2006-2644: NUCLEAR ENGINEERING TECHNOLOGY STUDENTS CAPSTONE EXPERIENCE TO ASSESS THE TECHNICAL COMPETENCIES: A CASE STUDY

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Abstract

At Excelsior College, one particularly unique dimension of student assessment is the Integrated Technology Assessment (ITA). This portfolio-based assessment method is a capstone experience for Engineering Technology students, documenting their ability to integrate knowledge from various technical and general education areas and apply it in a meaningful way.

The on-line learning environment facilitates a learner-centered approach to learning, with the learner as an active participant in the learning process. The approach requires that the teachers help learners to direct their own learning in ways that suit their individual learning styles.

This manuscript describes the development and implementation of a Web CT-based course which requires the nuclear engineering technology students at Excelsior College to develop online portfolios reflecting technical competencies acquired by them during their academic studies and through practical experience. It is a capstone requirement in which students document their ability to integrate knowledge from technology areas, general education, and practical experience in order that program outcomes are achieved.

The manuscript provides a complete description of the ITA process at Excelsior College. Details regarding the use of information technology in creating the on-line learning environment for ITA students are also presented.

Background

Excelsior College in Albany, New York, was founded in 1971 by the New York State Board of Regents, and was originally known as Regents College. In 1998, it was granted a charter to operate as a private, independent college and changed its name to Excelsior College in 2001. Currently, it has approximately 27,000 enrolled students and is one of the most respected distance learning institutions in higher education.

It is also recognized that there are many individuals who have acquired their knowledge and capabilities through experiences other than formal classroom learning. It has long been acknowledged that in many areas, 'on the job' training, self-learning, and other life experiences can result in an individual having full competence in pursuits normally associated with study in a college setting. [1] Neither the United States nor the world can afford to overlook the squandering of talent and potential among its citizens. This is especially true in technical fields, where society has a well documented need for more engineering science and technology graduates. [2] Recognizing that college-level knowledge can be obtained in many ways,

Excelsior provides access to many different avenues for earning college credit, focusing on what students know, rather on where and how they learned it. Undergraduate credits are earned through a variety of accredited sources including for-credits exams, traditional campus-based courses, military and corporate training and distance learning and online courses offered by Excelsior and other institutions. Through these means, the college makes associate, baccalaureate, and master's degree more accessible to busy working adults. Thus the program that the student takes is a learner-based, individually tailored course of study that directly addresses the gaps in the students' knowledge and achievements needed to achieve the program objectives. [3]

Distance Learning

Distance learning provides excellent opportunities for students to acquire academic degrees from educational institutions while working at remote locations. [4] Although not yet "mainstream," on-line courses delivered over the Internet are becoming more common. [5] Educational institutions at all levels are looking at this form of delivery in the context of the future learning needs of their students. There are many advantages of online learning. It is borderless and is a practical way of learning for those who cannot travel to attend classes at an educational institution. It is flexible and allows students to learn at their own pace.

Excelsior made its first ventures into instruction at-a-distance with the introduction of its Master of Arts in Liberal Studies (1998), Master of Science in nursing (1999), and Master of Business Administration (2005) programs. Using the experience gained in these, the college has recently made a successful transition into the delivery of instruction in its undergraduate and graduate programs and now offers about 150 courses online. Excelsior College uses WebCT as its online course management system. To enable its students, all of whom are studying at a distance, to have online access to library facilities, the Excelsior College Virtual Library was introduced in 2000. In cooperation with the Sheridan Libraries at The Johns Hopkins University, Excelsior's students have access to the collection and services of one of America's most prestigious and extensive libraries.

