

## Cost Analysis of E-learning: A Case Study of A University Program

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*Due to the advantages of e-learning, more and more schools and companies are adopting e-learning and increasing their investment in it. The increased investment has brought the need to demonstrate the cost-efficiency of the investments. This study reviewed the literature related cost drivers of e-learning programs and analyzed the cost-efficiency of the HRE Online program at the University of Illinois. Breakeven analysis revealed that the minimum enrollment should be twenty-three to attain the cost-efficiency.*

Key words: cost analysis, cost-efficiency, e-learning

In an age of severe competition and turbulent change, survival is a pivotal problem which organizations confront. Organizations have tried to find ways improving employees' performance, and training has been regarded as one of the most important strategies to solve the problem.

In addition to the accelerated importance of training, rapid development of technologies and computers has changed methods of education and training and caused the blossom of e-learning programs. The use of technology-based training and electronic training (e-learning) is one of major trends in the field of HRD (Bassi, Benson, & Cheney, 1996; Bassi & Van Buren, 1998). Various terms are being used to name these emerging training methods, i.e., asynchronous learning, distributed learning, online learning, web-based learning, computer-based training, e-learning and distance learning. Asynchronous learning focuses on the difference of time when learning occurs; online learning, web-based learning, e-learning and computer-based learning emphasize the learning technology and tools used; distance learning concentrates on the difference of places where a learner and a teacher exist. Regarding the interrelation among those terms, Urdan and Weggen (2000) identifies e-learning as a subset of distance learning, online learning as a subset of e-learning, and computer-based learning as a subset of online learning. Among those terms, e-learning is the most increasingly used concept especially in corporate setting. E-learning is defined as "the acquisition and use of knowledge distributed and facilitated primarily by electronic means (Wentling, Waight, Gallaher, Fleur, Wang, & Kanfer, 2000, p.5)." Based on this definition, e-learning would be evolved to systems consisting of a variety of channels and technologies and can take the form of courses as well as modules and smaller learning objects and may incorporate synchronous or asynchronous access and be distributed without geographical limits (Wentling, et al., 2000).

E-learning using technologies and computers to improve learner's skill and knowledge has the following advantages (Schrivver & Giles, 1999; Au & Chong, 1993): space is not needed; learners do not need to wait until a class is available; learners can complete training when it is least disruptive to their schedule; and the methods can increase learner's interesting, deliver contents clearly, and feedback students easily.

Due to these advantages of e-learning, the popularity of e-learning has dramatically increased over the past few years. According to the National Center of Education Statistics, the number of enrollments in all distance education courses approximately tripled from the 1994-

1995 school year to the 1997-1998 school year. About one third of all are two-year and four-year postsecondary institutions offered distance education in 1997-1998 in the U.S., and an additional twenty percent planned to start it within three years (Morgan, 2000).

The increased investment in e-learning has led companies to be concerned with the performance and efficiency of the method. That is to say, organizations are eager to know how effective e-learning is. Accordingly, organizations have increased efforts to prove whether the training intervention was successful or not, especially e-learning (Phillips, 1997).

Based on the literature related to evaluation of e-learning programs, three major factors were identified as the focus of e-learning program evaluation: cost efficiency, learner satisfaction, and learning resources. Among these issues, cost-efficiency of e-learning programs has been increasingly important because some institutions have failed due to the lack of well-thought out financial plans (Morgan, 2000). Further, chief executives are increasingly concerned with the impact of training on “the bottom line” (Phillips, 1997). In addition, it was revealed that trainers perceived that cost is a key barrier for successful implementation of e-learning (Xebec McGraw-Hill, 2000).

### **Cost-efficiency of e-learning programs**

Cost-efficiency and cost-effectiveness are two similar terms related to financial performance. Even though they have slightly differentiated meanings, they have been used without clarification. Efficiency means the ratio of output to input and effectiveness is concerned with only output. Stated differently, efficiency focuses on “how much output was obtained from the input,” that is, the quantity and effectiveness focuses on “how relevant the output is,” that is, the quality. A learning method is relatively cost-efficient in the case that its outputs cost less per unit of input and it is cost-effective if its outputs not only spend less cost than others but also are relevant to learner’s needs (Rumble, 1997). Hence, a learning method can be effective but not necessarily efficient and vice versa. Accordingly, two terms should be used cautiously and be well-defined.

