A Re-Structuring of the Critical Success Factors for E-Learning Deployment

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Abstract

E-learning, being an information system, suffers high failure rates due to the complexity of deployment. This paper has 2 objectives: (I) to compile the critical success factors (CSFs) of e-learning from current literature; (II) group CSFs that approximately attain the same objective into roles where the roles together accomplish the main goal of a best e-learning deployment. 17 critical success factors (CSFs) were obtained through an exhaustive search, and were partitioned into 4 natural roles of Student, Instructor, Technology, and Institution. The confinement of the CSF interactions to within roles resulted in a dramatic reduction of pair wise comparisons. Pair wise comparisons are a measure of interactions and concomitantly of complexity.

Key words: E-Learning, Critical Success Factors (CSFs), Roles, Pair-wise Comparisons.

1. Introduction

In its broadest sense E-Learning can be defined as instruction delivered via all electronic media including the Internet, intranets, extranets, satellite broadcasts, audio/videotape, interactive TV and CD-Rom. E-learning for the purposes of this article refers to teaching and learning that is web-enabled (Govindasamy, 2002) . E-learning has been viewed as synonymous with web-based learning (WBL), Internet-based training (IBT), advanced distributed learning (ADL), web-based instruction (WBI), online learning (OL) and open/flexible learning (OFL) (Khan, 2001). E-learning is the effective learning process created by combining digitally delivered content with learning support services (Hara & Kling, 1999). Above are the varied definitions and meanings that can be ascribed to the modern pedagogy known as e-learning.

2. Attributes of E-Learning

The profile of a college student is changing. In the new education environment, the traditional 4-year degree has evolved into a 40-year degree to indicate a lifetime relationship between education and human beings (Galloway, 2000). E-learning provides more learning opportunities to adults who are no longer of the formal education age which ranges from 17-25 years (Goi & Ng, 2009). The confluence of technology, demographics, and work/family requirements make life-long learning imperative (Berge, 1998). E-Learning in a way can provide flexibility to those students who possess a full time job and study at the same time, also known as "earner-learner". Flexibility means that provision should be made to these types of students so that they spend fewer hours on campus or do not come on campus but still have the ability to fast track their education (Stuparich, 2001).
E-learning possesses the ability to transform the educational process as never before. As John Chambers, president and CEO of Cisco Systems beautifully put it; "There are two fundamental equalizers in life: the Internet and education. E-Learning eliminates the barriers of time and distance creating universal, learning-on-demand opportunities for people, companies and countries".

Internet-supported distance education courses do more than bring new students into online classrooms (Hara & Kling, 1999); it is also viewed as a cost-effective tool to address present fiscal realities (Pardue, 2001). Institutions are gradually jumping on the bandwagon as a cost cutter. Governments and organizations do not have to worry about building more concrete campuses to train and equip the working generation (Mat, 2000). Many states in the U.S. are developing virtual schools to support non-traditional or special needs learners as well as to reduce the need for new buildings; many of these virtual schools are utilizing some of these technologies to support hundreds and in some cases thousands of learners (Greenberg, 2009).

E-Learning keeps evolving. Table 1 (appendix) compares and contrasts the subtle differences between current e-learning and its recent past. Of particular interest is the steep change in the technologies. In e-learning lectures, there is no problem of unmanageable class size or insufficient number of students to start the course. As long as there are students taking the course, they can attend the class anytime at any place they want.

Hence, e-learning can be a way to produce a quality and innovative generation (Mat, 2000). In the past, learners had to spend much of their time and money to get to the physical campus for lectures. The learners can now access the campus from their home without much traveling and being away from their families. It cuts the learning time and cost. Thus, it encourages more organizations to support e-learning education for their employees (Mat, 2000).

3. Growth and Momentum

According to U.S. Dept of Ed 1998 survey released Dec.'99, 78% public 4-year and 62% public 2-year universities offered Distance Learning (DL) programs. 87% of all institutions had over 10,000 student enrollments. From 1995 - 98, there has been a 33% increase in institutions offering distance education, while number of DL courses and enrollments doubled. Internet and Web-based courses increased by 32% (Vucetic, J. (2003). Table 2 (appendix) summarizes the exponential growth in U.S. and worldwide Internet users over the many 20 years. It is estimated that the number of unique students enrolled in fully online distance-learning programs in 2002 was approximately 350,000 representing 2% of all students enrolled in postsecondary education in the US. The growth rate was 40% and revenue of $1.75b in tuition was generated for host institutions (Gallagher, 2002).

