

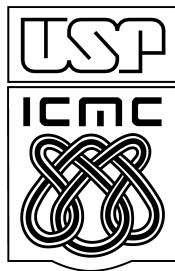
UNIVERSITY OF SÃO PAULO
Institute of Mathematical Sciences and Computing

Systematic review on critical factors for distance
e-learning

Marco Aurélio Graciotto Silva
Ellen Francine Barbosa
José Carlos Maldonado

n. XXX

TECHNICAL REPORT



São Carlos - SP - Brazil
November/2011

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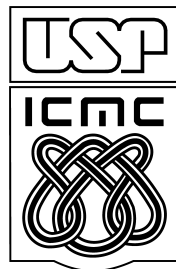
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Introduction

The undoubtful importance of education and the widespread usage of information technology spurs the development of distance education. The promises goes from cheaper and faster (the favourite arguments from the industry point of view) to broader and better (the favourite from academia). Although much can be argued for and against each side, one important consequence is that, indeed, distance education will not ever leave our life and, without even our consent, it will seamlessly increase, complementing and, in some cases, even replacing, the daily face-to-face educational practices.

Nowadays, when discussing distance learning, we often implicates on e-learning. However, there is an important different between them. Distance education is any form of education which actors and elements are in different place or time. For instance, one of the first forms of distance learning used letters with educational material sent to students all over the country. Each student was at a difference place, studied in different times and was studying different subsets of the subject. E-learning is the use of computing technology to support educational activities. The use of learning management systems in universities, providing a single point to every student grab resources required for a class, is a classical example: nonetheless, the teaching of every student took place at the same time and place, in a traditional face-to-face setting. Clearly, it is an obvious consequence to employ e-learning for distance learning, reducing costs with educational material distribution (and providing new opportunities for interaction between student and instructor/institution/content), but it must not be mistaken e-learning by distance learning: they are both different things and one does not implicates the other.

Several distance education have been deployed along the centuries, and the use of e-learning has bloomed such initiatives, funded either by the government or by the private sector. A successful example is the Open University at United Kingdom, which offers several distance e-learning courses. However, the very same Open University is a failure example, as its branch at the United States, after only four years, closed its doors due to budget issues.

Actually, it is difficult to clearly define what are the critical success factors for implementing a distance education institution. It may depend not only the institution competence itself, but on the scenario where

it is inserted. A careful analysis of such factors should be carried out, keeping track of the educational, technological – and even financial – aspects, considering the stakeholders viewpoints – institutions, professors, students – and respective learning experience focus (program, courses and classes). This study collects the factors identified in the literature. Such factors can be later considered in new studies, correlating and identifying the impact of each of them in an educational enterprises.

The analysis is based on a systematic review first conducted in 2009 and updated in 2011. A systematic review is a synthesis method that involves searching the literature for evidences regarding a given research question (KITCHENHAM, 2004; SILVA, 2011). It is carried out using a protocol, defined before the search and analysis themselves. Such protocol is defined in Chapter 2. The studies identified in the review are screened using selection criteria, and data (evidences) are extracted, as described in Chapter 3. The collected evidences are synthetized (Chapter 4) and, based upon these results, conclusions are drawn regarding the original research question in Chapter 5.

Protocol

The protocol of a systematic review defines the research question and its attributes, establishes the requirements and procedures regarding primary studies selection, the evidences to be collected and the method of synthesis of such evidences.

2.1. Research question

The research question drives the entire research review. It can be defined by means of a broad question or using scientific hypothesis. The former is often used for systematic mapping: a special kind of systematic review, which aims at the summarization of the evidences regarding a research topic. For everything else, it is preferable to define hypothesis (null and alternative hypothesis).

The main research question of this technical report is: “What are the critical factors to deploy a successful distance learning course using online resources and services (e-learning)?”. We can further describe this question using, but not restricted to, the following secondary questions:

- What are the most important factors or requirements regarding the use of educational resources and activities used in e-learning?
- What are the most important factors regarding faculty?
- What are the most important factors regarding physical facilities?
- What are the most important factors regarding sustainability of e-learning enterprises?

Such questions captures some essential facets of educational scenarios. Nonetheless, the ultimate goal is the proper education of the student to fulfil its role in the society: family, work, community. We expect that the selected studies provides evidences on what factors are more relevant regarding such goal when considering e-learning. And more: we expect that some factors are specific for distance learning, *i.e.*, not critical for face-to-face or “old fashion” distance education but essential for distance e-learning settings.

