# Cost Comparison – Instructor-Led Training vs. E-learning
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***Note: This is the author's original submitted article and has not been edited for style and content by ASTD.**

Of the many factors that come into play when determining the proper training delivery approach, efficiency, timeliness, consistency, and appropriateness of delivery method, a key driver is program cost. Program cost, which includes among other factors, the cost of initial development, instructor's time, material, travel, and opportunity cost of the learner, can vary widely for similar programs depending on the delivery method. To help us better understand the relationship between cost and delivery methodology, we have constructed a mathematical model to better calculate the key cost components.

The key finding of this exercise is that when similar programs are compared, e-learning is less expensive to deliver almost regardless of learner population. In all cases where there is a learner population larger than 100, e-learning has a clear cost advantage. As population increases, this difference becomes more pronounced. Even with a population as small as 100 and a class as short as one hour, e-learning was still over 40% less expensive than instructor-led training ($9,500 vs. $17,062 or $76/learner). When large populations are modeled (40k), the cost advantage of online learning is even greater, with savings as high as 78% ($1.1 million vs. $5.0 million or $99/learner) when compared with traditional delivery methods (Figure 1).

Figure 1 - E-learning Savings per Student by Class Length and Learner Population
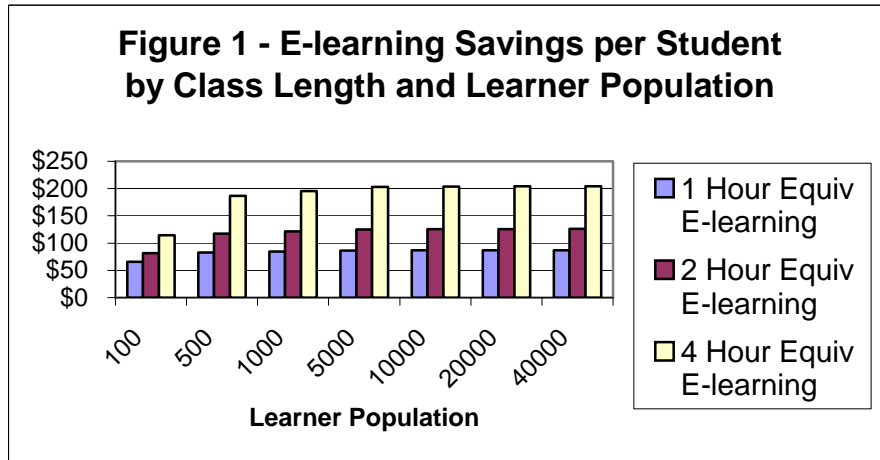
Determining the Cost Per Development and Delivery Hour

A number of factors can be examined when comparing the respective costs of learning delivery methods. These factors can include course development costs, the salary of the instructor, including the time required to prepare for and conclude each class, the cost of the instructional material, travel costs, learner opportunity costs, and the allocated cost of the classroom or conference room. Beyond these factors there are the very real costs of instructional efficiency and learning "velocity", or how quickly a program can be delivered across an organization, learning efficiency, timeliness, consistency, and ease of updating material. E-learning has an advantage in virtually all of these areas including efficiency and velocity. As Hall (2000) noted, online learners enjoy an efficiency advantage in being able to cover the same material in approximately half the time of a traditional class. Additionally, e-learning has a velocity advantage by being able to reach a large number of learners in a short amount of time. This advantage becomes even more pronounced as the number of learners increases and/or they are geographically dispersed (Hall, 2000).

One of the factors that we have not included in this analysis is the allocated cost of a learning management system or LMS. Almost every organization uses a learning management system of some sort whether they think they do or not. Systems range from pencil and paper on the low end to sophisticated enterprise web-based systems such as SABA, Docent, or Aspen, on the other. Regardless of the system used, there will be system costs associated with scheduling, tracking, and delivering both instructor-led and e-learning classes and these costs will essentially cancel each other out.

The following table outlines the values chosen and the rationale behind several of these factors affecting both the cost and the efficiency of different delivery methods. The fourth column contains a more complete explanation of each factor along with a conclusion on the relative merit of both delivery methods. While this list is not exhaustive, it does cover the major areas that can influence the cost of training delivery.

