

An examination of critical success factors in the implementation of ePortfolios in universities

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Many Australian university teachers have been experimenting with the use of ePortfolio applications as a learning tool for students in recent years. The typical characteristics of an ePortfolio include a learner-centred approach, formative assessment, and collaborative sharing. These characteristics enable a highly individualised elearning environment. However, few teachers conduct early assessments to determine if their students, syllabi, and learning environments suit the implementation of ePortfolios. This paper presents an overview of the critical success factors in elearning and mlearning from existing literature and offers a set of critical success factors which could be used by teachers to determine if the use of ePortfolios is appropriate for their class settings. The identification of these factors is based on investigations of previous successes and failures of ePortfolio projects and other elearning systems and tools in learning environments. While previous research focused primarily on pedagogical approaches, technology, or aspects of the learning environment, this work-in-progress attempts to adopt a broader perspective, taking into consideration other factors such as social network strategies, usability studies, and factors in human-computer interaction design. It is argued that a preliminary assessment of the critical success factors would help the teacher to decide whether to use ePortfolios, and minimise the chances of failure or rejection by students. The identification of the critical success factors would lead to a comprehensive model for the implementation of ePortfolios in universities.

Key Words: ePortfolio, elearning, social presence, CSF, HCI.

1. Introduction

Professionals from the creative industries, such as artists, designers, and architects, often keep portfolios to showcase their work. A portfolio is essentially a collection of the achievements and products of a person's career. The same concept has been extended to electronic versions of portfolios, dubbed ePortfolios, since the 1990s (Barrett & Carney, 2005) in the field of education and assessment. With ePortfolios, users are able to document their projects, essays, assignments, and theses as online versions of portfolios. The data and work stored in ePortfolios also enable users to keep track of and reflect on the growth of their competencies and performances. Users of ePortfolios can opt to share access to their work with other users. This would allow other users to post comments, criticisms, and assessments. Many researchers have attempted to define ePortfolio by focusing on its approach (Cotterill, 2008), learning processes (Calderon & Hernandez, 2006), and purposes (Dorninger & Schrack, 2007).

Love, McKean, and Gathercoal (2004) attempted to distinguish between the terms "hardcopy portfolio", "ePortfolio", and "webfolio" by examining their "maturity" levels. They suggest five levels of maturity: "scrapbook, curriculum vitae, curriculum collaboration between student and faculty, mentoring leading to mastery, and authentic evidence as the authoritative evidence for

assessment, evaluation, and reporting” (Love et al., 2004, p. 26). The researchers elaborate that “hardcopy portfolios” are paper based, “ePortfolios” are digital (could be stored in any memory device), while “webfolios” are internet based. The authors posit that only webfolios could achieve all five levels of maturity, while hardcopy portfolios and ePortfolios merely achieve the first two levels of maturity, being showcase portfolios at best (Love et al., 2004, p. 26). In this paper, however, our use of the term “ePortfolio” takes into consideration all forms of digital portfolios. Since the World Wide Web supports any digital form of data, the line of separation between ePortfolios and webfolios is grey at best. In the context of education, we also do not perceive “showcase portfolios” to be any different from “educational assessment portfolios”, and argue that a “showcase” is merely the end result of the learning process of an ePortfolio project. In other words, the journey leading to the showcases in ePortfolios is always a learning process, irrespective of whether it is formal or informal. However, the use of ePortfolios in education institutes usually requires teachers to formalise the learning processes and assessment. It should be stressed, nevertheless, that is not the intention of this paper to discuss or debate the different types of ePortfolios. Instead, this paper adopts Brown’s (2008) definition of ePortfolio as “an online collection of reflections and digital artefacts that students can use to demonstrate their development over time” (p. 43).

Though introduced in the nineties, ePortfolios became increasingly popular in higher learning institutions only recently (Ishaya & Wood, 2005, p. 1). In 2007-2008, four universities in Australia (Queensland University of Technology, University of Wollongong, University of New England, and University of Melbourne), worked with the Australian Learning and Teaching Council (ALTC) and experimented with the use of ePortfolios (Hallam et al., 2008). Other universities such as RMIT began testing the use of ePortfolios in 2008 (Botterill, Allan, & Brooks, 2008).