Accreditation

Accreditation is more valuable at a non-traditional institution such as Excelsior than at a traditional institution. The accreditation process is one very crucial source of input to the institution's continuous improvement program. It provides a metric against which the institution can assess its performance, and especially its decisions regarding the creditworthiness of life experiences. It helps assure all stakeholders, students, faculty, and prospective employers, of the value of this form of education. Most importantly, it provides a continuing reminder to the faculty of the professional goals of a technology education, and provides a guidepost for the degree of rigor that should be acceptable in coursework. Accreditation also simplifies the process of certifying creditworthy courses from other institutions and provides one guidepost (but a very important one) toward assuring that the courses in question provide the necessary content and rigor. [6] Excelsior College has been continuously accredited by the Commission on Higher Education of the Middle State Associate of Colleges and Schools since 1977. Excelsior's associate, bachelors and master's degree programs in nursing are accredited by the National

League for Nursing Accrediting Commission. Its Bachelor of Science degrees in Electronics Engineering Technology and Nuclear Engineering Technology are accredited by the Technology Accreditation Commission of the Accrediting Board for Engineering and Technology (TAC of ABET). The American Council on Education (ACE) recognizes all Excelsior College Examinations for the award of college-level credit.

When Excelsior (then Regents) College was first accredited by TAC of ABET, it was under the 'old', prescriptive accreditation criteria. [7] It was quite a challenge to both the commission and the school to provide a meaningful visit experience to an institution that had no on-campus students, classrooms, labs or teaching faculty. The adoption by ABET of assessment-of-outcomes based criteria has made a world of difference; as Excelsior has always been essentially an assessment, rather than a course delivery, institution. [8] At the same time, Excelsior itself has gone more 'mainstream,' by offering a growing number of on-line courses. In this environment, the accreditation experience has been more valuable than ever. [6]

The Excelsior College BS-Nuclear Engineering Technology Program

The ABET-accredited BS in Nuclear Engineering Technology degree program offered by Excelsior College requires 124 semester hours of credits, including at least 60 credits in the arts and sciences component and at least 48 credits in the nuclear engineering technology component. All of the BS-Nuclear Engineering Technology students must complete at least one course or examination in each of the following subjects constituting the Nuclear Engineering Technology core requirements.

- Electrical Theory
- Computer Applications
- Materials
- Nuclear Materials
- Health Physics/Radiation Protection
- Radiation Measurement Laboratory
- Plant Systems Overview

In addition to the Nuclear Engineering Technology core requirements, students must complete a 3-credit Integrated Technology Assessment (ITA) requirement.

The 3-credit ITA requirement consists of the submission of a comprehensive portfolio by the BS-Nuclear Engineering Technology students at Excelsior College. This portfolio consists of information regarding students' achievement of the learning outcomes of the given program of study. The academic and professional portfolios are effective tools for academic programs to use in assessing program outcomes. All the desired outcomes for engineering education identified by ABET Criteria are addressed by these portfolios.

Integrated Technology Assessment

All BS candidates in Engineering Technology must complete an Integrated Technology Assessment (ITA) requirement. [9] The ITA process used at Excelsior College requires the

student to reflect on past academic and professional experiences and to use the information gained from this reflective exercise to develop written narrative statements related to the degree program Learning Objectives. It may be worth noting that these objectives are exactly the same as required by ABET for accredited degrees. Therefore, by completing an acceptable ITA the students are demonstrating achievement of the ABET learning outcomes for the Bachelor degree.

A learning objective is a statement of what the student should be able to do under the given conditions, at the end of a specified lesson, block of material, or course. The learning objectives may involve level of complexities such as knowledge, comprehension, application, analysis, synthesis, and evaluation. The narrative must be supported by documented evidence of mastery of these objectives. Such documentation may include but is not limited to copies of term papers, tests, laboratory reports, and other class assignments. It may also include videos of presentations given in class or on the job, and letters from professors or employers attesting to skills in the particular areas of interest.

An independent study guide, which outlines all of the information needed to prepare a successful ITA, is provided to the student. A faculty mentor is assigned to advise the student throughout the process. The ITA is evaluated in detail with extensive feedback provided to the student. Most recently, the ITA experience has been presented as an on-line course, NUC 495, with the mentor serving as the course instructor. [10] NUC 495 is a 3-credit course that when successfully completed satisfies the 3-credit ITA requirement. This course is conducted online in WebCT course management system platform. An Excelsior College faculty (Mentor) guides students to develop different parts of the ITA report and present the final report for grading.