From the perspective of education, when relating the financial performance of education and training, it does not mean just program costs but costs related to educational value and learner’s needs. Therefore, the cost-effectiveness rather than the cost-efficiency is more apt to mention the financial performance of education and training. However, many educators and decision-makers believe that the fact that e-learning can save costs is the major advantage of an e-learning program, because it is assumed that enhanced student enrollment would result in increased revenue and lower cost. Most decisions related to training, especially in private organizations, are based on cost-efficiency. Even though this fact does not mean that cost should be the most critical information for educational decisions, it is certain that cost efficiency is one of the crucial types of information.

The analysis of cost-efficiency of e-learning programs has three benefits (Parsons, 1995). First of all, the analysis might help trainers look at the program through the customer’s perspective. Secondly, it provides a guide to discuss the program with major stakeholders of them. Lastly, it is helpful to make a decision related to the program.

There are various methods to measure and analyze the cost-efficiency. Mostly used methods to analyze cost-efficiency are cost-to-benefit ratio (CBR), return-on-investment (ROI) (Phillips, 1994) and breakeven point analysis (Whalen & Wright, 1999)

The cost-to-benefit ratio is simply the program benefits divided by program costs. The formula is as follows:

$$\text{CBR} = \text{Program benefits} / \text{program costs}$$

Return on investment utilizes the percentage of the net program benefits over program costs. The net benefits are the program benefits minus the costs. The formula is as follows:

$$\text{ROI (\%)} = \text{Net program benefits} / \text{program costs} \times 100$$

When calculating the program benefits, it is crucial to convert various data to monetary value in order to get an accurate and credible result. Phillips (1997) suggested ten major strategies to convert data to monetary value: output data is converted to profit contribution or cost savings; cost of quality is calculated; wages and benefits are used for the value for time; historical costs; internal and external experts; external database; participants estimates; senior management provides estimates; and HRD staff estimates.

Breakeven analysis means the number of students that offset the fixed cost of the e-learning program. E-learning programs need enormous investment at the start-up stage of developing and delivering a program. Because of the high start-up and fixed costs, e-learning programs are more expensive than traditional classroom learning in the case of small enrollment (Jewett, 1998). Young (1998) summarized and synthesized eight case studies evaluating the benefits and costs of mediated instruction and distributed learning. Four out of eight studies included breakeven analysis.

There is no firm formula for determining the optimum number of students for e-learning programs (Bates, 2000; Morgan, 2000). Bates (2000) mentioned that the appropriate number of students should be determined by educational philosophy, course design, and the number of students who can be handled by the technology. Despite this difficulty, Bishop (2000) tried to determine optimum cohort size based on the cost analysis. According to the result, a cohort consisting of 25 students appeared both fiscally viable and pedagogically sound, even though the result showed a small profit with the 20 student cohort. In the case of courseware for remedial mathematics which utilizes an interactive (Cates, 1998), multimedia learning system developed by Academic Systems Corporation in order to improve the success rate of students, sufficient levels of annual enrollment that the costs of mediated learning system can be less than those of classroom course were 1,000 students per year. Another study compared the cost-efficiency of on-campus programs and multiple receive sites programs via an integrated satellite and videoconferencing system of the Human Computer Certificate Program at Rensselaer Polytechnic Institute (Bray, 1998). Consequently, the course had a break-even enrollment of about 15 receive-site students. Whalen and Wright's study (1999), which hypothesized that there are several key design elements that should be identified as costs in the web-based training programs and analyzed a break-even point and return-on-investment, revealed that the program had a break-even number of 112 students and a ROI of 228% through 3283%. Even though a break-even point of each program is totally different, the common fact is that an e-learning program is more expensive than traditional instruction makes it important to compute. Therefore, the decision about how many students would be admitted to one cohort is important educationally as well as economically.