For the first time ever, an impartial stakeholder has asserted that "blended" instruction (using a variety of face-to-face and distance-oriented pedagogical methods) can have a larger advantage relative to purely face to face instruction or instruction conducted wholly online (Greenberg, 2009). Internet use and diffusion is growing at an unprecedented pace, reaching a 25 % market share in only 7 years, compared to 35 years for the telephone and 30 years for the microwave. According to International Data Corporation (IDC), Internet access is forecasted to grow to 320 million users in 2002, up from 14 million in 1995 (Kah et. al., 2000). There is a speeding up of all things related to distance education. The momentum is fueled by technological innovation, perceived value, timing and need, learner expectations and competition. A Sloan Consortium survey shows that concerns about course quality were less of a factor in 2007-2008 than in a previous survey, whereas issues regarding course development and/or purchasing costs, and limited technological infrastructure to support distance education, were moderately or significantly increased in the latest survey (Greenberg, 2009).

3.1 Failure Rates

But the story is not rosy all round. A 2003 Hackett Group study reported that 30% of Information Systems projects fail E-learning, being an information system, suffers even higher failure rates. These high failure rates indicate the existence of misconceptions regarding the implementation process and use of e-learning (Sela, 2009). And there are roadblocks. Table 3 (appendix) groups together the most cited obstacles to videoconferencing deployments, where videoconferencing is assumed a good metric of distance education in general. Bandwidth unavailability should certainly be a more potent problem in resource-starved environments like Africa. Also, concerns about the ability of online courses to meet quality standards seem to be receding while concerns about the ability to actually deliver online classes (development and infrastructure) are growing (Greenberg, 2009).

3.2 Challenges

In developing fully online programs, it is critical that institutions make sufficient investments in their technology and services infrastructure. The efficient operation of a fully online program rests upon the strength of its technology and services architecture, as the core business of the institution is now being delivered entirely via the web (Gallagher, 2002). And there are barriers. Student barriers to Distance Learning include students' alienation and isolation, lack of effective advice, costs and motivators, feedback and teacher contact, student support and services, lack of experience, frustration in learning, and training (Hara & Kling, 1999). Distance learners are more likely to have insecurities about e-learning. These insecurities are founded in personal and school related issues such as financial costs of study, disruption of family life, and lack of support from employers. These pressures often result in higher dropout rates than among traditional students (Falowo, 2007). Another source of insecurity is the **perceived irrelevance** of online studies. It is doubtful if national accreditation boards of African countries will accord online programs the same cognizance as their terrestrial counterparts.

3.3 Reasons for E-learning Failures

Many of the first e-learning programs have failed, resulting in the failure of many e-learning technology companies.

One of the major reasons given is the reluctant adoption of e-learning by learners - not because of the technology, but rather because of the failure of educators and organizations to provide quality content and to create an effective, interactive e-learning experience (Engelbrecht, 2003). The early models emphasized the role of the technology in providing content (information), delivery (access) and electronic services. Owing to the continuous ICT developments, the focus was primarily on the use of technology to create convenient virtual learning environments for learners to access anywhere, any time. Many educators and technology vendors assumed that the delivery of traditional learning content via the Internet constitutes e-learning (Engelbrecht, 2003). Many online courses cannot sufficiently motivate students to participate. In other words, e-learning is apt to isolate trainees and this can lead to high rates of failure (Mehregan, 2011).

Below is a list of reasons why e-learning deployment would fail:

- Being overly ambitious in terms of desired outcomes for the budget and time available.
- Utilizing particular information technologies for their own sake, without sufficient regard for appropriate learning design.
- No change in the assessment of learning to suit the changed learning outcomes.
- Commencing software development without adequate planning.
- Failure to prepare students for participation in learning experiences such as working in groups.
- Failure to obtain copyright clearance (Goi, 2009).

3.3.1 Profile of E-Learning students

E-learning is tailor-made for the non-traditional student. This type of student often works full time, attends classes after work, is married, has children or other familial obligations, and is a degree-seeking or continuing education student. Many are pursuing education in order to gain new skills and advance their careers. These busy, mature students are looking for quality, convenience and flexibility and should comprise a significant constituency of institutions with an e-learning outreach. The confluence of student needs and the potential of fully online distance learning create virtually limitless opportunities for institutions to serve students with educational offerings (Gallagher, 2002).

3.3.2 Universities In A Business Context

Corporate and academic institutions have invested in e-learning as it seems to offer possible solutions for three immediate business goals, namely: 1) increasing or sustaining the quality of educational or training programs and consequently the quality of employees/graduates 2) improving access to learning opportunities 3) reducing the total cost of education (Engelbrecht, 2003). A well run e-learning system can thus contribute revenues to an institutions' coffers.

