

Utilizing Experiential Learning for Capstone Project Credit

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I. Abstract

The typical student at many (urban) universities works a part or full time job while attending school and may already have several years of industrial experience. This experience may very well be applicable to courses in their engineering, engineering technology or other curricula. In 1998, Old Dominion University established and implemented an assessment program called Experiential Learning with the primary purpose of providing a formal mechanism for the assessment of college level knowledge and skills gained outside the college classroom.⁽¹⁾

Experiential learning has a rich history in the United States and around the world. In the 1930's Dewey (1939) focused on the importance of experiential learning in the natural sciences. After World War II, returning veterans pushed America's educational system to recognize alternative systems of learning. This resulted in the development of standardized examinations such as the College Level Examination Program (CLEP).

The American Council on Education (ACE) is an umbrella organization for our colleges and universities, located in Washington, D.C. In 1942 it founded the Center for Adult Learning and Educational Credentials. This program pioneered the evaluation of education and training attained outside the college classroom. Through the College Credit Recommendation Service, formerly known as PONSI, college and university faculty across the United States evaluate workplace training offered by business, industry, labor unions, professional associations and government agencies and make college credit recommendations where appropriate. More than 200 groups currently participate, including Ford Motor Company, American Bankers' Association, General Electric, Bell Atlantic, Central Intelligence Agency, and Society for Human Resource Management. ACE also provides extensive evaluation guidelines for military training and professional certification examinations. Students with related military experience and training benefit from ACE assessment when entering degree programs such as engineering technology

Since Old Dominion's Experiential Learning has been in effect, programs in engineering technology have assessed experiential learning for technical course credit, through the options of training evaluation, departmental examination and portfolio development. Returning adult students, with extensive work experience and engineering responsibilities, requested that their related workplace knowledge and skills be assessed for possible academic credit for the senior capstone project course. Many of these students already had job titles of project engineer or

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project manager. Hesitant at first, engineering technology program directors, in the midst of fine-tuning course goals, objectives, and outlines for TAC of ABET, investigated this possibility and developed guidelines for portfolio assessment. As of Fall 2003, ten engineering technology students, approximately 3% of the students in the degree program, have received credit for the capstone project course with experiential learning.

Experiential learning credit can only be received for the capstone course through extensive portfolio development. This portfolio must meet all course objectives and outcomes required of those taking the course. It must be project oriented and not merely a potpourri of experiences; all aspects of the presentation, including design analysis, vendor contact, drawings, written results and other supporting documentation must be verifiable as the student's own work. This paper discusses the evaluation process, and how experiential learning meets the objectives of the course, and the program. It provokes some interesting discussions about how the portfolio process might foster a culminating or capstone experience in the student's degree program.

II. Background

Old Dominion University has been involved in innovative methods to deliver its programs and evaluate work related experience for academic credit for almost two decades. Because Old Dominion University is in an urban setting with a broad range of industries including one of the largest naval complexes in the world, the typical student works full- or part-time. Students bring a wide array of experience and knowledge to the classroom, enhancing the learning environment for the entire class. Much of their background is directly related to the courses the students take.

The background and experience of many students, including certificate and apprentice school programs, are directly applicable to coursework in their programs of study. In 1998, the university implemented a formal assessment program to evaluate work and practical training for college level credit. This assessment program, called Experiential Learning (<http://www.odu.edu/webroot/orgs/ao/clt/explearn.nsf>), resides in the university as a separate academic entity, and provides a mechanism for the formal evaluation of a student's workplace knowledge and experience. Old Dominion, with its large returning adult population on the Norfolk campus and at its other sites, recognizes that learning takes place in many settings and that a substantial number of students re-enter the college classroom with a significant amount of college level skills and knowledge. The University believes that what these students have learned in the workplace could very well apply to their degree programs. Experiential Learning works closely with program faculty and administrators and with students in determining the applicability to appropriate coursework, in facilitating the development of assessment options, and in fostering successful completion of experiential learning requirements. The history of Engineering Technology at Old Dominion University and its interaction with Experiential Learning is described in detail in the proceedings of at a previous conference (Crossman and Lakin, 2004).