The secondary questions we defined provides some guesses of areas where there should be some differences

between distance and face-to-face education. Although computational educational resources can be used for both (e-learning), in distance learning there are some traits of the student that must be considered (as they are out of control/independent variables): time, pace, and space. The faculty probably has some different structure also, with more emphasis on support (to help students in any trouble they face when using learning management systems and educational resources, to help professors creating resources and deploy them correctly). Physical facilities are obviously different: there is no need for huge buildings, but for computational resources (or use of cloud computing services). As for sustainability, first it must be addressed is the financial one, but the enterprise must also be accepted by the students, highly regarded as of its quality.

Considering such arguments and the questions previously established, we can define the attributes of the question using the PICO technique (SANTOS *et al.*, 2007):

- **Population:** Universities that provides e-learning courses either in blended or distance learning settings.
- **Intervention:** E-learning courses offered as blended or distance learning.
- **Control/Comparison:** No control has been established.
- **Outcomes:** Requirements and critical factors for the success (or failure) of a distance (e-)learning course.

Analyzing the PICO attributes, we can derive the following keywords and synonyms to be used afterwards, when searching for studies:

- Critical factors:
 - success factor
 - failure factor
 - critical factor
 - requirement
 - lessons learned
 - lessons learnt
- Distance learning and blended learning:
 - distance education
 - distance learning
 - blended education
 - blended learning
- Computer-supported/based education:
 - e-learning
 - elearning

Although we are considering both success and failure factors, the scientific literature usually does not provides negative evidences (failure factors). That may probably create a bias towards success factors. Although that does not concerns our research question based on evidences, it is an important issue regarding the predictability of the success of e-learning (by the presence of success factors and absence or handling of failure factors).

2.2. Source selection criteria

In a systematic review, the studies are searched and recovered from libraries (usually digital ones). The method of choice for searching is based on search expressions (thus the keywords defined in the previous section): it not only provides a feasible way to assess a large literature body, but also provides a fair selection method (as the search does not depends upon the human factor and is exactly the same for every library).

Considering the use of digital libraries, the criteria for selection of sources are the following:

- SO-1:** It must index papers on e-learning initiatives and experiences (preferably the main research journals and events on computer-supported education).
- SO-2:** It must index papers written on English.
- SO-3:** It must support searching using boolean expression (at least the operator OR and AND must be supported).
- SO-4:** It must provide access to the complete text of the paper (preferably in PDF format).

Regarding criterion 4, for some sources, it is the case that they do not provide direct access to the full paper, but a direct link to the authoritative source. That is not a reason to exclude the source (as most of the papers can be retrieved). However, the study selection criteria (defined in the next section) must enforce it.

Finally, although not explicitly defined as a source selection criteria, free access to the source must be available in the research institution where the systematic review will be executed.

2.3. Study selection criteria

After retrieving the search results from the selected sources, the studies must be screened according to some criteria pertinent to the research question. The criteria for selection of studies are:

- ST-1:** The study must be reported on a full research paper written in English.
- ST-2:** The full paper must be available for downloading.
- ST-3:** The study must have the keywords (as in the search expression) in the abstract or title. This is required as some search engines do not behave as expected, returning studies that have such words in the keywords or content instead.
- ST-4:** The paper must be novel and unique. If the same study is reported by several papers, the newest or more complete paper will be selected and all the others will be excluded.
- ST-5:** The study must report the use of e-learning on a university using distance or blended-learning.

Some of these criteria, at a first glance, may be redundant when compared to the source selection criteria. For instance, the first selection criterion, about the language, should not be an issue for papers retrieved from a source that has been selected. However, as evinced in previous studies (FERRARI; MALDONADO, 2007, 2008), some sources do not behave as expected. Therefore, it is important to double-check the paper regarding the selection criteria whenever it is possible. That is the case for criteria ST-1 (SO-1), ST-2 (SO-4) and ST-3 (SO-3).

2.4. Data extraction

For every selected study, data (evidences) regarding the critical factors towards the success or failure of a distance e-learning course must be recovered. The data to be extracted is as follows:

1. Factors
 - 1.1. Success factors.

1.2. Failure factors.

Besides the critical factors, we should also collect the research method of every selected study.

