MEASURING THE BENEFITS OF CONTINUING ENGINEERING EDUCATION

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In response to a challenge by one of the department's corporate customers, a study was initiated to measure the return on investment (ROI) of continuing engineering education programs. The literature reports several techniques, but is extremely limited with regards to engineering. Two program series were selected for detailed study. Scientifically constructed questionnaires were created and participants were asked to submit responses either on-line or via mail. Results revealed students' reasons for selecting the programs, what they valued most about the programs, whether they would be interested in and receptive to a future conversion to distance delivery formats, and a subjective measurement of the overall value received. Specific calculations of ROI were found to not be practical. The primary limitation was the lack of financial data available to the students. Plans for future study include helping students to better assess costs and benefits and refining our survey techniques.

Introduction

A review of the literature reveals that there are many ways to calculate and demonstrate the benefits of continuing education and professional development programs. Based on three models (Swanson & Sleezer (1989), Lyau & Pucel (1995) and Phillips (1997)), we collected survey information from course participants in two content areas in Engineering Professional Development (EPD) at the University of Wisconsin-Madison. This information has lead to more accurate calculations of return on investment and other benefits of EPD programs; we have also cataloged perceived and real benefits that are not part of the formulas suggested in the literature. We are left with two outcomes; 1) a comparison of satisfaction with the experience students have had in EPD courses between the initial survey and the follow-up survey and 2) a basis for accounting for the benefits of EPD programs. In the end, we hope to use this information to create a customized, systematic method for tracking the benefits of the EPD programs.

The Impetus to Measure ROI

The Workplace of the Future

Colloquially, businesses are noting the shift in the nature of the workplace and the looming possibilities of highly trained worker shortages in the next decade. Companies must be able to transfer knowledge from those who are retiring and keep the younger workers they've got. In addition, they must be able to keep pace with the industry and continue to be innovative within it. Educators and policy makers in the field of continuing education have long been attempting to track the developments in the workplace in order to gauge the needs of individuals and industries and create programs that fit those needs.

Decision makers in organizations must justify strategies, projects and programs to top management – "economic thinking related to human capacity, human expertise, human effort and the effects of each is disjointed" (Swanson, 1998). It is possible for organizations to conduct after-the-fact cost-benefit analysis. The "forecasting financial benefits" (FFB) or HRD method was designed by Richard Swanson and colleagues in order to provide businesses with a way of doing just this. It is a "practical, step-by-step method for making accurate investment decisions based on forecasting the financial value of improved performance projections for a program, the cost of implementing a program and the return on the program investment" (Swanson, 1998). Improvements of this method can be made, however, when applying it to interventions loosely connected to performance requirements. While the field of engineering overall requires the use of performance-based evaluation methods and demonstration of skill, not all job duties are this clear-cut and therefore the application of the FFB method becomes problematic. Today, employees are being asked to be 'portfolio people'. Corporations are "progressively aligning themselves with each other and converging on such notions as 'communities of practice' (Gee, 2000)".

We can look very far back into the literature and find examples of measurement of training in the workplace. Meissner's research in 1964 studied simple work behavior. It compared the work of those who had received bagging training and those who had not. The premise of his piece was that for any task – simple or complex- there was a right way and a wrong way, and financial consequences to each. The concept of continuing professional education, thus, is not new. It "can and has been traced as far back as apprenticeship and guild systems (Houle, 1983 in Stern and Queeney, 1992)".

Engineering in the 21st Century

The characteristics of engineers in the 21st Century will reflect the changing economy. Communication of solutions and challenges that are developed within the engineering field, for public and corporate buy-in, is an increasingly important skill for leaders in engineering. We will see engineers assume a more prominent role not only as "innovators and technical guardians of the knowledge-based economy" (Wirasinghe, 2000), but also as future leaders of inter-disciplinary teams. Education must respond to the new reality of globalization, the information revolution, sustainable development, lifelong learning, and gender equality. Traits engineering leaders must have in this new reality include; exhibition of leadership, multi-disciplinary teamwork, excellent communication, commercialism, the ability to function within and lead start-up enterprises as well as be lifelong learners. Industry/University partnerships, then, can provide for an important and growing need in continuing education in engineering considering the efficiency inherent in these partnerships for rapid response to lifelong learning needs. These partnerships include learning strategies and tools that are; on-demand, just-in-time and experiential learning-based (Wirasinghe, 2000). Furthermore, these partnerships allow students to earn portable credentials that can be moved with a student from one employer to the next.

