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# Distance Learning (EaD): Cost-Optimization Strategy for the Continued Training Education of Electrical Energy Professionals in Brazil

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**Abstract:**

*The new technologies have spread globally at a dazzling speed, in various segments of society. In a corporate business environment it was not different, the methodologies of continued education has increasingly relied on new information and communication technologies (NICT's). In this perspective, the objective of this Article is to analyze the economic advantages of Distance Learning (EaD) mode, adopted in programs of continuing education in a large energy*

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*company sector. The Course Hygiene and Safety at Work is one of Eletrobras required courses for the operating personnel working in maintenance that will be further analyzed. Until the first half of 2007, the course was offered only in classroom mode but after the second half of 2007 it has also been offered by distance learning mode that has led us to compare the costs involved in classroom modality within the distance learning mode (EaD). The theoretical framework was based on a case study that allowed us to prove that there is an effective reduction in costs with professional training when the modality adopted becomes the EaD, due to economies of scale. The comparison between the two modalities allowed to observe that many companies can reach a much larger number of employees, providing agility in drills, flexibility on training, better managing its availability, keeping well connected with the new trends of the market.*

**Key words**: Distance Education, Continued Training, Cost Management

## 1. Introduction

The trend of the changes in political, economic and social scenarios has manifested itself each time with more intensity and at a dizzying speed. New forms of interaction with the environment, new technologies and organizational arrangements characterize an extreme volatile scenario. All these influences also involve changes of cultural patterns, redefining power relations, causing the transformation processes that becomes more complex and pointing out at multiple directions.

The revolution of greatest impact for humanity happens at first glance without people perceiving its depth. Again, this phenomenon is what various scholars denominate as "information revolution", a term that covers the use of computers, globalization, deregulation and, even, an expected second revolutionary phase called the era of biotechnology.

In times of great change, the lack of synchrony produces

dramatic disaccord between thousands of people looking for better jobs and several companies with vacancies that cannot be filled. There is no magic solution to this problem: only a change in the mindset of both, as individuals and companies can mitigate it. It is believed that the key is the continuing education, which requires from individuals, detachment, humility and provision, and from the companies, a new perception of what is an investment.

It is notable that the current process of technological transformation expands exponentially due to its ability to create an interface between technological fields, through a common digital language in which information is generated, stored, retrieved, processed and transmitted. We currently live in a world that has become digital.

The observation that the new technologies have taken over the education, leads us to question an effective economic advantage of Education by Distance Learning, in comparison with the system of presencial education, when the subject is continued education at a large company, raising some factors that allows us to view the pros and cons of this new system of education, which is growing day by day.

To adopt distance *teaching* in order to replace the traditional classroom, due to a considerable reduction in costs (provided that met certain assumptions, such as: scope and others that will be identified in the course of this Article) is a factor cited by several authors specialized in the area and among the bibliographic survey of this research.

The central problem of research is analyzed from an observations perspective combined with previous readings on the theme: What are the economic advantages of the Distance Learning (EaD) option in the continuing education development of professional workers of a large electrical power company in Brazil?

The first hypothesis considers that there is an effective

optimization of costs with professional training when the system adopted by the company is the distance learning mode. The second hypothesis is that there is a greater functionality in the process of qualification, taking into account the contemporary technology in our times, a customary tool in all sectors of large companies. In This way, the general objective of this study is to point out the economic advantages of adopting a distance learning system (EaD) in programs of continuing education for a large energy company in Brazil, based on actual data.

## 2. Conceptual Aspects of Classroom Teaching X Distance Learning

It is undisputed that all economic segments were affected by the phenomenon of globalization and revolutionized by technological advancement of informatics. There is a transformation in corporate management that after computerized, has sought in education support for a redesign. Education needs to be promoted through new instruments where the computer is replaced to occupy traditional jobs.

The necessity of understanding forms of education used in Brazil has led the Ministry of Education (MEC) to classify the teaching in three distinct modalities, based on their characteristics. These teaching methods are: classroom, a semi-distant and by distance learning.

According to Aretio (1994) classroom education is face-to-face using direct communication between teacher - student, in a defined location such as classroom, workshops and laboratories which is the conventional education. A semi-distant happens part in the classroom and another part by distance, through technologies. Distance education or distance learning may or may not have classroom moments, however, it happens primarily with teachers and students physically

separated in space or time, but they may be together through the use of communication technologies. (Moran 2002). As a modality of nontraditional education, EaD has emerged within the industrial society and the use of their technologies, covering different forms of learning that cast a range of methods, technical resources and use of their own information technologies.

