Academic Quality Management Based Assessment

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Abstract

This paper describes an Academic Quality Management (AQM) based assessment process and the outcome results that showed positive student's acquired knowledge and retention. Continuous improvement is the theme emphasized by ABET [1] and our AQM based assessment has worked for us and is used in the continuous improvement of course delivery to improve the learning and retention of knowledge by the students. The AQM was initially implemented in three of the freshmen courses in 2000 and based on its positive results it was tried in three more upper level courses in 2002 that gave us positive student learning and knowledge retention results. We discussed our assessment results at micro level in a paper presented titled "Academic Quality Management" [2] at the 2004 ASEE annual meeting. The AQM approach was extended to both micro and macro level to ensure that the students' life long learning experience would carry on through their professional life.

Assessment at micro-level

Various assessment techniques [3] are used in classrooms to improve delivery of instruction to improve student learning. Home work and quizzes are widely used to gauge student's learning progress along with other techniques.

AQM involves a) Active listening, b) Maintaining a Portfolio that reflect student work in total, c) Interactive learning, d) Intro to concepts through project implementation, d) Cooperative collaborative learning [4] through team approach, and e) Assessing students at the micro level using what we call a "ten minute" quiz that is given at beginning of every lecture hour to keep the students in a continuous study and inquiry mode.

The AQM was initiated in our department back in fall 1994 with stream lining of the prerequisites to our circuit courses. College Algebra was changed to a prerequisite rather than a pre/co requisite. This change helped the students in applying algebra to circuit analysis in particular for solution of problems with more than two unknowns that encountered in mesh and nodal analysis. It helped the instructor in the teaching process by spending less time teaching matrix methods to solve problems. We recognized that student's learning must be a continuous process for the retention of knowledge. The characteristics of the incoming students vary widely every semester in terms of their mathematical skills and the mix of full-time and part-time

students in the class; this aspect has to be taken into account in the delivery of instruction for success.

Evaluation of student progress is made on a continuous basis and corrective action implemented immediately. With this in mind we implemented a process we called “ten minute quiz” in three lower level courses in fall 2000. The ten minute quiz was given at the beginning of every class hour that covered concept oriented problem that was taught in the previous class hour. A benchmark of 95% of the students scoring at least 80% in every quiz was established as the base for the instructor to either review the concepts for the entire class or proceed with the next item in the learning objective. Individual cases were handled through supplemental instructions.

This process has kept the students in a continuous studying mode. The outcome results [2] showed student performance improvement in the retention of knowledge over that semester in which the course was taught. This micro level assessment was extended to three upper level courses in fall 2003 and the results are very positive.

Assessment of student learning at macro level

The department was interested in measuring the students learning and retention at the time of graduation so that we could develop and implement a continuous improvement process for the program. To close the assessment loop, in fall 2000 we developed a comprehensive testing tool that was administered to all graduating students with an Associate in Science degree. Our Electrical and Computer Engineering Technology (ECET) program offers five areas of specialization and a general plan of study in both AS and BS degree. We decided to have the Assessment Test for the graduating AS degree students. The test incorporates one hundred questions from the required ECET courses at associate level only.

The students are tested in the areas of 1) electrical circuit theory, 2) digital fundamentals, 3) electronic circuit fundamentals, and 4) microprocessor fundamentals. The questions selected were based on the learning objectives that are used in each course area. The test is a multiple choice format so that a Scantron type analysis could be made and gathers statistical information on students’ performance. Critical thinking and analytical problem solving are required to succeed in this test. The time duration is 90 minutes and is closed book.

We did not want to make the test a comprehensive examination for graduation. We developed a letter (attachment-1) that was mailed to all AS and BS graduating students every semester since fall 2001. The letter appealed to the pride of the students in taking the test and helping the department in the improvement of the department’s educational goals. The test was given six times and we shared the data (Table-1) with our Industrial Advisory Committee (IAC) for their comments and input. The mean score around 55 is a good one according to IAC. The Department collected data for three semesters to establish a baseline and then developed goals to make the necessary changes to the curriculum to achieve those set goals. The current goals are to aim for a mean score of 57 for spring 2005 and 60 for spring 2007. This goal was endorsed by the IAC. We are currently analyzing the student answers to the questions in the subject areas of the test to identify program weaknesses and to make the necessary improvements. We hope to present the statistical analysis at the conference.

Conclusions

The test is intended to assess the retention of knowledge by the students at the time of graduation. The test is closed book, and only a calculator is allowed. Our student body is almost fifty-fifty between full-time and part-time students. The average graduation time is about six semesters for the AS degree students. A number of guest lecturers are teaching the entry level courses in the Associate degree program and this will be changed by increasing the percentage of full-time faculty teaching the entry level courses subject to availability of funds. We are currently using the "ten minute" quiz in three out of four subject areas, and we expect this will have a positive impact on the mean score in the long run. Students' cooperation in taking the test is almost 100%. It is a common practice for the employers in this region to give a knowledge and aptitude test for job applicants. The students are made aware of the fact that the assessment test will be beneficial to them when they go for job interviews and take the job entry tests that are given by the employers. We are currently developing a second assessment test that will be given in fall 2005 to students who will be graduating with a B.S degree. We strongly believe that retention of knowledge by the students is achieved only when they are kept in a constant studying mode, this we encourage by using the "ten minutes" quiz. We expect the macro assessment test results to show a positive knowledge retention trend that will benefit our graduates.

