Exploring the e-Learning State of Art

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Abstract: e-Learning implementation is an area in progress that continues to evolve with time and further research. Researchers in the field argue that e-Learning is still in its infancy, resulting into numerous implementation strategies across a wide e-Learning spectrum. This paper explores the e-Learning state of art. It provides a general overview of the learning process, evaluates some current implementation trends pointing out a range of frameworks and strategies used in the past decade. It further looks at the changes created by the adoption of e-Learning within the higher education process. This is followed by an identification of emerging issues from which two problems are identified; 1) the limited uptake of technology as an instruction delivery method; and 2) the ineffective use of technology to support learning. In respect to this, future research should therefore seek to further investigate these aspects and to explore suitable approaches for effective implementation of e-Learning to support learning. Not the least in higher education contexts.

Keywords: e-Learning; learning, e-Learning implementation; higher education, learning process, learning theories, learning methods.

1. Introduction

e-Learning is a concept derived from the use of information and communication technologies (ICTs) to revise and transform traditional teaching and learning models and practices has evolved in the past decade. This evolution has resulted from the emergence of the information society and has greatly impacted on the global economic and socio-cultural development. However, researchers in the field still argue that the development of e-Learning has not been tested by time and is still in its infancy (Hui *et al.* 2005; Gao *et al.* 2006). This has resulted into continued research in the e-Learning field generating numerous implementation strategies a scope that requires identifying and understanding.

While e-Learning presents numerous opportunities to support learning, e.g., Garrison and Anderson (2003) notes that creating an e-Learning experience involves "*a serious commitment to understanding the different features of this medium and the ways it can be used most advantageously to impart learning*".

It is particularly interesting to note that even in supposedly mature contexts, such as university education, there are wide discrepancies. While some universities have achieved considerable benefit in the adoption of e-Learning (Meredith and Newton 2003), others are still struggling to realize the attainment of the minimal educational value (Marshall and Mitchell 2002). This is the case despite that skilled and interested personnel as well as increasing number of students in many cases force universities to embrace this education venture.

Therefore, as a base for research in the e-Learning field with an aim of identifying suitable strategies for effective e-Learning implementation, this paper explores the e-Learning state of art in higher education. It provides a general overview of the learning process, theories, and methods. Thereafter, it analyses e-Learning implementation trends, eliciting a range of frameworks and strategies. It investigates some e-Learning implementation aspects within higher education and finally it provides a discussion where some emerging trends with high impact on e-Learning implementations are identified. We conclude the paper by suggesting some particularly interesting topics for future research in this field.

2. Conceptualizing the learning process

It comes as no surprise that education is becoming increasingly vital in the knowledge society, resulting in new ideas within the area of learning and teaching (cf., e.g., Bleimann 2004). Furthermore, general developments in higher education, resulting from societal demands as well as an increased need for

students to become autonomous, have increased the need for academics to understand the learning process (Webster and Sudweeks 2006).

Needless to say, many approaches to e-Learning have been suggested over the years, but most people tend to agree that learning is a process through which learners achieve their learning goals by carrying out a number of learning activities and participating in interactions to reflect their understanding (cf., e.g., Sun *et al.* 2004). Thus, learning seems to result from a change in students' perception of reality related to the problem area under study as discussed in, e.g., (Rekkedal and Dye 2007). Learning is then concerned with the way people acquire new knowledge and skills and the way in which existing knowledge and skills are modified to solve problems (Shuell 1986). It does not involve some kind of obscure transfer of knowledge from one source to another, but rather consists of the active role played by the learner to process the information for use (Barnard 2006).

In this direction, Shuell and Lee (1976) define three criteria of learning which are: a) a change in an individual's behavior or ability to do something; b) a stipulation that this change must result from some sort of practice or experience; and c) a stipulation that the change is an enduring one. The latter two exclude behavioral changes such as maturation and temporary change due to drugs, etc.

Furthermore, it has become increasingly apparent that the amount of knowledge students possess has a substantial impact on their learning processes (Chi *et al.* 1982) and learning styles. Students learn in differing ways and the manner in which information is presented to them affects their ability to learn. Consequently, the learning style must be differentiated. In this regard, Sun *et al.* (2003) identify three learning styles to support students in their learning process:

- *Visual learners* learn best through seeing things such as images, demonstrations, facial expressions, and body language of the instructor to fully understand the content of the lesson;

- *Auditory learners* learn best by hearing things through verbal lectures, discussions, talking things through and listening to what others have to say;

- *Tactile/Kinaesthetic learners* learn best through experiencing, reflecting, interacting, and doing things. These learners prefer to actively explore the physical world around them and would benefit from manipulating real objects and/or acting on them in a simulated environment.