The benefits of an ePortfolio learning system as opposed to the typical traditional elearning system is that it allows for reflective learning, is suitable for constructivist approaches (Chau & Cheng, 2010), is a manifestation of the life-long learning philosophy (Barker, 2006; Dorninger & Schrack, 2008; McAllister, Hallam, & Harper, 2008), and acts as a single repository for work done (Ittelson, 2001). In other words, the ePortfolio is thought to be an appropriate application for modern teaching, especially in higher institutions of learning, where many educators are moving towards life-long learning strategies. Though ePortfolios have been touted to be the next generation elearning tool (Barker, 2006, p. 3; Ittelson, 2001, p. 44), most implementations of ePortfolio projects in universities do not take into account the new sets of problems and challenges, and choose to treat them like typical elearning software or applications. One of the key research areas for ePortfolio implementations is, hence, the identification of success factors (Dorninger & Schrack, 2008).

This article proposes a set of possible Critical Success Factors (CSFs) for ePortfolios based on the analysis of existing literature. Four of the CSFs are derived from an overview of previous CSF studies on elearning and mlearning (i.e. mobile learning), while two are based on studies of website usability and social network applications.

2. Overview of CSF studies in elearning and mlearning

Critical success factor (CSF) is a concept developed by Rockart in 1979 (as cited in Turban, McLean, & Wetherbe, 1999). It has been used widely in the area of knowledge management, especially by information systems specialists. According to Freund (Selim, 2007), critical success factors are “those things that must be done if a company is to be successful” (p. 397). In other words, identifying CSFs is crucial for an organisation or a project to achieve its aims. Traditionally, CSFs are developed through a series of personal interviews followed by refinements through the organisational objectives (Laudon & Laudon, 2006; Turban et al., 1999). CSFs are often strategic, managerial, or operational in nature and should be measurable, easy to monitor, and able to be benchmarked to standards (Turban et al., 1999). As CSFs are generally designed along the perimeters of the objectives of the project, they help project managers keep the projects in check if used efficiently.

In the last decade, some researchers have attempted to identify CSFs in elearning (Selim, 2007; Soong, Chan, Chua, & Loh, 2001; Sun, Tsai, Finger, Chen, & Yeh, 2008; Testa & Freitas, 2004; Volery & Lord, 2000). At the same time, other researchers (Barker, Krull, & Mallinson, 2005; Cochrane, 2010; Herrington & Herrington, 2007) have looked into the CSFs of mobile learning. While the use of ePortfolios is fast gaining popularity in the tertiary education system, very few studies which specifically focus on ePortfolio CSFs have been conducted.

To obtain a general overview of CSFs in elearning and mlearning, an analysis of five different key studies was conducted. Of these, only one (Gathercoal et al., 2002) focused specifically on ePortfolios. The five studies are as follows.

2.1. Study 1

Cochrane and Bateman (2010) conducted studies on mlearning projects for three years. Their studies attempted to explore the key factors for the integration of wireless mobile devices within tertiary education courses. The research adopted an action research methodology using five case studies. The study concluded that the CSFs for mlearning are:

the level of pedagogical integration of the technology into the course criteria and assessment, the level of lecturer modelling of the pedagogical use of the tools, the creation of a learning community, the appropriate choice of mobile devices and Web 2.0 social software, technological and pedagogical support, and allowing time for developing an ontological shift, both for lecturers and the students. (Cochrane & Bateman, 2010, p. 6).

While most of these CSFs are self-explanatory, the researchers elaborated that “the level of lecturer modelling of the pedagogical use of the tools” refers to how a lecturer steers a student to reach the level of the lecturer’s competency (Cochrane, 2010, p. 3). This CSF also includes the development of relevant activities based on social constructivist theories (Cochrane, 2010, p. 3).

2.2. Study 2

In 2002, Gathercoal, Love, Bryde, and McKean (2002) proposed a comprehensive list of CSFs for the successful implementation of webfolios. The CSFs proposed by the researchers were based on the experiences gathered during the implementation of a webfolio project in the California Lutheran University’s School of Education. The CSFs proposed include: information services cooperation, administrative support, technology infrastructure, portfolio culture, student learning-centred culture, “implementing force” and project champions, implementation milestones, training and help resources, faculty commitment, a standards- or competency-based curriculum, integrated curriculum developed by teams of faculty, and feedback provided by supervisors and mentors using the webfolio. While the list of CSFs provided by the researchers provided early clues to possible CSFs for ePortfolios, they are unfortunately not based on a systematic qualitative or quantitative methodology.

