

# A METHODOLOGY FOR THE EVALUATION OF AN E-LEARNING SERVICE IN THE CULTURAL HERITAGE DOMAIN

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## **ABSTRACT**

*In this paper is presented a methodology we have developed for the evaluation of an asynchronous e-learning service that will be created in the European cultural heritage domain as part of the project ERMIONE (E-Learning Resource Management Service for InterOperability Networks in the European Cultural Heritage Domain) project of the eTEN Program of the European Union. The theoretical foundations of the methodology are the basic constructs and conclusions of i) the traditional education evaluation research, ii) the e-learning evaluation and critical success factors research, iii) the information systems (IS) success research and iv) the technology acceptance models - related research. This methodology evaluates e-learning capabilities and resources (content, electronic support by the instructor, learning community, technical quality, customization capabilities and perceived ease of use), e-learning context (such as previous familiarity of the e-learners with the computers and the e-course subject), e-learning outcomes (extent of accomplishment of educational objectives and use), and the relations between them. It can be used for both formative and summative evaluation of asynchronous e-learning, while with some adaptations it can be used for the evaluation of other types of e-learning and in general of other electronic services as well.*

**KEY-WORDS:** *asynchronous e-learning, evaluation, cultural heritage*

## **INTRODUCTION**

The importance of protecting and safeguarding of cultural heritage in all its forms has been widely recognized worldwide. Especially for Europe its rich and diverse cultural heritage is of critical importance, both as a vehicle of cultural identity and as a factor in economic development. According to the most important international treaty in this area, named the 'Convention concerning the Protection of the World Cultural and Natural Heritage' (UNESCO 1972), cultural heritage includes 'monuments (architectural works, works of monumental sculpture and painting, elements or structures of an archaeological nature, inscriptions, cave dwellings and combinations of features, which are of

outstanding universal value from the point of view of history, art or science), groups of buildings (groups of separate or connected buildings, which, because of their architecture, their homogeneity or their place in the landscape, are of outstanding universal value from the point of view of history, art or science) and sites (works of man or the combined works of nature and man, and areas including archaeological sites which are of outstanding universal value from the historical, aesthetic, ethnological or anthropological point of view)'. Subsequently the concept of cultural heritage has been broadened and includes also the 'intangible cultural heritage', which according to UNESCO is defined as 'the practices, representations, expressions, as well as the knowledge and skills, that communities, groups and, in some cases, individuals recognise as part of their cultural heritage' (manifested inter alia in the following domains: oral traditions and expressions, including language as a vehicle of the intangible cultural heritage; performing arts; social practices, rituals and festive events; knowledge and practices concerning nature and the universe; traditional craftsmanship)' (UNESCO 2003).

In this direction the ERMIONE (E-Learning Resource Management Service for InterOperability Networks in the European Cultural Heritage Domain) project ([www.ermione-edu.org](http://www.ermione-edu.org)), which is part of the eTEN Program of the European Union (with a total budget of 2,088,304 Euro and a duration of 18 months), has as basic objective the initial development (up to the level of a number of pilots) and the evaluation and market validation of an eRM (e-learning Resource Management) service, which is based on an electronic environment-platform:

- supporting the collaborative development and delivery of e-courses concerning the European cultural heritage, through collaboration among many cultural heritage institutions (e.g. museums, galleries, libraries, archives, etc.) and educational institutions (e.g. Universities) from all over Europe,
- providing an 'electronic-one-stop-shop' for learners, teachers and researchers who need digital content and e-courses in the European cultural heritage domain from all over Europe,
- and enabling teachers to build and operate their own e-courses concerning European cultural heritage, using a big variety of digital content and e-learning modules uploaded on this electronic platform from multiple cultural and educational institutions, and also to offer asynchronous e-learning services to mixed 'virtual classes' with students from several educational institutions from all over Europe.

For achieving the above objectives the ERMIONE project consortium consists of: Fratelli Alinari ([www.alinari.it](http://www.alinari.it)), Tilde ([www.tilde.lv](http://www.tilde.lv)), and the Head Office of the State Archives of Poland ([www.archiwa.gov.pl](http://www.archiwa.gov.pl)) (digital content providers), University of the Aegean ([www.aegean.gr](http://www.aegean.gr)), Katholieke Universiteit Leuven ([www.kuleuven.ac.be](http://www.kuleuven.ac.be)) (higher education institutions), European Dynamics ([www.eurodyn.com](http://www.eurodyn.com)) (technology provider), and also Fondazione IARD ([www.fondazioneiard.org](http://www.fondazioneiard.org)) (project coordinator) and Atos Origin ([www.atosorigin.es](http://www.atosorigin.es)) (service enablers).