However, students need to utilize the different learning styles interchangeably during the learning process in order for them to have an effective learning experience.

2.1 Learning theories

Learning theories are concerned with the actual process of learning, not with the value of what is being learned. The central ideology of learning theories is that learning occurs inside a person (Siemens 2004). There are basically three main perspectives in learning theories that provide an understanding of an inherent learning process through which learners can construct knowledge within a particular environment.

Constructivism (Honebein *et al.* 1993; Fosnot 1996) guides learners and instructors in conducting, managing and encouraging personalized learning activities through collaborative learning. This type of learning facilitates critical thinking and problem solving. The learner actively constructs or builds new ideas using previous knowledge and experience attained. During the learning process, the teacher takes on a facilitator role focusing on making corrections, fostering new understandings, and creating social disclosure. The learners take on the responsibility of learning by actively participating in the learning activities placed at the centre of the learning process. This learning theory has guided many educationists in providing education encouraging hands on for learners (Gregson 1997). To this effect, Koohang and Harman (2005) affirm that in a constructivist environment, learning situations represent the normal complexities of the real world. As a result, multiple perspectives and representations that promote cooperative and collaborative learning are encouraged.

Cognitive theories describe learning as involving the attainment of the cognitive structures through which human beings process and store information (Good and Brophy 1990). They demonstrate how a student perceives, processes, interprets, stores, and retrieves information and are mainly concerned with the changes in a student's understanding that results from learning. The student is involved in the learning process, so the teachers have to present organized information in a way the student can relate to. Shuell (1986) emphasizes that a cognitive approach stresses learning as an active, constructive, and goal oriented process that is dependent upon the mental activities of the learner.

Behaviourism defines learning as an observable change in behaviour. Consequently, behaviourists assume that behaviours are observable and can be correlated with other observable events. The learning focuses on *stimuli*, i.e., what has an impact, and *response, i.e.,* how the behaviour of organisms changes. Belkin and Gray (1977) emphasize the significance of conditioning in behaviourism theories. They indicate that learning occurs as a result of positive reinforcement leading to old patterns being abandoned as a result of negative reinforcement. The learning activities carried out during teaching are arranged contingencies of reinforcement under which learners construct knowledge.

Thus, learning theories explain the learning process through which learners are able to acquire knowledge, but there is no single learning theory that can fully explain all types of learning. Consequently, several theories coexist and complement each other during a learning process. It should be kept in mind, though, that the attainment of the learning concepts varies from one learner to another and the learning methods dictate the level of knowledge to be attained. We will therefore take a closer look on this issue in the forthcoming sections.

2.2 Learning methods

Learning methods are referred to as ways through which instructors deliver instructions and learners access these instructions. Several learning methods have been described in literature, including traditional learning, e-Learning, blended learning, mobile learning, and personalized learning.

Traditional learning refers to face-to-face sessions, through which the teacher delivers course material to students in the same place and at the same time. The learning method is teacher centred, where the teacher focuses on providing the learning information to the students. Assessments depend on study notes given to students by the teacher, limiting the learner's knowledge acquisition boundary. However, Chickering and Gamson (1987) suggest that students must do more than just listen to what is said in class, such as read, write, discuss, or be engaged in solving problems constructively.

e-Learning, on the other hand, refers to the use of ICTs to transform and support the learning process ubiquitously. For instance, Meyen *et al.* (2002) define e-Learning as the acquisition and use of knowledge which is distributed and facilitated primarily by electronic means. Such electronic means may include internet, intranet, extranet, CD-ROM, video tape, DVD, TV, and personal organizers. e-Learning can be carried out in several ways which include computer based, asynchronous, and synchronous learning (AEN 2002). This facilitates an environment where the students take ownership of their learning. However, given the varied forms of learning styles, unavailability of e-Learning technologies and skills, a blended approach is often adopted.