As stated above, breakeven point analysis provides crucial information for deciding class size. Deciding online class size is balancing between quality and budget and one of the crucial issues course designers should consider (Distance Education Report, 2000). Accordingly, this study focused on measuring the breakeven point and further suggesting an appropriate cohort size of a course in HRE Online program at the University of Illinois at Urbana-Champaign.

## Questions

As indicated above, the importance of cost analysis of e-learning program is getting more important. So is that of HRE Online program at the University of Illinois at Urbana-Champaign. Accordingly, this study addressed the following questions:

1. How cost-effective is the HRE Online program?
2. What is the appropriate cohort size for HRE Online in terms of cost?

## Background of the HRE Online Program

The University of Illinois at Urbana-Champaign has a rich history of technology leadership and was the home of the first web browser development that has resulted in the major growth and access of the Internet. In the mid-nineties, the University of Illinois saw an emergence of professors using the Internet within their instructional efforts. These efforts were pedestrian to today's use but they represented the growth of ideas and use. By 1997 several campus leaders decided that the university should invest in the design and delivery of online courses and programs.

The HRE Online program is entitled "Global Human Resource Development" was proposed in the Spring of 1998. The HRE department initiated this effort for several reasons. The department has a fairly sophisticated faculty in terms of technology use, with faculty using web support for most on-campus courses. The department also has several faculty who teach courses related to instructional technology and they also conduct research in this area. Consequently, there was a built-in interest in online instruction. Additionally, the HRD emphasis of the department puts faculty in contact with practitioners in the private sector who are involved with e-learning projects (the author has major research funding from the industrial partners of the National Center for Supercomputing Applications, the Office of Naval research, and the National Science Foundation). This provided for increased levels of faculty expertise as well as awareness of trends in the field.

The Department was also experiencing a growth spurt in terms of adding faculty. Consequently, capacity for new ventures was present. This increased capacity allowed for released time for development and the adding of additional online course offerings. The department had experience in delivering a master's degree in off-site locations that included Chicago, Peoria, Rockford, and Nairobi Kenya, even though these early programs were delivered face to face. Consequently, the move to an online program was attempted to meet an existing demand for a master's degree in HRD. The online approach allowed for the identification of a broader audience than ever before for off-campus programs because of the "anywhere" feature of online learning. The first cohort of fourteen students graduated in May and August of 2001. The department recruits students on an annual basis and simultaneously enrolls three cohorts of students.

This program is a degree program resulting in a Master of Education degree. The program includes nine courses. These courses are similar in content to courses taught on-campus as part of the masters program. A cohort of students is recruited every year. Students take one course per term that includes Fall, Spring, and Summer. The course length was adjusted to twelve weeks after experience with the first cohort. Campus based courses are sixteen weeks long, however, the same amount of subject matter is included in both length

courses.

The department achieved a high level of support and involvement of the faculty - with nine different faculty members being involved in the masters program. The faculty were provided released time from the teaching of one course to compensate them for the extra time involved in transforming a course to the online form. Consequently this was a cost to the department - the loss in teaching capacity for one term. However, since development/transformation was spread over a two-year period of time, it did not place an extreme strain on the department. In addition to release time, faculty were provided "development assistance" for the technical parts of course transformation. This assistance was provided by a team of graduate research assistants, who had technology experience. It is estimated that fifteen hours per week for sixteen weeks in development assistance was provided for each course. During the term that faculty actually teach or deliver a course, they are provided teaching assistant ten hours per week.

The nine courses are delivered in a combined synchronous and asynchronous form. The asynchronous delivery occurs through students receiving a streamed PowerPoint supported lecture. These lectures are usually fifteen to twenty-five minutes in length. Additionally, students are provided by learning activities that they complete either independently or as a team activity, depending on what the professor requires. Students submit their work electronically in a variety of forms and ways, according to professor's preferences. Synchronous instruction is provided through once per week session that lasts approximately one hour. This session involves all students logging onto a text chat system with each other and the professor. The professor uses live, streamed audio to talk to the students and to lead discussions

## **Data Collection**

This study collected cost information about cohort 2 among three cohorts who are enrolling in HRE Online program at the University of Illinois at Urbana-Champaign at present and conducted the breakeven point analysis. The reason why this study focused on the cohort 2 instead of the cohort 1 which already graduated in May 2001 is that tuition of the first cohort had been underestimated and it was adjusted for the second cohort. In addition, because the second cohort will graduate in next summer, the remaining cost for this cohort can be projected accurately and easily.