3.4 E-Learning Design

Transforming "learning" into "e-learning" is not just about developing online courses. More factors should be taken into account. There should be useful and easy to use e-learning tools. Complexity decreases usage. Therefore, "over-abilities" should be avoided (Sela et al., 2009). E-learning tools should be learner focused (simple, easy to use, not overwhelming, and familiar to users) and developed by experienced professionals (Sela, 2009). An **organizational culture** that supports and encourages learning, and especially e-learning is important. Training, once an interpersonal process, has become a one person (and one computer) process. This radical change requires adjustments to the organizational culture and a new thinking about the role of computers as part of organization life (Sela, 2009).

3.4.1 E-Learning Alternatives

There are different variations of distance learning. Eduventures research indicates 3 core models, each with its own characteristics and requirements.

E-course/face-to-face: Students attending class on campus complete some amount of coursework online. It employs extensive web-supported resources as a required component of the course; enriches the learning experience and improves students' technology literacy and skills.

M-course/mixed mode: Hybrid or Mixed Mode combines face-to-face courses with a fully online course component to reduce classroom seat time; reduces instructional costs and improves student performance and retention.

W-course / fully online: Students complete their courses entirely at a distance with no on-campus component. Learning delivered as part of an online certificate or degree-granting program; aims to provide education access to students for whom distance, convenience, and flexibility are paramount considerations (Newman, 2003). The availability of free web services online provided mostly by GOOGLE and Microsoft makes the first alternative easier to implement by faculty with some level of computer competency. The second and third alternatives however require more resources and permissions, and can be deployed only as part of the strategy and mission of the institution.

4. Critical Success Factors of E-Learning

A complex technological initiative like an e-learning deployment is an undertaking involving a multiplicity of factors that impact the implementation to varying degrees. A factor that is critical to the success of the project is intuitively referred to as a Critical Success factor (CSF). Therefore, critical success factors (CSFs) are variables that are fundamental to the success of the implementation, and an organization must handle these CSFs well in order to have a successful implementation (Frimpon, 2011).

The CSFs approach has been used by managers as a framework for strategic planning to direct them in determining those elements that must go right to succeed in achieving goals and objectives (Jafari et al, 2006). About 81.5% of the variation in the ERP systems implementation can be explained by the CSFs (Colmenares, 2009). Therefore, it is critical to focus on the critical success factors for a successful deployment exercise.
The core alternatives of distance learning have very similar modes of implementation. They thus have similar challenges and success factors.

Table 4 (appendix) is a listing of critical success factors compiled from various academic papers. Due to the many competing elements and factors of an e-learning process, it is necessarily a complex one. Beyond the complexity are the nuanced meanings in the CSFs which may make it unclear as to whether they are in tandem or in conflict with each other. A task of this paper is to map the CSFs onto natural groupings such that complementary ones end up in the same group where they together achieve a sub-objective of the main objective of a successful e-learning deployment.

4.1 Compilation and Sifting of CSFs

A compilation of the success factors from 14 papers resulted in a count of 74 non-unique CSFs as seen from Table 4 (appendix). A compare and contrast exercise to eliminate duplications result in 17 unique CSFs. Table 5 shows the much shorter list of reviewed CSFs, their definitions and sources. A process with this many variables is necessarily a complex one. This complexity is further magnified by the number of interactions and relationships between the variables. To be able to have a successful implementation this complexity has to be managed.

Figure 1 (appendix) is a graphic of the 17 unique CSFs from Table 5 placed in their respective roles. 17 attributes is pretty large for any software process. With such a large number there is the likelihood that some may have differing objectives. Therefore, it is helpful to bring some structure into the process by placing similar and consistent CSFs into same groups where they may together help achieve a sub-objective of the main e-learning objective of a successful implementation. Grouping criteria can help the process of checking whether the set of criteria selected is appropriate to the problem, can ease the process of calculating criteria weights in some methods, and can facilitate the emergence of higher level views of the issues (UK DTLR, 2001).

4.2 Roles and their rationale

A good way to mitigate this complexity is to aggregate the attributes in groups, and furthermore restrict interactions to "within groups". We shall define a role as a group of CSFs identified and put together for the purpose of achieving a sub-objective of the main objective. In simple terms, a role is a container for holding specific CSFs. As an example, the Student Role contains the attributes that are best needed or required by the student for the attainment of a successful e-learning experience. Table4 which gives the definitions of these attributes help to group the CSFs. This paper uses as groups the 4 accepted e-learning categories of (1) Instructor; (2) student; (3) information technology; and (4) university support (Selim, 2005). There is good supposition that the above categories are the main actors of an e-learning initiative.

