HIERARCHICAL SYSTEM OF OUTCOMES ASSESSMENT AT PARKS COLLEGE OF ENGINEERING AND AVIATION

Karunamoorthy, S., Kirkpatrick, C., and Stolzer, A.
Saint Louis University, St. Louis, Missouri

Abstract

Outcomes Assessment is one of the keys for continuous quality improvement of academic programs. It is a vital catalyst for the pedagogical paradigm shift from Teaching to Learning. The regional and program accreditation agencies are placing greater emphasis on outcomes assessment than ever before. A typical system of program assessment should be consistent with the mission, objectives, and outcomes of the University as well as College. This paper describes the design, development and implementation of such a system at Parks College of Engineering and Aviation, Saint Louis University.

Introduction

Parks College of Engineering and Aviation offers degree programs that span a variety of disciplines: engineering (aerospace, biomedical, electrical, mechanical) aviation (aviation science professional pilot, aircraft maintenance engineering, aircraft maintenance management, avionics engineering, aviation management) computer science, and physics. The result is a diverse set of accreditation requirements from several agencies. In addition, Parks College is one of the eleven schools and colleges of Saint Louis University, an institution that takes pride in its ability to deliver a liberal arts education in the Jesuit tradition.

Developing a clear and meaningful assessment system in this environment is a challenge, and is the focus of this paper. The university administrative structure is centralized, and it follows that assessment at the program level has a significant component of university-wide content. At the same time, academic programs must meet the expectations of their students, the employers who hire the graduates, and the agencies that accredit their programs.

Parks College has chosen a hierarchical system to meet its outcomes assessment needs. This system enables the greatest amount of flexibility at the program level while enabling consistency with the missions of the university and college. This paper describes assessment with different levels of the hierarchy—from the overarching goals and objectives of the university, down to the day-to-day learning activity in the classrooms.

Hierarchical System of Assessment

A hierarchical assessment system should be consistent with the Mission of the University and hierarchical in nature with respect to the University, College, Program and Course. These five different levels of hierarchy and the body that is responsible for the development of each level is given in Figure 1. The president of the University establishes the vision and mission at all levels of administration and academic units. The Office of Institutional Study develops and implements an assessment plan that is consistent with the University's mission, to graduates from all academic units (colleges/schools). The Dean's office for each academic unit (college/school) develops an assessment system for students within the respective academic unit that is consistent with the University system.

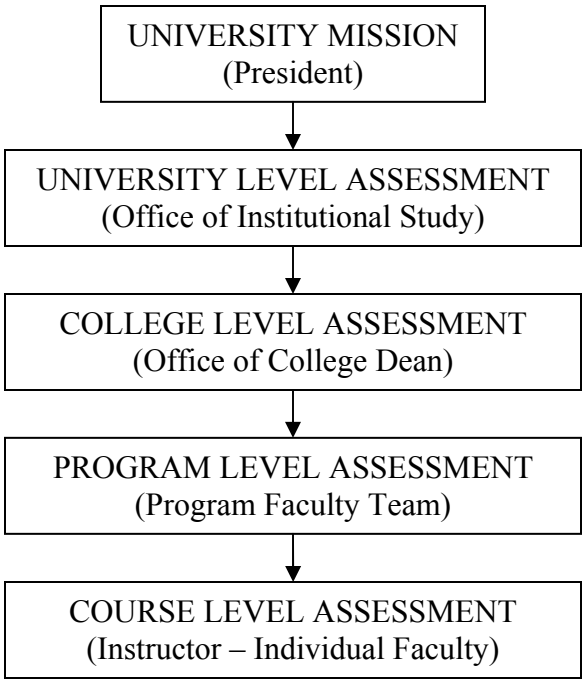

Figure 1. Development of a Hierarchical Assessment System

The faculty members in each academic program are responsible for developing an assessment scheme that is consistent with the College assessment system. Course instructors are responsible for developing a course level assessment method. If more than one faculty member teaches a particular course, they all should agree on a unified set of educational objectives and learning outcomes for the course.

University Assessment

The Office of Institutional Study (OIS), comprised of an Assistant Provost and supporting staff, is responsible for developing and implementing the University assessment system with the help of a University Assessment Committee. This committee has representatives from different academic units as well as career services and campus ministry. The committee has identified Five Dimensions of the Saint Louis University Experience that may be interpreted as University Educational Objectives. They include Scholarship & Knowledge, Intellectual Inquiry & Communication, Community Building, Leadership & Service, and Spirituality & Values, and these are consistent with the Mission of the Saint Louis University. Each dimension includes some sample Indicators of Engagement that can be translated as University Learning Outcomes.