2.3. Study 3

A quantitative study by Volery and Lord (2000) collected 47 responses to online learning administered to students at Curtin Business School’s Global Business 650 course. The aim of the survey was to collect data to form CSFs for online learning (Volery & Lord, 2000, p. 216). Based on a factor analysis performed on the data, three CSFs were identified: “technology (ease of access and navigation, interface design and level of interaction); the instructor (attitudes towards students, instructor technical competence and classroom interaction); and the previous use of technology from a student’s perspective” (Volery & Lord, 2000, p. 222). The researchers identified two limitations of their studies: the small sample size (n = 47), and the unavailability of student grades as a measure of student performance.

2.4. Study 4

Selim’s study (2007) on the CSFs for elearning was based on a survey administered to 900 undergraduates at the United Arab Emirates University (n = 538). Using structural equation

modelling, the study identified eight CSFs which were classified under four broad categories: instructor characteristics (attitude towards and control of technology, and teaching style); student characteristics (computer competency, interactive collaboration, and elearning course content and design); technology (ease of access and infrastructure); and university support. Selim (2007, p. 409) examined the critical level of the CSFs by determining the validity coefficients of each CSF and its expected criticality levels. However, it does not explore any causal relation between the CSFs proposed.

2.5. Study 5

The work by Soong, Chan, Chua, and Loh (2001) on CSFs for online course resources at Nanyang Technological University resulted in five CSFs: human factors (adequate time and effort by instructors, instructional motivational skills); technical competency (instructor and student to be IT competent); mindset (instructor and students should have a constructivist mindset); level of collaboration (course design – high levels of collaboration, marks for online discussions); and perceived IT infrastructure (online resources to be perceived as user-friendly and useful, and technical support for instructors and students). The study was based on interviews with instructors, a survey of students, and records from forum logs and emails.

Table 1 summarises the CSFs identified in the five studies above by re-classifying them into groups which share similar characteristics.

3. Re-classified critical success factors

While the methodologies adopted by the researchers described in Section 2 differ, it is clear that many generalisations and shared findings can be drawn from the results of their studies. An analysis of the factors in the five studies reveals that the CSFs proposed could be represented by four major categories. The Venn diagram in Figure 1 shows how the CSFs in Table 1 could be represented broadly by these factors. The groups are: user, infrastructure, learning approach and teaching pedagogy, and community. The descriptions of the four factors in this section take careful consideration of some of the CSFs which overlap. The CSFs which overlap are absorbed into one of the categories and included in the descriptions of the CSFs as described later in this section.

