

Institutionalizing the Assessment of Engineering Entrepreneurship

John C. Wise¹ and Sarah E. Rzasa²

Abstract - Several years ago, Penn State received a grant from General Electric to establish a minor in Engineering Entrepreneurship at the College of Engineering. Along with the grant came a requirement for extensive assessment and evaluation of the program. Now that the grant period has expired, there is a desire to continue the assessment process that was created. Unfortunately, with the expiration of the grant came the loss of funds dedicated to the assessment of the entrepreneurship program. Institutionalization is seldom a concern when a program assessment is contemplated, designed, or executed. A well-planned process, however, can become a continuing source of quality data for many years with little or no additional cost to the user. This paper reports on the efforts taken to continue the assessment of the entrepreneurship minor without the funds that were previously available. This requires the development of a leaner design. The use of online forms, automation, and existing college-level databases is discussed.

Index Terms - Assessment, Continuous Improvement, Engineering Entrepreneurship, Online Data Collection

BACKGROUND

In the spring of 2001, the College of Engineering at Penn State University received a grant from General Electric (GE) to implement a new minor designed to enhance the skills, knowledge, and attitudes necessary for students desiring to become entrepreneurs. The entrepreneurship, or E-SHIP, minor was evaluated extensively as part of a requirement of the funding agency. While the evaluation was undoubtedly useful in collecting information for these purposes, after the grant expired, the funding allotted for program evaluation was no longer available. This paper describes efforts to institutionalize assessment and evaluation of the E-SHIP minor within the more constrained budget. Plans for the evaluation system including challenges experienced and suggestions are discussed.

DESCRIPTION OF E-SHIP MINOR AND ORIGINAL ASSESSMENT PLAN

In order to complete the E-SHIP minor, students are required to take a series of four courses taught by faculty from engineering, business, and information science and

technology. These courses are: 1) Entrepreneurial Leadership, 2) Technical Entrepreneurship, 3) Entrepreneurship Business Basics, and 4) Entrepreneurship and New Product Development. In addition, several other courses are offered as supplements to the four core courses. Opportunities in entrepreneurship are available to the students throughout the academic year. At the end of each semester, selected student teams are invited to participate in a venture competition or "Product Showcase" which allows student teams to "pitch" a product or service idea to a panel of judges consisting of entrepreneurs from the local community. Seminars and workshops are also held throughout the semester to provide additional exposure to entrepreneurial concepts. A more detailed description of the Penn State E-SHIP minor is provided by Kisenwether and Bilén.[1]

The original assessment plan contained both formative and summative elements in order to both continuously improve the program and to determine if intended goals were being met.[2] In addition to formative questions regarding necessary programmatic changes, the original evaluation questions are as follows:

- 1) Are students more motivated and more likely to perform at higher levels?
- 2) Are students more successful in tackling ambiguous problems?
- 3) Are students more likely to see the connections to aspects of problems outside their major discipline?
- 4) Do students exhibit better communication and teamwork skills?
- 5) Are students acquiring and improving skills that will allow them to become successful entrepreneurs?

The assessment plan incorporated a mixed-methods design including both quantitative and qualitative data collection. This type of design allowed for triangulation of results to determine whether the programmatic goals were being met. The primary quantitative method of data collection consisted of an online instrument containing demographic questions and several surveys designed to measure characteristics relating to entrepreneurship. The scales utilized included the General Enterprising Tendency (GET) scale, an entrepreneurial self-efficacy scale, and a leadership scale.[3,4,5] The instrument was administered to all students enrolled in the core and supplemental classes at the start and end of each semester. Additional demographic variables, such as GPA and SAT scores, were obtained using a database

¹ John C. Wise, Director, Engineering Instructional Services, Penn State College of Engineering, jwise@enr.psu.edu

² Sarah E. Rzasa, Graduate Research Assistant, The Leonhard Center for the Enhancement of Engineering Education, Penn State, ser163@psu.edu

provided by the College of Engineering. The online instrument was also administered to a comparison group of students not enrolled in any of the core courses. Other quantitative methods included pre-and post-tests of content knowledge and in-class rating scales. The results of the quantitative data collection methods are reported by Bilén, Kisenwether, Rzasa, and Wise, and Wise, et al.[6,7]

Qualitative methods of data collection, including classroom observations, student portfolios, and focus groups with students from the core courses, were used to gather additional rich information about the minor. The results of the focus groups are discussed in Rzasa, Wise, & Kisenwether.[8]

Although the combination of both qualitative and quantitative methods was found to yield valuable information, it soon became clear that the extensive design being utilized could not continue without additional funding. For example, holding the focus groups was both time-consuming and expensive. In addition to the time needed to actually lead the focus group, staff had to spend a tremendous amount of time recruiting students, planning the event, transcribing, analyzing and reporting results. Money was also needed to provide food for students as an incentive for participation. In comparison, the online-survey was somewhat less time-consuming and expensive after the initial implementation, although assistance from data-warehouse specialists and data analysts was still a necessity.