OIS conducts a survey of recent graduates and alumni as an assessment process to measure the outcomes and the results are quantified and analyzed statistically. The results are communicated to all the Colleges and Schools. Also, the OIS fosters the assessment activities in other Colleges, Schools and Institutes.

College Assessment

Parks College of Engineering and Aviation has seven departments with eleven baccalaureate degree programs. The programs under the engineering branch include: Aerospace Engineering, Biomedical Engineering, Electrical Engineering, Mechanical Engineering, Computer Science, and Physics. The programs under the aviation branch include: Aircraft Maintenance Engineering Technology, Aircraft Maintenance Management, Avionics Engineering, Aviation Science/Professional Pilot, and Aviation Management. To develop and coordinate an assessment system and processes for all these programs, an assessment council (Parks Assessment Council) has been created. The council includes the Associate Dean of Engineering and one faculty member from each program/department.

Building Blocks of College Assessment

Consistent with the mission of the University and College, the essential building blocks are: Active Constituency, Educational Objectives, Learning Outcomes, Evaluation Processes, and Continuous Quality Improvement[1].

In general, an assessment system should be constituency-consulted and faculty-driven. A typical constituency should include: Students, Alumni, Faculty, and Employers (SAFE). The constituents should actively participate and have a high degree of involvement in defining objectives, outcomes, assessment, and improvement cycles. An Industrial (or Constituent) Advisory Committee should be created to seek input on curriculum and assessment methods[2]. Also, this committee is a valuable source for advice on contemporary issues, life-long learning, donation of used equipments, new equipment grants, capstone design projects, recruitment, etc. This committee is a valuable asset to a

program and it creates a great partnership between academia, industry and/or government.

Educational objectives should be General, Executable, and Measurable (GEM). Also, these objectives should be flexible, comprehensive, defined and documented. They should be systematically reviewed and updated with inputs from various constituencies. The learning outcomes should be Specific, Measurable, Attainable, Relevant, and Track-able (SMART). All outcomes should be well defined in terms of specific knowledge, value, and skills. They should be demonstrable, and common sources of problems in this process should be understood and eliminated.

Evaluation processes should be quantifiable. The processes used for measurement of outcomes should be quantitatively understood and controlled. The results from evaluation processes would serve as feedback information for continuous quality improvement. Such an integrated hierarchical assessment system deployed throughout the College and Programs would lead to feedback results clearly caused by a systematic approach. Also, such a system, driven by mission and objectives, would lead to continuous quality improvement of College as well as Programs.

College Mission, Objectives, and Outcomes

The mission statement describes the role and function the college serves for the students. The educational objectives describe the expected attributes of a graduate while the learning outcomes describe the expected accomplishments of a graduating student in terms of specific knowledge, value and skills.

Mission

The mission of Parks College of Engineering and Aviation is to prepare students with knowledge, skills and values for careers in Engineering, Aviation, Computer Science, Physics or related disciplines.

College Educational Objectives

1. To provide an education with knowledge in mathematics, science and information technology
2. To enhance written and oral communication skills
3. To provide an education of values in the spirit of the Jesuit tradition
4. To provide an experience in cultural diversity
5. To provide an education with a capstone experience

College Learning Outcomes

1. Ability to communicate effectively with written and oral communication skills
2. Ability to use computer skills
3. Ability to apply mathematical concepts in solving problems
4. Ability to apply scientific principles in finding solutions to problems
5. Ability to appreciate faith and spirituality
6. Ability to appreciate philosophy and/or ethics for personal growth

7. Ability to appreciate service to others and society
8. Ability to integrate knowledge for capstone experience
9. Ability to appreciate cultural diversity in community building

College Core Curriculum Requirements

In order to accomplish these objectives and outcomes, a common core curriculum has been developed. This core curriculum is required of every student entering a major degree program offered by Parks College of Engineering and Aviation. The core curriculum requirements are given below:

Professional Orientation (minimum of 1 Cr. or equivalent)

One course designed for incoming freshmen students providing an orientation to careers in the intended field of study. Also included is the presentation of resources available to students from the Department, College, and University.

Jesuit Tradition (minimum of 12 Cr.)

Theology (3 Cr.)
Philosophy and/or Ethics (3 Cr.)
Humanistic values* (6 Cr.)

Knowledge (minimum of 16 Cr.)