The ITA is driven by the program's published learning objectives. The students are required to demonstrate their accomplishment of each objective with individualized learning statements drawn from their own academic, professional, or life experiences. The portfolio is to also contain evidence supporting these statements; examples of such evidence may include copies of examinations or laboratory reports, design drawings, citations from supervisors or peers, honors or awards, or similar documentation. The faculty mentor evaluates the body of information in the portfolio and provides the student with feedback throughout the process, and ultimately a quantitative grade.

The ITA is a primary assessment tool with several important functions. It fills in the picture of the student, whom the school may know only from dialog at a distance to this point. It serves as a quality check on the student evaluations performed by the school on the student. It also demonstrates to the faculty and staff the efficacy of the student body's achievement of the program objectives and provides feedback on what areas of the program may need improvement. The ITA thus helps the school fulfill its 'continuous improvement' responsibilities in addition to evaluating the individual.

The ITA also serves as a capstone experience for the prospective graduate. It helps reinforce to the student his or her accomplishments, and provides a sense of 'belonging' to Excelsior College that may have largely been missing for students that have not had extensive contact with the school. The ITA requires that learners take an active part in the learning process and participate by formulating initial ideas, considering the faculty mentor's responses, and reflecting on ideas

in the light of contribution to the discussions with the faculty mentor. In this way, learners go through a cognitive process whereby thoughts and ideas are refined and adapted taking into consideration other views and perspectives of the original concept. The ITA students experience this development as a transforming process that leads to greater personal understanding and professional confidence. [6]

Implementation of the ITA has been one of the most rewarding developments in improving the Excelsior learning model. It was first implemented as a 'do it yourself' scrapbook of the student's achievements. Based on valuable feedback from students, faculty, Industry Advisors and consultants, in grew into a more formal experience, with interactive faculty mentoring and a standard grading rubric. In its present form, the ITA is a web-based course that not only gives the student a sense of great achievement, it puts Excelsior's distinctive stamp on the student's education, no matter how few or many courses he or she has taken at Excelsior. [6]

An Overview of the ITA Process

Every student enrolled in the BS-Nuclear Engineering Technology program at Excelsior College is required to participate in the ITA development process by taking a senior-level WebCT-based asynchronous online course labeled NUC 495 and is assigned a faculty mentor. The entire course process consists of a 15-week timeline. In general, weekly assignments for students during the 15 weeks are as follows:

- Week 1 – Review course and Develop professional resume
- Week 2 – Develop ITA plan/outline
- Week 3 – Develop draft learning statements for ITA objectives 1-6
- Week 4 – Develop draft learning statements for ITA objectives 7-13
- Weeks 5 through 12 – Student completion of ITA
- Week thirteen – Faculty mentor review of complete ITA document
- Week fourteen – Student revision, if necessary
- Week fifteen – Final grading by faculty mentor

The Faculty mentor is required to review and provide feedback on the student's professional resume during week 2, ITA plan/outline during week 3, draft learning statements for ITA objectives 1-6 during week 4, draft learning statements for ITA objectives 7-13 during week 5, different parts of the ITA during weeks 5 through 12, and ITA report as indicated in the above list. To allow flexibility, individual students and the faculty may agree to change the above schedule so long as the overall 15 week schedule is followed.

Nuclear Engineering Technology ITA Objectives

Students enrolled in the BS-Nuclear Engineering Technology program are required to address thirteen ITA learning objectives. As previously mentioned, these objectives are exactly the same as ABET learning outcomes for the BS-Nuclear Engineering Technology. The objectives are listed in Table 1.