Blended learning makes use of a combination of various learning methods that include face-to-face classroom activities, live e-Learning, and self-paced learning (Valiathan 2002). This learning method encompasses a variety of tools for simulating and maximizing the learner's learning potential. Some have suggested that the provision of a learning process with a variety of methods, through which learners can acquire knowledge, improves their learning potentials (Dean *et al.* 2001; Lubega and Williams 2003). This has resulted in the adoption of this learning method in various higher education institutions of learning.

Mobile learning is defined as learning or delivery of content that is facilitated by the use of portable technologies such as mobile phone, PDAs, or iPods (Wagner 2007). The global penetration and the use of mobile technologies have created new avenues and enhancements in teaching and learning activities in higher education (Armatas *et al.* 2005). Currently, mobile learning presents vast benefits that facilitate and enhance e-Learning. However, (Kinshuk *et al.* 2003) note that mobile learning methods are still in their infancy and have not been fully adopted as a learning method.

Personalized learning is a learning approach that facilitates and supports individualized learning. Each learner has a learning path that caters for learners learning needs and interests in a productive and meaningful way. One of the attributes of personalized learning is the ability to dictate the students' learning. For instance, learning objects can be used to facilitate personalized learning if integrated with systems that can present different learning objects to different students simultaneously (Graven and MacKinnon 2005).

Advancements in technology have led to a paradigm shift from traditional to personalized learning methods with varied implementation strategies and we will explore the e-Learning state-of-the-art over the past decade.

3. e-Learning implementation trends

Significant work in e-Learning development have been presented in the literature ranging from comparison studies, pedagogical aspects, perception studies, and evaluation to monitoring studies. This has, not surprisingly, resulted in the development of various e-Learning implementation strategies and models.

3.1 Defining e-Learning

Although the term *"e-Learning"* has been commonly used in the past decade, various definitions have been formulated to refer to the same educational experience. Examples of definitions include:

- Instructions delivered via all electronic media including the internet, intranet, extranet, satellite broadcasts, audio/video, interactive TV, and CD-ROM (Engelbrecht 2003);
- Learning facilitated by internet and www technologies, delivered via end-user computing that creates connectivity between people and information and creates opportunities for social learning approaches (Meredith and Newton 2003);
- Distance education using the internet and/or other information technologies (Watanabe 2005).

We will take a general approach herein and define e-Learning as a learning method that uses ICTs to transform and support teaching and learning process ubiquitously. This takes into consideration a multitude of e-Learning technologies that we will discuss in the section that follows.

3.2 e-Learning technologies

There are several e-Learning technologies in use that dictate how actual learning will take place depending on the environment in which they are implemented. These technologies include TV, CD ROMs, LMS, CMS, LCMS and virtual worlds as well as collaborative technologies (Barron 2002).

CD-ROM media have been used to deliver learning material to students on distance programs (Gooley *et al*. 1994). This media was adopted mainly in the early 1990's and supports learning content in text or multi-media formats. Use of CD-ROM media encourages independent learning where learners learn by executing special training programs on the computer irrespective of internet connectivity. This tool is commonly used for Computer Based Training, such as those usually offered as tutorial with new software and tutorials for learning foreign languages.

Learning Management Systems (LMS) are a whole range of information systems and processes that contribute directly or indirectly to learning and to the management of that learning (Mayes and De Freitas 2004). They are primarily developed to provide online learning services for students, teachers, and administrators. Examples of LMS include (KEWL 2005) and (Blackboard 1997)

Content Management Systems (CMS) such as (Moodle 1999) are developed to facilitate the collaborative creation of content, organisation, control and to manage the publication of documents in a centralized environment. *Learning Content Management Systems (LCMS)* are mostly web-based systems that combine the management and administrative functionalities of LMS and CMS to author, approve, publish, and manage learning content. An example of such technologies is the Macromedia Course Builder (2008).

Multimedia Communities and Virtual Worlds have transformed e-Learning environments from disseminating only text based to one that incorporates multimedia content. Omwenga and Rodrigues (2006) affirm that "*it is the online delivery of information, communication education and training providing a new set of technologies that can add to all the traditional learning modes-CD-ROM, and traditional computer based training*". The CSILE/Knowledge Forum (Scardamalia 2004) is an example of such a tool which incorporates a multimedia community space that enables learners to make contributions and share reference material.