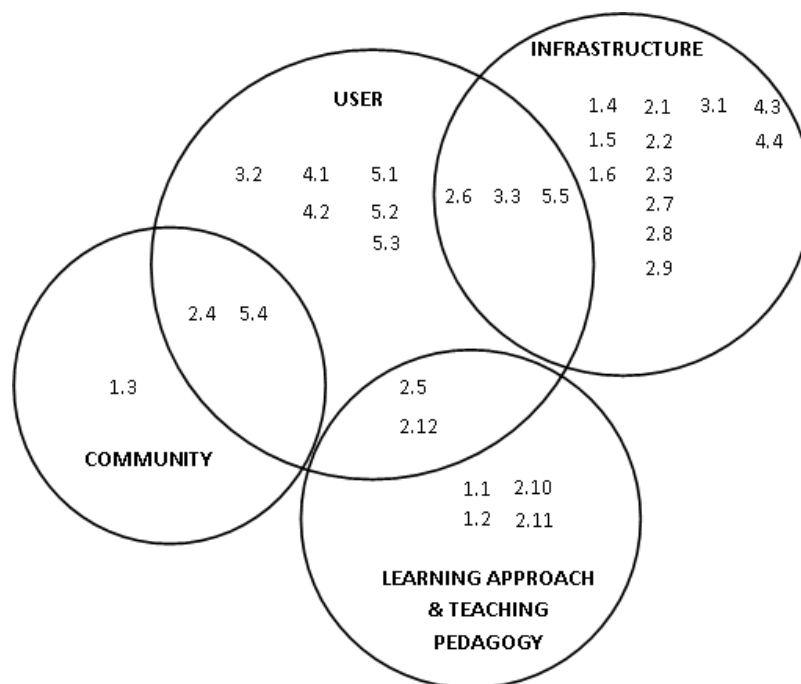


Figure 1. Re-classification of Critical Success Factors

Table 1. Summary of CSF Studies in eLearning and mLearning

CSFs	Study 1 (Cochrane, 2010; Cochrane & Bateman, 2010)	Study 2 (Gathercoal, et al., 2002)	Study 3 (Volery & Lord, 2000)	Study 4 (Selim, 2007)	Study 5 (Soong, et al., 2001)
Infrastructure	1.1 Appropriate choice of mobile devices and Web 2.0 social software 1.2 Technological and pedagogical support 1.3 Allowing time for developing an ontological shift	2.1 Information services cooperation 2.2 Administrative support 2.3 Technology infrastructure 2.7 Implementation milestones 2.8 Training and help resources 2.9 Faculty commitment 2.6 "Implementing force" and project champions*	3.1 Technology (Ease of access and navigation, interface design, level of interaction) 3.3 Previous use of technology from students' perspectives*	4.3 Information technology (ease of access, infrastructure) 4.4 University support	5.5 Perceived IT infrastructure (online resources to be perceived as user-friendly and useful, and technical support for instructors and students)*
User			3.2 Instructor (attitudes towards students, instructor technical competence, and classroom interaction)	4.1 Instructor (attitude towards and control of technology, teaching style) 4.2 Student (computer competency, interactive collaboration, and elearning content and design)	5.1 Human factors (adequate time and effort by instructors, instructional motivational skills) 5.2 Technical competency (instructor and student to be IT competent) 5.3 Mindset (instructor and students should have constructivist mindset)
Learning Approach & Teaching Pedagogy	1.1 The level of pedagogical Integration 1.2 The level of lecturer modeling of the pedagogical use of the tools	2.10 Standards- or competency-based curriculum 2.11 Integrated curriculum developed by teams of faculty 2.5 Student learning-centred culture*			
Community	1.3 Creating a supportive learning community	2.12 Feedback provided by supervisors and mentors using webfolio* 2.4 Portfolio culture*			5.4 Level of collaboration (course design – high levels of collaboration (marks for online discussions)) *

* CSFs which may overlap

3.1. User

The users of the system would include not only the owner of the portfolio, but also the members he or she shares it with or allows access. In the context of higher education, these members would also include teachers or instructors and other students (sometimes even the technicians who are given access to troubleshoot problems).

The users' previous experience in the use of information technology would play a significant role in the success of the ePortfolio process. If users are not familiar with information technology, they will need to be trained. The training will encompass not only the use of the ePortfolio applications, but may also include information technology skills such as the use of word processing software, operating systems, and the internet (Soong et al., 2001).

The success of the user will also depend largely on the users' motivation to use the ePortfolio system. Extrinsic motivation (Hrabe, Adamy, Milman, Washington, & Howard, 1998) for the users could tie closely to the teaching methodology factor, where the teacher or facilitator can offer various incentives for the use of the ePortfolio system, such as grades for time spent in the use of the application or an efficient feedback system (Hodges, 2004). Research has shown that intrinsic motivation tends to have a higher impact on student success in elearning (Martens, Gulikers, & Bastiens, 2004). However, intrinsic motivation would largely depend on the user, and could very well be related to other factors, such as community, social presence, and fun.

For a typical student user though, the challenge is not only learning how to use the system, but using it consistently and regularly. Likewise, the typical teacher user would also need to adapt his or her teaching style to the ePortfolio system (Selim, 2007). As an elearning facilitator, the teacher's role is important in acting as an example for the students.

3.2. Infrastructure

Infrastructure is a broad term which encompasses the hardware, software, and network of the system. Hardware would include any device used to access the ePortfolio software and the internet, such as a computer, an iPad, or even a mobile phone. Hardware would also include servers, which not only act as remote storage for data, but also store and run applications. The use of inappropriate hardware and technology might severely hamper the success of the ePortfolio project (Gathercoal et al., 2002, p. 34; Selim, 2007, p. 409).