Science* with laboratory experience (4 Cr.)
Mathematics (3 Cr.)
Computer Science/Information Technology (3 Cr.)
Additional experience in Science and/or Mathematics (6 Cr.)

Communication Skills (minimum of 4 Cr.)

Written and Oral Communication in English (4 Cr.)

Cultural Diversity (minimum of 3 Cr.)

Cultural Diversity experience* (3 Cr.)

Capstone Experience (minimum of 3 Cr.)

A senior level course or sequence of courses providing opportunities for students to use their acquired and accumulated knowledge on a problem or in a setting that is representative of that found in their profession.

Total Credits: Minimum of 39 Cr.

Program Assessment

Accreditation is a significant factor in developing a program assessment system. In the case of the Parks College programs, multiple accreditation agencies were considered. Several of the programs are accredited by the Accreditation Board of Engineering and Technology (ABET), including the Engineering Accreditation Commission[3], the

Computing Accreditation Commission, and the Technology Accreditation Commission. Other programs are accredited by the Council on Aviation Accreditation (CAA).

The program assessment is a constituency-consulted and faculty-driven system. Each program was required to identify their constituency and form an Industrial Advisory Committee. The faculty team then developed the Program Mission, Program Educational Objectives and Program Learning Outcomes. These objectives and outcomes were subsequently modified with feedback from constituents. The revised objectives and outcomes were disseminated to all the constituents while the Program Educational Objectives were published in University Catalog. The program learning outcomes were mapped to program educational objectives, college learning outcomes, and the appropriate accreditation criteria.

The assessment process specifies methods used to collect qualitative and quantitative data on a continual basis to determine how well the graduates satisfy the program learning outcomes. In addition to regular quizzes, tests, homework, projects, and exams, the programs were encouraged to use as many methods as possible from a suggested list of viable assessment methods. The list includes (a) Industrial Advisory Committee, (b) Program Outcome Portfolio, (c) Graduating Senior Exit Survey, (d) Freshmen Survey, (e) Alumni Survey, (f) Employer Survey, (g) Three-Year Program Review, (h) Town Hall Meeting, (i) Focus Group, (j) Student Advisory Committee, (k) nationally-normed exams (e.g., F.E. Examination, FAA examinations) and locally developed exams.

Course Assessment

The course instructors are encouraged to develop Course Educational Objectives and Course Learning Outcomes for their respective courses. The course outline distributed to students at the beginning of a course should normally include the course objectives and outcomes. The educational objectives constitute the expectations of a student in terms of knowledge, value, and skills after the course are completed. The learning outcomes constitute the accomplishments of a student in terms of specific knowledge, value, and skills at the time of completion of a course. The course learning outcomes should be mapped with program learning outcomes.

A typical course assessment processes normally include homework, quizzes, tests, web-based tests, project reports, final examinations, oral presentations, etc. In addition a Course Assessment Survey by both students and the course instructor(s) should be performed. The survey questions should focus on accomplishment of objectives and outcomes in addition to feedback for continuous improvement of quality of a course.

The emphasis on assessment by an instructor should include his/her reflection on pedagogical methods used and satisfaction of accomplishing the course objectives[4]. A list of viable pedagogical methods included on the survey are: classroom lecture, laboratory demonstration, design experience, computer application, web-based tools, guest lecture from industry, seminar, video presentation, field trip and other innovative methods. The instructor is encouraged to check all the methods he/she used in a course.

The feedback from the instructor should include suggestions to improve the current course and/or prerequisite course, and students' learning process. It may also include comments on institutional facilities and resources available for effective teaching of a course.

At the end of each semester, the program or department chair is encouraged to have a faculty retreat to discuss and share the assessment results in a non-threatening way so that it does not affect rank, tenure or annual performance of an individual faculty. It should be clear to everyone involved that the focus of this activity is to achieve course improvement – not to critique faculty members. Participation in this process is greatly enhanced when the results are not used adversely toward the faculty. A flow chart for course assessment is given in the appendix.

Classroom Assessment

It would also be valuable to have an assessment at the end of each classroom period. However, it should not take more than one minute or two minutes of the class time. Also, it could be made available on the web or web-based course tools (ex: WebCT etc.) so that students can respond in their own time. If appropriate, a weekly or topic-based assessment would be a viable alternative. A typical assessment process could be a survey consisting of three simple questions.

(1) Did you learn the topics discussed today? YES NO (circle "YES" or "NO")
(2) What are your concerns in learning the topics discussed today?
(3) What needs to be improved so that you can learn better?