Virtual worlds, on the other hand, mimic the real world and have become popular and promising in facilitating student learning. They provide an enrichment of the educational experience that is compelling, informative, and fun (Klaila 2001). In addition, they create new learning opportunities through which exercises and situations can be simulated and tested (Hansson 2006). Graven and MacKinnon (2005) point out the following examples:

- DVTS-Based remote laboratory across the pacific Over the Gigabit network
- Web-based Activities around a Digital Model Railroad Platform

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- The Automatic Control Telelab: A User friendly Interface for Distance Learning
- A low-cost PC based Virtual Oscilloscope

According to Cross *et al.* (2007), multimedia communities and virtual worlds provide a learning environment that stimulates learners' high order thinking and knowledge development and creates social groups.

Learning objects as defined by Wiley (2000) are digital resources that can be reused to support learning. The definition includes anything that may be offered across a network such as digital images, text, etc. IEEE-LTSC (2005), on the other hand, defines a learning object as an entity, digital or non-digital, that can be used, reused, or referenced during technology supported learning. Learning objects are created to provide useable content in various disciplines and context, as a result cutting down on production time and cost, enhancing productivity, and improving the quality of learning (Koohang 2004). The learning object's potential of being reused, adapted, and scaled has led to their wide usage within e-Learning (Hodgins 2000). In this respect, they provide a comprehensive suite of e-Learning capabilities that enables interoperability, accessibility, and reusability of web-based learning content. Graven and MacKinnon (2005) affirm that the current e-Learning trend should place emphasis on creating pedagogical technologies to support the authoring of learning objects.

Game authoring technologies aim at enhancing and facilitating the students' learning process through built-in simulations and interactions (Gee 2004). Online games range from text based games to games that incorporate graphics and virtual worlds populated by many players simultaneously (Graven and MacKinnon 2005). They create social communities that facilitate knowledge sharing and creation; a concept commonly referred to as "*edutainment*". Examples include (JISC 2007);

- Supercharged: developed as an MIT-University of Wisconsin partnership project as part of the Education Arcade, and has been piloted in schools in the US – Used to teach high level conceptual physics.
- Savannah: is a mobile game that introduces young learners to natural history concepts. The game, designed at the Futurelab with the BBC National History Uni -s designed to enable young children to role play the life of lions in the open savannah.
- The Racing Academy game: is a racing car physics simulation and has been developed by Lateral Visions with Futurelab to support learning communities in the field of engineering and science.

These technologies have facilitated communication and interactivity between students-students and students-teacher as affirmed by the models and strategies in the next section.

3.3 e-Learning communication and interactivity

Hansson (2006) points out that the adoption of technologies in education has created new opportunities for interaction in teaching and learning activities. For example, Garrison and Anderson (2003) through their community of inquiry model assert that the true uniqueness of e-Learning lies in its multidimensional forms of multiplicative communication and interaction. Through these interactions, learners are able to assume control and directly influence their learning outcomes. This interactive form of learning is further illustrated in:

- Salmon's Five Step Model (Salmon 2000) that reflects a positive progression in the quality and intensity of interaction between students-students and students-teacher. This model advises on the instructor's role during learning depending on the students' needs and circumstances in a learner-centred atmosphere.
- The Content-Communication-Collaboration Model (Dempster 2004) providing for a selection of technologies and methods that support increasing integration of dialogue across the learning activities. This model allows mapping of learning activities (presentation, practice, communication, interaction and collaboration) during learning.
- Conversational framework (Laurillard 1993) constitutes an iterative dialogue between teacher and student that facilitates high-level cognitive skills.

Omwenga and Rodrigues (2006) also advocate technology mediated learning systems to aid learning in a flexible environment. They provide a framework for evaluating and validating e-Learning processes in an integrated environment, taking into consideration the contextual and pedagogical issues. These initiatives present an understanding of the importance of building communities and interactivity within e-Learning environments that facilitate student learning.

e-Learning significantly enhances the learning process by enabling increased access to knowledge and interactive learning techniques (Digital Opportunity Initiative 2001) at all educational levels. The section that follows provides an account on the e-Learning developments within the higher education context.

