

Improving Academic Quality in a Computer Science Graduate Program

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Abstract—Building quality programs based on academic metrics are considered an effective means for recruitment and retention in higher education, especially in the areas of science, technology, and math. The aim of this paper is to share the academic review process of Nova Southeastern University and the results of the collegial, peer, and external review to continually build the quality of the Master of Science in Computer Science.

Keywords: Computer Science, Academic Review, and Assessment

I. INTRODUCTION

Although most institutions of higher education are collecting evidence of student learning, it is not clear how results are being used for improvement (Baker, Jankowski, Provezis, 2012). Some institutions measure education program quality strictly on the publications of faculty (Laender, Lucena, Maldonado, Siva & Ziviani, 2008). According to the New Leadership Alliance's Committing to Quality Guidelines for Assessment and Accountability in Higher Education (2012), the following are four principles for effective assessment practice: set ambitious goals, gather evidence of student learning, use evidence to improve student learning, and report evidence and results. Borrego and Cutler (2010) recommend enlisting assessment/evaluation assistance when evaluating and improving the curriculum. At Nova Southeastern University, Academic Program Review consists of ongoing, high quality peer reviews of all the University's academic units and programs on a five-year cycle. This paper reports on this academic review process; this is followed by the results occurring through the review the M.S. in Computer Science. Wendler, Bridgeman, Cline, Millet, Rock, Bell & McAllister (2010) suggest that a strong system of graduate education is the basis for global competitiveness. Additionally, they discuss how graduate students and academic expectations are changing.

II. ACADEMIC PROGRAM REVIEW

The continuous assessment of academic learning in order to stimulate action for improvement stands as one of the most challenging and necessary undertakings for higher education academic leaders. In response to this need, Nova Southeastern University created an Academic Program Review system, which facilitates the university's processes for internal reflection and program growth. The Academic Program Review allows for an outcome-based review of the program's progress on the road to academic excellence and preeminence by defining and enumerating academic improvement metrics in the areas of curriculum, faculty, students, student services, and living their mission. Academic review involves a six-step process that is evaluative and prescriptive leading to plans for building the quality of the program, students, curriculum, and resources.

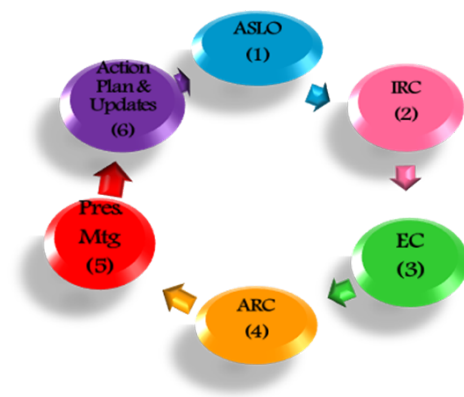


Fig. 1. Academic Program Review Cycle

The six-step evaluation process includes:

1. Academic Information Collection & The Assessment of Student Learning Outcomes (ASLO);
2. An Internal Review Committee (IRC) Evaluation and Report;
3. An External Consultant's (EC) Evaluation and Report;

4. A Summary of Evaluations and Recommendations from the Academic Review Committee (ARC);
5. The program's response to the Academic Review Committee's summary, evaluation, and recommendations; and
6. An action plan developed by the dean and faculty and accepted by NSU's president and provost. The action plans, once accepted, are incorporated into each academic unit's long and short-term planning process.

A. *Assessing learning*

Working with data collected for the M.S. in Computer Science, the faculty measured their programs against the standards of the most prestigious programs in the areas of curriculum, faculty, students, educational support services, and mission and vision. Computer Science faculty, faculty from the university, and an external consultant worked together to evaluate the program and outline necessary elements of preeminence. The process began with a formal reporting of the assessment of student learning outcomes. This paper reports on the program outcomes and includes a discussion of the rationale for which outcomes are being analyzed. The direct assessment method is described in the report, including how data is collected and analyzed. Faculty are asked to clearly show the linkages between the expected content of student products and performances, assessment instruments (such as rubric items), and the program outcome under study. An outside reader must be able to see the relationship between the direct assessment, the assessment instrument, and the program student-learning outcome. An analysis, interpretation, and discussion of result is compared to the expected level of achievement of the program-learning outcome. If applicable, a comparative analysis of student achievement for each type of location and/or modality is provided with a summary of achievements, strengths, and weaknesses in student learning. Faculty are asked to reflect upon the assessment results, outline strategies for improving student learning, and discuss implementation methods.