While information on the E-SHIP minor had already been collected and has helped to improve the program, a desire grew to institutionalize the assessment plan with the goal of providing information in support of continuous improvement. Just because a funding agency no longer required an evaluation plan did not mean that assessment should not continue to be performed. The information collected is still vital to determine whether the program is meeting intended goals and to guide decision making regarding necessary improvements. Therefore, efforts to streamline the evaluation system became essential.

PLANS FOR CONTINUING ASSESSMENT

Both the program director and the assessment team were interested in continuing the assessment of the entrepreneurship minor beyond the limits of the grant funding. Therefore, decisions had to be made on how to best simplify the evaluation plan.

Online Data Collection

The ability to collect data online is instrumental in the attempt to make the data collection routine. The main purpose of the online instrument is to gather summative information about the E-SHIP program. An automated system was created that would send an email at the beginning of each semester to every student taking an entrepreneurship course asking them to complete the online instruments. Students enrolled in the E-SHIP classes could easily be identified from already existing college databases. This type of data collection results in little disruption to the E-SHIP classes and the involved faculty.

Using this online system, data collection using the GET, entrepreneurial self-efficacy, and leadership scales would be continued. Hypothetically, student performance on each of these tests should improve over the course of the program. The online approach could potentially allow for automated data collection, analysis, and reporting. The system can be programmed to generate descriptive statistics, conduct basic statistical tests and create graphs and reports for the evaluation of the minor. Without grant support, it proved difficult to realize this activity. Automated analysis and reporting remains in the planning stage.

Focus Groups

Although previous focus groups yielded important data regarding the student experiences in each course, the associated costs raised the question as to whether the focus groups were truly necessary in the continued evaluation of the minor.

Rather than holding focus groups with students from every individual class, the application of focus groups would be based on changing conditions in the program. For example, a new instructor may begin to teach one of the four core courses and have different ideas as to how content should be presented. Because of concerns about the impact of the course changes on the overall curriculum, a focus group will be held for this class. The results of this particular focus group could then be compared with student perceptions of the class from previous years.

As a further example, a new supplemental class entitled “Market-pull technology and commercialization” was added this semester. Information from a focus group with students enrolled in this new class was provided to the instructors as feedback and also helped to further elucidate the effects of the E-SHIP minor. Therefore, by balancing cost with need, focus groups will be targeted to changing conditions within the program.

Discontinued Techniques

Some of the assessment techniques that were discontinued in the streamlining process include the pre- and post-tests of content knowledge and collection of student portfolios. These techniques proved somewhat difficult to analyze as they required the development of specific rubrics and the extensive involvement of faculty members for rating. Faculty members still often collect this type of information from their individual classrooms, but they are no longer used as part of the evaluation of the minor. Rather, the faculty members are encouraged to utilize their own classroom assessment techniques.

Classroom observations are also done less frequently than before, being reserved to an “as-needed” basis, such as prior to a scheduled focus group for a newly added class.

Summary

In summary, the focus of the evaluation of the E-SHIP minor has begun to shift from an all-inclusive system consisting of a variety of data collection techniques to a much sparser plan

which is based on the need to answer pertinent questions as they arise. The online instrument is the key method for collecting summative information on the minor. Focus groups remain important for collecting formative information when necessary due to programmatic change.

CHALLENGES FOR INSTITUTIONALIZATION

Several challenges surfaced when we attempted to implement the extension of the assessment plan. This section will present a few of them.

Faculty Support

Institutionalization of an educational program requires significant support from the involved stakeholders, including faculty members and program administrators. As McGourty notes, "Administrators must provide a great deal of support and resources if the process of assessment and continuous improvement is to become an integral part of the institution's educational fabric. Faculty must take ownership of the design and implementation of assessment initiatives." [9]

During the length of the grant, the faculty was very supportive of the assessment team requirements. Most saw the need of assessment for the purpose of grant reporting. When the grant expired, we found a somewhat lessened level of enthusiasm regarding assessment. Faculty members were less likely to emphasize the importance of the evaluation to their students, resulting in reduced sample sizes for the online data collection.

This lack of enthusiasm is due to a failure on our part to emphasize the importance of assessment for continuous improvement rather than on the requirements of the funding agency. Assessing the impact of the program as part of the requirements of the grant proposal required different tools and approaches than an assessment focused on the continuous improvement of the overall program. Assessment requirements and benefits for continuous improvement must be clear to faculty in order to be accepted as a living part of the program. Without this effort to focus on improvement, the assessment will continue to be seen as external to the everyday functioning of the program, with the result that few faculty will "buy in" to the process.

