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## **AC 2011-2744: ASSESSMENT IN THE HIGH PERFORMANCE LEARNING ENVIRONMENT**

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## Assessment in the High Performance Learning Environment

The High Performance Learning Environment (Hi-PeLE) is a multidimensional learning platform where students are exposed to and engaged in a variety of activities. It is this characteristic that distinguishes Hi-PeLE considerably from those of traditional lecture-based courses. For example, in Hi-PeLE, one may encounter individual or team-based projects or both. Students interact with the facilitator of learning (i.e., the professor), classmates, TAs, and even former instructors and vendors. Projects, primarily team-based, may be theoretical, computational, or experimental in nature and in some cases a combination of these are also used. For those versions of Hi-PeLE that use an innovative and creative student-centered component (part of the Linear Engineering Sequence, LES) a working prototype of a proposed device may be required as an outcome. Furthermore, a course offered in a Hi-PeLE format may involve student participation in reading and/or discussion in formal or informal groups. In some cases, the purpose of these discussions is in order to “clean” student “dirty” notes (part of the Documentation Cycle). Facilitators of learning can use periodic oral presentations (during the class period throughout the semester) or oral presentations as a final assessment; alternatively, poster presentations may be required. In addition, brief or detailed written reports may be required to assess individual or team-based activities. Since there are a plethora of options available to use in designing a Hi-PeLE, this learning platform offers a multidimensional environment to assess students and makes the Hi-PeLE a very rich environment to assist the students in their learning progress. The nature of activities encountered in High Performance Learning Environments (Hi-PeLE) often leads to a need for assessment techniques different than those of traditional lecture based courses.

The Hi-PeLE characteristics described above bring a challenge for the facilitator of learning in identifying an effective assessment approach with a goal of maximizing student learning. Certainly, traditional “mid-terms” for the traditional based delivered courses are not the most efficient for Hi-PeLE activities. Instead, the facilitator of learning may want to take advantages of the multi-dimensional nature of the Hi-PeLE and use a variety of tools to assess student learning and progress. In order to make the most of the learning experience for the student, each type of activity requires a unique type of assessment and a combination of qualitative, quantitative, and summative types should be present. For example, the manner in which an individual project is assessed may be focused on the technical content and writing whereas a team-based project would also require an evaluation of the team itself including formation, managing, performance as an individual responsible for functions within the team, and overall team goals. Moreover, assessment of teams can take on many different forms but should include a final evaluation by the team members themselves of their own performance in addition to the performance of their team mates. This is critical to the maturation of the student as a team player and to enhancement of the ability of the student to become an independent agent to learning.

There is a host of ways in which to approach these assessments. Self-assessment and assessment of one’s teammates can be completed in a survey form and made a standard part of any project offered by the instructor or within an entire department, provided adequate faculty buy-in. One part of the assessment which is highly effective at identifying the “loafer” is to ask each student to divide a number of points, typically 100, among the three or more team members, including his/her self, along with a verbal justification of the division. If areas needing improvement are significant, one or more of the team

members are likely to divulge it as part of this exercise. In order for the instructor to intervene in a timely manner, a mid-term or mid-project evaluation is critical. This approach requires self-reflection on the part of the student and also provides peer evaluation. This information can be invaluable to the instructor who may likely not have had the opportunity to observe the finer workings of the team. As another example, to assess whether or not students have utilized a process in decision making, as opposed to, for example, a majority vote, students can be asked to write a short memo outlining a decision they made, options considered, and the means by which they determined the outcome. A well-defined rubric can then be used to analyze the responses.

The technical content of a report, whether written by an individual or a team of students, can be assessed using a well-defined rubric in which the core objectives are identified. A three level rubric quickly gets to the point with the highest level being one in which all the objectives are met, a second level in which some minor points or perhaps a single major point is inadequately addressed, and a third level where numerous objectives have not been sufficiently addressed. In addition, standard feedback forms can be utilized to review written work. For example, incorporating a peer-review aspect to a written project is very useful for both the students doing the reviews and the one whose work is being reviewed. A peer who is not working on the same project topic is assigned to review the paper using a standard form. The peer reviews the work, completing the form indicating areas in which objectives such as adequate explanation of underlying theory or physical processes have been met successfully or need improvement. The owner of the work then revises the report based on the peer feedback and submits the revised work to the faculty member. The faculty member then utilizes the same form in his or her review. The consistency is useful to the student in terms of clearly defining expectations. The work has been assessed by a peer and by a faculty “expert”. A third level of external evaluator could also be incorporated, again asking them to use the same standard for the review of the work.

Oral presentations, poster presentations, and working prototype demonstrations are all means by which external evaluators are readily incorporated into the assessment process. In some cases, the course instructor may provide a rubric for the evaluators to use and in others the evaluators themselves may develop a questionnaire with a likert type scale to utilize in the evaluation process. External evaluators can be members of a department’s advisory board, from local industry or other faculty within the department or college or university. Many are willing to participate in such an event and typically provide insight into the strengths and weaknesses of the presentations or prototypes that one would not have otherwise gained. It is also beneficial to students to showcase their work to “outsiders”. The pride that is evident in the student after successfully demonstrating a prototype of a shell and tube heat exchanger made from household items, with a very limited budget of course, indicates the positive learning experience the student has had. Such activities provide opportunities for the students to be creative and innovative. Assessing the level of creativity or innovation can be difficult and approaching the assessment from multiple angles is beneficial. It is recommended that the assessment be three or preferably four fold: self-assessment, peer assessment, instructor assessment, and external assessment. Moreover, evaluation of working prototypes can include the overall design, functionality, economics, and reproducibility, in addition to creativity and innovation. The assessment may be focused on specific ABET criteria or on specific learning objectives for a course or both. A three level rubric that homes in on the specific learning objectives typically works well for such evaluations.

Clearly, there are numerous scenarios that can be used to constitute a High Performance Learning Environment and many approaches to the assessment of these activities. Some specific examples and additional details will be provided as part of the presentation.