In this paper, after a short review of previous research in the areas of evaluation of

traditional education and e-learning, is presented a methodology we have developed for the evaluation of the asynchronous e-learning service to be developed in the ERMIONE project.

## **REVIEW OF PREVIOUS RESEARCH**

Extensive research has been conducted for long time in the area of traditional education evaluation and especially in the area of students' evaluation of (traditional) teaching effectiveness (SETE) (e.g. Marsh 1982, Marsh 1987, Hoyt & Cashin 1977, Cashin & Downey 1992; Wang 2003). Wang (2003) mentions six SETE instruments: Endeavor Instrument, Student Instructional Rating System (SIRS), Instructor and Course Evaluation System (ICES), Student Description of Teaching (SDT) Questionnaire, Students' Evaluations of Educational Quality (SEEQ) Instrument, and Instructional Development and Effectiveness Assessment (IDEA). Among them the most widely used ones are IDEA and SEEQ. The IDEA instrument (Hoyt & Cashin 1977, Cashin & Downey 1992) consists of 38 evaluation criteria, which are grouped in the following four evaluation dimensions: instructor methods, students' ratings on course objectives, course content and students' self-ratings. The SEEQ instrument (Marsh 1982, Marsh 1987) is longer and has the following nine evaluation dimensions: learning/value, enthusiasm, organization, group interaction, individual rapport, breadth of coverage, exams/grades, assignments and workload. However, these SETE instruments cannot be used for the evaluation of e-learning, since e-learning is characterized by significant differences from the traditional teaching concerning the way courses are taught, the role of the teacher and the interaction between teachers and learners. In e-learning the knowledge transfer is not based on the teacher, but on various electronic channels (such as Internet, intranets, satellites, interactive TV, CDs, etc.), and therefore becomes more impersonal than in the traditional teaching; the role of the teacher has changed in e-learning, being mainly focused on guiding, supporting and motivating the e-learners via a non face-to-face interaction with them through electronic channels. Nevertheless the existing SETE instruments include useful elements that should be taken into account for the evaluation of e-learning.

On the contrary, even though considerable research has been conducted concerning e-learning evaluation, this area is characterized by 'absence of widely established and practiced methodology by which rigorously to evaluate e-learning, and through which to develop the secure body of knowledge on which to build learning technology as a discipline' (Dempster 2004), and there are only some general 'e-learning evaluation frameworks' reported in the relevant literature. The framework of Jackson (1998) proposes that the evaluation of e-learning should focus on the initial objectives (intentions), the implementation and the outcomes; it also provides a systematic way for the evaluation of e-learning outcomes based on the 'Structure of the Observed Learning Outcome' (SOLO) taxonomy developed by Biggs & Collins (1982); moreover, it suggests that it is necessary to take into account the context (previous knowledge, attitudes and conceptions of the e-learners). More detailed is the 'Evaluating Learning

Technology' (ELT) framework (Oliver & Conole 1998), which provides systematic guidance for the following six e-learning evaluation stages: identification of stakeholders, formulation of questions to each group of stakeholders, selection of a research approach (quantitative or qualitative), selection of data capture techniques, selection of data analysis techniques and choice of presentation format; for each stage are presented various possible alternatives and their distinguishing characteristics, so that the evaluators can select the most suitable to the current situation. The framework of Garrison & Anderson (2003) is based on a model of 'proactive assessment' developed by Sim (2001) and proposes that e-learning evaluation includes the following seven stages: determination of strategic intent of the e-learning program, examination of the courses' content, examination of the design of the interfaces, identification of amount of interactivity supported, evaluation of student assessment methods, measurement of the degree of student support and evaluation of outcomes. However, these evaluation frameworks are at a more abstract level than the SETE instruments, as they propose directions and stages but not instruments (questionnaires), and they lack extensive utilization and empirical support.

