Assessing Experiential Learning in Engineering

Assessing experiential learning in engineering presents unique issues. Unlike standardized exams, each project or off-campus learning experience is unique. These “open-ended, authentic, and complex” learning experiences are difficult to assess because learning outcomes can be broad or indistinct, and different stakeholders (site supervisors, accrediting organizations, faculty) can have different concepts of what constitutes successful learning (Lakshminarayanan, 2013). Furthermore, rather than assessing factual or rote knowledge, experiential learning has at its core a different set of values. Aspects of experiential learning that need to be assessed include:

a. Knowledge and application of fundamental principles/concepts/theories
b. Creativity
c. Problem solving and troubleshooting skills
d. Professional judgment and decision-making ability
e. Ability to see the connectivity of things (the big picture) – zooming in and out
f. Initiative and self-reliance
g. Ability to communicate and cooperate (teamwork)
h. Punctuality and ability to meet deadlines
i. Resilience in dealing with setbacks, crises and failures
j. Sense of responsibility
k. Leadership ability (Lakshminarayan, 2013).

Traditional classroom assessment methods are thus unsuitable for experiential learning, as “approaches are needed that do not just encourage descriptive work but allow students to think deep about their experience in relation to the educational context.” If students are required to work outside the university, or to be supervised by their peers, professionals, or community members, then there must be “measures in place to ensure that work is assessed in the same standard as required by the university” (Chan, 2012).

Another important consideration when developing assessments for experiential learning is that assessment must provide “continuous feedback to the learners regarding their progress and to the facilitators regarding the learning outcomes in relation to the pre-established learning goals.” This helps students to gauge their own success, gives instructors an idea of what concepts need to be reinforced or which learners need to be redirected, and helps with the assessment and improvement of the course for the future (Mitchell & Delaney, 2004).

To successfully assess experiential learning in engineering, Lakshminarayan (2013), recommends taking the following steps:

1. Gather together faculty with the members of the professional community that typically supervise students in internships and placements, and work together to craft learning outcomes together.
2. Assessments should be “multimodal and provide a clear window into the progress achieved by students on… multidimensional learning outcomes.”
3. The assessment process should be facilitated by rubrics and instruments that standardize the process and ensure that grading is fair and consistent.

4. “Tight and continual collaboration must exist” amongst all the stakeholders in the learning process, as it is “critical for the team to exchange information, monitor progress, and chart future plans on a periodic basis.”

**Assessment Methods**

Assessment methods for experiential learning include reflective journals, presentations, oral interviews, academic posters, conference participation, direct observations, project reports, portfolios, pre- and post-experience surveys, physical models built by the student, feedback and comments from peers, or videos of the student at work. These methods can include peer assessment and self-assessment, in addition to assessment conducted by faculty members or site supervisors. When planning an assessment method, it is important to keep in mind that “the assessment methodology employed needs to be linked to the teaching methodology adopted and it should be planned at the same time the course itself is being planned” (Mitchell and Delaney, 2004).

Some of the most well known assessment methods for experiential learning in engineering are the reflective journal, direct observation, presentation, and oral assessment.

1. **Reflective journal**: A student uses a reflective journal to record ideas, thoughts, experiences, insights, and reflections on the learning process. This can give students the opportunity to practice problem solving, think independently, or voice opinions they may be reticent to mention in class. However, students may also be wary of being fully honest in their reflections, and may limit their comments to ones they perceive will be viewed more favorably by their assessors. Reflective journals can also be difficult for students who have English as an additional language. To circumvent these limitations, the University of South Australia assesses reflective journals for “evidence of critical thought rather than assessing students’ opinion” (Chan, 2012). It can also be difficult for students to keep up with their entries, so it may be beneficial to provide alternate methods of creating entries, such as photos, videos, or audio recordings. Students should be given rubrics and examples for guidance, as many will be unfamiliar with the format (Chan, 2012).

2. **Direct observation**: Here students are observed performing the required tasks and are assessed in relation to pre-established learning outcomes. Benefits of direct observation are that it is not subject to plagiarism or cheating, there may in fact be no other way to assess those particular learning outcomes, and it can capture otherwise ephemeral moments. However, direct observation does not assess higher order thinking, the process of being watched can intimidate students, and grading criteria can be difficult to develop for a potentially subjective process (Chan, 2012).

3. **Presentation**: The benefit of using presentations is that they can be done as part of either individual or group work, and can utilize peer and self-assessment. However, the time required to present means this method is often unfeasible for large classes. To make presentation effective, there needs to be explicit assessment criteria and a well-structured marking scheme. These criteria need to be made clear to students before they begin work to ensure that students understand exactly what is expected of them (Chan, 2012).
4. **Oral assessment**: Oral assessment assesses learning outcomes directly. It “complements perfectly with practical assessments” and “allows assessors to receive immediate reactions and responses.” However, it is a time-consuming method and can be rife with issues of subjectivity, so once again clear assessment criteria are key (Chan, 2012).

Examples of assessment plans from engineering programs, as highlighted by Chan (2012) include:

1. **The Engineering Projects in Community Service (EPICS) programs** implement each assessment task as a “different project milestone during the semester” and are designed to align with both the EPICS program outcomes and objectives of engineering education as specified by ABET EC2000.
   a. Reflection work sheets with specific questions
   b. Discussion on design process
   c. Self-assessment by listing and evaluating team values
   d. Reflection on ethics through presentation and review

2. **Butler University** hosted an EPICS program that assessed students by a peer review procedure, gathering comments from community partners and interviews with advisors. Students were required to submit:
   a. Progress reports
   b. Responsibility forms
   c. Personal semester goals
   d. Project reports
   e. Personal reflective journals
   f. Public presentations

3. **The Colorado School of Mines’ “multidisciplinary senior design course”** allowed student to have a “real world” experience of the design process through an “emphasis on professional conduct and professional communication.” Students were required to:
   a. Submit project proposals and design reports to meet client specifications
   b. Present formally to students, clients, and faculty
   c. Meet regularly with their faculty supervisors to discuss their progress
   d. Work in design teams that were evaluated by the client for their “technical quality, problem-solving ability, communication quality, and overall team performance.”

4. **The University of Hong Kong Sichuan Reconstruction Service Project** sent students to work on a post-earthquake reconstruction project. Students were assessed via:
   a. One page pre-trip expectation
   b. Presentation at a conference
   c. Performance in team building activities
   d. Daily performance
   e. Daily reflective journal
   f. Summative post-trip report
Work Cited