2.5. Concluding remarks

A systematic review is encompassed of four phases: planning, execution, analysis and packaging/reporting. This chapter is the result of the planning, which is a critical one for a systematic review. We have described the main points of the protocol here, but purposely omitted description of the procedures to execute it and data analysis issues. We direct the reader to a technical report on systematic reviews we have published (SILVA, 2011) that address such matter, considering the systematic review performed by small groups (or even individually) to assess/summarize the literature regarding a given subject.

Results

The results of the execution of the protocol defined in the previous chapter are reported in this one: from the selection of sources, the definition of search expressions for each source identified, recovery of papers from such sources, screening of papers and data extraction.

3.1. Source selection

Regarding source selection, the following sources comply with the criteria established in the protocol: ACM, IEEE and Scopus. In fact, journals indexed by ACM and IEEE are also indexed by Scopus, but the same does not apply for conferences (Scopus index just a subset of them: the ones organized by ACM and IEEE). As the Computer Science community considers research events (such as conferences) as important as journals, we have to include ACM and IEEE as representatives of this community. As of Education field, journals are accepted as the main publication venue (conferences are often limited to short papers or full-papers that are not peer-reviewed as rigorously as in Computer Science). Scopus, which index journals, have been selected, as most papers on Education are indexed by it. Thus, we consider the first criterion (SO-1) satisfied by these sources.

Regarding the remaining criteria (SO-2, SO-3, SO-4), ACM, IEEE and Scopus also comply with them. Although some studies cannot be retrieved directly from ACM and Scopus, they provide links to the authoritative source. However, it should be noticed that some of this authoritative sources are not freely accessible from our research institution.

3.2. Search expression

Using the terms identified in Chapter 2, the following (generic) search expression was defined:

```
(success factor OR failure factor OR critical factor)
```

```
AND
(distance education OR distance learning OR blended education OR blended learning)
AND
(e-learning OR elearning)
```

However, in the first trial of this systematic review (in 2009), we opted for ((education OR learning) AND (computer OR internet)) instead of e-learning and elearning. That is a much broader search, and not necessarily better, as e-learning is the *de facto* term to designate education with online resources (which is the topic here). We will consider, for analysis, just this search expression (and not the 2009 one).

The terms **requirement**, **lessons learned** and **lessons learnt** was not considered as they return too much results: **requirement** is a word commonly found in Computer Science, and **lessons learned/learnt** are used for concluding remarks for papers in every knowledge field. Nonetheless, we believe that the current choice of terms will provide enough resources regarding our research question.

3.3. Search for studies

Using the generic search expression, we derived a specific search expression for each source we have previously selected. The studies recovered were then subjected to the selection criteria, as defined in the protocol).

3.3.1. Scopus

Using the generic search expression, the following search expression was derived for Scopus:

```
TITLE-ABS-KEY(
  ("success factor" OR "failure factor" OR "critical factor")
  AND
  ("distance education" OR "distance learning" OR "blended education" OR "blended learning")
)
```

In 2009, a total of 125 studies were retrieved. In 2011, the result was quite different: 66 studies were identified.

3.3.2. ACM

Using the generic search expression, the following search expression was derived for ACM Digital Library:

```
("success factor" OR "failure factor" OR "critical factor")
AND
("distance education" OR "distance learning" OR "blended education" OR "blended learning")
```

A total of 11 studies were found in 2009 and 26 in 2011. We could not restrict the search for both abstract and title, thus we used the entire metadata. As this also includes keywords (which are not often relevant, despite the naming), such papers will have be further reviewed regarding selection criterion ST-3.

3.3.3. IEEE

Using the generic search expression, the following search expression was defined for IEEE Digital Library:

```
("success factor" OR "failure factor" OR "critical factor")
AND
```

A total of 6 studies were found in 2009 and 5 in 2011. We could not restrict the search for both abstract and title, thus we used the entire metadata. As this also includes keywords (which are not often relevant, despite the naming), such papers will have to be further reviewed regarding selection criterion ST-3.

3.4. Study selection

After consolidating the studies found in each source (and removing the duplicates), a total of 142 were found in 2009 and 91 in 2011. From now on, we will just consider the 91 studies identified in 2011. After applying the selection criteria, 31 papers were selected, as illustrated by Table 3.1. Most papers were excluded by criteria that enforce source selection criteria (and that demonstrate a clear deficiency of the sources' search capabilities) and by abstract.