Table 1: BS- Nuclear Engineering Technology ITA Learning Objectives

Objective #	A graduate will be able to:	Characteristics
1	Demonstrate a fundamental knowledge of natural sciences, including physics, chemistry, thermodynamics, atomic physics, and nuclear physics.	• Recognize the connections between the knowledge of natural sciences and your discipline, job, hobby, or courses completed later • Identify the specific scientific principles used
2	Demonstrate the ability to understand, measure, and provide quantitative expressions of natural science phenomena, including experimentation, observation, and accurate measurement.	• Determine the types of data needed; the instrumentation needed to record the data; and the documentation, analysis, and presentation (both oral and written) of results • Demonstrate competencies in using lab instrumentation that measures physical quantities including error, accuracy, precision, and resolution • Demonstrate recording and reporting skills
3	Apply the fundamentals of algebra, trigonometry, and calculus to problem solving in nuclear technology areas.	• Recognize and identify the mathematics used in problem-solving experiences • Apply the fundamentals of mathematics to either coursework, job, or other life experiences
4	Make technical presentations in English using language appropriate to the audience.	• Demonstrate good use of the English language in the presentation of technical topics • Identify how the presentation was adapted to the audience
5	Demonstrate proficiency in the written communication of technical information using Standard English.	• Demonstrate the ability to organize and be concise in written communication • Use effective grammar that does not impede meaning • Use language appropriate to the audience • Demonstrate the ability to effectively communicate grasp of technical concepts
6	Demonstrate a working knowledge of computer usage, including knowledge of one or more computer languages or documentation of the use of one or more computer software packages for technical problem solving appropriate to the nuclear engineering technology discipline.	• Provide documentation – including some source code – showing software the student has written using a high-level language such as Fortran, C, C++, or Java **OR** • Identify the problem the student solved • Discuss the rationale for choosing the software • Discuss how the computer software package was used to solve a particular problem • Identify issues that arose and their resolution
7	Demonstrate technical competency in electrical theory, nuclear and engineering materials, health physics/radiation protection, reactor core fundamentals, plant systems, heat transfer, fluids, and radiation measurement lab.	• Show technical competencies/samples in all areas listed in objective • Demonstrate knowledge and comprehension of fundamental technical concepts discussed in coursework in each area • Demonstrate problem-solving skills in

		each area
8	Demonstrate comprehension of radiation protection procedures; currently applicable rules and regulations; maintenance, control and quality assurance; and a commitment to quality, timeliness, and continuous improvement.	• Indicate knowledge of current rules and regulations in the field • Indicate how a commitment to quality, timeliness, and continuous improvement is achieved
9	Integrate knowledge of the functional areas of nuclear engineering technology in the operation and maintenance of nuclear systems.	• Identify and describe work and life experiences that use multiple engineering technology functional areas • Show how the functional areas are interrelated
10	Demonstrate the ability to apply design concepts, creativity, balance, accuracy, and confidence limits through the understanding of the relationship between design and the operation of nuclear systems.	• Take design specifications and turn them into a device or system • Test, modify, evaluate, and improve (if necessary) an existing design • Integrate several functional units into a larger system (e.g., microprocessor, interface) • Discuss the use of tradeoffs resulting from creativity in applying balance, accuracy, and confidence limits in the development of a successful operating system
11	Participate effectively in groups.	• Describe involvement in group projects or activities • Interact effectively with colleagues who have critical involvement with projects
12	Demonstrate an ability to understand professional, ethical, and social responsibilities, including the impacts of culture, diversity, and interpersonal relations.	• Demonstrate comprehension of ethical issues • Discuss how cultural, diversity, and interpersonal issues relate to professional, ethical, and social life
13	Demonstrate a commitment and ability to continue to engage in lifelong learning.	• Describe how you engage in lifelong learning currently • Describe how you plan to continue lifelong learning

ITA Learning Statements

Students enrolled in NUC 495 are required to develop learning statements that objectively address the ITA learning objectives. A learning statement must include an explanation and example(s) of how a given learning objective has been met. Evidence must be provided in support of every learning statement. The relationship between the given learning objective and the corresponding evidence must be explained. The essential elements of good learning statements are as follows:

- Written clearly and concisely in Standard Written English
- Written in the form of a narrative
- Supporting evidence is referenced and provided
- Describe how the evidence supports the learning statement
- Show how the learning statements relate directly to the objectives
- Address each of the characteristics of the objectives in full

In order to develop the learning statements the student starts with current or the most recent position, as listed on the professional resume, makes notes addressing each of the items listed below and repeats this procedure for each of the listed positions.

- When the final draft of each Learning Statement is prepared, the student may wish to combine information from a variety of experiences. The student does not need to cite learning from each work experience, but may refer to more than one job situation for each Learning Statement, as is appropriate, e.g., one might cite previous educational experience, experience as an electrician's mate in the navy, and position as a senior reactor operator in a nuclear plant, as related to a specific objective.