4. e-Learning changing the higher education process

The structural changes in higher education institutions over the past decade have mainly been attributed to the introduction of technology initiatives (Singh *et al.* 2005). e-Learning has created flexible approaches to learning for students who in the past lacked opportunities due to factors such as employment, families, lack of money, distance, and time. To this effect, technology in general has not only improved knowledge storing methods and learning techniques but has also acted as a catalyst to combat the barriers of inflexible organisational structures (Shabha 2000). As a result, many higher education institutions have adopted e-Learning in their curricula.

e-Learning has transformed the traditional teaching and learning models and strategies (Graven and MacKinnon 2005; Suresh 2005). Inevitably, the competitiveness created by e-Learning within the higher education context implies that institutions that have not joined this education venture risk losing out. The current transformations of the higher education processes have been mainly attributed to:

- The drive to join the knowledge society and knowledge based economy;
- The opportunities presented by the advances in ICTs to meet the increasing student needs at a reduced cost;
- The growing demand for knowledgeable and skilled personnel in the labour market;
- Escalating numbers of on-campus students, off-campus students, and life-long learners and the *"on-the-move"* personnel who seek to continue with education in the workplace;
- The growing demand for alternative learning methods and availability of electronic learning resources;
- Collaborative research opportunities.

However, while e-Learning provides a flexible learning environment, it requires more than just transforming learning material into web-based environments and learning online. Successful implementations of e-Learning environments require an understanding of the technology and pedagogy integration for learning to take place effectively (Govindasamy 2002; Engelbrecht 2003).

Additionally, the paradigm shift from teacher centeredness to student centeredness has greatly influenced the higher education learning process (Sherry and Wilson 1997). In this case, the teacher takes on a facilitator role while the students take ownership of their learning and personal development.

On the other hand, the adoption of e-Learning has reportedly created new educational issues for lecturers, such as the changing work patterns and in some cases the reluctant integration of technology (Singh *et al.* 2005). This has been mainly attributed to the perceived increasing workload and the lack of skills to develop and manage an online course. Serwatka (2002) points out that teaching techniques used by lecturers in traditional courses may also have to be reviewed and modified, as they do not always prove to be effective or necessarily transferable into e-Learning environments.

5. Discussion

5.1 Evolution of e-Learning

Within the e-Learning context, advancement in network technologies, e-Learning technologies, and content development has facilitated multiple content presentations, personalization and ubiquitous learning.

The evolution of network technologies has been evidenced from the development of client-server networks to wireless broadband access technologies. The architecture of client-server networks enable learners to access the learning materials from a centralized server. This architecture has been further developed to include web-based features that have led to the emergence of Internet/Intranet/Extranet technologies that support learning through virtual/web-based environments. The progression of technology has further led to

the development of wireless broadband access technologies that support learning through the use of portable devices. Figure 1 illustrates the evolution of the network technologies.
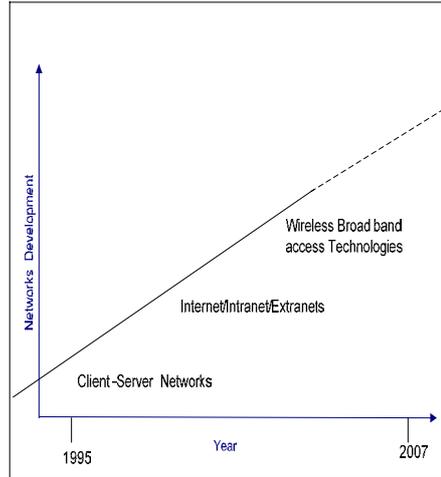

Figure 1: Evolution of the network technologies

In the past decade, e-Learning tools have evolved tremendously from CD-ROM media to personalized technologies that cater for individual students' needs as shown in Figure 2. This evolution has been partially enabled by network technologies as underlying infrastructure. The basic CD-ROM media provides portable content that can be accessed by learners without being facilitated by network technologies. LMS/CMS/LCMS, multimedia and virtual communities, game authoring tools, and personalized tools on the other hand are facilitated by network technologies in providing various capabilities that support student learning as pointed out in the section that discussed e-Learning technologies.
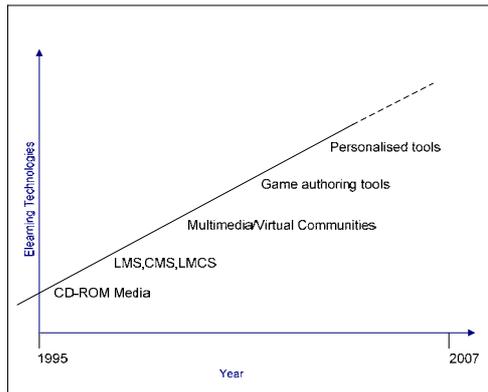

