# 2006-1964: NON-TRADITIONAL LEARNING AND ASSESSMENT APPROACH TO NUCLEAR ENGINEERING TECHNOLOGY EDUCATION

**Byron Thinger, Diablo Canyon Power Plant**

Dr. Byron Thinger is a member of the Nuclear Engineering Technology Faculty at Excelsior College in Albany, NY. He recently retired from PG&E's Diablo Canyon Power Plant where he was a Senior Nuclear Engineer. He is a Senior Life Member of IEEE, a Life Member of ASEE, and a member of ANS.

**Altaf Memon, Excelsior College**

Dr. Altaf A. Memon holds MSCE, MPW, and Ph.D. degrees from the University of Pittsburgh, Pittsburgh, PA. He is currently serving as the Interim Dean, School of Business and Technology, Excelsior College in albany, NY.

**Li-Fang Shih, Excelsior College**

Dr. Li-Fang Shih holds a Ph.D. degree in Education from SUNY Albany and is currently Director of Online Course Management in the School of Business and Technology, Excelsior College, Albany, NY.

# "Non-Traditional Learning and Assessment Approach to Nuclear Engineering Technology Education"


## Abstract

One of the major challenges of the twenty-first century for colleges is to provide the kind of support that ensures that non-traditional prospective students are not disenfranchised by obstacles in their life situation. Excelsior College offers an effective learning model for accommodating the non-traditional student. Excelsior College emphasizes student assessment activities, including conventional assessment techniques, articulation agreements, industrial partnerships, and testing. It also has recently embarked on an extensive program of distance course delivery.

Excelsior's Nuclear Engineering Technology program represents this innovative assessment, articulation, industry collaboration, and course delivery to further the cause of recognizing and educating worthy students who might not otherwise be able to complete traditional degree requirements. It is shown in this manuscript that this model is effective for creating nuclear engineering technologists that pass all the benchmarks for success in the nuclear field and serve as a testament to the Excelsior credo, "What matters is what the individual knows, not where or how he or she learned it."

There are three keys to successful execution of this model. First is the customization of program content to the individual student. The second key is the assessment, recognition, and incorporation of the specialized nuclear training within the program curriculum. The third key is strict adherence to the objectives and outcomes of the academic program in which the student is enrolled as dictated through effective counseling and advising by the Excelsior College staff. To navigate this path and determine that the program Objectives and Outcomes have been met, Excelsior has devised a unique assessment tool called the Integrated Technology Assessment. TAC of ABET provides a strong incentive for Outcomes based Assessment and the accreditation process has helped inform and improve the concepts to the continuing benefit of the program and the individual student.


## The Challenge

The typical undergraduate college student enters college straight out of high school, attends for four years, graduates, and then begins his or her professional career. Such students are increasingly being displaced by those with more complicated life histories that may make it difficult for them to realize their full potential in a traditional learning environment. One of the major challenges for colleges in the twenty-first century is to provide the kind of support that ensures that non-traditional prospective students are not disenfranchised by the hurdles of their life situation. Indeed, there may be attributes to their background that can enhance their prospects for a college career if an inventive approach to matriculation and assessment is performed.

There are many obstacles that can prevent a student from graduating from a four year institution. One particularly common one is mobility enforced by job requirements that restrict students from completing a sufficient number of credits at any one school. This is

particularly prevalent for those in military service, but it can also be true in other venues of life because of our increasingly mobile society and international economy. Another detriment to completing degree requirements are health problems and handicaps, which have the opposite effect of restricting mobility so severely that the individual's options for formal education are limited to a very local area. The many other inhibiting conditions range from poverty to advanced age. The net effect is that there is a significant number of otherwise deserving students who would have enormous difficulty obtaining a degree that certifies their true level of ability and accomplishment.

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 student in a college setting.[1] Few educational institutions, however, have the capabilities or motivation to fully assess these individual's knowledge and reward them with the appropriate credit.

Neither the United States nor the world can afford to overlook the loss of talent because individuals do not possess a four year degree. This is especially true in technical fields, where society has a well documented need for more engineering science and technology graduates. [2] In order to mobilize this resource, one must identify the roadblocks to recognition and educational attainment and seek to overcome them. Two factors, credit 'residency' requirements and lack of effective assessment policies, loom large as major obstacles for prospective students who are denied or discouraged from attaining their degree objective. This untapped reservoir of potential engineering technologists needs institutions that have the will and flexibility to meet their needs without compromising on the quality of the education or the ultimate capabilities of the graduate. That is a worthy challenge for educators in the twenty-first century.