Table 1: Factors Affecting the Development and Delivery Costs of Training Delivery

	Instructor-Led Training	E-learning	Notes
Development Cost per hour of instruction	33 hours @ $135 per hour = $4,455	100 hours @ $135 per hour = $13,500	Brandon Hall identified (2000) at least a "two to one" ratio "rule of thumb" between instructor-led training (ILT) and e-learning development time. For purposes of this calculation, we are using the 3:1 ratio identified on page 115 of Caterpillar University's BOL. Costs are Caterpillar University Performance Support & Usability (PS&U) average cost - costs can vary depending on complexity of material and familiarity of developers with material. *In general*, internal developers are able to develop instructional material in less time than external developers because of this (Smulders, 2004). External developers may sometimes be seen as a less costly option, especially if project management and SME time is not counted. "Hours required" totals assume that accepted instructional design standards are followed. Hall (2003) noted that if the intent was simply to deliver a message quickly, and ID is not followed, e-learning can actually be developed quicker than instructor-led.
Instructor Cost per hour of instruction	$150/hour instructor burden rate	n/a	We are using the same $150/hour instructor burden. The Business of Learning uses a $145/hour rate for instructors, but that data is now several years old. There is one caveat with this number. There is an often-voiced perception that initiatives using a "train the trainer" approach are either delivered "free" or at the average burden rate. This factor is a variable in the spreadsheet that can be easily adjusted.
Prep-time & Post Class Activity	$150/class	n/a	There is approximately ½ hour of prep time both before and after each class. Prep time includes room setup and material gathering. Post class activity includes not just tear down but entering class completions into the LMS.
Material Cost	$280/14 person class	n/a	Material costs approximately $20 per student per class. This includes development, duplicating / printing, collating, binding, and storage. Class size is actual historical average Caterpillar Inc. 2004 YTD ILT classes registered in CLMS.

	Instructor-Led Training	E-learning	Notes
Instructor Travel Costs	10% of instructor cost.	n/a	Travel can add to the cost of any program – especially for facilities that do not have instructors on site (Moran, 2002).
Learner Opportunity Cost	Length of class + 15 minutes before + 15 minutes after	½ length of equivalent instructor-led class	This is the cost to the organization when learners are away from their job. This cost doubles if learner's position must be covered during class (Moran, 2002). In general, e-learners will cover the same course material in ½ the time (Hall, 2000 and Moran, 2002). This means that, on average, an e-learner can cover one hour of classroom material in ½ hour online. Since e-learning is usually done at the employee's desk, there is little or no "interference" time before and after class.
Physical Classroom	Overhead allocation	n/a	E-learning does not require the use of a dedicated classroom in most cases. (Learners who do not have access to a computer will have to use a computer lab.) A more complete cost comparison would include the allocated cost of a conference room or classroom (Moran, 2002).
Efficiency	Much less efficient	Very efficient	Moran (2002) defines training efficiency as "gained knowledge or skills" divided by "all information delivered". If only 15 minutes of a one-hour class is relevant, the class was 25% efficient because the learner had to sit through 45 minutes of unnecessary material. If an e-learner is able to skip the 45 minutes of "known" material, or pass a pre-assessment, allowing them to focus exclusively on the 15 minutes of new material, the efficiency of the online class would equal 100%. It is this efficiency that gives e-learning the 2:1 time advantage it enjoys over instructor-led training (Hall, 2000). In general, a learner will need ½ the time to cover the same material in an online class as they would in an instructor-led class. Also refer to the section on learner opportunity cost.

	Instructor-Led Training	E-learning	Notes
Velocity	Lowest	Highest	A key e-learning driver is velocity. There is simply no better way to drive knowledge across an organization more quickly than e-learning (Moran, 2002). In October of 2004, for instance, over 1,500 Caterpillar Inc. employees took the half-hour Office Safety, (08C1208), e-learning class. Had this class been delivered as instructor-led training, it would have required the scheduling of 107 one-hour classes. (1,500 divided by average Cat ILT class size of 14). A task that could not have been completed in a single month under the best of circumstances. If we look at the 20 most popular e-learning titles that month, we see that they accounted for 14,000 successfully completed classes. Had those classes been delivered in the traditional manner, it would have required scheduling 1,000 one and two-hour instructor-led classes, or looking at it another way, about six months worth of non-stop 40-hour man-weeks. By comparison, there are 365 ILT classes delivered at Caterpillar in an average month. Also, since e-learning classes are web-based, they were taken by learners in virtually every business unit worldwide in the same month.
Timeliness	Lowest	Highest	Timeliness refers to the immediacy of the instruction. Namely, how relevant is it to the task at hand. Instructor-led training has been referred to by Hall (2000) as training that was delivered "just in case" while e-learning was "just in time". Instructor-led training requires the coordinated scheduling of the instructor, facilities, and students at some future date. E-learning, on the other hand, can be delivered anytime it is convenient for the learner.
Consistency	Lowest	Highest	One of the e-learning advantages noted by Hall (2004) is consistency, or the ability to deliver the same message every time. This can be especially important in topic areas such as government regulation, or whenever a consistent message is required. It is also noted as a strength of e-learning and a weakness of instructor-led training by Workforce Management magazine in a 2001 article.
Ease of Update	Lowest	Highest	Because e-learning material is delivered from a central database, it enjoys the flexibility of being easily updated. New material can be added, old material can be updated, and mistakes corrected in a single location (Hall, 2004 and Workforce Management, 2001).