According to Eick (1997), the EaD had a first consolidation at the beginning of the 20th century, and later, with the development of means of communication, in the second half of that century, there were conditions for the expansion of existing projects and for the emergence of new projects. Currently, with the use of satellites and the Internet, geographic barriers are no longer impediments for educational development as stated by Giddens (1997):

The social changes occur at an accelerated pace, being especially visible in the advance of information and communication technologies (ICT) causing profound changes, structural imbalances of the field of education. The intensification of the process of globalization generates changes not only in markets by at all levels and spheres of society generating new life styles, consumption and new ways of seeing the world and learn.

The second half of the 20th century was marked by a significant increase of new technologies, especially in the last two decades, at which time the cybernetics shows a rise in quality stimulated by the informatics market. It is in this context that the distance Education and the new teaching modality relies on the use of electronic media and the era of using information technology tools such as computer, TVs and videos, earning a large expansion (Niskier, 2001).

For Aretio (1995), the fundamental distinction of classroom education and the distance learning mode, is the replacement of personal interaction in the classroom between

teachers and students through systematic and joint action of several didactic resources among the elements that constitute the process of Distance Education. Aretio (1995) highlights some as:

| ELEMENTS | HOW HAPPENS? |
|---|---|
| Physical Distance Teacher X Student | Contact happens virtually |
| Independent X Individualized Study | Construction of knowledge |
| Teaching-learning Process independent media coverage | Differentiated Means of support and structure |
| Use of technologies | New technologies + communication resources |
| Communication in both direction | Critical and participatory interaction |

*Source: RODRIGUES, Daniele Fernandes. Comparative Analysis of the costs of training in classroom environments and distance: a case study in Eletrobras. Master Thesis. UCAM-RJ, 2008.*

**Table 1. Elements that constitute the Distance Education**

As stated by Preti (2000), the majority of students in Distance Education has particular characteristics, such as: are adults inserted in the labor market, reside in locations distant from the cores of teaching, does not have approval in regular courses, are very heterogeneous and with little time for studying in classroom teaching. In Brazil, the Distance Education (EaD), using information technology, changes to be implemented with governmental support, being regulated by the Law no. 9394, of december 10, 1996, which lays down the Guidelines and Bases of Education (Brazil 1996).

Various are the denominations related to this modality, that is, often, in Distance Learning and Distance Education as if they were synonyms, expressing a teaching-learning process. Teaching represents instruction, socialization of information, learning, etc, while Education is "basic strategy of human formation, learning to learn, think, create, innovate, build knowledge, participate, etc. " (Fretwell, 1995). In This way, the present Article makes option through distance Education by understanding this to be the modality of education that covers

the relations of learning for teachers, tutors and students by the system of exchange of information

## 2.1 Corporate Education, continuing Education and Distance Learning: the appearance of e-learning.

Historically the companies of the capitalist world little bothered with the continued training of their employees, since the productive models adopted did not require that corporations invested in capacity of staff and even to enhance individual and the collective of their employees. The changes encountered in the world of work and the increased competitiveness gave birth to corporate education, currently a field that is growing increasingly in large companies, driven by new technologies.

For Meister (1999), the traditional programs of continuing education already does not meet the needs of training and updates required by the current market dynamics. In consequence to all this, organizations bet on continuous learning process as a way to build competitive business intelligence, thereby responding to the demands of the globalized world. In this context of need, the EaD becomes a resource for training and improvement of the people in the enterprise environment.

This new learning environment adopted not only in schools and homes, but mainly by companies, brings new challenges, as says Guizzo (2002):

> ( ... ) in corporate education, the Internet brings an innovative potential odd, because it allows us to overcome the walls of the classroom, with the exchange of ideas with cities and countries, exchanges between professionals, nationally and internationally, online search in databases, electronic journals memberships and sharing of common experiences.

The advantages with the use of the Web are numerous, but what stands out in the opinion of Litwin (2001): ease of use, elimination of geographical barriers, interaction learner-

instructor and learner-learner, possibility of unlimited search, updated information, modern instrument of motivation for learning. By taking into account all these advantages, many companies have discovered that technology is a fast and efficient way to maximize the improvement of employees in order to obtain competitive advantage in the marketplace, valuing the culture itself, the intellectual capital and the reduction of costs.

