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ACADEMIC PROGRAM PLANNING AND SCHEDULING
DECISION SUPPORT SYSTEM USING
OBJECT-ORIENTED SIMULATION

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Abstract

This paper describes a research project that is being conducted on using object-oriented simulation within a decision support system (DSS) to support department level course planning. The use of objects in the simulation allows attributes for the student entities based on life circumstances, locality and past performance. The DSS also supports the modeling of program requirements and faculty. The anticipated results of this research will be a fully functional DSS based on a simulation model of students that will support course schedule development, analyze section effectiveness, and provide justification of staffing levels.

Keywords: Decision support systems, object-oriented simulation, academic program planning, higher education, scheduling

Introduction

The task of academic program planning and scheduling in institutions of higher education is highly complex and demanding. The department is responsibility for creating a schedule for its courses to meet the requirements of three different parties: faculty, students, and administration. This task becomes increasingly difficult when resources are constrained.

This paper studies academic program planning and scheduling in the Management Information Systems (MIS) department at a small university located in the Midwest. A significant change in resource requirements has recently occurred when the department began to offer its Master of Science degree program via the Internet. The enrollment in the master's program is growing, and the number of MIS faculty is becoming insufficient to meet the increased needs. This results in teaching and advising overloads, course cancellations, and, in turn, delays student graduations.

Problem Statement

The need for program planning in the MIS department is driven by several factors: increase in demand of information systems (IS) professionals, change in curricula delivery techniques, and difficulty in recruiting and retaining MIS faculty. First, the growing demand for highly skilled IS professional in the Midwest area (Murphy 2000) has led to the return of students to graduate school. New bachelor degree graduates go to graduate school expecting to get better jobs as a result of a master's degree. Second, advanced technology such as the Internet has opened a door for instructors to explore a new way of delivering courses. Third, faculty shortage due to constant turnover becomes increasingly burdensome as the number of enrollments increase. In the past few years, it has become extremely difficult to recruit and retain faculty members due to the tight job market.

All the aforementioned problems create driving forces for the department to find a means to improve the program to meet current and future needs. We propose a decision support system (DSS) using object-oriented simulation to support the model management of program requirements and faculty availability.
**Academic Program Planning**

Environmental factors such as economic policies, technological developments, political decisions, and population demographics are changing rapidly and higher education institutions have a hard time keeping up with the fast pace of change (Parnell 1990). Colleges and universities need a new mindset to develop new organizational structures and strategies to respond quickly to the rapid change in the environment. Many studies have been done in the area of enrollment management which focus on a systematic set of planning and monitoring activities whose purpose is to exert influence over student enrollments at the institutional level (Hossler et al. 1990, Penn 1999). However, little has been examined on program planning at the departmental level.

Program planning is an important function that assists an academic department to attain its short-term and long-term goals and also maintain a high-quality education. The value of employing a systematic planning approach to program planning has been demonstrated widely in colleges and universities throughout the country (Hass 1987). An effective plan needs to be built not only on the strength of the program, perceived student interest and community needs; but it must also align with the program objectives (Academic Program Planning and Approval Process 2000). The results of planning can be affected by factors such as the number of student enrollments and degree completions for different sets of program requirements, faculty sizes, and course delivery mechanisms. Since academic planning is difficult and complex due to many factors involved (Murray 1995), we need a decision support tool that is able to provide information necessary for successful planning.

**Characteristics of DSS Model**

The objective of the DSS is to provide estimates of student enrollments and degree completion for different sets of program requirements, faculty size, and course delivery mechanisms. This DSS needs to be flexible in use and to support adaptation to various decision strategies because of the diverse set of users.

The profiling of student attributes is based on statistical analysis of actual student experiences over a 12-year period. Some of the attributes, which are obtained from statistical analysis, include new student enrollments, course preferences, course completion, course loads, and student retention. Heuristic parameters for on-line course preferences are based on a two-year period of offering courses in both in class and on-line formats. Additional parameters will be developed to support the impact of marketing the on-line program over a wider area and the impact of economic changes or partnerships with other organizations.

The DSS is constructed using Java technology (with an object-oriented simulation core), which allows for the potential of a Web-based deployment. Key components of the research project will be the creation of a model using an object-based simulation of students and graphical user interfaces. We intend to examine the impact of this form of model and interface of the various user groups from both technical aspects, e.g., usability of the interface, acceptance to the system, and a process perspective, e.g., decision effectiveness and efficiency. The later research will involve the individual and organizational goals and decision-making processes.

**Simulation and Course Schedule Planning**

Simulation modeling includes the concepts of entities, events, and resources. In the realm of course schedule planning, the entities are the faculty and students. The goal of an academic organization is not only to provide course sections in sufficient quantity and frequency to allow students to complete a program of study in a reasonable period of time, but also to provide flexibility of when the student can enroll in core courses and to provide a selection of non-core courses.

The events that are appropriate to the modeling process include admission to the program, enrollment in a course, course completion (which includes withdrawals and unsatisfactory grades) and completion of studies (graduation or termination). The tracking and prediction of these types of events are important because they are used to generate the student retention and enrollments in the simulation model. Predictive validation using several years of student data will be used to test the simulation model (Balci 1998). A student object in the simulation model that will perform course selection decisions based on current student state and available. Statistical analysis will be used to develop choice parameters. Students are expected to change their selection criteria over their enrollment period.
The faculty is represented in the model as resources that are assigned to specific course sections in a multiple semester schedule. The availability of faculty is variable due to employment issues and other responsibilities (research, administrative duties, sabbatical, etc.) resulting in dynamic set of resources.

The overall goals of the DSS are to provide students with a schedule of courses adequate to allow successful completion of their degree while minimizing faculty costs. The DSS will combine simulation and optimization to identify solutions that match several sets of goals (Glover 1996).

**Conclusion and Future Direction**

The results of this project are expected to contribute to the academic community at three different levels: university, college, and department. First, at the university level, the top administration can incorporate program planning information into its marketing plans and activities and make appropriate commitments of fiscal, human, and technical resources. Second, at the college level, the dean will be provided with information necessary to determine the efficiency and effectiveness of the program, to identify the staffing level needed in the program, and to communicate between the administration and the department. Third, the department can use the decision support tool to plan course schedules and to evaluate students-related issues (e.g., course completion rate, retention, and graduation delays). Program planning information will also assist the chair in justifying the level of staff allocated to courses scheduled in each semester.

Future research needs to focus on how information from the DSS can be used to improve the effectiveness of the department and the student’s ability to plan their long-term schedule. We expect to improve this DSS to provide information necessary for a long-term course planning schedule, advisement system, student academic planning, and justification of program improvements and staffing levels. With top administration support, well-prepared faculty and staff, departmental-wide participation, and adequate resources, the DSS can help academic programs meet the challenges of the 21st century.

**References**