The software would include any resident application or online application which runs the ePortfolio system. The software infrastructure would also include the design of the ePortfolio application. The design would need to take into consideration aspects such as ease of use, perceived usefulness, interface design, and other human-computer interaction aspects. Access to broadband either via wired or wireless means is the final requirement to run an ePortfolio system so that data can be shared with other users.

The infrastructure requires regular maintenance through a host of support services, including the information technology support services in the university, as well as help desk officers or trainers who would train and help users to solve any problems related to the ePortfolio systems. Users' perception of the support and infrastructure provided to them will foster more user confidence in the use of ePortfolios (Soong et al., 2001, p. 114).

Typical of any information system project, the infrastructure for ePortfolios should take into consideration the relevant managerial support required (Ward & Peppard, 2008, p. 128). These include the champions of the ePortfolio projects and steering committee (Ward & Peppard, 2008, p. 172).

3.3. Learning approach and teaching methodology

The use of ePortfolios requires a different approach to learning and teaching (Hamburg, Lindecke, & Thij, 2003). Research into ePortfolios has shown that it is best suited for reflective learning (Hughes, 2008; Lambert & Corrin, 2007; Meredith, 2010). The ePortfolio student will need to learn that an assignment is not an overnight piece of work, but a project which requires

ideas to be learned, formed, drafted, redrafted, and proofread, during which it is consistently reflected on for improvements. In order to inculcate such behaviour in students, assignments and projects will require constant progressive monitoring and assessment (Acosta & Liu, 2006, p. 19; Wyllie, 2010, p. 2).

In tandem with the reflective learning strategy often used for ePortfolios (Doig, Illsley, McLuckie, & Parsons, 2006, p. 164; Roberts et al., 2005, p. 6; Stefani, Mason, & Pegler, 2007), researchers often advocate the use of the constructivist approach to teaching (Gulbahar & Tinmaz, 2006; Soong et al., 2001). The constructivist approach is deemed suitable for the ePortfolio due to its student-centric nature (Read & Cafolla, 1999, as cited in Gulbahar & Tinmaz, 2006). Since reflective learning often requires students to spend time to think and redraft their work, the change of teaching approaches and methodologies could potentially mean a change of the respective syllabus or curriculum.

The different learning and teaching approaches to ePortfolios would mean a reassessment of evaluation techniques conventionally used in education. Unlike the typical paper-based assessment which is submitted before a deadline, the reflective style of an ePortfolio would be better suited to a progressive assessment, in which the teacher provides formative assessment on the “journey” of the project and not only on the end product. Other invited students can also make comments and participate by providing informal assessment to the owner of the portfolio. This may change the traditional marking scheme of a project significantly and marks could be awarded to different stages of the project, instead of just the finished product. The teacher may even allow the students’ peers to co-assess the ePortfolio. Research (Chang & Tseng, 2009) has shown that even the student user can also be a self-assessor of his or her own work.

3.4. Community

Generally, community refers to the entire group of ePortfolio users that each user is linked to. The community centres on a user and includes other shared users in his or her ePortfolio network. The community is important because it plays a role to ensure that feedback, comments, and assessments are actively shared among its members. In this sense, the community’s participation in the ePortfolio system builds the knowledge base for the general community (Thomas, 2005). For example, research by Drouin (2008) shows that students who participate actively in discussion boards tend to demonstrate a stronger sense of community. In an ePortfolio system, a passive community would result in poor communication and low interaction among members, limiting crucial information which could potentially allow the user to better reflect on his or her portfolio. On the other hand, a community which is overzealous could also provide information overload, or inaccurate or mixed feedback which may confuse the student user. Therefore, the teacher as the gatekeeper of information (Cobbah, 2004, as cited in Abuzaid, 2007) needs to control and monitor the feedback to ensure that the community contributes constructively and thrives healthily.

In the context of community, the culture of the users as a whole also needs to be considered. A community which has poor motivation or is not engaged will result in the project losing momentum. At the same time, a collectivist community would behave very differently as compared to an individualistic community. In this sense, the community members’ frustrations, perseverance, and commitment need to be monitored closely by the teacher.

4. CSFs from social networks and website usability studies

The five studies examined in Section 2 do not take into consideration possible CSFs from website usability and studies of social networks. As ePortfolios in universities are often implemented in a web environment, the previous studies of website usability should not be ignored. ePortfolios also share many similar characteristics with social networks: they are primarily used to store and showcase information, and are a medium of communication within a user’s social or academic network. Hence, the investigations on the success factors of social network applications should also be taken into consideration.