In fact, the Universities created by corporate companies do not necessarily have a physical space, even because many of pedagogical resources used are the media for distance education that way the term e-learning became often used, for the distance education through electronic means. In this concept, Wilson (1997) explains that: "the e-learning enables the distance education through an efficient system of management, which owns content developed with theoretical and pedagogical framework and specifics theories".

From the studies of Rosenberg (2002) he also highlights the following advantages of e-learning: individual and global cost of training programs; standardization in education; greater knowledge exchange; breakage of geographical barriers and systematic measurement and Management of training programs.

As highlighted by Levy (2003), the e-learning market grows in Brazil 50% a year, according to data from site E-Learning Brazil. The 47 organizations that participated in the award E-learning Brazil received more than R$ 180 million in return with R$ 84 million investment over the past five years. The return on investments has been happening in the average periods of less than 12 months. According to Ramal (2003), the business in this area in Brazil, in 2003 moved more than 80 million, with growth of 60% in relation to 2002. On the world market, the figures are even more impressive, coming out of 6 billion in 2003 to 23 billion in 2006.

The question is why the e-learning grows so much? In spite of its implementation be expensive, in medium and long-term e-learning helps to reduce costs with staff training. In addition, help to create a network culture in organizations that uses it, allowing the sharing of information and the collective production of knowledge. E Anninger (2001) in his Article "Training online: key strategies for success" stands out as the main advantages for organizations moving towards adopting online training, as the reduction of time invested in training and a considerable reduction in costs.

Rosenberg (2002), also points out the benefits in the use of e-learning for organizations: a considerable reduction in costs, as well as leverage the investment in corporate Web; the content presented at the right time and the most reliable way; learning occurs 24 hours per day, 7 days per week, which consequently allows a much larger number of employees to be trained.

Therefore, the choice of e-learning system use by organizations are due to several factors, but primarily the three fundamental reasons are as follow: first to the fact that it enable the company to empower a much larger number of employees compared to the classroom system. Secondly, it shows also a considerable reduction in costs due to economies of scale, and finally it does not compromise the quality factor. The quality factor will not be the object of study in this Article, but the factor costs and agility of training will be evidenced through a case study of a course offered by Eletrobras system.

## 2.2 Costs in the classroom (face-to-face) and distance (e-learning) systems

UNESCO (1998), confirms what has been stated up to now by drawing a economic comparison between the education face-to-face and distance education. It is clear that due to e-learning

mode companies does not require large investments in buildings and its cost over time becomes smaller than in classroom or face to face education that besides the need for fixed assets , also has considerable expenditure on maintenance of physical facilities and payroll, since this requires more labor-intensive than the EaD mode.

Pagano (2002), also believes that at the time of deployment costs of online courses are already higher as it needs a technological ballast in order to operate. But with overtime observation it was noted that the costs are actually higher in the Institution In class, which requires various employees for their administration and service to the student who is daily present, causing cascading effect in other departments.

For the organizations the advantages are enormous, because they are able to save about 50% of the time invested in training and cutting one third to 50% of costs. However it is necessary to understand the strategic secrets to an investee successful and analyze the most frequent errors (LITWIN, 2001). E Souza (2000) points out that the first step for the decision of using e-learning mode should be the analysis of the components costs, as shown in table 2:

| COMPONENTS | COMPOSITION |
|---|---|
| TEACHERS | Payment of teachers or external instructors; Salaries and expenses of employees of the company |
| TEACHING MATERIAL | Purchase of books, publications and other instructional materials. |
| CONSUMPTION | Material of administrative support. |
| ACCOMODATION | Spending on food, lodging and cost assistance to participants. |
| TRANSPORTATION | Airline Tickets, bus, taxi and reimbursement of mileage. |
| SERVICES OF THIRD PART | Provision of services linked to the activities of vocational training. |
| OTHER EXPENSES | Lease of premises, equipment rentals, acquisition of other consumable materials. |

*Source: RODRIGUES, Daniele Fernandez. Comparative Analysis of the costs of training in classroom environments and distance: a case study in Eletrobras. Master Thesis. UCAM-RJ, 2008.*

**Table 2. COMPONENTS OF COST.**

Rumble (1988) has written about the experience in defining of courses costs in of EaD and makes clear that in any project or activity, it can and should be budgeted, further explaining that the difficulty in obtaining this type of information related to costs, due to several factors as fear of cuts in the budget, afraid to expose their difficulties and even by lack of control.

For Lacerda and Abbad (2000) programs of continued training in enterprises should be interpreted taking into account the existence of four possible different scenarios: the offering of the course in their own classroom inside the enterprise, the option for the companies to send the professionals to carry out the course in another locality, the companies buy the distance courses of educational institutions and the company build their own structure and offer the courses at a distance.

