AC 2008-732: LEAN LEARNING: PROFESSIONAL EDUCATION AND GENERAL EDUCATION JOIN FORCES

Verna Fitzsimmons, Kent State University - Kent

Verna M. Fitzsimmons, Ph.D., Associate Professor and Assistant Dean for Academic Affairs, College of Technology, Kent State University. Dr. Fitzsimmons received her Ph.D. from the University of Cincinnati majoring in Industrial Engineering. She has over 15 years of experience working with businesses (both manufacturing and service sectors). She has also taught at several universities in Ohio and Wisconsin. She currently teaches courses in both the Baccalaureate and the Master of Technology programs and is now involved in applied research in several areas including rapid prototyping, process improvement, quality management systems, and automated manufacturing.

Stephane Booth, Kent State University - Kent

Stephane E. Booth, Doctor of Arts, Associate Provost for Academic Quality Improvement, Associate Professor, Department of History, Kent State University. Dr. Booth received her doctorate from Illinois State University. She has over 30 years of experience in teaching students of all ages. Currently she provides leadership in the areas of student learning assessment and continuous improvement initiatives at Kent State University. She continues to teach in the Department of History and her research areas include U.S. Women's History, U.S. Labor History and assessment of student learning outcomes in higher education.

Professional Education and General Education Join Forces?

Abstract

The rapid pace at which technology is changing makes it imperative that students develop the skills that will enable them to be proactive and reflective rather than reactive. This will require them as professionals and responsible citizens to integrate the content knowledge that they have learned in their professional education with the abilities valued in general education and by employers. These include critical thinking, reflective practice, valuing diversity, ethical behavior, and civic responsibility. How can this be effectively accomplished? How do we model for the students everything that is worthy in professional education as well as general education? One way is for faculty to see their mission as one that converges. Application of this convergence needs to be modeled for the students throughout their program of study in order for them to be able to make connections among professional education outcomes, general education outcomes and life experience.

Body of the Paper

Professional education (for example: engineering, architecture, nursing) is seeing a demand to increase the content and depth of knowledge as technology and the various fields evolves. Thereby the number of courses required in undergraduate programs has a tendency to increase. The increased professional coursework demands combined with a university's general education requirements tends to lengthen students' time to complete the degree. At the same time accessibility and timely degree completion is high on stakeholders' agendas. Added to these circumstances, state legislators are considering regulatory efforts to limit the number of credit hours needed for a baccalaureate degree for subsidy calculations. This situation lead us to ask the question: Is there a way to integrate the learning opportunities provided through professional and general education that would reduce the number of courses but do so in a pedagogically sound way?

One answer to this question might be to integrate the learning objectives of general education and professional education and not see them or treat them as separate entities. We began this discussion by comparing the student learning objectives of the baccalaureate degree in technology and the learning objectives of university's Liberal Education Requirements (LERs). (Table 1) Through this comparison it became evident that several objectives from both lists overlap. Because there is such an overlap, the immediate question was one of redundancy and differentiation. Based on conversations with members of our Liberal Education faculty as well as out Technology faculty, it became apparent that the learning outcomes form each of their perspective more aligned than different. However, the structure and context was different. The Liberal Education faculty expected that students could take the "learning" and apply it to any situation, including professional situations. The Technology faculty expected the students to be able to apply the outcomes to any technical situation. It became apparent that the differences were one of perspectives. Liberal education was expected to have a broad

application where as the Technology education was expected to have a focused application.

The next question became: Is there a better pedagogical approach, and perhaps more efficient approach, that would provide students the opportunities to obtain and demonstrate the learning objectives noted and perhaps decrease, or at least not increase, the number of required course hours? A follow-up question was: Could this course be team taught by a faculty member grounded in professional education and one steeped in general education?