Figure 2: Evolution of e-Learning technologies

The development of e-Learning content has been highly facilitated by advances in e-Learning technologies. Content development has been transformed from text based to include multi-media supported content that caters for personalized learning, as illustrated in Figure 3.
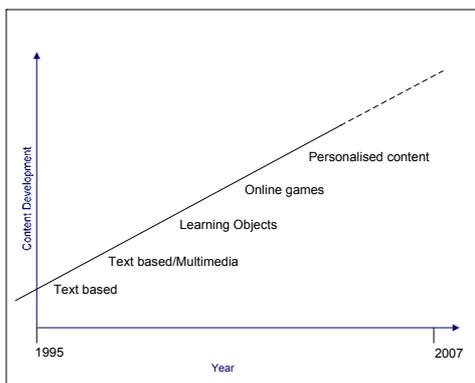
Figure 3: Evolution of content development

Implementation of e-Learning has been attributed to the evolution of technologies as described in figures 1-3. However, the implementation of e-Learning needs to be applied within a context, such as environment, resources, digital divide, in order to successfully realize the full potential of e-Learning.

5.2 Emerging issues within the higher education context

Despite the advancement of e-Learning tools, several emerging issues that have impact on successful e-Learning implementations in higher education have been cited. These include:

Identifying pedagogies underlying online courses
Successful implementation of e-Learning necessitates a two-tier training approach. The 'learning' which refers to pedagogical aspects, through which individuals learn, acquire and retain skills and information to facilitate knowledge development. The 'e' refers to technologies which communicates information to be learnt. This implies that the use of technology in itself does not cause or improve the quality of learning. To this effect, Garrison and Anderson (2003) assert that "*to realize that potential of e-Learning as an open but cohesive system to support learning, it is essential that we rethink our pedagogy*".

Improving ICT skills
The level of ICT skills for both teachers and students affects the effective use of technology to support online instruction. For instance, Muilenburg and Berge (2005) point out that confidence and comfort in using ICT reduces barriers to social interaction, administration, learner motivation, and time. Therefore, the lack of relevant skills interferes with the learning process and often causes problems for both teachers and students.

Technology use
Miller *et al.* (2003) assert that "*[the] arguments against online learning often focus on what is viewed as negative impacts from not having face-to-face contacts and anxiety caused by the nature and quantity of information transmitted through technology*". In this regard, reluctance of teachers in adopting e-Learning relates to their being too traditional in their teaching style, unwillingness to adopt change, or perceived increased teacher work load (Watson 2001).

Management support
Furthermore, e-Learning initiatives require full commitment and support from management for their operationalisation and sustainability. Successful transitions to more flexible modes of delivery require significant buy-in from senior management and a long-term commitment to support, foster, and monitor strategic change (Scottish Funding Council 2007). Marshall and Mitchell (2002) further point out the need to improve organisational processes associated with e-Learning. O'Hearn (2000) contends that university structures are rigid and unproven, regarding the incorporation of technological advancements.

6. Conclusion and future works

There is a strong need for identifying suitable strategies for effective e-Learning implementation and we have here provided a general overview of various theories for learning processes and methods. We have analysed some quite recent e-Learning implementation trends and discussed e-Learning implementation aspects.

More specifically, we have discussed e-Learning state of art, eliciting different implementation strategies indicating the continual evolution of e-Learning. We have also taken a look at e-Learning within a higher education context and emerging issues that have impact on its implementation. We, as many others, have noted that e-Learning implementations are serious commitments in a variety of ways, involving encompassing change processes which consider strategic, didactic, organisational, economic, and cultural dimensions for all stakeholders (Schönwald 2003).

From the emerging issues of e-Learning implementation within the higher education context, two problems emanate: 1) the limited uptake of technology as an instruction delivery method; and 2) the ineffective use of technology to support learning. In respect to this, future research should therefore seek to further investigate these aspects and to explore suitable approaches for effective implementation of e-Learning to support learning. Not the least in higher education contexts.

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