**A Model**

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. Its motto is 'what you know is more important than where or how you learned it'. The College is accredited by the Commission on Higher Education of the Middle States Association of Colleges and Schools. All its programs are approved by the New York State Education Department and its examinations are recognized by American Council on Education (ACE). The School of Business and Technology offers a variety of degree programs, two that are accredited by TAC of ABET. They are the Baccalaureate degree programs in Nuclear Engineering Technology and Electronics Engineering Technology.

The model used by Excelsior to bring deserving students closer to their degree and professional recognition owes much to the early implementation of an outcomes assessment process. Both accredited Bachelor of Science degree programs require 124 semester hours of credit, including at least 60 credits in the arts and science component and at least 48 credits in the technology component of the major. The remaining credits

are distributed among technical electives or additional arts and science courses. Upper level technical coursework is calculus-based.

The program diverges from the conventional in three significant respects. First, there is no residency requirement, that is to say there is no minimum credit- earned requirement imposed by Excelsior College--almost all the credits could have been earned elsewhere. Hence, when the student applies to Excelsior, the college performs an assessment to verify that he or she has met the knowledge requirement of the program and to determine if there are any deficiencies that require additional study. This assessment approach ensures that the program of study is a learner-based, individually tailored course of study that directly addresses the gaps in the students' knowledge and abilities needed to achieve the program objectives. [3]

The second major difference is the many ways that credit can be earned. These include transfer credits from another school, distance learning experience from many sources, for-credit examinations including those offered by the military, and evaluated on the job training activities. A recent example of the latter type of assessment is credit recommendations for training programs in the nuclear utility industry that are accredited by the independent Nuclear Training Accrediting Board of the National Academy for Nuclear Training (NANT). [4] The first step involves assessing the training to ensure that it is a rigorous as college coursework and then assigning course and credit equivalencies. Strict adherence by nuclear utilities to follow the guidelines set forth by the Nuclear Regulatory Commission (NRC), and monitored by the Institute of Nuclear Power Operation (INPO), is required.

Because of the non-traditional nature of the program, the major focus of interaction for the student is with the advisory staff rather than the faculty. This is the third major difference. The School's advisors are specifically qualified and trained to assume this primary interface role, and have been recognized nationally for their particular competence. Since 1991, the National Academic Advising Association has presented two Outstanding Advisor Awards and six Certificates of Merit to Excelsior College advisors. A Senior Advisor in the Technology unit of the School of Business and Technology recently received one of the Outstanding Advisor Awards.

The faculty comprises both a teaching faculty that develops and facilitates on-line coursework and an advisory faculty that develops and review curricula, act on academic policy matters, evaluate courses and other credit-worthy experiences, and provide oversight to the Advisors when specific questions arise. The faculty is appointed by the Dean of the school and is recognized for their senior level standing in the profession. Faculty communicates via emails and also attends meetings at Excelsior College. Several travel to Albany from California, New Mexico, and Idaho locations.

There also are very active Industrial Advisor Committees for the baccalaureate degree programs. Members work closely with the faculty and attend almost all faculty meetings in addition to their own meetings with the Dean of the School of Business and Technology.

## Outcome Assessment

All BS candidates in Engineering Technology must complete an Integrated Technology Assessment (ITA) requirement. [5] The ITA is driven by the program's published learning objectives. Students are required to demonstrate their accomplishment of each objective with individualized learning statements drawn from their own academic, professional, or life experiences. The resulting portfolios must 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. It may also include videos of presentation given in class or on the job, and letters from professors or employers attesting to skills in the particular areas of interest. A faculty mentor evaluates the body of information in the portfolios and provides students with feedback throughout the process, and ultimately a qualitative grade.

The ITA is a primary assessment tool with several important functions. The ITA process requires the student to reflect on past academic and professional experiences and to use the information gained from this reflective exercise to demonstrate they have met the degree program Learning Objectives. [6] It completes the picture of students who the school may know only from dialog at a distance to this point. It serves as quality check on the student evaluations performed by the advisors. It also demonstrates to the faculty and staffs 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. As the 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, consider the faculty mentor's responses, and then reflect 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 students experience this development as a transforming process that leads to greater personal understanding and professional confidence.

The ITA experience has matured from the time when there was only an independent study guide (outlining all of the information needed for preparation of a successful ITA) provided to the student to the most recent on-line WebCT course with a faculty member serving as the course instructor. [7]

## Execution of the Model

For over thirty-five years, Excelsior has been deploying and refining its model for accommodating adult learners. The college has grown to have over 100,000 alumni

worldwide, with the overwhelming majority succeeding in appropriate professional careers. It graduates some 5000 students annually. The makeup of the student body is approximately evenly divided by gender and is well represented by minorities; it currently has 33 undergraduate degree programs and three master's degree programs including an online MBA program in the School of Business and Technology.