The initial philosophical underpinning assumed that the Liberal Education Requirements were meant to enhance professional education and not be a separate and unrelated set of requirements. The opportunity to test this idea presented itself in the form of a new course in Lean Manufacturing that was being developed. The Technology faculty had decided this was important content that needed to be added to the curriculum.

The initial content and outcomes of the course were those usually contained in a lean manufacturing course, As these were examined, the answer of how to integrate some of the LER learning outcomes became more apparent. The lean manufacturing process is built upon the premise that people are at the heart of the process. Lean cannot be defined only by a stepwise progression. People must gather information, analyze the information, and make decisions throughout the process, thereby utilizing critical thinking skills, demonstrating the ability to be a lifelong learner and someone who understands and appreciates difference. In addition, communication is considered a key component of any lean effort.

Elements of the course were developed that challenged students to make use of these skills within a professional setting. The learning goals of the course included the student's ability to:

1. Define Lean Manufacturing
2. Define the 14 foundational management principles behind a Lean production
3. Identify the roles and responsibilities of people in the development and implementation of the Lean philosophy
4. Identify and develop mechanisms for eliminating the many types of waste
5. Apply the tools of the lean philosophy in various situations
6. Identify and implement a process for continuous improvement
7. Identify key traps that prevent applying these principles effectively
8. Demonstrate the different types of learning
9. Demonstration of how you value others in a particular type of situation

The first seven outcomes would normally be found in a course such as this. The last two outcomes were added from the LER perspective. It was expected that if the students better understood various types of learning styles and were explicitly aware of their own, they would have a deeper understanding of communications and team work.

The course format was primarily discussion based on either class presentations or assigned readings. In-class and out-of-class projects were assigned, as was a reflective journal. Depending on the assignment, students worked individually, in pairs, or as a team. A final take home exam was also assigned.

Throughout the course, the instructors worked from the perspective that the students were in management positions and would be the ones to provide leadership for the introduction of Lean to their workplace. Using this perspective, the instructors challenged students on a daily basis to think about the implications of every step in the implementation and sustaining phases of lean. Students identified their learning styles and reflected upon implications of diverse learning styles in the workplace. They studied personality types, as well as motivation and behavior change issues. This was follow by discussions of the various topics in Lean. Then we asked students to assimilate the learning and determine how all of this information could inform them as managers and more specifically provide a platform for successfully implementing and sustaining a lean effort.

Students enrolled in this course were either seniors or graduate students and all had some industrial experience through coop, internships or regular employment. On the first day of class, the reflective journal assignment was briefly explained; a handout on reflective journal entries was distributed, as was a rubric for its evaluation. Given the level of the students enrolled in this course, it was assumed that they had been asked sometime during their earlier liberal education academic careers to write in a reflective manner. However, it became apparent to the instructors by the second week of class that a reflective journal and its purpose was an entirely foreign concept to the students. This was not as shocking of a finding as it was disappointing.

Discussions were then held periodically about the purpose of the reflective journal assignment. We wanted to know how the students perceived the assignments and why they were having difficulty with the assignment. The students indicated that they needed much more structure as they began the reflective process than what we had provided. They needed concrete prompts. One student specifically requested a “list of steps” and another asked for a “set of questions to answer” to complete the reflective journaling. It was apparent the rubric that had been provided was too subtle for the level at which they were working. Nomenclature also seemed to be a problem. Not only were they unsure as to the “reflective” piece but also journaling was not an activity in which most had participated. Again, this was disappointing considering these were students about to graduate or who were working on a graduate degree. During the discussions, the students did suggest and agreed that if the term “reflective blogging” were used they would have a framework with which they were familiar.

The regular discussions, along with the reflective journal entries, provided the instructors with added insight to the challenges posed by an integrative approach. The problems that occur when skills and/or content are taught in isolation from what is relevant to the learner present barriers for integrated and life-long learning. Students commented that in most courses (professional and LERs) they were not asked to reflect on what they had

learned. They had been expected only to regurgitate information or solve specific problems. They felt that the purpose of the LERs was similar to professional courses: to present the content of a discipline (e.g. sociology, psychology, thermodynamics) but they had developed no skills to transfer the knowledge obtained in those courses to other experiences (academic or nonacademic). They also had no perception that any skills (e.g. critical thinking, communication, etc) were identified as learning outcomes for these courses.