Table 3.1: Excluded papers and reasoning.

	Excluded	Studies
		91
Invalid language	1	90
Invalid paper type	7	83
Study unavailable	16	67
Excluded by similarity	1	66
Excluded by search	13	53
Excluded by abstract	17	36
Excluded by full text	5	31

There are some interesting data to learn from this selection. Regarding the publication type, 4 were published in academic events (conference) while 27 were found in journals. The journal with more impact is *Computers and Education* (6), as shown in Table 3.2. It was not possible to find two selected-papers that were published in the same conference.

Table 3.2: Publication venues.

Venue name	Journal/Event	Studies
Computers and Education	Journal	6
Turkish Online Journal of Educational Technology	Journal	3
Distance Education	Journal	2
Health Information and Libraries Journal	Journal	2

Another interesting characteristic is that there is little to no collaboration on the establishment of critical factors. Figure 3.1 depicts clearly the current situation. We expected, at least, one or two collection of studies from consolidated groups, which would be represented as clicks in the graph. However, we cannot identify any relevant click. Actually, not a single author has published different studies regarding critical factors (although there are papers on the same study, yet in just two cases). Nonetheless, we could verify (although we have not analyzed it deeply) that some studies acknowledge papers selected for analysis.

Although no conclusion can be extracted from such data, it clearly demonstrates that there is little consistent research on relevant factors on e-learning. That is clearly an issue when trying to establish a set of variables (factors) to be observed in any research on e-learning.

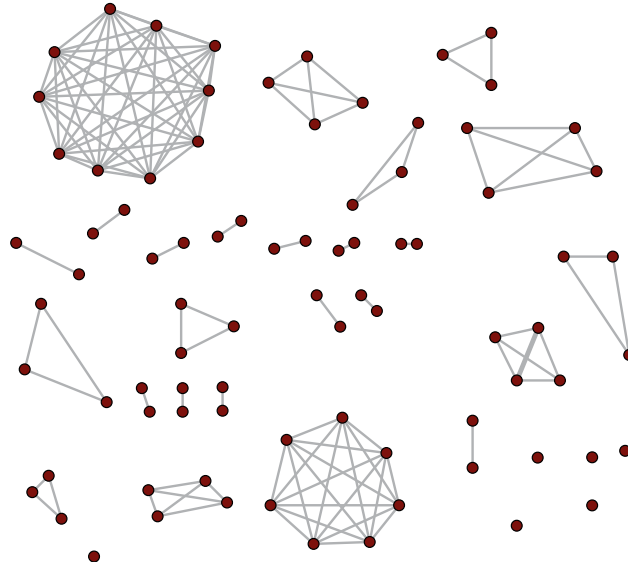


Figure 3.1: Graph of co-authoring for the selected papers.

3.5. Data extraction

After selecting papers to be analyzed, we proceeded to data extraction. For each paper, the identified critical factors are detailed in the following subsections.

A case in customizing e-learning

The paper discusses the development of a LMS specifically tailored to an Irish university (NEVILLE *et al.*, 2005). It identifies a learning management system (LMS) as an important element. The university approach to the LMS development is to leverage it to the same level of a customer relationship management (CRM). The main factors for success they have identified are simpleness, straightforwardness and usability (easy-to-use):

he most important of these was that the environment should be simple, straightforward and easy-to-use. Therefore, ease-of-use is considered to have a significant implication on the effectiveness of the environment. The eLMS should also be attractive and interesting, and students must be encouraged to use it through such mechanisms as rewarding the students who use it, and by making it a core part of the course. These include good design, aesthetics and human-computer interaction, as well as a consistent look and feel.

T

That does not imply that the LMS must be technologically complex. The findings of the paper is that it depends more on the pedagogy than on technology: “the technology (...) should serve a specific educational or pedagogical purpose, and that the bells and whistles should not be added just because they are there, but because they serve a pedagogical purpose”.

A final remark is the need for support from the educational organization: clearly defined policies, financial, technical and administrative support.

A flow theory perspective on learner motivation and behavior in distance education

The paper starts with the assumption that motivation is a key success factor for distance education (LIAO, 2006). It evaluates the flow theory to model the interaction of the students with the distance learning environment. Three different types of interaction types were evaluated: student-student, student-instructor and student-content. Their results are that student-instructor and student-content interaction types have a higher likelihood to provide a flow experience to students (and, thus, better education results). However, they could not prove the significance of student-student interaction towards flow experience. The authors state that such (unexpected) result can be due to the type of course (undergraduate students attending a distance learning literacy course).