Most of the empirical research that has been conducted in this area concerns mainly the formative level, and aims to identify and understand better the factors affecting either the extent of use of e-learning by learners (user acceptance), or their intentions to use e-learning again in the future or to recommend it to colleagues, which are regarded as good surrogate measures of the value that e-learning generates. In this direction Selim (2003) used the Technology Acceptance Model (TAM) (Davis, 1989) in order to investigate empirically the acceptance of course web-sites by students and identify its main determinants; for this purpose he developed "the Course Website Acceptance Model" (CWAM), which is based on the three main constructs of the TAM (Perceived Usefulness, Perceived Ease of Use, and Use). Saade and Bahli (2005) conducted an empirical study aiming at understanding and explaining the acceptance (intention to use) of Internet-based learning systems, based on an extension of the TAM, which includes the concept of Cognitive Absorption as antecedent of Perceived Usefulness and Perceived Ease of Use. Another extension of the TAM has been developed by Ngai et al (2005), which includes the technical support as an additional construct, and is used for an empirical examination of the adoption of Web Course Tools (WebCT) measured through current system use and intention to use in the future.

Wang (2003) has a totally different approach: in order to support mainly summative evaluation of e-learning and - to a lower extent - evaluation at a formative level, he developed a global instrument for measuring the total e-learner satisfaction with asynchronous e-learning systems (a global satisfaction index). This index was calculated as the sum of 17 relevant variables, which have been determined through a review of the literature, and then its reliability, content validity, criterion-related validity, discriminant and convergent validity and nomological validity were examined by analyzing empirical data collected from a sample of e-learners. His final model theorizes that e-learner satisfaction is determined by four major constructs: content, learner interface, learning

community, and personalization, which should be included in an e-learning evaluation methodology.

Also the critical success factors (CSFs) of e-learning should be taken into account for the development an e-learning evaluation methodology. Volery & Lord (2000) found three main CSFs of e-learning are: technology (ease of access and navigation, interface design, level of interaction), instructor (attitudes towards students, technical competence, classroom interaction) and previous use of technology by the students. Soong et al (2001) identified five main CSFs of e-learning are: human factors concerning the instructors (motivational skills, time and effort investment), technical competency of instructors and students, constructivist mindset of instructors and students, high level collaboration, user-friendly and sufficiently supported technical infrastructure. In a more recent study Selim (2005) investigated what do university students perceive as CFSs for e-learning acceptance, and finally came up with eight major CSF categories: attitude towards and control of technology, teaching style, computer competency, interactive collaboration, e-learning course content and design, ease of access, infrastructure and support.

From this review of the e-learning evaluation literature it is concluded that further research work is required in this area with focus on:

- combination of elements and conclusions from the extensive and rich previous research on the evaluation of the traditional education (e.g. from established SETE instruments), and also from the previous research on the evaluation of e-learning (e.g. from the existing e-learning evaluation frameworks), and development of efficient and effective instruments and methodologies (including more detailed guidance than the existing frameworks) for the evaluation of e-learning,

- and utilization and empirical validation of them in 'real-life' conditions and situations. These instruments and methodologies should support both the summative and the formative level, and include measures of both the outcomes of e-learning ('effectiveness evaluation', focused on the value that e-learning creates) and the capabilities and resources offered to the e-learners (e.g. content, support by instructor, etc). They should also include investigation of the impact of the latter, in combination with the context (e.g. motivation and previous knowledge of the e-learners concerning the course subject, level of familiarity with computers, etc.), on the former, using various statistical methods, such as correlations, regression analysis, structural equation modeling, etc. In this direction can be very useful the theories and models developed from the extensive research concerning the measures and determinants of information systems (IS) success (e.g. Delone & McLean 1992 and 2003), since they offer a good background concerning the meaning, the dimensions and the underlying relationships of the terms IS success, impact, quality, use and satisfaction.

Moreover, from this literature review it has been concluded that most of the empirical studies that have been conducted in this area focus on the formative level and aim to identify and understand the main factors affecting the extent of the current use of e-learning and/or the intentions to use it in the future, regarding these two constructs as

main surrogate measures of e-learning value, clearly influenced by a marketing or product placement perspective. However, in many practical situations the use of e-learning is either mandatory (i.e. there is no other option), or it is simply better than the other existing options, so these two constructs do not reflect the magnitude of the value created by e-learning: we can have e-learning systems with equal levels of use but offering very different levels of value. For this reason e-learning evaluation instruments and methodologies should focus on other more direct measures of the value created by e-learning, such as the extent of accomplishment of the various kinds of educational objectives.