- Write a brief description of experiences in each position and the learning gained from them. As the student reflects on these experiences, questions listed below should be asked by the student. In answering the questions, be sure to include the learning attained from the college-level studies and any continuing education that may help the student to demonstrate competency.

  What specific technology-related competencies did I acquire?
  How did I use these competencies in my work?
  What knowledge and skills am I still able to use?
  Did I attend any continuing education activities?
  Do I have any certifications to document attendance and completion of training programs?
  Do I have any project reports or letters of acknowledgement of work produced?

- Compare each learning experience student has identified to the required program objectives. These objectives are the standards by which student's learning will be measured. Student's reflection and analysis at this point represent a significant learning opportunity for the student. This is the most critical step in the entire ITA process. It will help the student to determine his/her areas of strength and areas requiring improvement.

The essential elements of good sources of evidence are as follows:

- Legible
- Clearly labeled and referenced in text
- Relevant to the learning statement
- Supportive of the learning statement
- Letters from supervisors or other individuals should include contact Information (if possible)
- Letters should be written on official letterhead (if possible)

Having identified the match between student's professional and educational experiences and the competencies, student must demonstrate how the evidence clearly validates that student has met the ITA objectives.

- Acceptable evidence includes graded coursework (exams, papers, lab reports, homework, computer programs, projects) documenting student's college-level studies from regionally accredited colleges or universities, military courses completed and/or occupational specialties/ratings held, and official documentation of ACE/NY National PONSI-evaluated employment training courses; job performance reviews which verify the skills identified; certificates from continuing education courses; position descriptions and letters from supervisors attesting to our competence in specific areas; videotapes of presentations student have made for employment or class projects or to civic or professional groups; copies of computer programs student have developed, etc.

- Letters from supervisors should specifically address the objectives rather than provide testimony to student's character. Analyze student's entire ITA and carefully identify all areas in which the writer can assist student. For example, a supervisor might be able to describe student's ability to apply mathematical concepts to solve problems (objective 3), as well as student's proficiency in written communications (objective 5). Be sure to confirm that the supervisor is willing and available to receive a phone call from the faculty mentor if follow-up information is needed.

- Supportive evidence should be clearly identified by the specific page number. Highlight the specific reference on that page, if it is not easily identifiable.

- Supportive evidence must be legible. Letters and performance reviews must be signed and dated. Evidence must be specific to student's work and educational experience.

- The faculty mentor reserves the right to authenticate all sources of evidence.

Sample Learning Statement and Evidence

Acceptable sample of learning statements and evidence that can be used to support them are as follows:

Learning Objective 1 – Demonstrate a fundamental knowledge of natural sciences, including physics, chemistry, thermodynamics, atomic physics, and nuclear physics.

Characteristics:

1. Recognize the connections between the knowledge of natural sciences and your discipline, job, hobby, or courses completed later
2. Identify the specific scientific principles used

Learning Statements:

- I completed Physics I-II, Thermodynamics, Atomic and Nuclear Physics at Naval Nuclear Power School. I completed Chemistry I at State Community College. My status report and the attached course materials document this.
- In the physics courses I learned about measurement, vectors, and Newton's three laws of motion. At Nuclear Field "A" School I learned reaction

turbines commonly use a dummy piston to balance the full load thrust on the machine. Newton's first and second laws apply to that design and are a practical application of what I learned from "mechanics" relating to steam turbines. I am including examples of my coursework as evidence.

- As a reactor chemist, I am required to calculate chemical additions based on the type of experiment and the power history of the experiment, using knowledge from both chemistry and nuclear physics. I am including sample calculations.
- As a reactor operator in the Navy, I was required to understand, control, and explain nuclear and chemical reaction concepts associated with a nuclear propulsion plant. The concepts included elastic and inelastic scattering collisions, atomic absorption and decay, and effects on chemical reaction rates. Attached is a copy of my job description.
- As an example of application of knowledge learned in an electrical circuits laboratory course, I assisted an electrician having difficulty calibrating an instrument because he was using two different multimeters and each was set on a scale with different ranges. I had learned that the multimeter internal resistance changes as a function of scale setting and observed that this was creating the problem. I am including a letter from my supervisor.