These 4 roles then help in the attainment of the main objective of a successful e-learning implementation and deployment.

Figure 2 (appendix) is a graphical display of the roles and their relationship with the main objective.

4.3 Structuring CSFs

In this structuring exercise, the CSFs are placed in roles according to the following criteria: (Bullen et al., 1995)

1. Function: Identify the CSFs necessary to achieve the goals and objectives.
2. Best measure: Many other CSFs can be measures of the role but this CSF is the best or among the best.

In addition, we make the *simplifying* assumption that the CSFs in different roles have no interactions. Using simple set theory notation; for any pair of CSFs,

$$\left(CSF_i \cap CSF_j\right) = \emptyset;\ i \in role\ I, and\ j \in role\ J, I \neq J \qquad \text{(A)}$$

4.4 Pair wise Comparisons

In any software deployment process, as the number of attributes grows so does the complexity of the implementation process. Pairwise comparisons are a measure of the number of interactions, and number of interactions is a measure of complexity, which implies that pairwise comparisons are a measure of complexity. The grid in Table 6 (appendix) shows the extent to which a mere grouping of attributes cuts down on complexity. The COMBIN function in Excel (COMBIN(X, Y=2) allows us to deal with the Combinatorics problem of comparing attributes two at a time.

As can be inferred from Table 6:

- Total pairwise comparisons in the grouped process is **(28 + 6) = 34**;
    - Number of pairwise comparisons between the CSFs *within* the roles = 28.
    - Number of pairwise comparisons between the 4 roles themselves = 6.
- Total pairwise comparisons between the 17 CSFs in an ungrouped process = 136.

The dramatic reduction of 102 pairwise comparisons is due to the fact that there are no interactions between CSFs in different roles.

5. A Structured E-Learning Implementation

The roles are the pillars that shoulder the burden of the implementation of the e-learning process. Figure 3 (appendix) depicts the configuration of the e-learning process. The structural integrity of the entire e-learning process is hinged on the strength of the pillars. A weakness in *any* of the pillars can result in a failure. On the other hand, *all* the pillars have to be managed well to result in a successful implementation. That is why there should be focused treatment of the roles to ensure each CSF receives consideration until it drops out if it has to. Taking out a CSF without analytic due diligence can weaken the pillars and result in the crumbling of the edifice, so to speak.

5.1 Conclusion

The evolution of distance education has been very fast. The speed of change is proportional to the speed of the internet, so that the astronomical growth of the web is the rocket fuel for distance education. As a result of the speed, technologies get moribund quickly and institutions have to be very alert not to deploy systems that will be 'dead on arrival'. It is proverbial that generals always prepare for the last war. Institutions, may unwittingly invest considerable resources in purchasing systems because they are already in use in sister institutions. Unfortunately, these existing systems may have been designed for the challenges of a past era, plus the fact that the newer technologies are cheaper and superior. With e-learning, the cost of infrastructure can be reduced tremendously from the millions required to build a campus to thousands to have a complete network infrastructure (Mat 2000).
This study defines a re-structured CSFs "role" model for ERP implementations. The model was developed through a multidisciplinary approach of Combinatorics, Decision theory and simple Set theory applied on a set of previously identified Critical Success Factors.

The compiled number of CSFs is large and could even be larger but their partition into the four groups of Student, Faculty, Technology, and Institution makes the model computationally less intensive and thus more easily manageable.

5.2 Limitations

The list in this research (Table 4) contains CSFs from 14 authors and papers. Perhaps increasing this sample and broadening the scope can result in more pertinent CSFs, especially since the model can handle any number of CSFs. The sample size although small is good enough for this early part of the project (Hubbard, 2009).

5.3 Future Research

Distance education is over 100 years old, and there is considerable literature to support deployment. However the web, which fuels the modern process, is barely 25 years old. Therefore, there is still on-going research especially on the interplay of student, instructor, technology and institutions and their roles in distance education.

The E-Learning solution selection is a multiple criteria decision-making problem that needs to be addressed objectively taking into consideration the relative weights of the criteria for any organization (Colace, 2008).
Metrics should be developed to measure the roles and their associated CSFs in order to be better able to quantify the implementation process. As management consultant Peter Drucker once said: "If you can't measure it, you can't manage it." A good methodology like Analytic Hierarchy Process (AHP) by Saaty can be used to determine the weights of the attributes in order to compare and rank alternatives for implementing the process. Figure 4 (appendix) is a graphic of a possible hierarchy of an e-learning deployment process that can be used to determine the weights. CSFs that are redundant or have no bearing on the implementation can drop out during the modeling process. If there are dependencies between the Critical Success Factors, as is most likely, then a modeling approach like Analytical Network Process (ANP) also by Saaty should be used to determine and calibrate the weights to further enhance the accuracy of the model.