## **AN E-LEARNING EVALUATION METHODOLOGY**

In order to evaluate the e-learning service that will be developed in the ERMIONE project the following tasks will be carried out:

I) Market analysis: initially a preliminary version of the business plan of this service will be developed based on market analysis in the five countries participating in the project (namely Belgium, Greece, Italy, Latvia, Poland and Spain).

II) Validation of the service through pilots: a number of pilots will be set-up, in which e-courses will be developed in the area of cultural heritage by the two Universities of the project consortium, using digital content that will be provided by the three content providers of the project consortium; then about 1000 persons will access the service (including the above e-courses and digital content) and evaluate various dimensions of it, based on a methodology we have developed.

III) Evaluation and development of the final deployment and business plan: finally all the information collected in the previous tasks will be analyzed and evaluated, in order to validate the whole business model of this service and develop the final version of its business plan.

For the evaluation of this e-learning service a methodology has been developed; it has been based on the basic conclusions and constructs of: i) the traditional education evaluation research, ii) the e-learning evaluation and critical success factors research, iii) the Information Systems (IS) success research and iv) the TAM-related research, which have been reviewed in the previous section. The basic structure of the methodology is shown in Figure 1.

As we can see, it includes, at a first level, evaluation of the basic e-learning capabilities and resources offered to the learner:

- ‘content’ (it concerns the quality of the course content),
- ‘electronic support by the instructor’ (it concerns all aspects of instructor supportive activity in asynchronous e-learning e.g. effort, skills, methods, motivation of e-learners),
- ‘learning community’ (it concerns the capabilities offered to e-learners for interacting electronically with the colleagues and the instructor(s) so that they have a feeling of ‘belonging’ to a community sharing a common learning objective),
- ‘technical quality’ (it concerns platform availability, accessibility, technical support

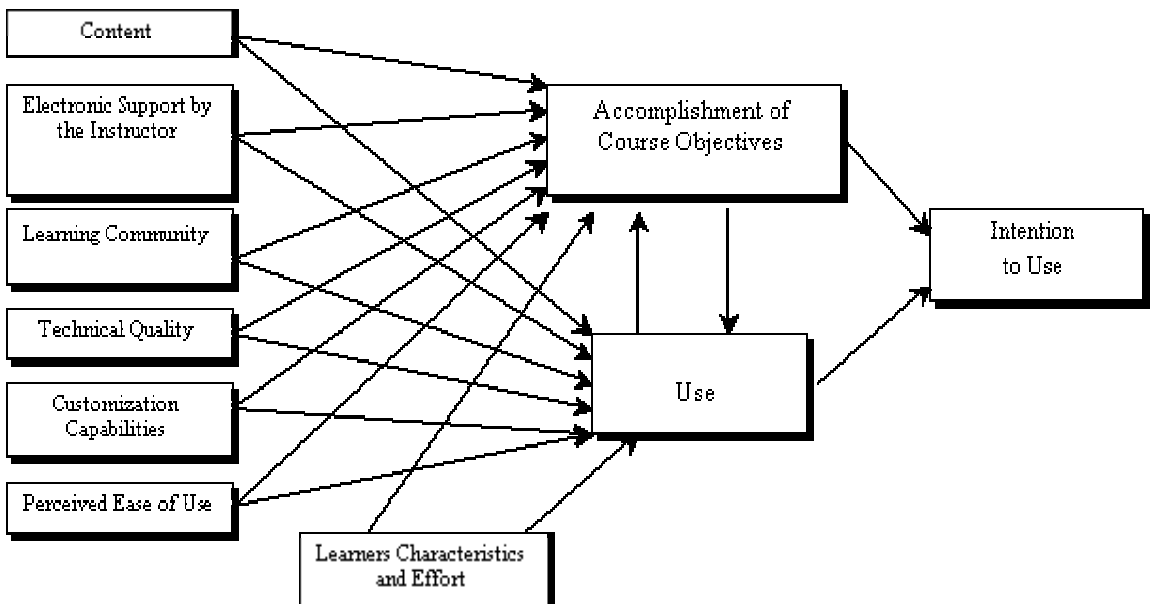
and problems of bugs, etc.),

- ‘customisation capabilities’ (it concerns one of the greatest advantages of asynchronous e-learning: the flexibility offered to the e-learner to adapt the learning process to his/her own wishes and learning style),
- ‘perceived ease of use’ (it concerns the level of effort required from the learner for using the system).