The enrolled student experiences a virtual learning environment that is different than that of most conventional college students. They are connected via the Internet, toll-free phone, and fax to their academic advisors, on-line course faculty, fellow students, library facilities, and an extensive database of available courses at many institutions. Laboratory work is completed in

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 achievement. Based on valuable feedback from students, faculty, Industry Advisors and consultants, it grew into a more formal experience, with interactive faculty mentoring and a standard grading rubric. In its present form, the ITA is an on-line 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.

In the pursuit of continuous improvement, several future developments are under consideration for the engineering technology programs. Among them are academic review and modification of existing programs and development and implementation of new programs such as Electrical Engineering Technology with Power Plant and Electronics Engineering Technology options, Nanotechnology, and Civil Engineering Technology. Others such as formalized student portfolio assessments for credit, the adoption of web- based technology for student and employer surveys, and graduate studies are under development.

The Role of Accreditation

The value of regional and professional accreditation is well established in the educational community. But accreditation is perhaps even more valuable at a non-traditional institution such as Excelsior. The accreditation process is one very crucial source of input to the institution's continuous improvement program. It provides a metric against which the institutions can asses its performance, and especially its decisions regarding the creditworthiness of life experiences. It helps assure all stakeholders, students, faculty, and prospective employers, the value of this form of education. Most importantly, it provides a continuing reminder to the faculty of the professional goals of an engineering 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. Academic advisors and students have at their disposal a database of courses from variety of institutions that have been deemed acceptable. A growing number of

articulation agreements with other institutions have identified entire programs that are likewise acceptable. But maintaining the database and instituting articulation agreements are complex and time- consuming processes. Accreditation provides one guidepost but a very important one toward assuring that the courses in question provide the necessary content and rigor.

When Excelsior (then Regents) College was first accredited by TAC or ABET, it was under the, 'old' prescriptive accreditation criteria.[8] 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 that a course delivery, institution.[9] 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.

**Conclusion**

A model has been developed for creating among deserving adult learners, engineering technologists who might have never had the opportunity for achievement and recognition under previous college education paradigms. These graduates have been shown to pass all the benchmarks for acceptance in their fields; including professional recognition, employer satisfaction, and a growing record of alumni accomplishment in their careers. ABET provides a strong incentive to Outcome-based Assessment, one that resonates very well with the founding principles of Excelsior College and other assessment-centric institutions. As such, the TAC of ABET accreditation process has helped inform and improve the concepts to the continuing benefits of the program and the individual students.

A number of other educational institutions have begun to adopt element of the Excelsior model. At the same time, Excelsior has begun an aggressive program of on-line course offerings, thus becoming more of a mainstream, course delivery institution. So we begin to see traditional colleges and this non-traditional one begin to adopt the best practices of each other, to the mutual benefit of both and to the students enrolled who graduate.

References

1. Mary C, Bateson, Lives of Learning, Chronicle of Higher Education, July 25, 2004, and Vol. 40, No 46

2. Jo-Ann Rolle, Getting a Jump on Future Shortages in the Nuclear Workforce, Electric Light and Power, September/October 2004, Volume 82.06

3. W. Buchanan, A. Peskin, Articulation Partnership with Non-Traditional Programs, Proceedings of ASEE Annual Meeting, Portland OR, June 2005

4. Joseph Kowalski, Credit for Utility Initial Nuclear Training, Silver Fox Synergies, LLC, September 2005

5. Robert Long, Altaf A. Memon, Li-Fang Shih, Nuclear Engineering Technology Students Capstone Experience to Assess the Technical Competencies: A Case Study, Proceedings of ASEE Annual Meeting, Chicago, IL, June 2006

6. Nuclear Engineering Technology Learning Objectives, Excelsior College Catalog, School of Business and Technology

7. Li-Fang Shih, Altaf A. Memon, Byron Thinger, Development and Delivery of Nuclear Engineering Technology On-line Courses: The Excelsior College Experience, Proceedings of ASEE Annual Meeting, Chicago, IL, June 2006

8. Accredited by the Technology Accreditation Commission (TAC) of the Accreditation Board for Engineering and Technology (ABET), 111 Market Place, Suite 1050, Baltimore, MD 21202

9. Criteria for Accrediting Engineering Technology Programs, ABET Technology Accreditation Commission, November 1, 2003