal to the Health Sciences faculty was sought over time. The Committee identified the major conceptual areas that would provide the substantive base for the "bank". The five areas selected were the following:

1. applicant pool characteristics (demographics, academic background);
2. registrant characteristics (demographics, academic background, admission scores on interview and autobiographical letter, applicant status);
3. registrant in-program performance (grades, clinical experiences, elective courses);
4. withdrawal profile (level of program withdrew, reason);
5. postgraduate follow-up (nurse registration examination scores, employment data, continuing education).

Figure I

B.Sc.N. Program

DATA BANK



Within each of these general areas, key questions were generated by various groups of faculty, e.g., admissions committee, evaluation measures group, etc., to address such issues as the admission process, the use and distribution of resources, the variety and effectiveness of teaching strategies, etc. Variables were then identified that were considered necessary to answer relevant questions. These variables and their description comprise the basic data of the bank.

The iterative process of question generation enabled the Committee to "test" the relevance and completeness of the proposed information items. Examples of key questions and the relevant data within each of the major areas are as follows:

1. Applicant Pool Characteristics
   (a) Is the demand for the program consistent over time?
   (b) Do the characteristics of the applicant pool remain stable over time?

To answer these and other similar questions, demographic and performance data, generated by high school/collegiate career record, autobigraphical letters, interview and reference letters will be collected routinely during the admission process. The type of applicant (grade 13, mature, diploma RN, etc.), place of residence, grades achieved in high school, college, university courses taken prior to application, scores obtained on interview and autobiographical letters, etc. will be entered and stored until statistical analysis is conducted.

2. Registrant Profile
   (a) In what ways do those students selected to the program differ from the applicant pool?
   (b) How do our selection criteria relate to subsequent program performance and postgraduate career choices?

All entrance information on successful applicants to the program will be entered into the program data base. Subsequent grades in all courses, types of clinical settings in which experience was given, and postgraduate employment profile including work settings and types of roles will be obtained.

3. Registrant In-program Performance
   (a) What is the relationship between admission data and in-course evaluation?
   (b) What is the impact of our admission policies and student characteristics on the educational activities of the program?

All courses taken and grades achieved throughout the program will be entered for each registrant. The types of evaluation methods that are employed in the nursing courses will be coded and entered along with the grades for the courses. Concurrent and predictive validity of our various evaluation methods should be possible.

4. Withdrawal Profile
   (a) What are the characteristics of students at risk for failure or dropping out?

For those students who leave the program prior to completion, either by failure or withdrawal, data on their activities and reflections on the program will be obtained by questionnaire. Reasons for leaving the program (personal, e.g., financial; career, e.g., dislikes nursing; educational, e.g., too unstructured; etc.); strengths and weaknesses of the program; future plans; etc. are addressed in the questionnaire.

5. Postgraduate Follow-up
   (a) Is there a relationship between program clinical experiences and postgraduate employment decisions?
   (b) Is there a relationship between program performance and performance on the registration examinations?
   (c) What is the extent and type of migration of graduates?

The location and employment activities of program graduates will be obtained through questionnaires at various points in time. The type of setting (hospital—specialty, community, etc.), type of position (staff nurse, head nurse, etc.), length of time in position, educational responsibilities, research responsibilities, and continuing education activities will be obtained through questionnaires. Patterns of career choices and opportunities should emerge over time. Individual scores on the registration examinations will be obtained with the permission of the student.

Coding and Data Entry

Admission process information, including demographic and academic information, are coded and computerized at the time of application to the program and are available for statistical analysis. Personal interviews and autobiographical letters are scored by teams of assessors at the time of selection and these raw scores will also be added to the data base. Throughout the course of the program, all grades achieved in all courses taken will be entered. In addition, all clinical settings will be coded and each setting in which the student has a clinical experience will be entered as well. Withdrawal interview questionnaires and postgraduate follow-up questionnaires will be scored, coded, and entered at appropriate times throughout the year.

Data entry will occur at particular intervals during the year as the data become available. For example, admission data can be entered during the early fall, while program performance data (grades and clinical experiences), will be entered in the early summer. Postgraduate follow-up questionnaires will be distributed during the early fall and returns will be scored and coded during the late fall.