Evidence:

- Identification of applicable courses on Excelsior College Status Report
- Copy of DD Form 214 Military Discharge Papers
- Copies of certificates and licenses
- Examples from completed coursework
- Descriptions of job assignments and responsibilities
- Letters from supervisors

Students Requirements

When students take courses on-line, there are assumptions that students will have a basic knowledge of computer hardware and software. Specifically, students taking NUC 495 are expected to possess:

- Knowledge of computer terminology;
- Knowledge of computer hardware;
- Skill in electronic communication;
- Ability to prepare a word processing document;
- Ability to prepare a word processing document;
- Ability to navigate the Internet;
- Working knowledge of database and spread sheet software;
- Ability to evaluate information presented on a web site;
- Ability to search the literature using an on-line database.

The role of the student in the ITA process is to:

- Complete WebCT course and follow all rules, policies, and guidelines established by Excelsior College, WebCT, and the faculty mentor
- Submit professional resume during the first week of the course

- Submit ITA plan/outline during the second week of the course
- Submit draft learning statements for learning objectives1-13 during weeks three and four
- Submit learning statements and evidence during weeks five through twelve culminating in a draft full ITA report in the week twelve
- Submit any revisions to the draft ITA report by week 14
- Grade ITA according to established procedures/deadlines and scoring rubric and post grades to WebCT grade book.
- Stay in touch with faculty mentor during the semester by phone, WebCT mail, WebCT chat, etc.

Role of the Faculty Mentor

The role of ITA faculty mentor is to:

- Review and comment on the student's professional resume during the first two weeks of the course
- Review and approve the student's ITA plan/outline during the third week of the course
- Review and provide feedback on draft learning statements 1-13 during weeks four and five
- Review and comment on learning statements and evidence and draft full ITA report submitted during weeks five through twelve
- Provide feedback on all materials submitted by student promptly or as mutually agreed to
- Grade ITA according to established procedures/deadlines and scoring rubric and post grades to WebCT grade book.
- Stay in touch with student during the semester by phone, WebCT mail, WebCT chat, etc.

ITA Grading Rubric

ITA students submit all the ITA materials within NUC 495 course. The professional resume, ITA plan/outline, and learning statements should be in Word format. Evidence may also be in Word files or may be scanned as graphic files. The completed ITA must be submitted by the end of week twelve. Upon review, the faculty mentor may require the student to resubmit a section or sections. The resubmission/final draft of ITA must be submitted by the end of week fourteen.

A 5-point scale is used to evaluate learning statements and sources of evidence relative to program objectives. The learning statements for each objective are graded on the following scale:

NS – No Submission
NR – Not Responsive to Objective
MR – Minimally Responsive to Objective
R- Responsive to Objective
HR – Highly Responsive to Objective

Faculty mentor will evaluate each ITA with the characteristics for a rating NR and then moving to MR, R, and HR if the relevant characteristics are evident in the student's work. To be successful, a student must receive a minimum grade of "MR" (Minimally Responsive to Objective) or above on all program objectives. This will result in an overall grade of "PASS" on the ITA. Students who receive a rating of NR on one or more objectives after the final review would be required to register for another ITA course and obtain ratings of MR or above in those areas where they initially achieved NR ratings. For example, for the Nuclear Engineering Technology ITA Objective 1, the competency statements associated with the scoring rubric are as depicted in Table 2.

Table 2: Scoring rubrics for ITA

Rating Scale	Rating Definition	Nuclear Engineering Technology Objectives 1 Competency Statements
NS	No Submission	
NR	Not Responsive	Evidence not provided for relevant courses. Coursework and other examples not demonstrative of required knowledge
MR	Minimally Responsive	Presents appropriate course evidence with a few examples from coursework and a few connections between coursework and applications
R	Responsive	As in MR above and presents multiple examples of coursework and clear evidence of applications to the discipline, job, hobby, or later courses
HR	Highly Responsive	As in R above and presents many detailed examples of coursework and applications in career or other activities