A fuzzy logic-based quality function deployment for selection of e-learning provider

Kazançoğlu e Aksoy (2011) report the results of survey to identify the requirements of a e-learning design in order to select an e-learning service provider. They used a questionnaire to collect the data and Quality Function Deployment to analyze the data. It provides the viewpoint of a company that will hire a e-learning service provider. The highlighted factors were technical support, qualified design team, and technical capability.

A new hybrid model for exploring the adoption of online nursing courses

Using questionnaires, Tung e Chang (2008) analyzed six universities in Taiwan. The following factors were evaluated regarding the behavioral intent to use online nursing courses: (personal) compatibility (with the course), usefulness, ease of use, financial cost, computer self-efficacy. From those, the compatibility was the most important, along with usability (usefulness and ease of use).

A survey and a theoretical model of distance education programs

Hamzaee (2005) identified several critical success for distance education programs using a survey as research method. The main factors were: program quality (as of instructors interaction with students and use of learning management systems), program recognition and academic integrity, students' satisfaction and progress (graduation).

Action plan on communication practices: Roles of tutors at EMU distance education institute to overcome social barriers in constructing knowledge

The study addresses the proficiency of tutors on distance learning (AKSAL, 2009). A major hurdle identified is that they lack proper training on online pedagogy, using communication and facilitation play as instrument.

Adult distance education students' perspective on critical success factors of e-learning

Chen *et al.* (2009) analyze four groups of critical factors – instructor, student, information technology, and university support – from the point of view of students in an adult distance learning course in Taiwan.

Considering the aforementioned groups, the most important was the instructor one. Another relevant factor was the learning management system (web site) usability.

Assessment of instructors' readiness for implementing e-learning in continuing medical education in Iran

The study considers academics' readiness as a critical factor for e-learning (ESLAMINEJAD *et al.*, 2010). Using a research questionnaire, they assessed instructors regarding their knowledge, attitudes, skill and habits in both technology and pedagogy domain. The conclusion of the study is that instructors should be continuously trained in both domains (instead of one-off training opportunities).

Blended learning and pure e-learning concepts for information retrieval: experiences and future directions

Henrich e Sieber (2009) discuss blended learning and e-learning for information retrieval courses, identifying critical factors. The results are based upon authors experience on the subject. The success factors they identified are: educational material development (concepts, design, deployment, maintenance) and use of such material, with interaction between students and instructors.

Cognitive, social and teaching presence in a virtual world and a text chat

Traphagan *et al.* (2010) studies the cognition factor of e-learning on immersive virtual environments and on sole text-based environments. Two techniques are employed: mixed-method (code frequencies, coherence graphs and interviews) and surveys. Three critical factors were identified: tools, tasks, and group collaboration.

As of the tools, the text-based chat environment was more engaging (cognitively) than the immersive virtual environment. That is due to the simplicity of the former (with no information overhead and extraneous information in regard to the learning activity). Simplicity is a virtue. Training is also required to improve the familiarity of students in using the tools.

The task familiarity and nature of the task are related to the design of the learning, which should foster collaboration and engagement towards high level cognitive activities.

Critical success factors for on-line course resources

Soong *et al.* (2001) investigate critical success factors for distance education courses. The research method is a case study. The identified factors are: human factors such as time and effort dispended by the instructor, technical competency of instructors and students, collaboration and interaction between students, and technical support and computational infrastructure.

Fatores de sucesso: fatores humanos (tempo e esforço investidos pelo instrutor, presença de facilitadores do processo de aprendizado); capacitação dos facilitadores e estudantes quando ao uso de computadores; mentalidade dos professores e estudantes quanto a formas de educação (construcionismo); colaboração e interação entre os estudantes; suporte técnico e computacional.

Critical success factors in crafting strategic architecture for e-learning at HP University

The paper outlines the critical factors for a e-learning solution at HP University in India (SHARMA, 2010). The research method employed was a survey among students enrolled in a distance learning course. Several factors were analyzed, but the uttermost conclusion is that distance learning must make use of technological tools (software and hardware) aligned with pedagogy: the simple use of technology is no guarantee of success; actually it lowers the satisfaction of students.