As the importance of the decision on the scenario in which the company will offer its courses that several authors have studied on the subject. Dalmau, Valente and Lobo (2001) makes a comparative study between the media (face-to-face and distance) and the various costs that need to be analyzed for the best choice. The table below allows you to view this comparison:

| MEIO/CUSTOS | Docentes | Material didático | Consumo | Diárias | Transporte | Serviço de terceiros | Outras despesas |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| **PRESENCIAL** | | | | | | | |
| Empresas oferecem cursos em suas dependências | X | X | X | - | - | X | VIAGENS ESTRUTURA |
| Empresas enviam profissionais p/ realizar cursos em outro local | - | - | - | X | X | X | VIAGENS ALIMENTAÇÃO CURSO FUNCIONÁRIOS RESERVAS |
| | | | | | | | |
| | | | | | | | |
| **DISTÂNCIA** | | | | | | | |
| Empresas compram cursos a distância de instituições de ensino | - | - | X | - | - | X | INVESTIMENTO TECNOLÓGICO CURSO CONSULTORIA |
| Empresas montam e oferecem seus cursos a [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | TUTORES TECNOLOGIA CONSULTORIA |

*Source: RODRIGUES, Daniele Fernandes. Comparative Analysis of the costs of training in classroom environments and distance: a case study in Eletrobras. Master Thesis. UCAM-RJ, 2008.*

**Table 3. Model of Dalmau, Valente and Lobo.**

In this way, the model of Dalmau, Valente and Lobo (2001) is used in the Study of Case spelled out by this Article, to demonstrate the comparability and situations of adaptation and adequacy of system use for classroom and EaD (e-learning) in Eletrobras.

## 2.3 Case Study: comparative costs of continued education courses for professionals in Eletrobras via classroom/presencial and via distance learning

The idea of creating a proposal that assists in decision-making on the part of the companies on the "how to" work with distance education, arose from the need perceived by visits of the companies Human Resources Department (HRD) due to an existing gap regarding the methodologies for economic analysis of their projects for Distance Learning.

Several factors have been cited by the Division of Training director, such as compelling for deployment of courses and training sessions in the system EaD, among them: (a) Scope - due to the need of the company to meet an ever greater number of employees; (b) more Flexible/Optimization of the time - the employee administering your time better to be able to meet with their primary functions, taking part of the continuing education program of the company and (c) cutting-edge Technology - the company has as priority investments in cutting-edge technology.

However, there is the existent gap as a more detailed economic analysis of courses offered through the EaD modality, triggered a search for information on a company that would provide data for a later analysis. This information was obtained at Eletrobras, a company that will be the central axis of the

case study, both by being the biggest company in the energy sector, as it have already deployed the methodology of EaD.

## 3. Methodology

The method adopted was a field research, where the data were requested from Eletrobras through personal contact, semi-structured questions and open interviews, by the training analyst Antonia Ribeiro, responsible for the programs surveyed. The approach used for this research is qualitative; having in view that there was no statistical analyses of the data.

As Gil (1991) the point of viewing the objectives in this research is classified as exploratory, because it aims to provide a greater familiarity with the problem with views to make it explicit or to build hypotheses. It involves bibliographic survey; interviews with people who have had practical experience with the problem researched; analysis of examples that stimulate the understanding. Thus, regarding to the technical procedures, the search is: bibliographic, documentary, uses the technique of survey data and case study.

## 4. Characterisation of the Company

The chosen company is the largest of the electric power sector in Latin America Created in june 11, 1962, in Laranjeiras Palace, in Rio de janeiro, with the present president Joao Goulart. The Eletrobras (Central Brasileiras S.A. ), society of mixed economy, state holding company, leads a system composed by six subsidiary companies (Eletronorte, Eletrosul, Eletronuclear, Furnas, Chesf and CGTEE - Company Thermal Generation of Electric Energy), as in figure 1. The company has even half of the share capital of the Itaipu Binational and also controls the Search Center of Electric Energy (CEPEL), the largest of its kind in the Southern Hemisphere.


**Figure 1 - Companies of Eletrobras System - Source: site www.eletrobras.gov.br.**

The Eletrobras System is responsible for approximately 57000 (thousand) km of transmission lines, representing more than 65% of the national total. Does present in the entire Brazil possess 29 hydroelectric plants, 15 thermoelectric plants and two thermonuclear plants.