Constructing the Model

In constructing a model to compare the development and delivery costs of instructor-led and e-learning, we have by necessity included certain factors and excluded others. The factors that we have included are both easily quantifiable and generally understood. The ones excluded from this model, while important, and maybe even the most important depending upon the circumstances, require more research to quantify and enjoy less of a consensus as to their relative importance. The factors included in this model are; development cost per hour of instruction, instructor cost per hour of instruction, instructor prep time and post class activity time, instructor travel costs, and learner opportunity costs. Values for these inputs can be found in Table 1.

We have chosen not to attempt to quantify the allocated cost of the physical classroom because this can vary widely by business unit along with the availability or unavailability of dedicated classrooms.

We have also excluded efficiency, although this aspect is somewhat addressed by learner opportunity cost. Additionally, we have excluded velocity, timeliness, consistency, and ease of making updates. A strong case can be made for each of the excluded factors under the right circumstances. The value of training velocity during a new product introduction or the timeliness of software application training would have great value to a specific program but may not be as important as a general rule.

We chose Microsoft Excel as the platform for this model as it allows the user to modify various inputs to better reflect unique circumstances. Several inputs, including development cost per hour, instructor burden rate, material cost per student, instructor travel percent, learner burden rate, average ILT class size, ILT development hours, and e-learning development hours can be modified to more closely reflect business unit circumstances.

Key Findings

The key finding of this exercise is that when similar programs are compared, e-learning is less expensive to deliver almost regardless of learner population. Even with a population as small as 100 people and a class as short as one hour, e-learning was still over 40% less expensive than instructor-led training when learner opportunity costs were taken into account ($9,500 vs. $17,062). When large populations and longer programs are modeled, the cost advantage of online learning is even more pronounced, with savings as high as 78% (Figure 2). In our model, the per student cost for e-learning is less than the comparable instructor-led cost with a population as small as 21 students (one-hour example) and no more than 83 students (four-hour example).

Figure 2 - E-learning Savings Expressed as a Percentage
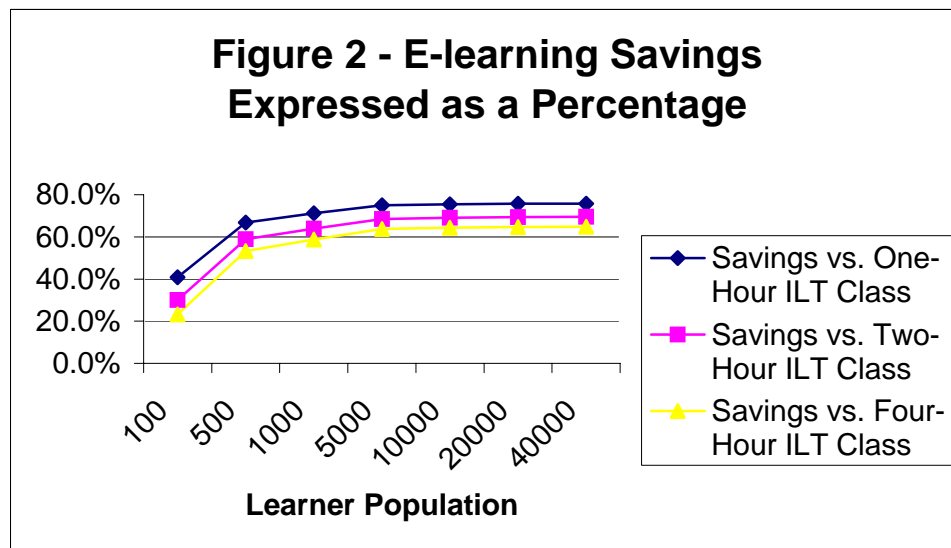
In the following pages we have included several graphs created by this model that plot the difference in development and delivery costs between comparable instructor-led and e-learning programs (Figures 3, 5, and 7). By plotting the number of learners on the X-axis and cost in dollars on the Y-axis, these graphs illustrate the cost advantage enjoyed by e-learning. The graphs compare one, two, and four hour-long classes respectively, and learner populations of 100, 500, 1,000, 5,000, 10,000, 20,000, and 40,000 students.