As stated above, e-learning programs need enormous investment at the start-up stage of developing and delivering a program unlike a traditional program. Because of the high start-up and fixed costs, e-learning program is more expensive than traditional classroom learning in case of small enrollment below the breakeven number of learners (Jewett, 1998). Even though the start-up cost of e-learning programs has a great impact on the breakeven point, start-up costs for this program have not been considered in this study. Since funding was received from the central administration for the support of start-up and because the department contribution was in released time, it was not necessary to recover these costs and thus this information was not collected. Accordingly, the cost analysis result of this study may be shown to be more cost-efficient than that of others.

## **The Results of Cost Analysis of HRE Online Program**

### *Cost-effectiveness of the HRE Online Program*

Cost drivers of the HRE Online program consists of two elements - fixed costs and variable costs. Fixed costs include tech coordination salary, administrative time, secretarial support, equipment, facility, contracted server support, network support, and office communication cost. Variable costs depending on the number of courses are faculty salary, technology support staff, teaching assistance salary, course materials, and mailing costs.

In strict cost analysis using a business model it would be expected to include all costs, that is, fixed costs, variable costs, direct costs, and even indirect costs. In the university setting, however, it is typically not required to include some of the fixed costs of a program such as office rental, secretarial support, network administration and so on. This analysis included only direct costs related to operating the program such as faculty salary, TA and tech support, coordination, software and equipment updates, and office supplies. Some of fixed and indirect costs are shared with on-campus program and it is hard to exactly differentiate the portion of the on-campus program and the portion of the online program.

The program start-up was funded through a cost sharing approach between the HRE department and the University Vice President for Academic Affairs' office (VPAA). The VPAA provided a sum of \$156,000 to be spread over a two-year period. These funds were used for hiring graduate assistants for development and teaching assistance, for equipment, and for design and programming on a work for hire basis.

The department invested both direct and indirect resources in the program. The major direct cost was in the form of faculty release time. This amounted to approximately twenty-five percent of nine faculty member's time for one semester. The teaching load at HRE/UIUC is two courses per term, which accounts for 50% of ones load (50% teaching, 35% research, and 15% service). Therefore, approximately fifty-five thousand dollars in faculty time was devoted to start-up. Additionally, indirect expenses in the form of space, utilities, and some equipment were costs born by the department.

Operating or recurring costs for the program included primarily the fixed costs of faculty salary and development and teaching assistants. This accounts for three faculty per year at twenty-five percent of their salary for one term each. Graduate assistants were funded at the level of .25 FTE for technical support and .25FTE for teaching support for each of the three courses offered per year. A .25 FTE appointment for graduate students is ten hours per week. The current salary for .25 FTE Graduate Assistants is \$687 per month. Also, a full-time coordinator is employed to oversee and support the program. This person's salary is split among the three cohorts in the HRD program and another online program offered by the department. Revenue for the program is based on tuition from enrolled students. More specific information regarding revenue and income statement for one cohort was presented in Table 1 and Table 2 respectively.

Table 1  
Summary of Revenue by course

	Semester	List of course	Number of students enrolled	Tuition	Total Revenue

Cohort 2	99 Fall	HRE 387 (1/2) HRE 389 (1/2)	34	848	28,882
	00 Spring	HRE 383	29	848	24,592
	00 Summer	HRE 384	20	848	16,960
	00 Fall	HRE 483	22	848	18,656
	01 Spring	Edpsy 362	21	848	17,808
	01 Summer	HRE 454	18	936	16,848
	01 Fall	HRE 450	19	936	17,784
Projected	02 Spring	HRE 457	19	936	17,784
	02 Summer	EPS 399	19	936	17,784
Total Revenue					177,098