Distance education in an era of elearning: Challenges and opportunities for a campus-focused institution

Forsyth *et al.* (2010) analyze the current distance learning practices on an Australian university. The research method employed was a survey and a workshop. The critical factors they have identified are organizational structure and culture: support for interaction and support for students with the learning institution; faculty training and learning/educational design. Interestingly, technology was not considered a critical success factor.

Distance education: what the literature says works

Schlosser (1996) performed a review regarding what the literature says about critical factors in distance learning. He points out that, despite the urge to use rich media to convey instruction, the actual major critical factor is instruction itself: media is just a vehicle.

Effective e-learning for health professionals and students - barriers and their solutions. A systematic review of the literature - findings from the HeXL project

Childs *et al.* (2005) use a systematic review of the literature, a survey (questionnaire) and interviews to identify success factors for e-learning in the health field. The main failure factors are: cost, poorly designed packages, inadequate technology, lack of skill, lack of face-to-face teaching, time intensive nature of e-learning, computer anxiety. The success factors are: standardization, funding, integration of e-learning in the curriculum, user friendly packages, access to technology, training, support, dedicated work time for e-learning, e-learning costs paid by employers.

Actually, the papers identify so many critical factors that it can be said that everything is a critical factor. Using the factors most discussed in the paper (instead of all that were defined as critical), it can be said that the critical success factors are: student training, instructor training, access to educational resources, development of educational resources (with proper learning design).

Embedding e-learning in geographical practice

The study conducted by Martin e Treves (2007) discusses the adoption of virtual learning environments at the University of Southampton in a blended learning setting. The main critical factors identified were: funding, project/design team and demonstrator material (used for training).

Evaluation of distance learning delivery of health information management and health informatics programmes: a UK perspective

Urquhart *et al.* (2002) review evaluations of distance learning programs in health information management in order to identify critical factors. The research method employed is literature review. The critical factors identified were: integration of learning in the working place into the curriculum and assessment methods; provide opportunities for interaction between students (both at distance and face-to-face).

Factors influencing the success of computer mediated communication (CMC) environments in university teaching: A review and case study

The paper reports a literature review to identify success factors for computer mediated communication environments (CMC) in university teaching (TOLMIE; BOYLE, 2000). It uses a case study to analyze the online communication and identify those factors that help the establishment of a shared purpose on learning activities: size of group, familiarity between students, students experience, task clarity, task ownership, need for CMC, and type of system. The conclusion is that all of them are important.

Considering a broader analysis, it can be said that student-student interaction, specially in group, is a success factor. Students should also be capable/trained regarding CMC. However, such groups interactions can only be successful if the task at hand is well understood (which is a consequence of a clear learning design).

Implementing a managed learning environment in the NHS

Gray *et al.* (2009) describe the implementation of a learning environment aimed at blended learning. The results are based on the experiences and challenges of such endeavour in a large organization. Although the authors argue that the critical factors identified were the quality of educational resources, and capability of the organization to response to changes, the real change made was the adoption of a learning management system (which, on the other hand, requires that organization to response to changes). The quality of data itself is not mentioned anywhere else in the paper.

Implementing constructivist approach into online course designs in Distance Education Institute at Eastern Mediterranean University

Gazi (2009) investigated the implementation of constructivist approach into e-learning. Several research methods were employed: interviews, literature review, and focus group. The main findings was that faculty is not sufficiently knowledgeable regarding constructivist. Another critical factor for a successful e-learning activity is the design of the course (which requires the aforementioned training).

Integrating ALN into an independent study distance education program: NVCC case studies

Sener e Stover (2000) describe the integration of ALN courses into several degree programs. The critical factors were: learning design, faculty selection, support and training.

Joint audio video quality evaluation for distance or online education systems

In this study, Srinivasan *et al.* (2009) considers technical issues regarding compression ratio and prompt delivery of data (voice and video) as critical factors for e-learning in distance education. They used videos produced for distance learning, videos which were delivered in different configurations (thus affecting the picture and audio quality). The quality, pedagogically speaking, of these videos were assessed by a questionnaire and by subjective evaluation.

The paper does not make any real specific evaluation regarding education, just about video understandability and how well knowledge could be extracted by watching it.

Learner and instructor identified success factors in distance education

The study reports the analysis of data collected over several years on learners and instructors on distance education (MENCHACA; BEKELE, 2008). The research method employed was participatory action research. The success factors are: use of multiple tools, with support for several media and interaction formats; computing competency (specially regarding the instructor), pedagogy (situated learning).