Tables immediately below these graphs (Tables 2, 3, and 4) compare the cost of instructor-led training to e-learning for each learner population. The same table also contains overall e-learning savings and savings per learner.

We have included three other bar graphs that illustrate the dollars saved per learner as a function of the total population of learners. Like the previous graphs, these compare similar classes and learner populations (Figures 4, 6, and 8). Additional analysis is contained in the spreadsheet file in the "Additional Information" and "Break Even Point" worksheets. The later worksheet calculates the point at which the e-learning becomes the least cost option based on the variables used in the first three worksheets. It is also useful to better understand the cost per learner of various population sizes.

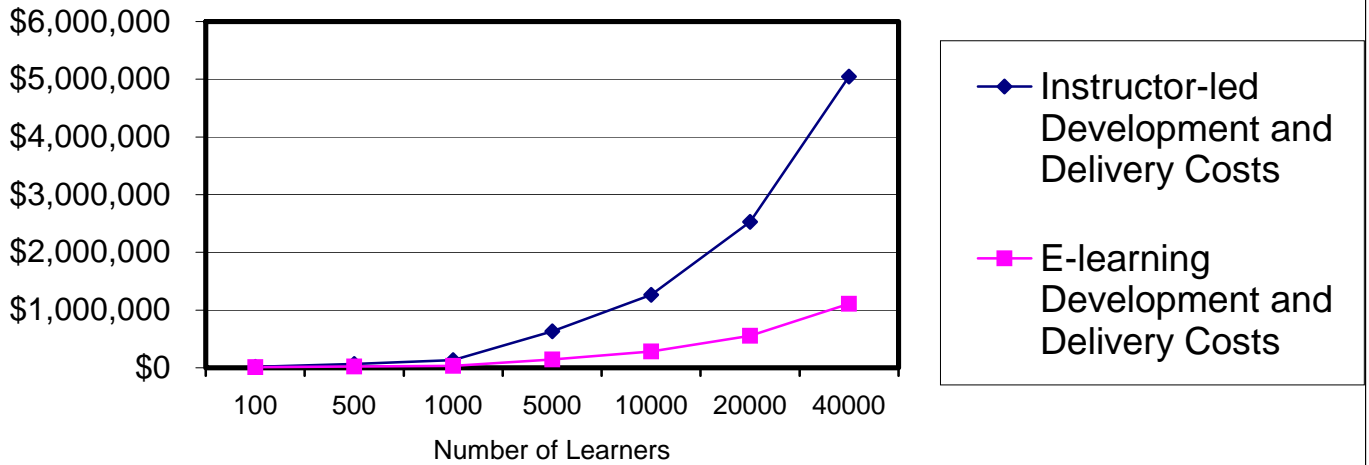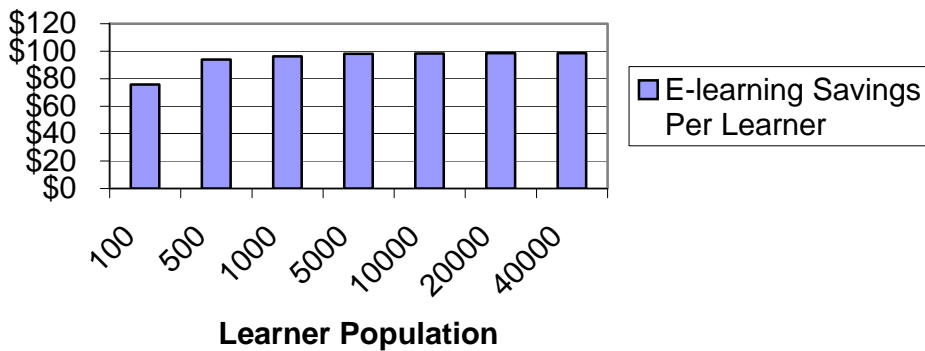**Figure 3 - Comparison of Instructor-led Development and Delivery Costs vs. E-learning for One-Hour ILT Class**