Cloud computing technologies enable institutions that do not have the technical expertise to support their own infrastructure to get access to computing on demand. For many institutions, cloud computing offers a cost-effective solution to the problem of how to provide services, data storage, and computing power to a growing number of Internet users without investing capital in physical machines that need to be maintained and upgraded on-site (Al-Zoube, 2009). Educational institutions are beginning to take advantage of existing applications hosted on a cloud that enable end users to perform tasks that have usually required site licensing, installation, and maintenance of individual software packages. The Cloud works on the principle of economies of scale at application, software and hardware level. It results in many benefits like service provisioning, reduced costs, optimum resource utilization (Goel et al, 2011). Providers such as Amazon, Google, IBM, Microsoft, and Sun Microsystems have begun to establish new data centers for hosting Cloud computing applications in various locations around the world to provide redundancy and ensure reliability in case of site failures (Al-Zoube, 2009). Cloud applications can be leveraged to help resource-starved institutions like those in Africa.

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TABLE 1: Evolution of Distance Learning

Choi, Kim, & Kim, 2006	**Past Distance Learning**	**Present e-Learning**
Definition	Any approaches to education delivery that replace the same-time, same-place, and face to-face environment of a traditional classroom (i.e., correspondence teaching; multimedia distance teaching)	The most recent evolution of distance learning that creates, fosters, delivers, and facilitates learning, anytime and anywhere, with the use of interactive network technologies (i.e., E-learning)
Paradigm in education	• Focus on teaching: lesson based Objectivist model of learning in which learners are passive • A series of lectures for efficient transfer of knowledge from instructor to learner	• Focus on learning: learner based • Constructive, collaborative, and cognitive information processing of learning • Individual differences in the learning process; learning as a social process
Interaction	• Lack of direct interaction between the teacher and the learner • Asynchronous interaction	• Interactions between instructor and learner, and among learners • Asynchronous/synchronous or real-time (e.g., chat forum, instant messaging, video conferencing) interaction
Technology	Written or printed materials, broadcast media, audio/ videotapes, telephone, and CAI/ CBT with stand-alone computers	All electronic media, especially, network technologies such as the Internet, intranets, and extranets

Table 2: U.S. & Worldwide Internet User Growth

	1985	**1990**	**1995**	**2000**	**2005**	**2009**	**2010**	**2015**
U.S. Internet Users (#Millions)	0.019	1.8	28.1	135	198	245	254	288
U.S. Internet User share (%)	89.6	84.5	62.3	31.3	18.1	13.4	12.5	10
U.S. Internet Users/1,000 People (#)	0.08	7.2	105	477	668	797	820	885
Worldwide Internet Users (#Millions)	0.021	2.13	45.1	430	1094	1825	2030	2890
WW Internet Users/1,000 People (#)	0.004	0.4	7.94	70.8	170	270	297	399

http://www.etforecasts.com/products/ES_intusersv2.htm

Table 3: Rank Order of Obstacles to Successful Deployments

Obstacle	**Ranking**
Lack of bandwidth and technology infrastructure, or old equipment	1
Staffing (inability to afford support personnel)	2
Lack of interest on the part of sufficient educators and administrators	2
Funding challenges	2
No statewide or district-wide policy / standards / champions	5
Firewalls	6
Resistance to change	7
Bell schedules / calendars	8
Costs	8
Learning curve	8
The need to create awareness of availability / value	8
Lack of dedicated rooms or not enough equipment	12
Focus on testing / (No Child Left Behind) NCLB	12
The technology was not perceived as high enough quality initially	12
The state is in the early stages of deployment	12