Steps to Consider in the Design and Use of an Educational Data Bank

From the foregoing description of the developmental process, it is apparent that an educational data bank is a necessary, but not sufficient condition for program evaluation. Close collaboration among educational planners, managers, and researchers is necessary to insure that:

1. Priorities in evaluation are agreed upon and the studies that are designed reflect these priorities. It is the multiplicity of program goals that is often

the source of disagreement among program personnel and, in turn, affects the quality and usefulness of subsequent studies (Suchman, 1976). For program evaluation, it is essential to classify the type of research objectives into useful groups that reflect some logical progression from hypothesis generation about the "causes" of educational performance through testing of ways of effecting educational performance, to assessing the impact of the educational program on individuals, and the provision of nursing services to the community at large. Each of the types of studies involves a different type of question and a different set of methods.

2. The program objectives are clearly specified and decisions are made regarding which are measurable and how they can be measured. As part of this process, it is useful to classify the most general objectives through steps or subgoals through which the program seeks to achieve them. Often these steps or subgoals are measurable while the less tangible general goals remain inaccessible.
3. The length of time that must elapse before an objective can be assessed is determined.
4. The items chosen for inclusion in the bank are reliable and necessary to answer the question posed. The most common dilemma in the development stage is deciding what items are to be included. There is a need to identify precisely the end purpose for which the data base will be used. A careful assessment of the minimum data required to achieve the objective would be reflected in a considerable reduction in start-up costs.
5. The data sources and when the data will be available are identified. Knowledge of the administrative information system that is currently in use is essential in order to avoid duplication of effort. Predictable data entry points will allow program and research planners to develop time frames regarding the initiation of studies and reports.
6. Implications for proposed program changes are considered and implemented changes are described in order to assess their impact. The role of evaluation may have little effect unless the results are understood and accepted by the faculty. The study findings must be useful and have practical value. The involvement of key planners in every stage of the evaluation process is essential. The more involved the educators can become in interpreting the results of the evaluation and in formulating the recommendations, the more acceptable are these likely to be and the greater chance they have of being put into practice.
7. Confidentiality is safeguarded by insuring access to data stored in the data bank is strictly controlled. The establishment of an ethics committee to vet all program and research requests may be useful both to confirm the confidential nature of the data, as well as the credibility of the resulting studies.

In addition, while a data bank may be seen as useful for both administrative and evaluative research purposes, it is a complex venture that requires commitment, collaboration, and co-operation at all levels of the organiza-

tion. Financial and faculty resources are most important, not only for the developmental stage, but also for the maintenance and use. Depending on the organization's resources (people and equipment) and structure (systems currently in use), start-up costs may be heavy. Once the system is operational, there should be minimal increase in cost over currently budgeted costs for actual data collection. Operating costs must be budgeted annually. Faculty involvement in stages of monitoring and priority setting regarding function and use of data are essential. Once the system has been established, a data bank manager must be in place to enter new data nd prepare statistical analysis. The quality and usefulness of the subsequent educational studies are dependent upon all of the above.

Value For Education Research

In summary, this data system will allow us to identify and monitor trends and patterns within the five categories of information. For example, changes in the applicant pool, over time, may impact our admission policies. Should increasing numbers of qualified diploma registered nurses apply for admission to the program, the present proportion of types of registrant may need to be revised. Similarly, the relevance of our objectives and educational methods should be able to be determined through follow-up studies of our graduates. Do our selected clinical experiences have a steering effect on career choices? In our program is emphasis on clinical problem-solving reflected in the types of responsibilities, positions, and continuing education of our graduates? Do our various evaluation methods have predictive validity?

Follow-up studies should be strengthened through our future ability to identify discrete cohorts of students with similar characteristics across classes. This should render sample sizes of sufficient strength to draw appropriate conclusions. In addition, we will be able to determine the representativeness of responding follow-up groups and the biases introduced by differences in respondent and non-respondent groups.

The data base will provide an opportunity for linkage with other internal and external systems and comparison with other institutions. Does our applicant pool differ in any significant way from that of other B.Sc.N. programs? Do our graduates' career paths differ from those of graduates from other B.Sc.N. programs? Ultimately, this data base and the questions that it can answer, should provide more reliable evidence to permit rational decision-making regarding admission policies, curriculum design, and revisions necessary to meet both the goals of the program and social requirements.

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