TABLE-1

PURDUE UNIVERSITY CALUMET
DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING TECHNOLOGY
ASSESSMENT TEST SCORES
TOTAL POSSIBLE SCORE=100

SEM-YEAR	MEAN	MEDIAN	STD DEV	HIGH SCORE	LOW SCORE	STUDENTS IN THIS GROUP
FALL 2001	53.53	54	12.54	75	21	19
SP 2002	54.71	55	14.63	73	24	17
FALL 2002	55.05	54.5	13.02	75	21	22
SP 2003	56.01	55.07	12.59	76	24	18
FALL 2003	59.43	62	7.05	68	47	7
SP 2004	58.28	56.5	12.58	79	26	18

Attachment-1

FROM: Professor C. Sekhar

TO: ECET Degree Candidates Fall 2004

SUBJECT: Assessment Test for Graduating Students

The department's programs offering the Associate of Science and the Bachelor of Science in Electrical and Computer Engineering Technology are accredited by the Technology Accreditation Commission for the Accreditation Board of Engineering and Technology (TAC-ABET). In order to maintain the accreditation, TAC-ABET require that we assess our programs on a regular basis. One of the ways in which to assess our programs is to test the knowledge acquired by our graduates on the fundamentals of electrical engineering. Based on these results we take corrective actions, if necessary, to show improvement.

The ECET department started giving the assessment test as of the fall 2001 semester to all graduating students as a requirement for graduation. The test is given to gather data and the results will in no way prevent you from graduating. We are sure that you are proud to be a graduate of Purdue University Calumet and want to show the community that you are equal to or better than graduates from other accredited institutions. We want your best effort when taking the assessment test.

The assessment test will have 100 multiple-choice questions covering the following areas:

1. Electrical Circuit Theory (ECET 102 and ECET 152)

2. Digital Fundamentals (ECET 109 and ECET 159)

3. Electronic Circuit Fundamentals (ECET 154)

4. Microprocessor Fundamentals (ECET 209)

The time duration of the test is 90 minutes and is closed book. A calculator is allowed. There are many testing sessions to choose from. Please arrive at the starting time for any one of these:

Monday, November 29, 2004, 11:00 am, 1:30 pm, 3:00 pm or 5:30 pm. Report to Potter 300
Tuesday, November 30, 2004, 11:00 am, 1:30 pm, 3:00 pm or 5:30 pm Report to Potter 300
Wednesday, December 1, 2004, 1:30 pm. Report to Potter 300
Thursday, December 2, 2004, 11:00 am, 1:30 pm, 3:00 pm or 5:30 pm Report to Potter 300
Friday, December 3, 2004, 11:00 am, 1:30 pm, or 3:00 pm. Report to Potter 300

Please contact Mrs. Janice Novosel, our department secretary, if other arrangements are needed. Call (219) 989-2471 or send an e-mail to novoselj@calumet.purdue.edu.

Thank you for your cooperation.

References

[1] "Criteria for Accrediting Technology Programs" TAC/ABET
[2] Sekhar, C.R, Farook, O, Jai.Agrawal, "Academic Quality Management" 2004 ASEE Annual Conference Proceedings.
[3] Assessment Forum; 9 principles of good practice for assessing student learning. American Association for Higher Education.
[4] A Model for Engineering Technician Education: Teaching What the Marketplace Needs. Regional Conference, Las Vegas, NV-2003. NJCATE.

Biography

CHANDRA R. SEKHAR is a member of the faculty of the Electrical and Computer Engineering Technology at Purdue University Calumet. Professor Sekhar earned a Bachelor's Degree in Chemistry from the University of Madras (India), a Diploma in Instrumentation from Madras Institute of Technology and Master's Degree in Electrical Engineering from University of Pennsylvania. Professor Sekhar's primary teaching and research focus is in the areas of Biomedical and Process Control Instrumentation and Clinical Engineering.

OMER FAROOK is a member of the faculty of the Electrical and Computer Engineering Technology Department at Purdue University Calumet. Professor Farook received the Diploma of Licentiate in Mechanical Engineering and BSME in 1970and 1972 respectively. He further received BSEE and MSEE in 1978 and 1983 respectively from Illinois Institute of Technology. Professor Farook's current interests are in the areas of Embedded System Design, Hardware – Software Interfacing, Digital Communication, Networking, C^{++} and Java Languages.

JAI AGRAWAL is a Professor with joint assignment in Electrical and Computer Engineering Technology and Electrical & Computer Engineering. He received his PH.D. in Electrical Engineering from University of Illinois, Chicago, in 1991, M.S. and B.S. also in Electrical Engineering from I.I.T. Kanpur, India in 1970 and 1968 respectively. Professor Agrawal has worked recently for two years in optical networking industry in the Silicon Valley in California. Professor Agrawal is the Founder Advisor to Agni Networks Inc., San Jose, California. His expertise includes optical networking at Physical and Data link layers, optical and WDM interface, SONET and Gigabit Ethernet and analog electronic systems. He is the author of a Textbook in Power Electronics, published by Prentice-Hall. His professional career is equally divided in academia and industry. He has authored several research papers in IEEE journals and conferences.

ESSAID BOUKTACHE is a member of the faculty of Electrical Engineering and Computer Engineering Technology Department at Purdue University Calumet. Dr. Bouktache received his MS and PhD in Electrical Engineering from Ohio State University in 1980 and 1985 respectively. His research and teaching interests include Digital Signal Processing, Computer Networks, and Digital Communications. Professor Bouktache has been with Purdue since 1992 and is a member of IEEE and ASEE. He has several publications to his credit.