It has been observed from the experience of implementing this grading system that there appears to be a tendency for students to be satisfied with MR grade. Furthermore, since MR is a passing grade and being a qualitative in nature it does not affect the students' grade point average. Therefore, they do not feel encouraged to exert more effort in order to receive higher than MR grade. The College looked into the reasons for this and investigated ways in which the grading system could be changed to encourage students to put more effort in developing their ITA reports so that higher grade could be achieved. It has recently been decided to convert the above grading scale points to integer values; where HR = 3, R = 2, MR = 1, and NR = 0. After an ITA has been graded by faculty, a sum of integer values for each grading scale point will be computed. If the ITA has no NR grades, letter grades of A, B. C, and F will be assigned for 31-39, 22-30, 13-21, and less than 13, respectively. The letter grades will carry the customary grade points and will be counted in computing the student grade point averages. If the ITA has one or more NR grades, the student would revise those learning statements and sources of evidence that were graded NR and resubmit and the process would be repeated.

NUC495 Course Evaluations

A course evaluation template is provided to students in each on-line course for course evaluation. The template has been developed by the College and is administered at the end of the course in a way that avoids any conflict of interest and the results are then provided for review and use by the individual schools. The template consists of 27 questions. Twenty four of these questions employ a rating scale ranging from 1 to 7. A rating of 1 denotes "strongly disagree" while a rating of 7 represents "strongly agree". The remaining three questions solicit a subjective response from students. All the twenty seven questions are listed below:

Course Objectives:

1. Initial instructions did not clarify the course objectives and content at the beginning of the course.
2. The grading policy was made clear at the beginning of the course

Global Evaluation:

3. The course schedule was not flexible enough to meet my needs.
4. I would recommend this course to others.
5. Overall I am very satisfied with this course.

Perception of Assignments:

6. Assignments stimulated my interest in the topics covered in this course.
7. The feedback I received on my assignments from this course helped me perform better on subsequent assignments.
8. The time given to complete assignments allowed me to do my best work.
9. Graded assignments for this course were returned quickly.
10. Graded assignments were not related to the course objectives.
11. The discussion questions did not help me learn the content of the course.
12. I understood what I needed to do to complete my assignments.

Perception of Faculty:

13. The instructor for this course did not seem interested in helping me learn the material.
14. The instructor conducted this course in a way that accomplished the stated objectives.
15. The instructor's feedback helped me learn.
16. The instructor for this course responded to questions in a timely manner.

Perception of Reading and Tests:

17. The readings for this course stimulated new thinking about course content.
18. The readings for this course were not presented in a logical order.
19. The readings for this course helped me meet the learning objectives of the course.

Precourse Information:

20. Before starting my online course(s) I received sufficient information about student support services.
21. Before starting my online course(s) I received sufficient information about registration requirements and prerequisites.

Quality of Interaction:

22. Engaging with other students in course related activities (e.g., discussions, team projects, etc.) made me feel like I was part of a community.
23. The instructor did an excellent job interacting with students using available technology (e.g., email, discussion boards, chat).
24. Interacting with other students helped me meet the learning objectives of this course.

Open-Ended Questions:

25. Do you have any additional comments you would like to share with us?
26. If you felt this course faired poorly on any of the above dimensions (or any that were not included above), what could we change to improve the course?
27. WebCT is the name of the software program used to administer this course. Did you have any problems using WebCT that you would like to share? If yes, what were they?

It may be noted that the questions in this evaluation are designed for a typical online course and not necessarily for an ITA or Capstone course such as NUC 495. In the course, there is no text or readings, no discussion boards, no student to student interaction, no testing, no faculty instruction to whole class, assignments are not designed to practice any knowledge but to complete the parts of ITA, etc. The course is conducted in a way to mentor students on individual bases online. This makes sense as ITAs of different students are not necessarily the same. This course merely replaces the previous mentoring process that was conducted via telephone, snail mail, faxing, or other means.