It became painfully apparent to each instructor that the assumption about the students was not accurate. The instructors thought that each of their areas (liberal and professional education) was doing a good job at accomplishing the learning outcomes as stated in Table 1. As demonstrated, the students were able to apply specific skills and demonstrate knowledge in specific situations. The positive outcome was that as we discussed the learning opportunities, the students seemed to catch on as demonstrated by the improvement in the reflective journaling. By the end of the term, many students still did not care for the assignment, but found it easier. Many also commented that they also saw its purpose and usefulness.

Another positive outcome was that the students seemed to develop a deeper appreciation for lean. This was demonstrated in their final project. The students were assigned to small groups and were challenged to "Lean" an active lab within the College of Technology. This required communication skills, data collecting, analysis, negotiation, teamwork, and writing skills. Their ability to complete this project in a very short time frame suggests that they were able to transfer a deeper learning experience to a practical application.

As the instructors reflected on what they saw, heard and read throughout the course, it became apparent that these students had not been provided with models on how to integrate and apply knowledge and skills obtained in disparate situations and when asked to do so were at a loss on how to proceed. This observation led to the realization that students need to be provided with transparent and intentional models throughout their learning experiences. Faculty cannot assume that somehow students know how to take all the elements (skills, information, and knowledge) of their academic experience and intuitively know how and when to use the relevant pieces.

The opportunity to teach this course in the manner described did not provide a clear answer to the questions initially posed but it does provide a basis for further discussions. In other words, it posed more questions. As it turns out these are the same questions that this university will be grappling with during the next year. Under a new president and provost the university will undertake a university-wide discussion on the philosophy of an undergraduate education and the impact of that definition on the curricula.

Table 1 Student Learning Objectives

Liberal Education Requirements	**Manufacturing Program**
• Acquire critical-thinking and problem-solving skills • Apply principles of effective written and oral communications • Broaden their imagination and develop their creativity • Cultivate their natural curiosity and begin a lifelong pursuit of knowledge • Develop competencies and values vital to responsible uses of information and technology • Engage in independent thinking, develop their own voice and vision, and become informed, responsible citizens • Improve their understanding of issues and behaviors concerning inclusion, community, and tolerance • Increase their awareness of ethical implications of their own and others' actions • Integrate their major studies into a broader context of a liberal education • Strengthen quantitative reasoning skills • Understand basic concepts of the academic disciplines	▪ Acquire analytical skills, logic and critical reasoning ▪ Apply scientific knowledge and application of basic sciences in chemistry, and physics ▪ Develop cognitive skills and demonstrate this through technical writing and communication ▪ Develop competencies for appropriate use of technology ▪ Understand basic concepts of business, and cultivate leadership for the management of technology ▪ Understand concepts of industrial psychology ▪ Be proficient in: o Industrial and Environmental Safety o Computer Aided Design o Energy/Power/ Instrumentation and Controls o Materials and Processes, Metallurgy and Material Science o Manufacturing Process and Machine/Tool Technology o Computer Integrated Manufacturing and Robotics o Manufacturing/Industrial Management including Quality Control, Production/ Operations Management, Cost Control and Project Management.

References

Peter D. Hart Research Associates, Inc, *How Should Colleges Prepare Students to Succeed in Today's Global Economy?* (Washington, DC: Peter D. Hart Research Associates, 2006.)

Association of American Colleges and Universities: College Learning for New Global Century (Washington, DC, 2007).

Liker, Jeffery K. *The Toyota Way: Fourteen Management Principles from the World's Greatest Manufacturer* (McGraw Hill 2004).