Parts of the "Return"

Individual Benefits

Career maintenance and enhancement are two major goals for enrolling in continuing professional education for the individual. Preventing obsolescence is one way for the individual to stay confident in their job role. Since knowledge is becoming increasingly complex, especially when interdisciplinary skills are called for, continuing education can help reduce the likelihood of incompetence (Azzaretto, 1992). In terms of

career enhancement, new knowledge can allow employees to advance in their career field – for instance, from a technical to supervisory role. For engineers, this means knowing how to communicate ideas, to relate to different cultures, and to work as team-members. When considering individual benefits, it is important to note that investment in education is not limited to economic gains. The most common approaches to cost-benefit analysis include accurate accounting of costs, but rarely of benefits. Benefits are reaped over a lifetime.

Enterprise Benefits

"As a group, employers are the largest providers of continuing professional education and simultaneously the largest consumer of continuing professional education provided by others (Stern and Queeney, 1992)". Does continuing professional education make employees more competent? A better question would be; can the organization afford not to invest in training? A tailored intervention that gets at the root cause of a specific problem can save a company thousands or even millions of dollars. This can be calculated both in terms of cost-savings and an increase in value. A given organization may save in both the time it takes for a job or task to be completed (time savings = cost savings) as well as materials (cost savings) from a job done right (increased quality of final product).

Academic Institution Benefits

"Short courses or full programs for adults are offered by most of the 3,000 post-secondary academic institutions in America and by nearly all of the more than 8,000 proprietary schools (Stern and Queeney, 1992)". This means that evaluation methods are extremely important and proof of the benefits of each particular continuing education initiative is essential for the success of the institution offering programs. One of the best ways to ensure quality is to do proper needs assessment before jumping in to offer interventions. Relating continuing professional education to real workplace needs is the goal. In designing both cutting edge continuing education, as well as ways in which the benefits of continuing education can be measured, leadership must come from the research universities (Stern and Queeney, 1992).

Methods

Using models published by Swanson & Sleezer (1989), Lyau & Pucel (1995) and Phillips (1997), we were able to design a pilot survey for the purpose of creating a customized system for measuring the benefits of EPD programs at the University of Wisconsin – Madison. Briefly, the Lyau and Pucel (1995) study revealed that when labor productivity is measured as value added per worker, removing the cost of materials from the measure of labor productivity, both measures of training investment (total and direct) have strong positive correlation between direct costs and value added per worker. The findings in this study show that if an average firm invests an additional 10% of its current training expenditures on additional training it can expect to gain 1.0 -1.2% increase in labor productivity. These findings suggest that investment in training and the returns shown due to training (other variables held statistically constant), warrants the money spent on training. Swanson and Sleezer (1989) use a "Benefits Forecasting Method" that is largely qualitative in its approach to estimate costs and benefits with a survey tool. The information collected is input into a standard calculation for ROI (increase in earnings/productivity/efficiency – costs = benefits). The key, as Phillips (1997) notes, is

to make sure that the values which are input are accurate. This can be achieved by assigning confidence values for each given answer and by verifying responses by asking the same survey questions at several levels within a corporation or entity (ex. survey the student, the student's boss, and a subordinate to the student).

We designed a survey as a follow up to information collected directly after training in two EPD course areas; storm sewer design and culvert design as well as ammonia refrigeration. The survey consisted of scaled items as well as open ended questions in four sections. Participation in the survey was 21%; giving us 118 survey participants. To encourage participation, we offered a small gift as a reward (choice of a UW ball cap, UW hard hat or UW pen). On-line surveying and data compilation was done with the Zoomerang survey system. We internally controlled for our non-random sample and accounted for selection bias.