It is observed that the questions in the currently used evaluation tools that are irrelevant to an ITA process are the question numbers 6, 11, 17, 18, 19, 22, and 24. Also, some of the questions need to be re-written to reflect the ITA course requirements. Based on the data from Fall 2004 through Fall 2005, overall average end of course evaluation for NUC 495 is about 5.0 and that is just about what the average evaluation is desired by the College. The average evaluation for the same period; however, would be 0.5 points higher or 5.5 if we remove the two constructs of Perception of Reading and Test and Quality of Interaction from the instrument. The college has recognized that the evaluations for NUC 495 are currently skewed due to reasons discussed above. The College is designing a separate tool for all ITA courses in that the irrelevant questions would be suppressed to make the student evaluation of NUC 495 truly reflective of the ITA course and evaluates the appropriate variables that are relevant.

The open-ended questions queried students about perception of their online learning experience. In summary, the results from these questions for the same period indicated that the students needed certain changes in course design and more technical assistance in order to navigate through the course. The College is making these changes in the course revisions that are currently scheduled to complete by May 2006. Also, the qualitative data collected from the open-ended questions reinforced the findings that some of the questions in the evaluation tool were not applicable or relevant for the type of course that NUC 495 was. In a typical course, the overall student satisfaction is influenced by the interaction with the instructor, interaction with the students, interaction with the content, and interaction with the interface. The design of NUC495 does not render itself for some of these interactions and consequently the evaluation results tend to be skewed.

Conclusion

This paper described development and implementation of a comprehensive assessment method used by Excelsior College to assess the skills acquired by students enrolled in the BS-Nuclear Engineering Technology program offered by the College. This ITA assessment method requires that students take an active part in the learning process and participate by formulating initial ideas, considering faculty mentor's responses, and reflecting on ideas in the light of contribution to the discussions with faculty mentor. In this way, learners go through a cognitive process whereby thoughts and ideas are refined and adapted taking into consideration other views and perspectives of the original concept. The ITA students experience ITA development process is a transforming process which leads to greater personal understanding.

The experience so far has identified two issues that the College is addressing. One issue is the grading rubric that does not encourage students to do better than MR. The College has converted the grading rubric to regular letter grades so that the students are encouraged to do better and not be satisfied with the minimum satisfactory achievement. The other issue is related to the end of course evaluation completed by the students. It is designed for typical online courses and not for a capstone or ITA course. Many of the questions asked of the students in the evaluation tool may not be applicable or relevant to the ITA experience. Consequently, the evaluation results tend to be skewed and not truly representative of the ITA course. The College is changing the evaluation questions that are relevant and applicable to ITA course and provide results that can then be used to improve the course and its delivery online.

Bibliography:

1. Mary C. Bateson, Lives of Learning, Chronicle of Higher Education, July 25, 2003, Vol. 49, No. 46
2. "Grads are Ahead of the Game," Engineering Times, Vol. 23, No.2, p 1,14
3. W. Buchanan, A. Peskin, Articulation Partnerships With Non-Traditional Programs, Proceedings of ASEE Annual Meeting, Portland OR, June 2005
4. Kandasamy, S., and Manian, R. "Distance Delivery of a Laboratory Based Controls for Manufacturing Automation Course – A Success Story", Proceedings of the 34th ASEE/IEEE Frontiers in Education Conference, October 20-23, 2004. Available CD-ROM
5. Lawrence-Slater, M. "On-line Learning: A Student Viewpoint", Proceedings of the 32nd ASEE/IEEE Frontiers in Education Conference, November 6-9, 2002. Available CD-ROM
6. A. Peskin, S. Anwar, JA Rolle, Learner Focused Program Content and Outcomes-Based Assessment Proceedings of ABET Annual Meeting, San Diego, CA, October 2005
7. Accredited by the Technology Accreditation Commission (TAC) of the Accreditation Board for Engineering and Technology (ABET), 111 Market Place, Suite 1050, Baltimore, MD 21202
8. Criteria For Accrediting Engineering Technology Programs, ABET Technology Accreditation Commission, November 1, 2003
9. S. Anwar, JA Rolle, Integrated Technology Assessment; A Portfolio-Based Assessment of Skills Learned by Engineering Technology Students, Proceedings of CIEC 2005, Savannah GA , February 2005

10. S. Anwar, A. Memon, JA Rolle, Use of Web-based Portfolios to Assess the Technical Competencies of Engineering Technology Students: A Case Study, Proceedings of ASEE Annual Meeting, Portland OR, June 2005