Table 2: One-Hour ILT vs. E-learning Comparison

Learner Population	100	500	1000	5000	10000	20000	40000
Instructor-led Training	$17,062	$67,491	$130,526	$634,812	$1,265,169	$2,525,884	$5,047,312
E-learning	$9,500	$20,500	$34,250	$144,250	$281,750	$556,750	$1,106,750
E-learning Savings	$7,562	$46,991	$96,276	$490,562	$983,419	$1,969,134	$3,940,562
E-learning Savings per Learner	$76	$94	$96	$98	$98	$98	$99

Figure 4 - Per Learner Savings - E-learning vs. 1 Hour ILT

Figure 5 - Comparison of Instructor-led Development and Delivery Costs vs. E-learning for Two-Hour ILT Class
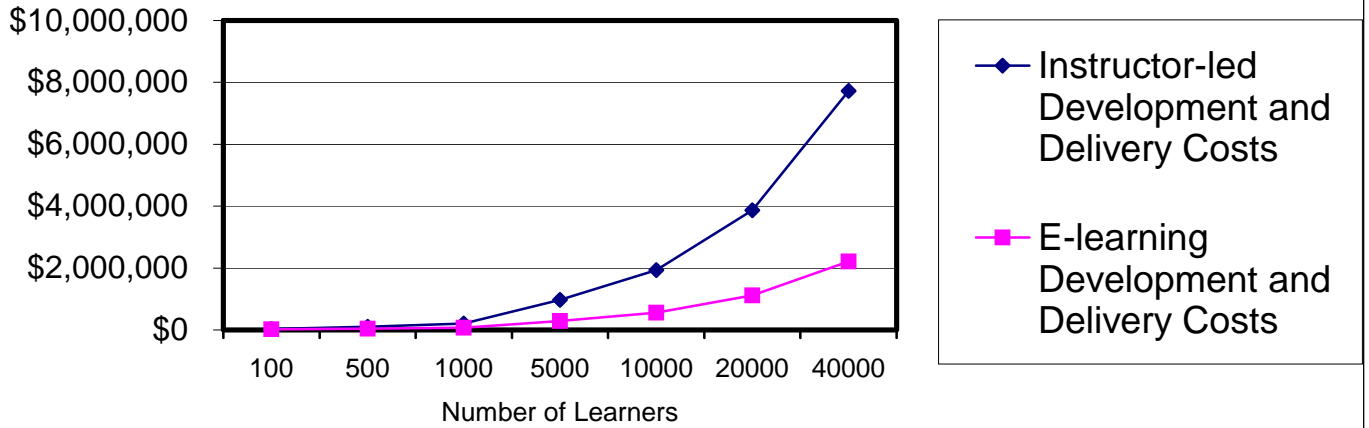
Table 3: Two-Hour ILT vs. E-learning Comparison

Learner Population	100	500	1000	5000	10000	20000	40000
Instructor-led Training	$28,196	$105,339	$201,767	$973,196	$1,937,481	$3,866,053	$7,723,196
E-learning	$19,000	$41,000	$68,500	$288,500	$563,500	$1,113,500	$2,213,500
E-learning Savings	$9,196	$64,339	$133,267	$684,696	$1,373,981	$2,752,553	$5,509,696
E-learning Savings per Learner	$92	$129	$133	$137	$137	$138	$138

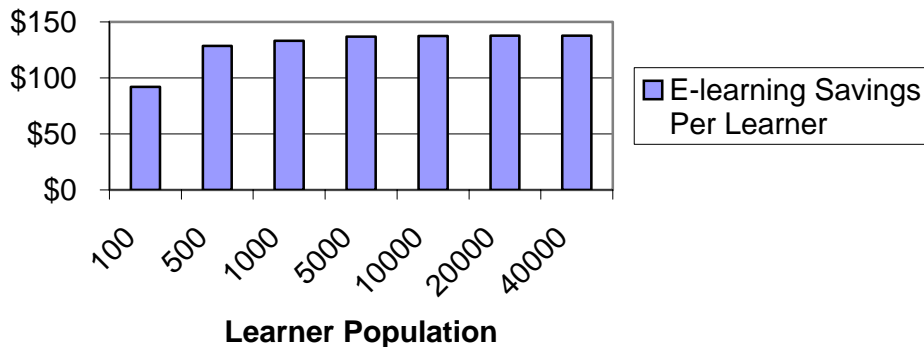**Figure 6 - Per Learner Savings - E-learning vs. 2 Hour ILT**