The system gathers around 15000 employees, being that 1/3 exercising operational functions of maintaining energy networks and having to do annually the course Hygiene and Safety in the Workplace, with an hourly load of 30h, which covers the following topics: control of the environmental conditions of work, security plan of work, supervision of work safety, security techniques and implementation of new technologies. The completion of the course decreases the levels of accidents at work to a minimum rate. Initially, the course was supplied through the system of classroom but this mode of study caused a panic disorder, because the stations for the production of energy operated with a lower number of professionals, having in view the displacement to the company headquarters in Rio de Janeiro, of those employees which would do the training. Table 4 presents data from the classroom

course offered in the system, which will enable a comparative analysis of their costs with the e-learning system.

## 5. Results and Discussions

In this section the results and discussions are presented as follow:

### 5.1. Analysis of Classroom or Presencial data mode

The course of "Hygiene and Safety in the Workplace" carried out in the first six months by classroom method had a duration of 30 hours, i.e. , the course took place in the period of three days, attending 160 employees in January 2007. In this case, it was necessary to divide them in at least 8 classes with 20 participants each.

| GASTOS | DIAS | PREÇO DIÁRIA | QUANT Empregados | CUSTO TOTAL |
|---|---|---|---|---|
| HOSPEDAGEM | 3 | $90,00 | 160 | $43.200,00 |
| ALIMENTAÇÃO | 3 | $60,00 | 160 | $28.800,00 |
| INSTRUTOR * | 30 Horas | $70,00 p/ Hora | 8 Turmas | $33.600,00 |
| SALAS AULAS | 3 | $350,00 | 8 Turmas | $8.400,00 |
| PROJETOR | 3 | $130,00 | 8 Turmas | $3.120,00 |
| APOSTILAS | - | $30,00 p/ Apostila | 160 | $4.800,00 |
| TRANSPORTE | - | $120,00 | 160 | $19.200,00 |
| TOTAIS | - | - | - | $141.120,00 |

Source: developed from data provided by Eletrobras in January/2008. ( * ) Instructors training Consulting of Maua Engineering College

**Table 4. Spreadsheet of costs in classroom modality.**

As shown above in table 4, during the study the costs relating to classroom training that involved the displacement of employees to Rio de janeiro were identified as follow: lodgings in hotels, daily power, hours of classroom instructor, snacks

during the curse of the training, costs of rentals of rooms, printing of handouts and equipment rentals of audiovisual presentation.

The total cost involved in classroom training was of R$ 141,120.00 (One hundred and forty-one thousand, one hundred and twenty reais) to each monthly edition. Even during the 1st half of 2007, the face to face course "Hygiene and Safety in the Workplace" was performed in five more editions, a model similar to that which occurred in January, providing training to 960 employees resulting in a total semester cost of R$ 847,200.00 (Eight hundred and forty-seven thousand and two hundred reais).

The number of operating employees responsible for the maintenance of the transmission lines are approximately 5,000 and through the classroom system, only 19.2 % of the total were trained leaving 4040 employees still in need for training. This demonstrates the theory of Meister (1999) who argues that the traditional programs of training already does not meet the needs of update required by new dynamics of the current market.

Due to this new scenario, organizations rely more and more, on the process of continuous learning as a way to maintain and build an enterprise intelligence. Thereby corresponding to the demands of the globalized world in constant change and evolution of its knowledge base. It is in this context that the EaD becomes a critical resource for training and development of people in the business environment.

In addition, as assured in the vision of de Souza (2003), the use of distance education programs for continuing education is a "path without return", because the companies are already successfully adopting this modality in the training of its professionals. The worker is being prepared to interact with the various environments in an autonomous manner, where by

means of technical manuals, video and teleconferencing, has responded to such proposal in a positive manner.

### 5.2. Analysis of data on the distance Modality

In view of the number of employees with the need for training and the increasing costs, the company has chosen to deliver in the second half of 2007, the training by remote system, thus replacing the classroom system, as the main advantage of distance training is the possibility to offer courses to students geographically dispersed. Ribeiro also clarifies that by being a vital area for all companies in the system, we sought through the e-learning to make this training possible in their own workplace, reducing the workload during one month on which the employee trained via the internet.

In the system of EaD, Eletrobras opted to hire a company to draw up all training, as it were a permanent and mandatory training course that, consequently, could be mounted and performed later for all employees by using the same basic training system, also representing a single cost for preparing the training. In this way, it becomes clear that costs of internet transmission was not taken into consideration for the calculation of the total costs, having in view that the course used the companies ombudsman itself.