Two other factors from previous research, found to significantly impact web experience, are social presence and fun.

4.1. Social presence

The social presence theory was first proposed by Short, Williams, and Christie in 1976, who advocated that it measures the degree or quality of “being there” between two or more users in a communication medium (as cited in Lowenthal, 2009, p. 127). In short, the higher the social presence, the more involved the users in the communication process. Researchers (Allmendinger, 2010; Kehrwald, 2008; Lowenthal, 2009; Rouke, Anderson, Garrison, & Archer, 2001) have concluded that social presence plays an important role in the success of elearning. Hamburg et al. (2003) argue that social presence is especially important in elearning due to the lack of non-verbal strategies (used in face-to-face communication, such as gesture and facial expression) in web-based communications. Social presence is closely associated with connectedness, which could arguably be developed by the act of sharing (Bolliger & Shepherd, 2010), by for example, the sharing of an experience. As sharing is an important element in ePortfolio systems, the role of social presence is a crucial CSF to consider in the implementation of ePortfolio projects. To prevent the sharing of ePortfolios from turning into mere individual showcases, instructors should ensure that reflective learning takes place (Greenberg, 2004, p. 33).

Social presence has also been found to be the key ingredient of the success of social network sites such as Friendster and Facebook (Chiu, Cheung, & Lee, 2008, p. 72). Social network sites “provide users with a profile space, facilities for uploading content (e.g. photos, music), messaging in various forms and the ability to make connections to other people” (Joinson, 2008, n.p.). In this respect, an ePortfolio site generally does the same in that it provides a space for users to upload and share documents made up of assignments, projects, and essays, and allows communication with other users. Greenberg (2004) elaborates that ePortfolios act as a “catalyst” to evoke feedback on students’ work, “for communication and interaction with teachers, mentors, peers, colleagues, friends, and family” (p. 28). Research by Bumgarner (2007) shows that voyeurism and exhibitionism are some of the main motivations for using Facebook. In the same manner, one could argue that one of the main motivations to use ePortfolio may very possibly be the ability for a user to show off his or her projects to members of his or her social network. This is evidenced by research which suggests that ePortfolio users showcase their work as a form of reflective learning (Barrett, 2010, p. 6). The importance of showcasing an ePortfolio led researchers (Kheng, Ho, Cheng, & Ling, 2005, p. 3) to suggest that showcasing reflects an ePortfolio users’ competence.

4.2. Fun

Researchers who examined the CSFs for elearning and mlearning seemed to have omitted a rather crucial factor – fun. The importance of fun as a success factor for ePortfolios should be seriously considered, as the primary users of the application are mostly young university students, who may quickly lose interest in the use of the application, should they find it dull. Research also indicates that students’ feedback on *early* designs of ePortfolios has shown that they generally do not find it fun (Chau, 2007; Cotterill, McDonald, Drummond, & Hammond, 2004). A simple example of fun in elearning could be humour (Taran, 2005), an apt motivation for elearning.

Fun is important because it diminishes the problem of remoteness in elearning (Neal, Perez, & Miller, 2005), where students tend to learn in isolation without the company of other students. It should be noted that, while Soong et al. (2001, p. 108) made mention of “enjoyment” in their model, this factor was listed as a product of the CSFs, but not a CSF in itself. This contradicts a study by Agarwal and Smith (2000), which reported an association between “playfulness” and “cognitive absorption” in the use of the World Wide Web. The findings by Agarwal and Smith suggest that an ePortfolio which is fun can engage users. This is further supported by research which found that users generally reported ePortfolios as enjoyable and fun to use (Duke, 2010, p. 91; Smallwood & Hartnell-Young, p. 312). Duke (2010, p. 96) also reported an association

between the “fun” factor and users’ motivation to continue the use of ePortfolios. In summary, the literature above suggests strongly that fun should be considered as a CSF for ePortfolios.

