

A METHODOLOGY FOR EVALUATING SOFTWARE TOOLS FOR THE DEVELOPMENT OF E-LEARNING SYSTEMS

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Abstract - E-learning is undoubtedly a method, which is an important and integral part of any complementary professional training system, as life-long learning becomes necessary and demanding in this rapidly evolving era of information and technological development. Regarding the technological point of view of e-learning, a number of technologies and capabilities are currently or will probably soon be available in the near future, which will change completely the way training is performed with e-learning systems. The aims of this work are, to present an integrated view of all actors involved in an e-learning system, using a SWOT analysis, to identify the basic and critical capabilities that a S/W package must satisfy and to develop a framework for evaluating these S/W packages. A number of criteria and sub-criteria are presented and analysed.

Index terms: E-learning, life long learning, SWOT Analysis, usability.

INTRODUCTION

Training is today the most important aspect of personal and social life of every citizen. It is the sector where a lot of development and a lot of changes are taking place, especially in the most recent years, where changes are much faster [1].

In addition, today's information society requires:

- from the enterprises to develop with continuously increasing pace, the development of knowledge, skills and creativity of their personnel in all levels.
- From the personnel to be able to overcome the continuously changing conditions and requirements of work.

Operating in an environment of continuous and complex changes, modern enterprises must be very flexible. One aspect of flexibility is believed to be the existence of highly qualified personnel. More and more enterprises are looking to maintain and to further develop their competitive advantage through high quality trained personnel. In addition a highly trained personnel is more capable of understanding the dynamics of his operating environment and it makes him more loyal to the enterprise. Therefore, today we talk about the socialization of the person within the

enterprise, and by that we mean the training and assimilation of company's culture and style of management.

Human resource development is the systematic and intensive effort of the organization aiming at improving the present and the future performance through the development of the skills and competencies. In particular, we separate the following categories:

- Vocational training, meaning the provision of skills (through training and practice) for performing a certain profession of type of work.
- Retraining is the additional training taking place after a general training.
- Quite often the term "development of leading executives" is used, where a person is developing skills particular useful for a certain sector. Such training is for collaborative work, forecasting, the development of emotional intelligence, the management of time, etc.

The continuous development of technology, the change of conditions in the supply and marketing of the products, the continuous development of required knowledge, information within the enterprise and the change in the way that various problems are handled within the enterprise, make the continuous training of the personnel absolutely necessary.

When an employee realizes that such training is necessary, and he is also persuaded that this training will contribute towards his aims and his development targets, then a great step has been made towards the correct and successful training.

The various factors, which make e-learning an essential part of the electronic commerce environment, are shown in the following figure 1. They are classified under the training demands and technology offers.

In general a training program must aim to three main directions:

- It must be informative, providing knowledge
- It must aim to skill development
- It must aim to emotional intelligence

The next step in the development of training contents is the definition of the trainees and the trainers, and the selection of the appropriate training system. E-learning has promised to provide important solutions to the training environment. It is not appropriate to describe here the e-

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learning methodology, but to give the basic elements which constitute the foundation for its adoption in the training framework or general training and also for inter-company training.

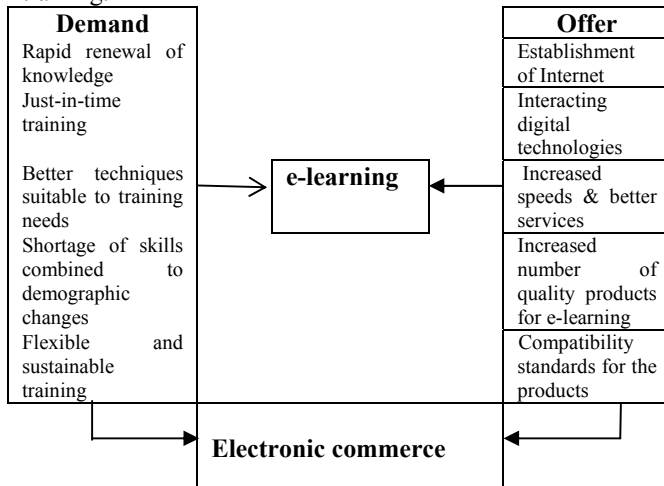


FIGURE 1.
DEMAND AND OFFER LEADING TO E-LEARNING

DEFINING E-LEARNING REQUIREMENTS

Today the foundation for using computer and communication technologies in teaching, learning and vocational training, is the principle that every human being must be able to learn through alternative means, to have equal opportunities for training, independent of physical or time constraints, to be able to choose what and how to learn and to be the focal point of the learning process.