The deployment of e-learning platform in the Eletrobras System, was deployed to the total number of 4,040 employees in six months, in view there was no need for traveling and lodging, because the same was done via the internet. The minimum time was one month, being an hour daily to access the web without interruption of labor activities.

The contractor has developed a platform for distance education that allows simultaneous access by means of conventional computers. The teachers and students have access to a shared agenda with lesson plans, handouts, frequency of students accessing the system to book and allocate resources for

the classes.

The costs of distance training are determined by the values paid: the company system (e-learning) training platform in the amount of R$15,000.00 (every 160 employees) and the connection costs in the value of R$ 7,300.00 (already available for other in company activities), i.e. already constitute a fixed cost within the Eletrobras System.

Thus, the total cost of distance training was of R$ 22,300.00 for each group of 160 employees, as highlighted in table 6:

| Treined/montly | Company cost E_learning | Broadband Connection | Total Cost |
|---|---|---|---|
| Até 160 | R$ 15.000,00 | R$ 7.300 | R$ 22.300,00 |
| De 161 a 320 | R$ 30.000,00 | R$ 7.300 | R$ 37.300,00 |
| De 321 a 480 | R$ 45.000,00 | R$ 7.300 | R$ 52.300,00 |
| De 481 a 640 | R$ 60.000,00 | R$ 7.300 | R$ 67.300,00 |
| De 641 a 800 | R$ 75.000,00 | R$ 7.300 | R$ 82.300,00 |
| De 801 a 960 | R$ 90.000,00 | R$ 7.300 | R$ 97.300,00 |
| ... | ... | ... | ... |

Source: developed from data provided by Eletrobras in January/2008.

**Table 6. Cost of the Course through the E_Learning System.**

For the group with 160 employees analyzed in the classroom system, the savings achieved by this option offering the training course of "Hygiene and Safety in the Workplace" at the remote system was R$118,820.00 (One hundred and eighteen thousand, eight hundred and twenty reais) Although the total value of that course offered by remote system would be R$ 22,300.00 while the classroom system reached an amount of R$ 141,120 .00, according to the table below:

| Classroom Cost | E_learning Cost | Economy |
|---|---|---|
| R$ 141.120,00 | R$ 22.300,00 | R$ 118.820,00 |

Source: developed from data provided by Eletrobras in January/2008

**Table 7. Savings achieved with courses by EaD system up to 160 employees**

**REDUCTION OF COSTS (MONETARY VALUES) - (Trained per month: 160 employees)**

Having in view that the connection is part of the fixed costs already in the organization, it can be said that the economy with the course was even greater, R$ 126,120.00 (One hundred and twenty-six thousand, one hundred and twenty reais) derived from the difference between the total cost of the classroom course in 1st edition (R$ 141,120 ,00) and the amount paid to the company that introduced the e-learning in 2nd semester, disregarding the value of R$ 7,300.00 of the broadband connection.

For the total group of 960 employees that participated in the training course of continued education in the first half by classroom system, the savings achieved was even greater, because in the system face to face the total cost was of R$ 846,720.00 while at the remote system the cost was only R$ 97,300 .00, representing a total saving of R$ 749,420.00 as it is displayed in the table 6.

In modality EaD is noted the ability to meet a large demand that requires continued training that is significantly higher than that in classroom modality, which today is an increasingly necessity for the companies. Through this sustaining evidence several authors prove their theses, as Peters says that Distance Education is a rational method of transmitting knowledge, competence and attitudes, always with the goal of reproducing material of high-quality education, which makes it possible to instruct a greater number of students, wherever they live. According to their own training analyst Eletrobras recognise that the e-learning modality allows control of the employee performance better then the classroom modality, since all actions of employees are recorded in the system. The UNESCO itself (1998) defining the EaD makes clear that the open access to education and training provision, frees the apprentices of boundaries of time and space, offering flexible learning opportunities individually or as a

group.

## 5.3 Comparison of costs in Classroom Environment and by Distance Learning

Relying on the data provided in table 6, it was possible to identify economic advantages of courses on e-learning system. In the view of many authors, there are various advantages that lead companies to adopt e-learning. Rosenberg (2001) affirms that the advantages have only increased, and by means of data from this case study we can prove the assertions of this. Rosenberg (2001) lists among the most evident advantages are: the economy of resources before allocated to physical structure; reduction of expenses with displacement of personnel; breaking of the geographical barrier itself; the improvement of the assimilation of information due to the interactivity.

