# Adaptive Model Of Assessment Strategy For Information Technology And Engineering Programs

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Introduction

This paper focuses on the methodologies and criteria leading to the development and implementation of the adaptive model for assessment of learning outcomes based on the fouryear research through coordination and analysis of several academic programs at the Department of Technology and Information Systems, School of Business and Technology, National University, San Diego, CA. Assessed academic programs included two baccalaureate and four graduate degrees: BS in Computer Science, BS in Information Technology, MS in Software Engineering, MS in Telecommunications, MS in Technology Management, and MS in E-Commerce.

Criteria leading to the adaptive model of assessment strategy (AMAS) utilize a) ties to the university's mission and objectives, b) strong focus on improvement of students' performance, c) ongoing assessment with real-time feedback, d) guidelines regarding implementation of assessment results, and e) ongoing evaluation of the success factors determined by the external requirements derived from the industry and marketplace.

Background for Assessment and Institutional Expectations

Founded in 1971 to serve the needs of a diverse group of professional adults, National has grown in size and stature to become one of the leaders in providing innovative and challenging degree opportunities to those actively involved in the fields of their studies. With 30 years of experience and more than 94,500 graduates, National University has been actively involved since 1995 in the research aimed at improving institutional effectiveness through assessment of educational outcomes. Traditional assessment strategy adopted by National University has been predicated on determining institution's expectations with emphasis on four major principles: stating intended educational outcomes, identifying educational domains to be addressed (courses,

programs, special studies), determining methods of assessment (tests, portfolios, focus groups), and stating each program's level of expected performance. Since 1996, National University in collaboration with Dr. James O. Nichols<sup>1</sup>, Director of the University Planning and Institutional Research at University of Mississippi, has been developing assessment portfolios. Important features of this process included involvement of each and every faculty assigned to the programs, participation of the members of academic administration at the departmental, school and university levels, annual iterative adjustments of the assessment process, and validation procedures through utilization of independent external reviewers.

Why Adaptive Assessment Model for IT and Engineering Programs?

Dynamic developments in the areas of information systems, computer science, software engineering, telecommunications, and Internet-based technologies pose very unique challenge to the institutions of higher education offering degrees in those fields. Fluctuating economies and globalization factor add another dimension to the equation dealing with optimization of the offerings by different colleges and universities. Thus, uniqueness of this challenge derives from both threats and opportunities the current and future graduates in areas of computer-based information technology and engineering might face.

Since 1998, assessment process at the Department of Technology and Information Systems has been utilizing a system approach modeled as an adaptive feedback control system. A system may be broadly defined as an aggregation of objects united by some form of interaction or interdependence. When one or more aspects of the system change with time, it is generally referred to as a dynamical system.

Applying the principal concern of systems theory to the educational enterprise, an assessment process and strategy at the Department of Technology and Information Systems have been modeled by utilizing the concepts of feedback control systems: by measuring the quantity of interest, comparing it with the desired value, and using the error to correct the process, the commonly accepted chain of cause and effect in the process is converted into a closed loop of interdependent events. Adding adaptability to such a feedback control system means that "the desired value" of the system becomes itself a multiparametric function of many internal and external factors.

Adaptive Model of Assessment Strategy

Adaptive Model of Assessment Strategy (AMAS) proposed and implemented by the TIS Department as part of the university-wide assessment development at National University, has been reviewed at the four consecutive Annual Assessment Workshops, in 1998, 1999, 2000, and 2001 with participation of the National University President, Vice Presidents, academic deans, department chairs, program leading faculty, and university assessment consultants. Similar to the commonly accepted standards of assessment by other universities and colleges offering engineering programs, AMAS incorporates three major elements: determining program's expectations; identifying cohorts and assigning responsibilities; and interpreting and sharing results to enhance programmatic, departmental, and institutional effectiveness.

At the same time, the added value of adaptability of an assessment process augments those assessment standards that govern *targeted* implementation of assessment results, or "targeted desired value" in reference to the feedback control system approach. Those criteria and standards included: a) infrastructure of each degree curriculum, b) architecture supporting the infrastructure: methodologies and science/design content of the curriculum, c) connectivity: both inter-program and inter-departmental, d) reactive logistics: response to the industry demands and expectations, e) proactive logistics: envisioning the forthcoming trends in the industry, f) high-tech support for degree programs: adaptive update on the instructional hardware/software in the classrooms and laboratories, and g) optimization of experiences, areas of expertise, and academic backgrounds of the faculty selected and assigned to the programs.