The response can be used to enhance the learning process with additional lecture, examples, or problem workshop. Also a feedback on how students' learn[5] would help to modify the pedagogical methods appropriately. The benefits of educational quality obtained from such assessment process are beyond the accreditation requirements[6].

Conclusions

Outcomes based assessment is a small step to take for academic programs and faculty members but it is a pedagogical leap towards students learning. It changes the focus of present day education from what is being taught to what is being learned. Learning centered hierarchical program assessment system is consistent with the assessment systems of the College and the University. Such an assessment system with SAFE constituency, GEM of educational objectives and SMART learning outcomes would certainly lead into (CQI) continuous quality improvement of a program. It facilitates a program to perform what it says it would perform as well as prove it with the analysis of collected data and use the results to improve it. Outcomes based course syllabus and classroom delivery are the important outcomes of this assessment system at both course level as well as classroom level. The implementation of such a hierarchical assessment system at Parks College of Engineering and Aviation improves the quality of education on a continual basis and minimized the efforts to prepare for various accreditations.

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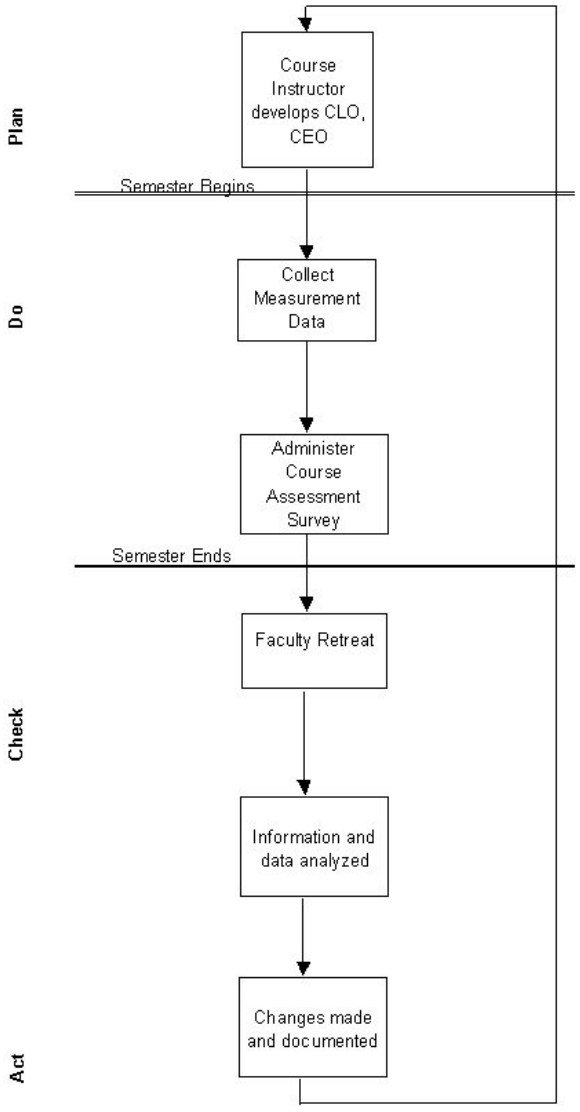
Biographical Information

DR. SWAMI KARUNAMOORTHY
Dr. Karunamoorthy is the Associate Dean of Engineering and a professor of Aerospace & Mechanical Engineering at Parks College of Engineering & Aviation, Saint Louis University. He has several publications in the areas of Aerospace Engineering, Mechanical Engineering and Engineering Education. He is the regional Vice President of AHS and an active member of ASEE, AIAA, and ASME.

DR. CHARLES KIRKPATRICK
Dr. Kirkpatrick has been Dean of Parks College since fall 1994, and has been a faculty member at the University since 1984. As dean, he oversaw the physical relocation of the college from Illinois to the main campus of the University in 1997. During this period of time, new undergraduate and graduate degree programs were established and enrollment increased by over 160%.

DR. ALAN STOLZER
Dr. Stolzer is the Associate Dean for Aviation and Professor of Aviation Science at Parks College, Saint Louis University. He holds a Ph.D. in Quality Systems, and is an ASQ Certified Quality Manager. Dr. Stolzer also holds several pilot and airplane mechanic certifications. He has several publications in aviation and quality areas, and serves on the board of the Council on Aviation Accreditation.

Appendix



Course Assessment – Flow Chart

CLO – Course Learning Outcomes
CEO – Course Educational Objectives