E-learning is taking place every time a physical distance exists between the trainer and the trainee and the technology is used to cover this distance, as opposed to the classical face to face training. Another definition consists of a number of criteria:

- Separation between teacher and trainee (at least during the largest part of the training process)
- The contribution of training institute (which includes and the evaluation of the trainee).
- The use of training means for the communication between the trainer and the trainee (including the distribution of training material).
- The provision of two ways communication (between trainer or training institute and the trainee)

In general e-learning is a training method which is focused on the trainee. It is training accomplished through the use of communication and information technology tools. The trainee has the absolute control over the learning pace, and the support from the trainer is available on demand. The trainers are allowed to choose the time and place of training which suits them best. It reduces the need for face to face communication between trainers and trainees. The

interaction between the trainer and the trainees and also between the trainees is appreciated and it is available. However, this interaction takes a new form. The trainer does not provide the classical lecture, but he/she provides directions to the trainees even on a personal basis. A successful student in such a program must be highly self disciplined. The main socio – economic reasons for the development of e-learning are the following:

- Knowledge and skills in addition to capital and work are the fundamental elements of all future development of the global society. Therefore, the higher education and research in the 21st century will be more demanding than it was during the 20th century.
- The quality of education will be determined by the fact that the competition between university graduates will be within a continuously increasing global environment.
- New knowledge will be found in the interaction and overlap of the classical scientific fields.
- Work places are made redundant and new places are created in new subjects as a result of the changes and the trends in the global market. This in turn makes necessary the update of knowledge and degree.
- The role of the trainer in today’s society is changing and he/she becomes the catalyst who motivates the students to knowledge discovery and at the same time he/she is the manager of the bulk of knowledge which is available.
- The trainee is also adapted to the new environment. He/she becomes independent, learns to discover and use the information, which is available in the web.
- More and more students are now self supporting their studies.
- The pressure and the demand from the companies and the society for continuous and life long learning is increasing.
- The continuous and life long learning is a must for the developing and for the developed countries, in order to gain a gain a social stability.

PEDAGOGICAL VIEW – ADVANTAGES AND DISADVANTAGES OF E-LEARNING

In evaluating e-learning from the pedagogical point of view, this should be build on various and efficient forms of interaction, such as:

- Interaction with the trainer – offering a structured training from distinguished persons.
- Interaction with material and sources, which are determined during the training procedure – presenting well designed study material which should include exercises, references, etc.
- Informal connection with the trainer usually when the trainee requires it – allowing the continuous communication of trainees with the trainers.

- Interaction with sources or persons outside the curriculum – providing interaction methods with third sources and persons.

To appreciate better the various aspects of the e-learning system, a SWOT (Strengths – Weaknesses - Opportunities – Treats) is performed [12,13], figure 2.

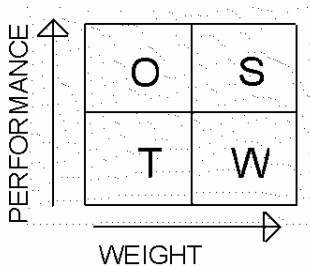


FIGURE 2.
SWOT ANALYSIS

It should be noted that advantages and disadvantages have an important effect on the present as well as in the near future, while the opportunities and treats are for a longer time period.

Schematically the SWOT analysis is based on the analogy between the weight and the performance related to the time frame. The classification of the various characteristics of an e-learning system is not unique, but it helps a lot in understanding their boundaries and their capabilities and their entrepreneurship [9, 11].

The following characteristics are classified in the four sectors of the SWOT analysis.

STRENGTHS

- Allows the attendance of students who could not otherwise attend it, stops any geographical restrictions.
- It removes teaching rooms' restrictions.
- It is highly efficient, when it is performed properly using advanced presentation means, such as multimedia, video, sound, text, pictures, presentations, speeches, interactive collaboration.
- It supports the training action with educational products which integrate multimedia elements.
- Capability to continuously upgrade the contents and the effectiveness
- It is not bounded to the traditional "serial learning" by allowing a dynamic "hyper learning", i.e. learning adapted to every individual.
- It measures the effectiveness of the training and therefore the result of the investment.
- It provides equal opportunities to Universities and to Training organisations to increase their activities.
- A new opportunity for personnel, citizens and students to subjects which were not available, in terms of cost, time and place.

- Make use of mechanisms and tools which are developed or wider applications in the Internet.
- It fully utilises the available infrastructure (intranets) to integrate solutions for distance education.
- Creation of a knowledge repository with the capabilities of a client server architecture.
- It enforces the common use of material and resources.

OPPORTUNITIES

- It ensures equal opportunities for learning independent of social characteristics
- It eliminates time constraints
- It is always available, we can always repeat it.
- It results to well designed techniques and training material.
- It maximises the efficiency of the available teaching personnel.
- It is extremely rich (or can be) in contents.
- It is provided with many available ways, and it is adapted to the preferences of the trainees such as, self training, with asynchronous collaboration, synchronous collaboration, communication with the trainer and the other trainees.
- Participating training with active trainees instead of passive recipients.
- Practically unlimited number of trainees, drastic reduction of time schedules, training rooms, trainees.
- Possibility to choose the trainees the available subjects.
- Development of personalised training programs.
- It allows the improvement of trainees to trainers ratio.
- It allows the participation of speakers who otherwise would not have been possible.

WEAKNESSES

- It is possible to require from the students to poses very good knowledge of the technologies.
- It sets difficulties in the evaluation.
- A time difference between different places is a possible problem. The training institution must cater the support of such remote students.
- Cost of equipment might be high for the trainees. It is required to create local centers.