# Assessment Process and Sampled Results

For each degree program under evaluation, assessment model AMAS incorporated the following subsystems: a) proposed program-specific outcomes (usually up to seven outcomes per program open for annual review and adjustments), b) proposed measurable objectives, c) proposed benchmarks for determining program success, d) proposed evaluation methodology, e) supporting database, and f) decisions based on the results of assessment and their targeted implementation.

Sampled results of AMAS implementation for specific academic programs follow.

Bachelor of Science in Computer Science

- Based on assessment and recommendations of the Faculty Judging Panels, a new course, CST 350, Computer Ethics, has been designed and included into the core BSCS curriculum.
- Based on assessment of the course CST 427, Programming in Java, and recommendations of the external reviewers, a new course, CST 440, Advanced Programming in Java, has been designed and included into the BSCS core curriculum.
- Based on assessment of the course CST 335, Data Structures and Algorithms, a new text has been selected to concentrate mostly on algorithms and data structures.
- Based on assessment of the core curriculum for BSCS program, a new course, CST 430, Programming Languages, has been designed and included into the BSCS curriculum.
- Based on recommendations of the Advisory Board for Computer Science, Information Technology and Engineering, the following new elective courses have been designed and included into the BSCS curriculum: CST 450, Artificial

Intelligence, and CST 452, Human-Computer Interaction.

Bachelor of Science in Information Technology

Based on both assessment of separate course outcomes and assessment of program outcomes, the BSIT program has undergone extensive renovation during 1999-2000 and 2000-2001 academic years: revised course descriptions for CST 431, 432, 433, 434, 435, 437, and 438, enhanced hands-on computer components throughout the program curriculum, and introduction of the two-part capstone project, IS 420A/B.

Master of Science in Software Engineering

- The updated MSSE curriculum emphasizes the state-of-the art concepts of SDLC (Software Development Life Cycle) and the Capacity Maturity Model.
- Enhancement of the web-based software principles and applications from the Internet, intranet, and extranet perspectives.
- Based on separate course assessment results and capstone project presentations, the National University's Software Engineering Capstone Project Manual and Document Specification have been designed and implemented.
- New curriculum development has been initiated to supplement the in-class content with an online environment; in particular, two Software Engineering courses are being designed for online offerings - SE 621 and SE 625.
- Development of the Software Engineering Dedicated Laboratory for capstone projects.
- Proposal to use the Artisan UML software as one of the software development tools in the industry. Department has been awarded the Unified Modeling Language license grant by Artisan Company (\$2.2M).

Master of Science in Electronic Commerce

- Courses CST 620-625, 638, and 656 have been redesigned, with new title and description.
- The course CST 625 (Electronic Payment Systems) has been enhanced by adding the topics on "Strategy and the New Economics of Information" by Harvard Business Review.
- To respond to the growing interest in the industry toward the ORACLE Database Platform, department is currently implementing two initiatives: accommodating the Oracle Database security features into the course CST 625 for conceptual enhancement and substituting the MS Access/SQL topics in CST 638 (Database Management for E-Commerce) with application concepts of the Oracle Database.

Master of Science in Telecommunications Systems Management

- A special course "Telecommunications Laboratory" is being designed as a mandatory part of the new program curriculum.
- Two new courses will be dedicated to the applications of the state-of-the-art software packages dedicated to the Decision Support Tools for Networks.

• New curriculum will include the Telecommunications Research Topics course dealing with new concepts, processes, and products in the industry, as well as serving as a springboard for the capstone Master's Research Project.

### Conclusions

This paper examines accumulated four-year assessment experience, lessons learned, and strategic planning process augmenting both internal (strengths/weaknesses) and external (opportunities/threats) factors. Emphasis is made on standards and criteria for implementation of assessment results intended to improve academic quality and rigor.

The following major innovations have been introduced as a result of the four-year adaptive assessment process:

- 1. New program, BS in Information Systems, with areas of concentrations in Database Administration, Telecommunications, and E-Commerce, has been designed and implemented effective June 2001.
- 2. Advanced computer system, including both hardware and software components, has been designed in support of several academic programs in Software Engineering, E-Commerce, and Computer Science.
- 3. New program, MS in Information Systems, is being finalized for offerings effective July 2002.
- 4. Currently, two new programs, MS in Digital Communications and MS in Wireless Communications, are being designed for offering at the beginning of 2003 calendar year.
- 5. MS on Technology Management has been redesigned with emphasis on data Mining Tools, Information Security Risk Analysis, and Emerging Trends in E-Business Implementation Management.

## Bibliography

1. James O. Nichols, "The Departmental Guide and Record Book for Student Outcomes Assessment and Institutional Effectiveness", Agathon Press, New York, 1995.

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