Table 4: Listing of Critical Success Factors				
#	**GOI**	**PAPP (from Selim)**	**Govindasamy (from Selim)**	**Baylor (from Selim)**
1	Program Content	Intellectual Property	Institutional Support	Planning
2	Web Page Accessibility	Suitability of The Course for E-Learning Environment	Course Development	Leadership
3	Learners' Participation and Involvement	Building The E-Learning Course	Teaching and Learning	Curriculum Alignment
4	Web Site Security and Support	E-Learning Course Content	Course Structure	Professional Development
5	Institution Commitment	E-Learning Course Maintenance	Student Support	Technology Use
6	Interactive Learning Environment	E-Learning Platform	Faculty Support	Instructor Openness to Change
7	Instructor Competency	Measuring the Success of an E-Learning Course.	Evaluation and Assessment	Instructor Computer Use outside School
8	Presentation and Design			
	Mehregan	**Benigno (from Selim)**	**SELIM**	**SOONG**
1	Instructor Characteristics	Student Characteristics	Student Time Management Skills	Human Factors
2	Student Characteristics	Student–Student Interaction	Discipline	Technical Competency of Both Instructor and Student
3	Content Quality	Effective Support	Computer Skills	E-Learning Mindset of both Instructor and Student
4	Information Technology Quality	Learning Materials	Prior IT Experience	Level of Collaboration,
5	Participations Interaction	Learning Environment	Attitude Towards E-Learning	Perceived Information Technology Infrastructure
6	Educational Institutes Support	Information Technology		
7	Knowledge Management			
	LEIDNER	**ELLIOTT**	**DILLON**	**HELMI**
1	Technology	Awareness	Technology	Information Technology
2	Instructor Characteristics	Identification	Instructor Characteristics	Market Demands
3	Student Characteristics	Implementation	Student Characteristics	Education Brokers
4		Evaluations		
5		Sustainability		
	VOLERY	**KAUPLA**		
1	Technology	Subject Matter Experts		
2	Instructor	Documentation		
3	Previous use of technology	Finances		

Table 5: Quoted definitions of CSFs

CSF	Quoted definition
Student Discipline	Students need to have time management, discipline and computer skills in order to be successful in the e-learning era. Student prior IT experience such as having a computer at home and attitude towards e-learning is critical to e-learning success (Selim, 2007).
Student Computer Competency	Technical competency of both instructor and student (Soong et al, 2001). Previous student experience with personal computers (Selim, 2007).
Student Attitude towards E-learning	Problems of Web-Based Distance Learning include the attitudes of instructors, students, and administrators. (Falowo, 2007)
Student Participation and Involvement	As reported by MacDonald et al. (2000), effective group discussion is very important in e-learning (GOI, 2009).
E-learning Mindset of Instructor	Effectiveness of distance learning is based on preparation, the instructor's understanding of the needs of the students, and an understanding of the target population (Omoregie, 1997) Falowo, R.O. (2007). Instructor openness to change (Baylor and Ritchie, 2002),
Instructor Technical Competency	Finally, instructors delivering course content must be able to effectively use the technologies. This might require them to modify or shift their pedagogical paradigm and behavior (Kah et. al., 2000).
Course Development	This is the putting together phase of the material before the commencement of the course. Guidelines regarding minimum standards are used for the design, development and delivery, while learning outcomes determine the technology being used to deliver course content (Smith, 2005)
Evaluation and Assessment	The program's educational effectiveness and teaching/learning process is assessed through an evaluation process that uses several methods and applies specific standards. Data on enrollment, costs, and innovative uses of technology are used to evaluate program effectiveness. Intended learning outcomes are reviewed regularly to ensure clarity, utility, and appropriateness (Smith, 2005)
E-learning Environment	By advancing information and communication technology (ICT), e-learning is emerged as a modern educational paradigm. This online learning environment improves the delivery of teaching content, knowledge sharing among trainees, social interaction and so forth. (Mehregan, 2011) In such well-facilitated learning environments, through technology, students become excited about what they are learning and aware they are members of a global community (Berge, 1998).
E-learning Platform	Virtual Learning Environments (VLEs) are electronic platforms that can be used to provide and track e-learning courses and enhance face-to-face instruction with online components. Primarily they automate the administration of learning by facilitating and then recording learner activity.
Tech Support	If the technical support is lacking, the e-learning will not succeed. University administration support to e-learning is essential for its success. (Selim, 2007).
Information Technology Quality	It is our view in this paper that the success of distributed learning courses and programs depends greatly on the quality and effectiveness of its design, content and mode of delivery (Kah et. al., 2000).
E-learning Course Maintenance	When building the original eLearning course, it helps ensure you're considering future maintenance issues in your current design. Once built, it provides a historical perspective of original design decisions to help you make more efficient and effective maintenance decisions throughout the course life cycle (O'Brien, 2005)
Subject Matter Experts	The top priority of any eLearning course is the SMEs. With their extensive knowledge and documentation, they provide the best picture regarding what type of training needs to occur, but that also means that you need to put their schedule into consideration for your project (Kaupla, 2001).
Intellectual Property	Therefore, the first critical success factor is to provide faculty with a certain level of security with respect to their intellectual capital (Kah et. al., 2000).
Institutional Support	University administration support to e-learning is essential for its success. Number one in Khan's 8 dimensions (Focused on aspects and issues affecting the organization such as administrative affairs, academic affairs and student services) (Chin, 2004).
Sustainability	After the initial e-learning activities have been delivered post-e-learning support is provided to embed e-learning in normal training practices, for example in induction, employee reviews and organizational procedures (Elliott, 2009).