Based on the data of table 4, it was calculated the cost per pupil in classroom course (R$ 882,00) considering the allocation of 20 students per class as referenced in this case study. Table 8 shows the evidence and the calculations made bellow:

| | TOTAL DAYS | DAILY PRICE | CLASS PRICE | SUB-TOTAL | COST PER LEARNER |
|---|---|---|---|---|---|
| **HOSTING** | 3 | R$ 90,00 | R$ 5.400,00 | R$ 43.200,00 | R$ 270,00 |
| **FOOD** | 3 | R$ 60,00 | R$ 3.600,00 | R$ 28.800,00 | R$ 180,00 |
| **INSTRUCTOR (*)** | | R$ 70,00 | R$ 4.200,00 | R$ 33.600,00 | R$ 210,00 |
| **CLASSROOM** | 3 | R$ 350,00 | R$ 1.050,00 | R$ 8.400,00 | R$ 52,50 |
| **PROCJETOR** | 3 | R$ 130,00 | R$ 390,00 | R$ 3.120,00 | R$ 19,50 |
| **HANDOUTS** | | R$ 30,00 | R$ 600,00 | R$ 4.800,00 | R$ 30,00 |
| **TRANSPORT** | | R$ 120,00 | R$ 2.400,00 | R$ 19.200,00 | R$ 120,00 |
| **TOTALS** | | | **17.640,00** | **141.120,00** | **R$ 882,00** |

Source: developed from data provided by Eletrobras in January/2008

**Table 8. Spreadsheet cost per student in classroom modality**

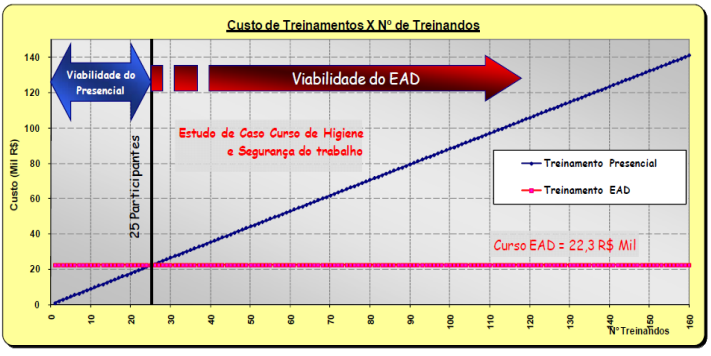
With the purpose of survey data for preparation of the chart, we projected the total costs of the traditional classroom training and the training with e-learning system of distance education considering a demand of up to 160 students, according to table 9.

| Nº Treinandos | CUSTO POR EMPREGADO R$ 882,00 Treinamento Presencial | CUSTO POR 160 EMPREGADOS R$ 22.300,00 Treinamento EAD |
|---|---|---|
| 1 | R$ 882,00 | R$ 22.300,00 |
| 2 | R$ 1.764,00 | R$ 22.300,00 |
| 3 | R$ 2.646,00 | R$ 22.300,00 |
| 4 | R$ 3.528,00 | R$ 22.300,00 |
| 5 | R$ 4.410,00 | R$ 22.300,00 |
| n | ... | ... |
| | | |
| 21 | R$ 18.522,00 | R$ 22.300,00 |
| 22 | R$ 19.404,00 | R$ 22.300,00 |
| 23 | R$ 20.286,00 | R$ 22.300,00 |
| 24 | R$ 21.168,00 | R$ 22.300,00 |
| 25 | R$ 22.050,00 | R$ 22.300,00 |
| 26 | R$ 22.932,00 | R$ 22.300,00 |
| 27 | R$ 23.814,00 | R$ 22.300,00 |
| n | ... | ... |
| | | |
| 156 | R$ 137.592,00 | R$ 22.300,00 |
| 157 | R$ 138.474,00 | R$ 22.300,00 |
| 158 | R$ 139.356,00 | R$ 22.300,00 |
| 159 | R$ 140.238,00 | R$ 22.300,00 |
| 160 | R$ 141.120,00 | R$ 22.300,00 |

Source: developed from data provided by Eletrobras in January/2008

**Table 9. Cost of training employees in both modalities.**

In order to have a clearer view of this comparison (Classroom X e-learning) a drawn-up chart was based on unit costs ( $ /training), which can be seen in Figure 2.




Source: developed from data provided by Eletrobras

**Figure 2. Comparative of Training Cost (Classroom and e-**

**learning)XLearners.**

By observing the graph 1, it is obviously noted that the course via distance presents greater economic advantage when offered to training of large scale with high number of participants.