At a second level, as we can see in Figure 3, the methodology includes one direct and two indirect evaluations of the effectiveness of the service from the viewpoint of the e-learner:

- the extent of perceived accomplishment of the educational objectives (ACEO) (direct evaluation of service effectiveness),
- the extent of use of the platform by the e-learner,
- and his/her intention to use it again in the future (both indirect evaluations of service effectiveness)

Finally the methodology includes evaluation of some e-learning context characteristics, which can affect its outcomes (effectiveness), such as the level of previous experience and familiarity of the learners with computers, Internet and e-learning systems, and their initial interest in and knowledge of the course subject (learners characteristics).



**Figure 1:** Basic structure of the methodology for the evaluation of the e-learning service

For each of the above ten constructs of this methodology a measurement instrument (set of questions) has been designed, based on the relevant literature and theory, e.g. the instrument for measuring the extent of perceived ACEO is shown in the Appendix, and has been based on Bloom's taxonomy of educational objectives (Bloom 1956), which has been extensively used and validated in previous research. The data that will be collected using a questionnaire based on this evaluation methodology will be processed in the four steps:

a) For each of the variables that correspond to the questions of this questionnaire (all of them use a five points Lickert scale) the relative frequencies will be initially calculated (as basic descriptive statistics)

b) For each of the ten constructs shown in Figure 1, from the corresponding variables-questions will be synthesized one factor (or more factors if required) using exploratory factor analysis.

c) From the variables corresponding to all the questions evaluating the capabilities and the resources offered to the learner and his/her perceived extent of ACEO, will be synthesized and validated a 'global e-learning satisfaction index' using methods of exploratory factor analysis (more complete than the one proposed by Wang (2003)), which will be useful for summative e-learning evaluation.

d) Finally the relations between the synthesized factors (in the above step a) of the first level (concerning e-learning capabilities and resources offered to the learner) and the synthesized factors of the second level (concerning e-learning effectiveness) will be investigated, in order to investigate the impact of the former, and also of the learners' characteristics (which constitute basic e-learning context variables), on the latter. For this purpose several statistical methods will be used, such as correlations, regression analysis, structural equation modeling, etc. The initial hypotheses that will be tested concerning these relations are shown as arrows in Figure 1. The whole structural model shown in Figure 1 will be tested using methods of confirmatory factor analysis and structural equation modeling. In this way we are going to find out which of the service capabilities and resources offered to the e-learner influence more the perceived level of service effectiveness (for formative evaluation purposes), and in general we are going to gain a better understanding of the e-learner value generation mechanisms.

## **CONCLUSIONS**

Based on conclusions and frameworks of both the traditional education evaluation research and the e-learning evaluation research, and also on conclusions and constructs of the IS success and technology acceptance research we have developed a methodology for the evaluation of an asynchronous e-learning service that will be created in the European cultural heritage domain as part of the project ERMIONE. This methodology combines evaluation of the e-learning capabilities and resources offered to the e-learner, e-learning context characteristics (such as previous familiarity of the e-learners with the computers and the e-course subject) and e-learning outcomes (extent of accomplishment of educational objectives and use), and of the relations among them. It can be used for



both formative and summative evaluation of asynchronous e-learning, while with some adaptations it can be used for the evaluation of other types of e-learning and in general of other electronic services as well. Further research is in progress for incorporating qualitative methods in the methodology, and for utilizing and validating it in the ERMIONE project.

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## **APPENDIX**

### ACCOMPLISHMENT OF COURSE OBJECTIVES

State the extent to which you agree or disagree on the following statements:

1. Strongly Disagree, 2. Disagree, 3. Neutral, 4. Agree, 5. Strongly Agree

1. I have learnt new concepts/terms/ideas.
2. I have learnt new methods and technologies as well as capabilities/opportunities offered by them.
3. I learned fundamental principles, generalizations or theories concerning the course subject.
4. I have learnt to apply the course material in practical situations in order to improve rational thinking, problem-solving and decision-making.
5. I have learnt how to analyze situations and problems concerning the course subject into smaller elements in order to examine and understand them better.
6. I have learnt how to evaluate situations and actions concerning the course subject.
7. I have developed creative capacities (e.g. how to put together or combine pieces of knowledge I have gained from the course).
8. I have developed specific skills, competencies and points of view required by professionals in the area of the course subject.
9. My awareness on the course subject has been enhanced.
10. I have developed a positive attitude towards the field of the course subject.