III. Senior Design Capstone Projects

In recent years, there have been opportunities to examine the awarding of experiential learning credit for capstone and project-based courses across disciplines such as management, nursing, human services counseling, professional writing, communication. Engineering Technology (civil, electrical and mechanical) requires senior project (capstone) courses of all students. Students generally take these courses in their last semester, after they have completed all of their fundamental engineering courses and most of their senior technical electives. This arrangement, of course, is to ensure they are in the best position to apply their composite technical knowledge to the project based course. Each of these engineering technology programs has their own version of the course. The Civil Engineering Technology program requires students working alone or in groups up to three, to complete one of the following project paths: structural design, site planning and design, or construction. Each group must identify a mentor, either an experienced engineer in industry or a faculty member. The Electrical Engineering Technology program requires individual projects of each student. In most cases electrical projects will culminate in a hard-wired device or prototype. Complex projects may result in demonstrated simulation. The Mechanical Engineering Technology program requires students working alone or in groups of two or three to complete a mechanical design. Mechanical Engineering students may initiate their own projects or in many cases work on projects identified by the instructor through his contacts with local industry. Students from all three programs submit a proposal at the beginning of the semester to be approved by the faculty member. In most cases, students submit progress reports during the semester. Oral presentations either videotaped or presented live to other class members are required for all three programs.

The projects in all three programs must address all aspects of the design process including engineering analysis, vendor contact, and component selection, detailed CAD drawings, and full discussion presented in written format and an oral presentation, usually using PowerPoint or similar computer software. Students are required to maintain and present a work log.

IV. Capstone Design Project Philosophy

The term “capstone” would seem to dictate that the senior project should be the result of knowledge gained in other coursework leading up to this final course. This course would put the “cap” on the rest of the student’s education in the program. It would be a gauge for how much the student had learned and his/her ability to bring the knowledge gained from a variety of courses to direct application to a broader design. In general, this is true, particularly when the capstone design project is a major assessment tool for the program. However, in some instances, a student may have gained most of the tools and knowledge through previous industrial experience. Because our student population includes professionals working in the engineering field, we determined to focus on what they could demonstrate at or near the end of their education, regardless of where they gained their skills and knowledge. The portfolio seemed to

provide the best method for assessing capstone competencies gained outside the college classroom. In the portfolio, the student could present related work products, verification from employees of demonstrated levels of expertise, and most important, an analysis of his or her role in the process of a team project in the workplace setting. As educators, we would like to be totally responsible for the design skills that our graduates demonstrate, but employers are primarily interested in the end product. For students with exceptional backgrounds that are demonstrated and verified, assessment of experiential learning for capstone design project courses is appropriate. Also, the portfolio process does not exclude the incorporation of academic course work. In fact, the most effective portfolio process and product include the integration of academic and workplace learning.

VI. Experiential Learning for Capstone Credit Process

The portfolio is an assessment method used in prior learning programs at colleges and universities in the U.S., Canada, Britain, New Zealand, Australia, France and South Africa. The use of the portfolio in institutions of higher learning for the award of experiential learning credit began in the early 70's. In the U.S., the Council for Adult and Experiential Learning (CAEL) has been a driving force in the development and implementation of portfolio standards. Hundreds of colleges and universities have implemented quality prior learning assessment programs using the CAEL standards.

Portfolios are used in a variety of ways in the academic and workplace settings. Working professionals such as teachers, artists, and architects maintain work-related portfolios to document their experiences and to assist them in career development and promotion. In the university setting, portfolios are used to assess learning during a student's academic career and are often used as tools for gaining entry-level positions. Trends point to the integrated use of portfolios in both university and workplace settings as tools for lifelong education. Not only is the portfolio an instrument for assessing what one has learned and applied, but also a means for setting future learning goals. Building a portfolio requires the student/employee to increase his or her awareness of strengths and gaps and promotes taking responsibility for continued professional development in the workplace (Stewart, 2000).

A typical experiential learning portfolio demonstrates skills and knowledge related to a specific course or subject area; portfolio elements include a resume, letters of verification, supporting workplace documents and a narrative analyzing the integration of theory and practice connected to the specific course work. At Old Dominion, a student must gain approval for developing the portfolio in the place of designated course work. Often, a faculty member or academic advisor may recommend the portfolio path to qualified students. Potentially successful portfolio are those with at least five years of related, and progressive, workplace experience, the ability to work independently and excellent critical thinking and oral and written presentation skills. A screening for approval includes the review of the student's academic record and an expanded resume. Upon approval, students complete an online portfolio workshop, are assigned a faculty assessor and given specific guidelines for the capstone.

At Old Dominion University, experiential learning credit for the capstone design course may only be received through extensive portfolio development. The applicable experience must be project oriented. The student must have completed the project from beginning to end and must have been involved in all aspects, not just portions of the projects. All contributions of the student to the project must be verifiable by appropriate supervisors. The project must be extensive enough to contain all of the components required of these students taking the senior capstone design course, including engineering analysis, vendor contact and component selection, CAD drawings, and a work log of project events. In the project portfolio, the student must also demonstrate knowledge appropriate to that found in junior and senior level courses in the program. The student must deliver the project in a formal written report and a videotaped oral presentation. (See Reference 2 for sample guidelines).