Furthermore, the e-learning portal Brazil disclosed information that demonstrates the number of organizations that have started to adopt the e-learning during the past 8 years as it is surprisingly high, with more evidence that the benefits have outgrown their inicial investments. As the choice of e-learning system should be due to several factors, but mainly due to the fact that there is a considerable reduction in costs due to economies of scale and the ability to empower a much larger number of employees when compared to the classroom system.

The two factors cited above in e-learning portal Brazil are boosters for those organizations adopting the modality of e-learning in their training delivery, as highlighted in this case study of Eletrobras. In the specific case of Hygiene and Safety in the Workplace course delivered by Eletrobras is noted that until the quota of 25 participants it is more viable to structure the course by classroom system. However, above this number of 25 students it becomes obvious the advantages of the e-learning delivery system, as this advantage increases to form baisc arithmetics due to incrised number of pupils, as shown in graph 1.

Rumble (1999) shows that the economy of scale happens when the unit cost of production is not incremented in direct proportion to the increase of its production, i.e. , to the extent that as more student joins the training, the added costs are fewer, with exception to variable costs involving for example didactic material offered to the student. Nevertheless, all other expenditures were unchanged, which leads to the conclusions of this case study.

In the 2nd half of Eletrobras case study, when it would be necessary to exhaust the annual demand of 4040 as only 960 employees had attended the course in the first half of training, when the real need was to deliver it to 5000 employees on total, there is no doubt the suitability of the economic e-learning system model.

## 6. Final Considerations

In the final considerations, it is noticed that there is on the market a shortage of capable methodology to assist the companies, at the time of choosing the best option for the courses to be offered to their employees. Therefore, it is sought to abolish the existing gap finding which education system is more interesting for the company to adopt in their processes of continued education: classroom or distance, when the focus is the economic analysis.

This study was made based on a particular required course by Eletrobras within a system offered to all employees of the operational sector. This course was delivered until the middle of the year 2007, only by the classroom delivery. Although, it has brought some distresses for the company, such as: displacement of large work teams for other locations, compromising the operating activity of the company. Furthermore, the delivery strategy did not answer the demands required and costs increased by the scale. However, within the deployment of e-learning mode delivery, the company was able to meet the entire demands reaching all employees at a significant lower cost.

Throughout the case study of Eletrobras System, it was possible to prove the real gains that the migration from an original classroom modality to the e-learning mode has provided in terms of cost reduction for the company. Also demonstrating how the system of distance learning provides

gains especially in scale, as its viability also increases, becoming evident that the higher are the number of students the higher is the evidence. In the classroom delivery mode the course is only viable when the demand is quite restricted to lower numbers.

The central problem was the comparative analysis under the focus of economic course delivery via Distance Learning x Classroom modality. In which evidence was shown through this case study, as it is proved that the use of the e-learning modality has in fact provided: considerable reduction of costs, due to economies of scale; conditions to meet ever-increasing numbers of employees; flexibility of time as the learner can reconcile with their own availability; agility in the implementation of the training, which becomes essential, having in view that the course is mandatory; a greater control of the performance of the employee; the creation of a culture of network, which allows information sharing and collective production of knowledge; connection with the new trends of the market, where big companies cannot afford to be out of new cutting-edge technologies.

The strengthening of corporate education and training processes for continued education, using the e-learning method, makes new companies to increasingly seek this kind of methodology. However, the more sensitive argument for the use of e-learning system in continued education courses in a business environment is the reduction of costs, combined with the effectiveness of having an ever greater number of employees trained, within a real reduction of the financial burden of the classroom training.

It is evident through this study that with an strategically management, the adoption of the distance learning methodology, in the case of Eletrobras, allowed the company to meet their own needs, their subsidiaries, as well as providing for other companies of the group, enabling the training of other

professionals, as well as recovering their original investment made in the course of "Hygiene and Safety in the Workplace".

In this way, the costs are reduced, because the entire segment of electrical energy starts to take advantage of the original investments made, using all their own infrastructure in information technology, assuring to professionals adequate technical knowledge to maximize their performance, potential and functionality.

Finally, it is understood that all and any intellectual intervention intending to develop methodological features that facilitate the understanding of the dynamic property in business context, as well as allowing the identification of the contribution of each of the parties to the achievement and maintenance of this heritage in order to "soften" the complexity of business management actions are challenging but necessary proving to be a pertinent and relevant area of research.

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