Table 2  
Pro Forma Income Statement for One Cohort

August 21, 1999 to August 20, 2002			
<b>Revenue</b>			
	Gross Revenue from Tuition	177,098	
	Less Waivers	31,936	
	Total Revenue		145,162
<b>Expenses</b>			
	Faculty Salary and Benefits	79,236	
	TA and Tech Support	51,828	
	Equipment and software updates	7,000	
	Coordination Expense	41,832	
	Others (office suppliers, phone, etc)	14,400	
	Total Direct Expenses		194,296
<b>NET</b>			(49,134)

The third cohort was admitted in August of 2000 and the first cohort started the program in 1998. The fourth cohort will begin in the Spring of 2002. The expectation of the Department is to run three cohorts simultaneously at all times. The first cohort paid the standard tuition rate charged to all off-campus students at the in-state rate. This amounted to \$640 per four-semester hour course. The cohort had paid the same rate through the duration of their cohort program. Before the second cohort was recruited and admitted, the department obtained approval to increase the rate of tuition to \$848 for each four-hour course. It has been increased to \$936 to the present. Because the tuition rate for the first cohort was underestimated, this study focused on the cost-analysis for cohort 2. For cohort 2, the total revenue based on students' tuition was \$145,162 and the total costs were \$194,296. Specific costs spent were presented in Table 3.

This result shows that total cost of this program exceeds total revenue. Thus this program is hardly said to be cost-efficient at present. Revenue for the program is based on tuition from enrolled students. On the contrary, most of costs are fixed and not affected by the number of students enrolled. As more students enroll in the program, revenue increases, but total costs do not fluctuate. Making profits from this program, therefore, depends on the

number of students enrolled. As seen from Table. 4, the number of enrolled students has gradually dropped out and it caused this negative result of cost-efficiency. To make this program cost-efficient, therefore, it is important to maintain the number of enrolled students over the breakeven point. The following section is focused on analyzing the optimal number of students for each course.

Table 3  
Expenses for Cohort 2

	Fall 99 N=34	Spring 00 N=29	Sum 00 N=20	Fall 00 N=22	Spring 01 N=21	Sum 01 N=18	Fall 01 N=19	Spring 02 N=19	Sum 02 N=19
Faculty salary*	6,988	6,988	6,988	6,988	6,988	6,988	6,988	6,988	6,988
Benefits	1,816	1,816	1,816	1,816	1,816	1,816	1,816	1,816	1,816
TA**	2,677	2,677	2,677	2,868	2,868	2,868	3,093	3,093	3,093
Tech Support **(DA)	2,677	2,677	2,677	2,868	2,868	2,868	3,093	3,093	3,093
Coordination** *	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000
Benefits	1,040	1,040	1,040	1,040	1,040	1,040	1,040	1,040	1,040
Administrative support	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Contracted server support	500	500	500	500	500	500	500	500	500
Others	100	100	100	100	100	100	100	100	100
Total cost	20,798	20,798	20,798	20,989	20,989	21,280	21,630	21,630	21,630
Total revenue	28,882	24,592	16,960	18,656	17,808	16,848	17,784	17,784	17,784
Net	8,084	3,794	-3,838	-2,333	-3,181	-4,332	-3,846	-3,846	-3,846

\*Salary was calculated for each faculty member, summed and divided by the number of courses. This preserves the privacy of salary data.

\*\*Based on .25FTE GRA for one semester.

\*\*\*Based on salary of coordinator being split among three cohorts and another online program

### *Optimal Cohort Size*

Based on the current amount of expenses, total costs for one cohort course are \$20,523. Based on the current tuition rate, the program begins to make profits from the point that 22 students enroll one cohort (Revenue: 22 \* \$939 = \$20,592). Consequently, the cohort size should be kept at or above 22 who pay tuition. Since it is impossible to predict the number that will receive tuition waivers, it is important to enroll more. It is also expected that attrition will occur and this should be estimated and considered in recruiting.

This study assumed that the start-up costs would be prorated over the first five years of the program. During that period of time, the number of courses offered would be 50.