TREATS

- The content is possible to serve the technology but it might alienate the trainers.
- It might face language or translation problems
- It is complicated regarding intellectual property rights.

METHODS TO EVALUATE AN E-LEARNING SYSTEM

Having accepted that the knowledge in an e-learning system is provided through the interaction of the trainee with the computer and in particular through the use of software (training platform), it is important to develop a methodological framework to evaluate such software products. It is very important to ensure that such an interaction satisfies the final user [4,7]. This is called usability, figure 3.

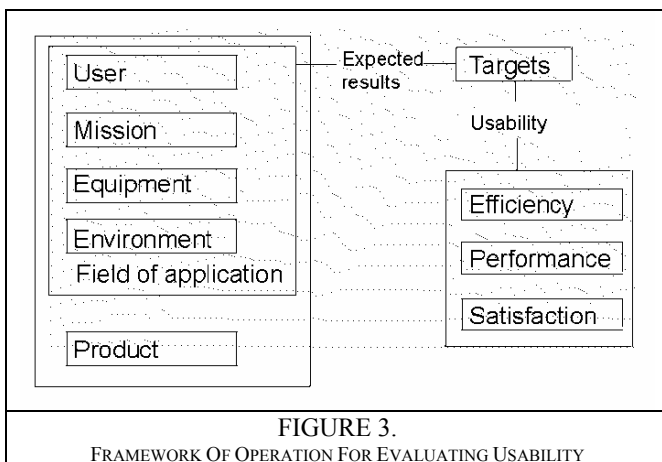


FIGURE 3. FRAMEWORK OF OPERATION FOR EVALUATING USABILITY

As usability is meant the easiness with which a system can be understood and used, its security, its efficiency and its performance, and in general its appreciation from the user. Based on this definition, the usability of a software product for training can be measured by the efficiency with which a user, who has a particular task to perform and he is supplied with a certain support can use it under certain conditions.

The measurement of usability allows us to identify the problematic areas in a software product and to reveal information regarding problems, difficulties, weaknesses and areas, which need special attention and improvement [3,5,8].

Usability can be defined and examined with a set of operational dimensions. These dimensions are referenced in the literature mainly for interactive multimedia software and it includes the following.

- Easy learning
- Easy usage
- Easy to remember
- Efficient execution
- Few mistakes and system integrity
- Flexibility
- Use satisfaction
- Navigation
- Presentation design
- Terminology
- Feedback

- Modality
- User controls
- Match with user tasks
- Information presentation
- Integration of multimedia

The operational dimensions can be classified in five general categories, figure 4.

- Ability to learn
- Efficient execution
- Flexibility
- Robust system
- User satisfaction

USABILITY				
Ability to learn	Efficient Execution	Flexibility	Robust System	User Satisfaction
Easy to remember	Easy to Use	Navigation	Few mistakes	Aesthetics
Terminology	Controls	Screen Design	Consistency	Compatibility with user operations
Expected operations	Presentation method	Feedback		Multi-media
		Redundancy		

FIGURE 4. DIAGRAM WITH ALL CRITERIA AND SUB-CRITERIA FOR EVALUATING USABILITY

Basic Principles for the Evaluation

In order to perform an integrated evaluation study the following steps must be performed [10]:

- Design of the experiment.
- Selection of the appropriate sample of users
- Preparation of the experimental material and of the environment in which it will take place
- Performance of the experiment
- Extraction of the necessary information from the user
- Analysis of the results
- Final report with all the results and recommendations for software product improvement

There are numerous methods for assessing usability and methods for collecting the data. The most important methods are the following:

- Heuristic Evaluation
- Heuristic Walkthrough
- Expert Walkthrough
- Guidelines
- Think aloud user testing
- Constructive interaction

- Formal usability inspections
 - Focus Group
 - Expert review
 - Guidelines walkthrough
 - Cognitive walkthrough
- All above methods can be classified in two main categories [2],
- User-based evaluation methods
 - Design Guidance methods
 - Model based assessment
- The user based evaluation methods are divided into:
- Performance based evaluation
 - Subjective evaluation
- The main methods for data collection are:
- Observation
 - Interview
 - Aloud thinking
 - Questionnaire
 - Video analysis
 - Auto data login program
 - Software support

CONCLUSIONS

The above analysis provides us with a number of conclusions regarding e-learning.

E-learning constitutes an additional and essential part of tomorrow's education system, as life long learning becomes necessary in today's rapidly developing society. Every human being must be in line with today's technological developments, if he wants to remain competitive in his working and in his wider social environment.

The technologies for realising e-learning systems are available, and their capabilities make their application competitive, as it can provide high quality educational products.

In evaluating the various tools for developing e-learning tools, the main emphasis must be placed on the final user of the system, i.e. the trainee. Having that in mind and using the principles of usability, a number of criteria and tools have been presented. These tools can assist the team being in charge of the evaluation task to guide them towards the assurance of the usability of the final system.

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