Online university students' satisfaction and persistence: Examining perceived level of presence, usefulness and ease of use as predictors in a structural model

Joo *et al.* (2011) investigate the relationship between perceived level of presence, usability of learning tools regarding learners satisfaction and persistence in e-learning at a South Korean university. The factors initially considered were teaching presence, social presence, cognitive presence, and usability. All those factors are relevant regarding learners satisfaction, but the same cannot be asserted regarding learners persistence.

Quality in e-learning - a conceptual framework based on experiences from three international benchmarking projects

Ossiannilsson e Landgren (2011) describe a conceptual framework for e-learning based on critical success factors identified in several international benchmark projects on distance learning. The critical factors are: strategic management, reliability, accessibility, benchmarking, computer-based assessment, employability, e-portfolios, information literacy of students, integration, learning material/objects, library services and resources, organizational learning, pedagogy, personalization, plagiarism, quality assurance, staff recognition and rewards, widening participation, constructive alignment, flexibility, legal security, interactiveness, participation, productivity, and transparency.

There are, clearly, too many factors. The conceptual framework the authors are developing tackles such issue. Four of those factors are considered crucial: accessibility, flexibility, interactiveness, and personalization. Transparency, participation and productivity is also regarded as very important.

Student perceptions of collaborative learning, social presence and satisfaction in a blended learning environment: Relationships and critical factors

So e Brush (2008) examined the relationship of collaborative learning, social presence and overall satisfaction in a blended learning environment. The research method was questionnaire and interviews of graduate students. From the analyzed factors, they could identify, using data collected from the questionnaire, a

significant relationship between collaborative learning and satisfaction, collaborative learning and social presence. However, they could not identify a significant relationship between social presence and satisfaction.

Considering the interview data, they could identify the following critical factors: course structure, emotional support and communication medium (and the interaction modes it supports).

Success Factors of E-Learning System Based on Students' Perspectives

Lin e Fang (2008) identified students concerns on e-learning systems usage. The research method employed was focus group, followed by theoretical coding of the focus group outcomes. The critical factors identified were: instructional content planning and arrangement, learning process support, system function and quality, usability, assessment with feedback, and interaction.

The development of cyberlearning in dual-mode higher education institutions in Taiwan

Chen (2002) describes the development of distance learning in Taiwan, heavily based on information and computing technologies (*e.g.*, real-time multicast). The critical factors he identifies are: governmental policies, funding, delivery format and accreditation in the form of credits and degrees.

The success of learning management system among distance learners in Malaysian universities

The study describe success factors regarding students' usage of learning management systems (AL-MARASHDEH *et al.*, 2010). The research method adopted was a survey conducted with undergraduate students. Three factors was subject to analysis: system design (system quality, service quality, information quality, usability), system usage (system use, behavioural intention to use and user satisfaction) and system Outcome (net benefit). The more important factor identified was system design.

Typology of teacher perception toward distance education issues - A study of college information department teachers in Taiwan

Although the author does not directly address critical factors, they do provide a relevant insight on them, based on the fact that teacher-student interaction is a key success factor. Tao e Yeh (2008) use a questionnaire to gather professors opinion regarding distance learning. Government support and training are among important factors highlighted in the study.

Using e-learning to support primary trainee teachers' development of mathematical subject knowledge: An analysis of learning and the impact on confidence

Burgess e Mayes (2008) discuss a model that combines distance learning education in mathematics (K5 – K11). The research methods comprised of discourse analysis, analysis of the outcomes of mathematical subject knowledge evaluations, interviews and questionnaires. The critical factors identified were: interaction between students (e-conferences), interaction between student and instructor (direct coaching).

3.6. Concluding remarks

It is worth noting that two types of studies were found: literature reviews and reports on distance e-learning in universities. The later we already expected, but not the former. As by our analysis, there are not enough primary studies to perform so much literature reviews. Maybe we should phrase it better: for every distance e-learning initiative, there probably is reports on success and failure factors; however such reports are not public or peer reviewed, thus of dubious quality in the scientific sense. How could we establish good synthesis reports based on evidences of unknown quality? That is the reason of our concern towards the literature reviews.