As indicated above, the start-up costs \$156,000 were funded from the University Vice President for Academic Affairs' office (VPAA) through a grant and the HRE department invested approximately fifty-five thousand dollars in faculty released time. Since a grant supported part of development, there is no need to recover that cost. However, the departments investment is of interest. When the start-up costs are divided by the average number of courses offered over the first five years (ten), the amount of money which each course should cover is about \$1,100. To earn \$1,100 from students' tuition, approximately 1 more student needs to enroll in each course in addition to 22 paying students for breakeven. Accordingly, the optimal cohort size is 23 students with waived students above this number. The result of this study was consistent with the result of Bishop's (2000), which was concluded that the 25 students cohort option seemed to be proper in terms of both finance and education.

## **Discussion**

When all expenses are included, the HRE Online program has not broken even since the program was launched. However, in the case of e-learning programs provided by a university, the cost-analysis does not always require faculty salaries to be included. This is especially true when existing faculty capacity is being used to cover the expenses of the program. If this analysis excludes the faculty cost, HRE Online is definitely cost-effective.

When considering the financial performance of education and training, it is to focus not on just costs but on non-costs related educational value and learner's needs. The basic question determining the financial performance is not "Does distance education cost more or less than traditional education?" but rather "Are the educational outcomes worth the cost" (Thompson, 2000). Hence, other factors are critical to the success of the program - student learning, student satisfaction, retention, and faculty satisfaction. Especially student retention is crucial factor to determine the success of e-learning program. As the number of students enrolled in the cohort 2 show, students' retention directly affects the cost-efficiency of the program and furthermore indirectly demonstrates the degree of students' satisfaction with the program. Therefore, special concern should be given to issues in relation to retention, e.g., how the program retains students and why students leave the program in addition to the cost-analysis. Related, it is important to estimate attrition when setting an enrollment goal for a program to ensure cost efficiency of the last course as well as the first. Historical retention data can provide predictive information for planning.

Additionally, a philosophy of the department which offered this e-learning program is not to view program cost information in isolation from other data. One major benefit of the e-learning program to the department is the establishment of a pipeline for its doctoral program. It is expected that some of the best e-learning students will be recruited into the on-campus Ph.D. program. Additionally, the e-learning efforts of the department generate almost \$60,000 in graduate student support for technical assistance and teaching assistance. The consequence is the ability of the department to recruit and support at least four half time assistants each year.

Examining the cost-effectiveness of e-learning programs is complicated, because the constantly emerging nature of technology makes it complex to assess accurate costs (Bishop, 2000). Also, it is difficult to analyze the cost-effectiveness across institutions because different institutions have unique background of the program development and analyze it based on different definitions of cost-effectiveness (Picciano, 2000).

## **How this research contributes to new knowledge in HRD**

Cost analysis is one of the major concerns that HRD practitioners need to consider. According to Middleton (1997), different educational sectors have different concern about the effectiveness of training and development. For instance, administrators and managers have a concern about why a given program or course is undertaken in the first place and whether or not it has been successfully accomplished. That is, overall evaluation, instructors or designers focus on teaching methods and contents, and students consider broader base of not only the test results but also their learning satisfaction. Among various concerns, the ultimate criterion the business sector uses to judge the financial performance of training is cost (Middleton, 1997). Whether a program is cost-efficient or not is crucial information for further decisions about expansion or contraction of the program. It is hard to expect the increased investment to HRD without demonstrating the financial effectiveness.

This study is meaningful in that it reminds HRD practitioners or scholars of the importance of cost analysis of e-learning programs which became a major educational form of the HRD field. This study, however, is not limited to emphasizing the importance of cost analysis of an e-learning program. This emphasized equally how unique a cost-analysis of an educational programs is. In other words, it is needless to say that cost-analysis in a business setting should include all expenses, but it is not always true in cost-analysis in educational settings. Some costs do not need to be included in the model, for instance, faculty salary. This case study provided information about which costs should be included in cost analysis of e-learning programs especially in university settings and which ones should not, how to get the breakeven point and optimal cohort size and so on. This result may influence further decisions regarding the number of students admitted or issues related costs for this program as well as for other universities which are planning to operate e-learning programs. Furthermore, other factors should be considered to ensure the effectiveness of the program - student learning, student satisfaction, retention, and faculty satisfaction in addition to costs. These variables are being monitored in relation to financial efficiency by the e-learning evaluation system. HRD practitioners should be able to understand distinctions of cost analysis of training programs and analyze the cost in an appropriate way.

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