Table 6: Results of Pair-wise Comparisons Calculations between the CSFs in their respective roles

ROLE	**n**	**COMBIN(n, 2)**
Student	4	6
Faculty	5	10
Technology	4	6
Institution	4	6
Totals	**17**	**28**
Pairwise Comparisons between the Roles		
	n	**COMBIN(n, 2)**
Number of Roles	4	6
Total Comparisons		**(28 + 6) = 34**
Pairwise Comparisons between the CSFs altogether		
	n	**COMBIN(n, 2)**
Total number of CSFs	17	136

Figure 1: The Critical Success Factors (CSFs) of E-learning

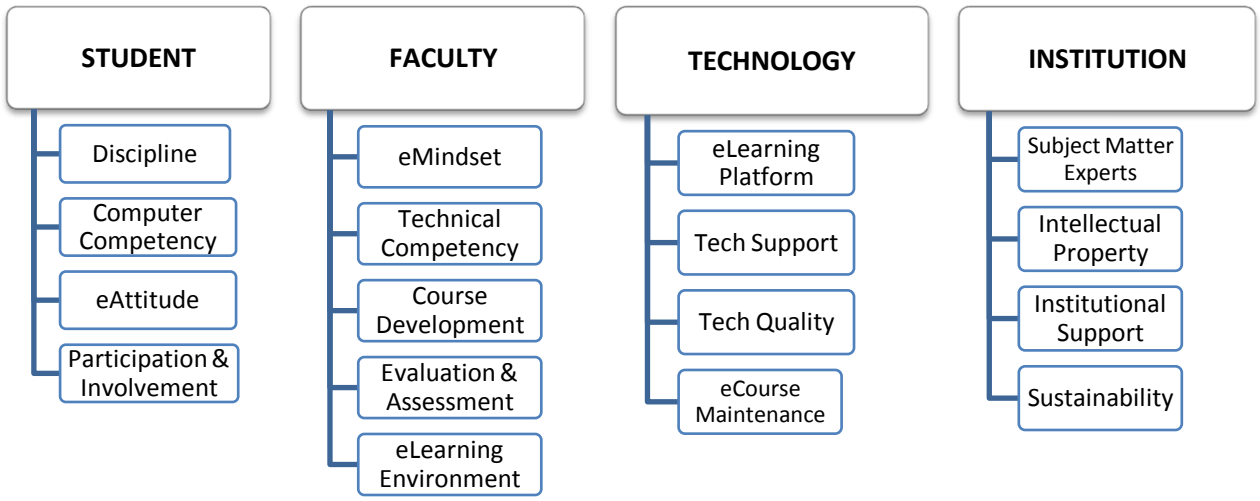

Figure 2: The Roles and their Relationship to E-Learning

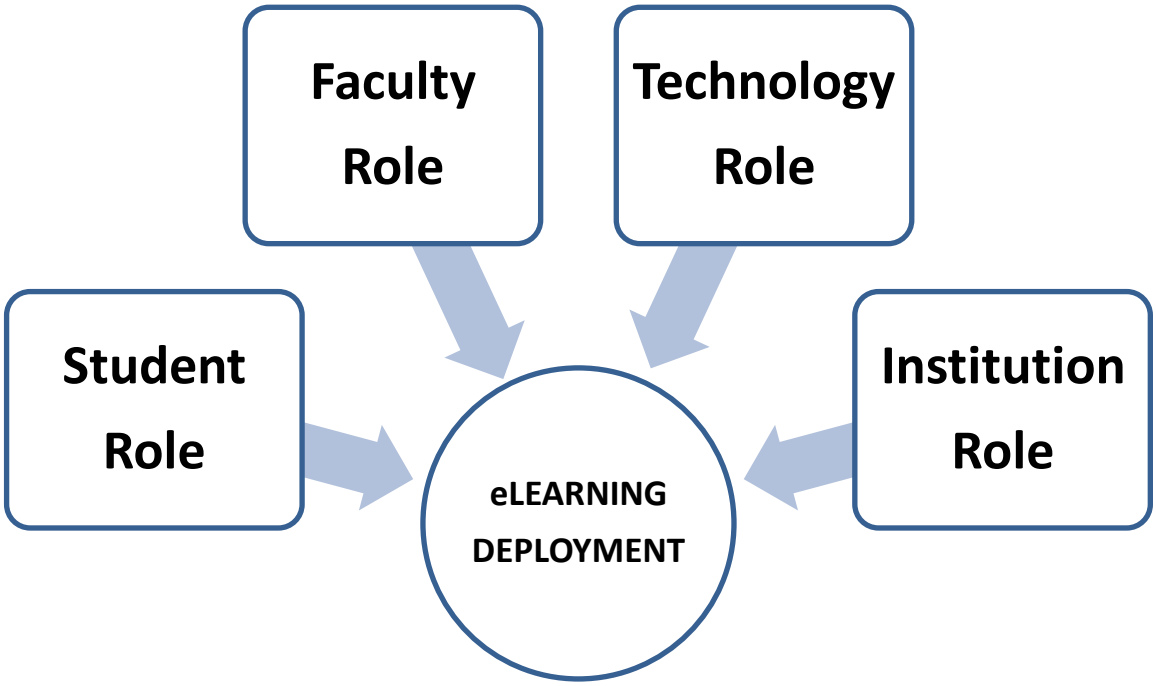

Figure 3: Pillars of E-Learning

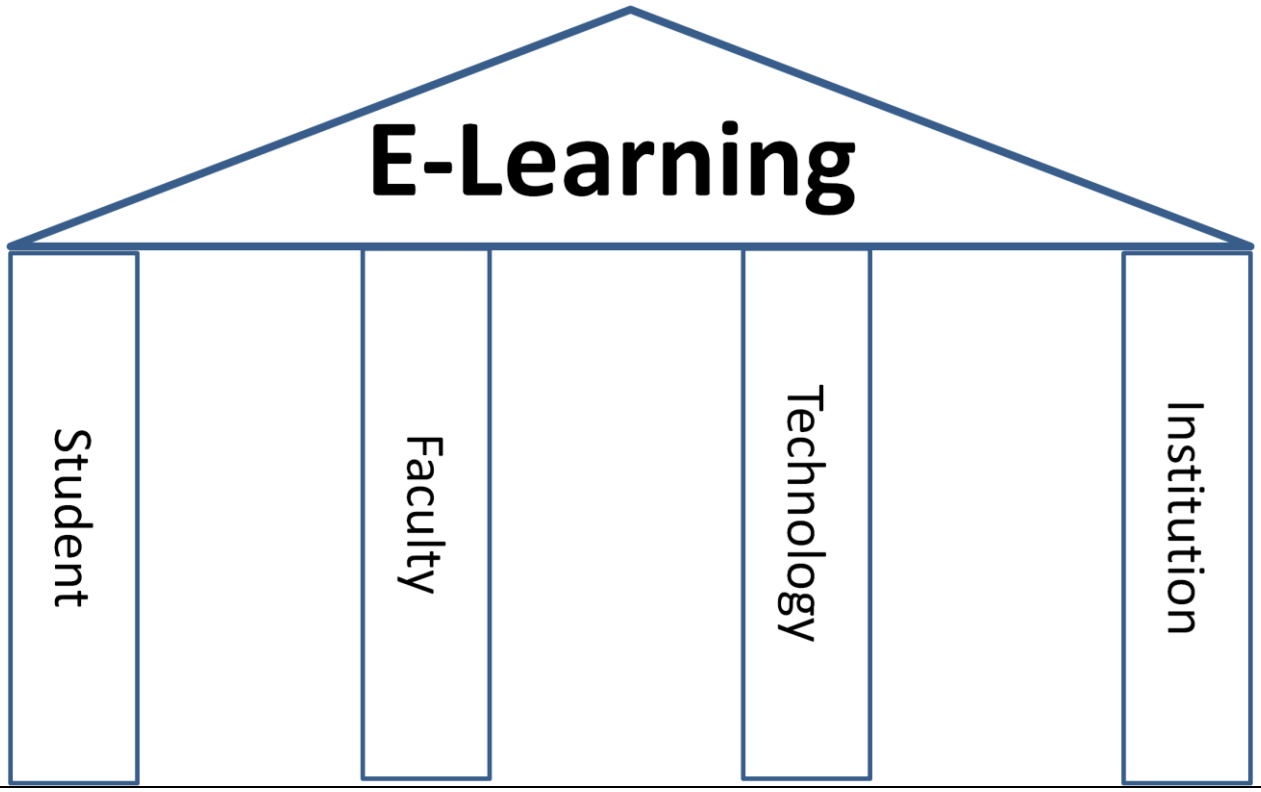

Figure 4: A Decision Analytic Hierarchy of an E-Learning Implementation Process