B. *Internal Review Committee*

Reviews are forward-looking and the Internal Review Committee Report is expansive. First, the Report identifies preeminent programs and highlights what qualities define "preeminence". Next, the Report summarizes the information that will be presented and positions the program in relation to the University's mission statement and overall goals. The most substantive part of the Report focuses on specific and in-depth analyses of the program.

The Assessment of Quality section of the IRC covers five general areas: Faculty Development, Student Enhancement, Curriculum Development, Student Services, and the Program's Fit with the University. Under each of these general headings, several areas are analyzed. For example, the Faculty Development section analyzes whether the faculty are sufficient in number and quality. Student data includes

enrollment, aptitude to perform in the program, and participation in faculty-student research.

C. *External Consultant's Evaluation*

External Consultants (EC) are experts in the field of the program to be reviewed, and accepted as leaders in their area of expertise. For each program to be reviewed, a designated EC will provide to the Provost a written evaluation of the program and a critique of the IRC report. Subsequent to the conclusion of site visit, the EC will provide a written assessment that comments on the validity and accuracy of the internal review committee report.

D. *Academic Review Committee*

The Academic Review Committee (ARC) is a permanent, standing university committee appointed by and reporting to the President. The main role of members is to serve as chairpersons for the Developing Academic Review Summaries that succinctly present the strengths and weaknesses of each program. Subsequent to the conclusion of an External Consultant's visit, the consultant provides a written assessment commenting on the validity and accuracy of the internal review committee report. The success of an academic program reviews depends on timely follow-through by the Dean, ARC, and the President's Office, with primary emphasis on how the academic unit can be improved through the effective use or reallocation of its existing resources.

III. ACADEMIC REVIEW RESULTS

The academic review results of the M.S. in Computer Science indicated particular attention was needed in the curriculum area. Although regular faculty review of the curriculum occurred, additional attention was needed to ensure the depth and flexibility in course selection for students. The EC found the curriculum to provide the breadth of the computer science field but at the expense of flexibility. In our experience, the curriculum revisions that enhanced flexibility of the program translated into an increased enrollment. Overall enrollment in our M.S. in Computer Science increased 43% from the fall of 2011 to the fall of 2012. New starts from academic year 2011-2012 to academic year 2012-2013 increased 133%. To this end, faculty should be discussing ways to add flexibility to their computer science curriculum to better address the needs of the workforce and attract more students into critical areas such as science, engineering, math, and technology. By designing a curriculum that is relevant we can engender interest in the field of computer science.

IV. ACTIONS FOR IMPROVING ACADEMIC QUALITY

As part of the follow through on the M.S. in Computer Science, the resulting action plan charged a faculty committee to review the program's curriculum with an eye to creating a more flexible program with multiple tracks. The committee created six concentrations in the M.S. of Computer Science program: Theory, Software Engineering, Computer

Systems, Database, Security, and Real-World Computing that began in fall of 2012. These six concentrations are designed to provide students with a deeper understanding of computer science theory and application in the areas of algorithms, computer systems, and software development. These concentrations are intended to supplement and enhance student study in computer science.

V. IMPLICATIONS OF THE FINDINGS

When thinking about assessment and improving quality that sets ambitious goals and a process that uses comprehensive program review process, higher education is called to gather data to improve student learning and improve the quality of its academic programs. Clearly, further work is needed to improve the quality of our academic programs and to optimize the learning in our graduate schools, especially in the areas of science, technology, engineering, and math. Perhaps the most significant aspect of academic review is charging faculty to look at regional and professional

accreditation standards to improve quality. This suggests the need for formal documentation of curriculum review and a formalized process that allows opportunity to reflect on the program as a whole.

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