The portfolio must contain all aspects of the project course with verification by appropriate supervisors as to the contributions of the student to each aspect. The student must be involved in all aspects. For example, he/she cannot do the engineering analysis and someone else does the drawings. Upon completion of the portfolio, the student then submits the portfolio to Experiential Learning with a fee approximately equal to one-half the cost of the course. Experiential Learning then submits the portfolio to the program director (or faculty member) for evaluation. The faculty assessor will approve the portfolio for course credit; return it to the student for further work or not approve it for credit. Generally, screening, guidelines and ongoing communication between the assessor and the student will enhance the likelihood of a successful portfolio. The assessor is paid a nominal stipend to evaluate the portfolio. Upon approval of the portfolio, the Experiential Learning office will process a grade of “XP” for the course on the student’s transcript.

Many students, even those with significant work experience are not suited for the portfolio development experience. For example, they may have gaps in their workplace learning; their presentation skills are not strong, and they need to strengthen them through the capstone course; or, they work better in a structured classroom setting than in an independent manner. In the portfolio process, students are asked to analyze their workplace experiences and demonstrate how they are related to the course; they must also articulate connections between their practices and trends in the field. Students completing this process see multiple benefits, in addition to the awarding of academic credits. First, it is a formal validation of their expertise. Second, it allows them to trace their professional development, to reflect on their accomplishments, and to more completely grasp what they know and what they do not know. Students may be surprised at the focus on disciplinary theory and terminology, thinking that a description of what they’ve done at work is enough. The requirement to analyze the ways in which their practice relates to current theory and to name it forces them to step back and reflect on the meaning of their professional practice. Third, students find that the process and product of portfolio development spills over into their workplace lives. The process fosters an examination of their career path and the identification of future educational and professional goals. It increases skills in critical thinking and presentation. The product provides a useful tool for possible career advancement.

Faculty assessors work with their own set of benefits and challenges in the portfolio process. Obviously, the portfolio experience will not work well if faculty assessors are not clear

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about the identification of learning outcomes. They must also determine specific criteria, level of sufficiency of documentation, appropriate level of writing, and issues with learning gaps. Courses often have objectives related to professional behaviors, or soft skills, such as communication, ethics, presentation and collaboration, so there must be consideration of how these skills can be assessed in the portfolio process (Lakin and Clark, 2002). At Old Dominion, the engineering technology faculty re-examined and clarified learning outcomes for the capstone course and how they could most effectively be assessed through the portfolio experience. For example, one issue was the way in which oral communication skills could be verified. The faculty determined that the videotape presentation requirement should be included as part of the portfolio process.

Faculty assessors should consider adapting what goes on in the classroom. If there are specific activities and work product expectations for students enrolled in the course, how do these requirements translate in the workplace? If the faculty assessor expects the portfolio development process to replicate the classroom experience, both the student and assessor are in for a frustrating, time-consuming experience that misses an important point about experiential learning. There are many routes to obtaining professional knowledge and skill, and methods of assessment, such as portfolio, can validate the level of learning (Lakin and Clark, 2002). The engineering technology faculty assessing the capstone portfolio struggled with the issues of sufficiency of documentation, including the kinds, range and amount. Through assessment experiences, faculty is increasingly more comfortable with, and competent at, prescribing and evaluating portfolio requirements.

Review and discussion of successful portfolios is part of an ongoing process among all faculty assessors across disciplines. At Old Dominion University, faculty assessors attend Experiential Learning Summer Institutes where they have discussions about the assessment of experiential learning. This fosters an interdisciplinary exchange of thoughts about the challenges and benefits of portfolio development. Faculty assessors find that they benefit from the interaction with portfolio students working in the field. As professional learning objectives converge in workplace and academic settings, faculty assessors and workplace practitioners find the portfolio process as an effective avenue for discussing trends and practices. Some faculty assessors have observed a “spillover effect” in their classrooms, re-examining objectives, assessment methods and classroom activities (Lakin and Clark, 2002).

VI. Conclusions

While capstone projects are (and should be) designed to assess the student’s ability to bring together various aspects of their education and present their knowledge in a project format, there are instances when an individual’s experience can demonstrate his/her abilities in this area. Many working students already have titles of project engineer or project manager and the appropriate experience to warrant the evaluation of experiential learning for credit in capstone design project courses. The successful completion of the portfolio process truly “caps” the academic and workplace experiences of the returning adult student in the engineering technology program. Thoughtful screening, appropriate timing in the program, clear criteria, focused student/faculty interaction, and the willingness to innovate assessment models are elements that

ensure the integrity of the process and enhance the capstone experience for the returning professional in the field of engineering technology.

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