Data Analysis

A brief analysis of the surveys that students submitted immediately following their program revealed a trend toward high levels of satisfaction with the courses surveyed (with some exceptions), but for the most part were useful in formative rather than summative capacities.

Overwhelmingly, participants attend UW-Madison's EPD courses because of the content, the reputation of the school, recommendation from others and the location. Thus, even though the Department depends on the reputation of the University as a whole, the content of the courses offered allow it to carry itself. Further, regardless of other logistics (including the instructor, the length of the course, the location, the course feel and the dates), attendees are coming to get the content they need and want for their professional development, given that 98% of the survey respondents indicated that they agree or strongly agree that the topics presented were why they chose UW-Madison for their engineering professional development. After setting the stage comparing UW-Madison's EPD programs to others, we were able to look at the benefits reaped from the programs. Several benefits are seen, including the usefulness of course materials on the job, the meeting of urgent needs on the job, networking advantages, the availability of information and knowledge that cannot be found elsewhere and the cost savings as a result. In addition, some employers are using continuing education as a retention tool. 93% of survey participants agree or strongly agree that there was information obtained in the course they took that they could apply on the job. Lastly, participants were asked if they experienced direct savings from their EPD course experiences (Figure 1).

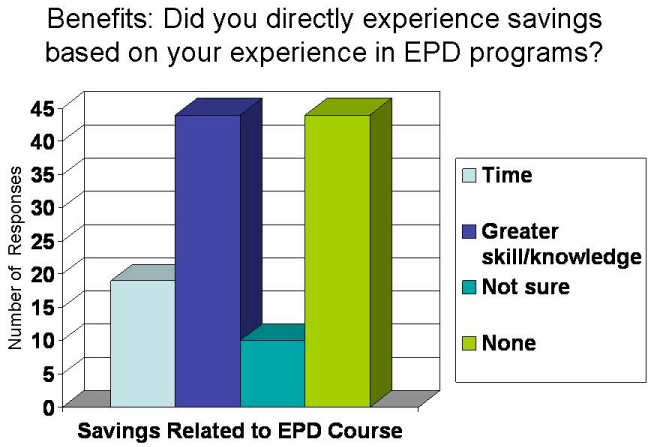

Figure 1 – Benefits to Engineering Professional Development Programs at UW-Madison

54% of participants indicated savings, whereas 38% indicated no savings. Nine percent of participants were not sure of any savings related to their coursework. Discussion of value estimates brought in several ideas of where money was saved, but no calculations. As one participant noted, “I don’t know any methodologies to compute savings”. Others noted savings through greater efficiency, time savings, consequences to not having the information (such as fines or injuries), new skills that can be used in-house (i.e., don’t have to outsource), savings on energy, and simply being better at their job. These important comments are the drivers behind the conclusion that we must find ways to calculate benefits and we must provide this information to customers.

Implications and Conclusions

Assessment of both costs and benefits can be improved by asking specific questions – How much money was spent on travel (car, air, etc.), how much was spent on accommodations and knowledge of the billable rate for each attendee would allow us to accurately calculate costs. As with any qualitative study which seeks essentially the opinion of those who attended courses, there are inconsistencies and bias. Methodologies could be expanded and improved to statistically compare responses and determine the significance of the responses gathered. When considering the survey results reported here, one point is clear; organizations do not have an obvious, communicated methodology for calculating the benefits of continuing education. Employees do benefit from gaining new knowledge (both practical and otherwise), as seen in this report. However, as suspected (and outright noted by one participant), employees are not shown how to account for these benefits. As information is gathered from diverse groups of participants, we must work towards a solution to this problem and offer a basic calculation to these organizations. Taking it a step further, we must also train customers on how to use these calculations to account for the benefits of continuing engineering education. Most participants understand that continuing education and new knowledge is essential to not only do their job, but to enhance their performance as well. This report serves as a springboard from which we might begin to quantify benefits. It also serves as an alarm that we need to provide ROI tools and teach customers how to use them.

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