Technological Support

Again during the grant, it was easier to gain technical support from data warehouse and information technology staff at the college level. Without the needs of an active grant, the continuation of the online assessment tools became a lesser priority. Added to this situation, the person most responsible for the development of the web pages transferred to another department. The assessment team was required to expend a great deal more energy to ensure that emails were sent and that the web pages were working properly. This lack of necessary technological support also resulted in difficulties automating the data analysis and reporting techniques.

Need for Outcomes / Objectives

As mentioned above, the goals stated in the grant proposal were limited by time to the length of the proposal. The tools developed and implemented to assess these goals were not necessarily appropriate for continued assessment of the entrepreneurship program. The assessment team should have built this change into the overall design, anticipating that the short-term goals of the proposal would surely be replaced by longer-term program outcomes and objectives. In the event, we attempted to continue assessing the program based on the proposal goals even after those goals were arguably achieved. In order to develop an assessment plan that will be incorporated into a continuing program, the plan must be based on program outcomes and course objectives developed and supported by the faculty.

Flexibility

The assessment plan must be flexible enough to respond to changes in the curriculum without requiring much additional effort from the faculty. If a course changes or is added to the curriculum, the plan must be able to adapt to the different objectives that are now in play. Our program assessment was too closely allied to the goals of the grant proposal and unable to adjust to changes without the use of expensive focus groups that failed to feed into the overall assessment design.

CONCLUSION

In order to determine that the E-SHIP program continues to meet programmatic goals and outcomes, a streamlined, institutionalized system of continuous assessment must be implemented. However, the more streamlined approach discussed above does not equate to a cost- and labor-free plan. As a rule of thumb, education-related grants should allow 5-10% of their budgets for assessment. This level of investment should result in the type of assessment plan that is designed to satisfy the needs of the grant and robust enough to include the types of outcomes and objectives that will continue beyond the term of the grant. An assessment of this type maximizes the return on the expense of establishing the plan in the first place.

Periodic review is necessary to compare expected and actual outcomes and to update the assessment plan as needed. An assessment plan of this type lends itself to continuous improvement of the program established through the grant process. Success in implementing these types of extended assessments may well positively influence future grant decisions. Finally, designing and implementing practical assessments for the purpose of continuous improvement will reinforce the value of assessment.

ACKNOWLEDGMENTS

The authors recognize and appreciate the support of the GE Learning Excellence Fund the National Collegiate Inventors and Innovators Alliance (NCIIA) for inter-disciplinary technology entrepreneurship education, the Penn State Minor

in Engineering Entrepreneurship, and the Leonhard Center for the Advancement of Engineering Education.

REFERENCES

- [1] Kisenwether, E. C. & Bilén, S. G., Developing Students' Entrepreneurial Skills and Mindset, Paper presented at the annual conference of the National Collegiate Inventors and Innovators Alliance, 2003.
- [2] Popham, W. J., Educational Evaluation. Needham Heights, MA: Allyn & Bacon, 1993.
- [3] Caird, S. "The enterprising tendency of occupational groups," International Small Business Journal, vol.9, pp. 75-81, 1991.
- [4] Chen, C. C., Greene, P. G., and Crick, A. "Does entrepreneurial self-efficacy distinguish entrepreneurs from managers?" Journal of Business Venturing, vol. 13, pp. 295-316, 1998.
- [5] Wielkiewicz, R.M., "The leadership attitudes and beliefs scale: An instrument for evaluating college students' thinking about leadership and organizations," Journal of College Student Development, vol. 41, n. 3, pp.335-347, May/June 2000.
- [6] Bilén, S. G., Kisenwether, E. C., Rzasa, S. E., and Wise, J. C., Developing and Assessing Students' Entrepreneurial Skills and Mind-Set, Journal of Engineering Education, Submitted for publication.
- [7] Wise, J., Kisenwether, E., and Rzasa, S., Assessing engineering entrepreneurship. Paper presented at the Annual Conference & Exposition for the American Society for Engineering Education, 2003.
- [8] Rzasa, S. E., Wise, J. C., & Kisenwether, E. C., Entrepreneurial endeavors in the classroom: The student perspective. Paper presented at the annual conference of the National Collegiate Inventors and Innovators Alliance, 2004.
- [9] McGourty, J., Strategies for developing, implementing, and institutionalizing a comprehensive assessment process for engineering education. Paper presented at the annual meeting of Frontiers in Education, Tempe, AZ, November 4-7, 1998.