Figure 7 - Comparison of Instructor-led Development and Delivery Costs vs. E-learning for Four-Hour ILT Class
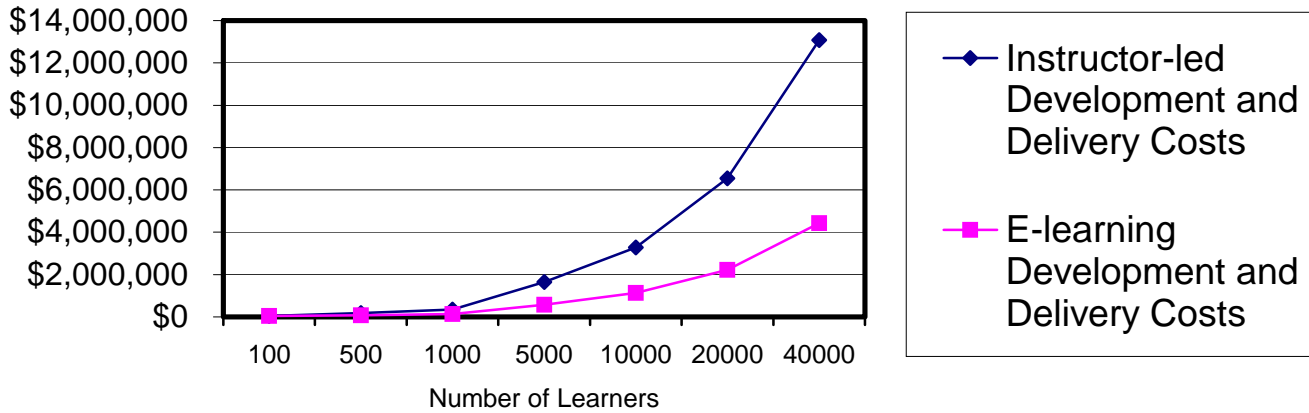
Table 4: Four-Hour ILT vs. E-learning Comparison

Learner Population	100	500	1000	5000	10000	20000	40000
Instructor-led Training	$50,463	$181,034	$344,249	$1,649,963	$3,282,106	$6,546,391	$13,074,963
E-learning	$38,000	$82,000	$137,000	$577,000	$1,127,000	$2,227,000	$4,427,000
E-learning Savings	$12,463	$99,034	$207,249	$1,072,963	$2,155,106	$4,319,391	$8,647,963
E-learning Savings per Learner	$125	$198	$207	$215	$216	$216	$216

Figure 8 - Per Learner Savings - E-learning vs. 4 Hour ILT
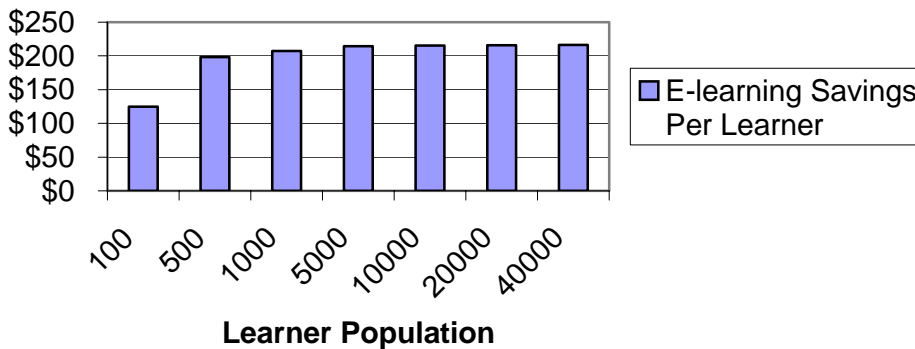
Summary

In all cases where there is a potential learner population larger than 100, e-learning has a clear advantage in the overall cost of development and delivery. As the learner population increases, this difference becomes pronounced and holds true even if the value of the learner's time is not included in the calculation. Beyond the factors used in model, many other factors such as consistency, velocity, and timeliness, affect the cost and quality of learning delivery. While this model does not consider them, they would be fertile ground for future research.

E-learning is not the appropriate delivery method for all training. Programs that require roll-playing or close observation by the instructor may not be candidates for an online program. On the other hand, the total cost of delivering an instructor-led class to thousands of potential students cannot be ignored and needs to be recognized whenever an organization is in the planning phase of a large training initiative.

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