Collectively, the proposed CSFs can be described in the diagram below (Figure 2):

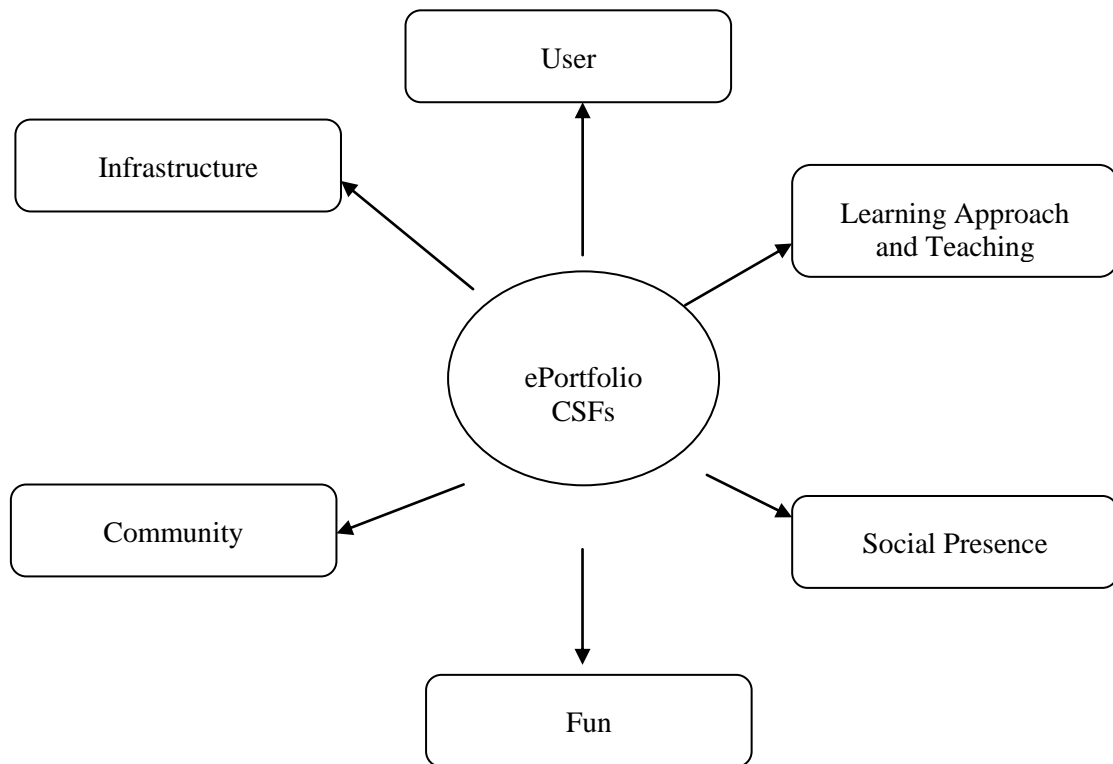


Figure 2. Critical Success Factors for ePortfolio

5. Conclusion

This study was motivated by the current interest in ePortfolios in tertiary education institutions. It attempts to apply the concept of CSF from the knowledge management domain to ePortfolio. It does so by summarising the results of previous CSF research on elearning and mlearning and proposing two new CSFs which are based primarily on successful social network applications and usability studies. This resulted in a total of six possible CSFs to be considered for ePortfolio implementations. Further testing using the typical methodologies in CSF studies using various qualitative and quantitative methods (Ward & Peppard, 2008, p. 139) is necessary to validate the effectiveness of the proposed CSFs for ePortfolio implementations in universities.

A few implications follow the proposal of the CSFs for ePortfolios. First, the six CSFs should provide a good guideline for a teacher who intends to implement ePortfolio in a tertiary programme. The CSFs can act as a checklist to ensure that ePortfolio projects potentially meet the necessary critical factors before implementation. Educators can also periodically check the factors to ensure that they are consistently in control throughout the ePortfolio project. Second, the critical success factors can be used to benchmark the success of an ePortfolio project against other ePortfolio projects by allocating weights to each factor as a form of measurement for a decision matrix or weighted decision table.

Further research to develop standard weights for all CSFs for decision criteria could be conducted in the future so that some form of weighted scores could be calculated before the start of an ePortfolio project to gauge its probability of success. In addition, further research to quantify and confirm the significance, correlation, and regression of the factors could reveal interesting results.

In conclusion, the objective of this paper is to propose a complete set of CSFs for ePortfolio projects in tertiary institutions. Considering the increasing popularity of ePortfolios as tools for

teaching and learning, it is worth exploring the CSFs prior to and during the implementation of an ePortfolio system.

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