Nonetheless, as no literature review was performed as a systematic review, we regarded them all as primary studies. That may introduce an important bias, as some studies may be double counted or contribute to a given result (if the study was considered in the literature review). However, as most of the studies found by those literature reviews were not found in our systematic review, we are considering such effect negligible.

Another point we would like to highlight is the search capability of the studies sources. We have to double check the results they provided: even for trivial requests, such as only studies in English, the search engines provided documents in another language. Not a single search engine provided the option to search using just the abstract or title: all of them included keywords in the search. That should not be an issue, as keywords are often present in the abstract. However, there are two incoherence here: several studies use, in the keywords, words that were not in the title or abstract; some engines (ACM, to be more exactly) try to guess keywords by analyzing the full text, despite the article using (controlled) keywords. From 91 studies, 13 were excluded due to keywords.

Finally, the studies availability. It accounted for 16 in our review. It is a real shame to provide access to indexed data and to deny access to the full paper, demanding a reasonable sum of money for each paper. As authors and reviewers for those publishers, we do not receive a penny for those bought papers. As a reward, we have flawed search engines, and restricted access to papers.

Analysis

The factors extracted from studies selected and analysed in Chapter 3 were summarize by simple counting, as shown in Table 4.1. The most cited critical factor is learning design, followed by instructor training. Learning management system usability and interaction are also regarded as important.

Table 4.1: Count of critical factors for the selected studies set.

Critical factor	Count
Learning design	11
Instructor/Tutor qualification/training	10
Learning management system usability	8
Student-student interaction	8
Student-instructor interaction	7
Student-content interaction	5
Technical capability	5
Governmental support and accreditation	4
Infrastructure and organisational support	4
Learning management system	4
Course compatibility with personal needs (context)	3
Design team qualification	3
Learning management system alignment with pedagogical approach	3
Student training	3
Student-institution interaction	3
Technical support	3
Accessibility	1
Educational resource quality	1
Personalization	1
Transparency	1

Factors related to a broader perspective, such as the institution, are, in general, not regarded as important in several context. Actually, in countries were the legislation on education is more open, such as in the United States, accreditation and public funding does not seems to be a concern. On the other hand, the cost of e-learning courses are a factor for such countries.

In what concerns e-learning in a more closer perspective – student and instructor – there is a consensus that the technology is just a tool used for education. The top critical factors are a clear demonstration of that: learning design concerns about the definition of content and learning activities, using a given pedagogical approach. It does not mandates any specific kind of media usage, such as high definition images, sound, virtual reality and so on (defined here as technical capability). Clearly, rich media and interactivity can improve the implementation of some educational approaches: it is just the case that plain use of technical and computing resources will not automatically provide an effective education (which is the main goal).

Regarding interaction, several studies have pointed out the important on interactivity in learning. However, some studies have also provided evidences that, although student/content and student/instructor interactions are important for learning success, the same cannot be asserted about student/student interaction.

Conclusions

There are some factors that are clearly important about e-learning: learning design, usability of systems used to access educational material and to run the activities required by the learning design, training to implement such learning designs and use the learning environment where they are deployed.

E-learning is often associated to constructivist. As a “different” kind of learning, it is expected that e-learning be used to apply new pedagogical approaches, which requirements that could not be fulfilled by ancient computing systems. That is the case for interaction: the support for synchronous and asynchronous communication between learners and instructors, using different types of media, at low cost and reasonable speed, is a real possibility today (and unfeasible a decade ago).

Nonetheless, most of the studies analyzed have a strong dependency to their subject context. Thus, any generalization must be taken cautiously. For instance, few studies identified failure factors: the common case was the definition of a set of interesting/candidate factors, a model to assess such factors, and the identification of some correlation between all those factors to e-learning success. It would be hard – may be even impossible – to identify every factor that can affect e-learning and, from those, identify the critical ones. However, keeping the analysis to just a few – carefully chosen – factors restricts the value of the outcomes and their applicability/comparison to other research studies.

Another important issue is regarding the control attribute, which the present study has not considered any. Nonetheless, we could have used current face-to-face courses and its requirements as a control or comparison regarding e-learning courses. This way, we could be able to assess whether e-learning courses has requirements specific to blended and distance learning (and which are not critical for face-to-face education). Actually, I expected that the selected studies have discussed such issue, separating what concerns computing technology and what concerns education theories. Such clear separation of concerns would provide a clear distinction on what should be improved in each area, providing a clear baseline for further research.

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