



Innovative Shift in Smart Learning Environment

Hadya S. Hawedi^{1*} and Abdulghader Abu Reemah A. Abdullah²

¹*Faculty of Information Technology, Al Asmarya University, Libya.*

²*Faculty of Education, Bani Waleed University, Libya.*

Authors' contributions

This work was carried out in collaboration between both authors. Author HSH designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author AARAA managed the analyses of the study and managed the literature searches. Both authors read and approved the final manuscript.

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ABSTRACT

Innovations in smart learning represent a domain of knowledge transfer platform to boost the effectiveness of the educational practices and learning outcome. The uniqueness of this form of electronic-assisted has been widely accepted as it provides its users with a powerful multi-search tool to access learning content that meet their intended needs. The transformative changes in the learning platform provide a flexible teaching/learning online outlet that has increasingly been adopted to improve learning outcome. In this study, the effectiveness of innovation in information and communication technologies (ICT) as a platform to rapidly transformed learning environment is discussed. Potential of smart learning environment is discussed and relevance of its flexibility in the learning environment and adaptable features for training workers in an organizational setting. This review extensively highlights the position of smart learning system in improving conventional learning and organizational practices that are limited in scope and their functioning environment.

Keywords: Smart learning environment; ICT; learning culture; learning environment; macro learning.

*Corresponding author: E-mail: hadia20008@asmarya.edu.ly;

1. INTRODUCTION

The emergence of information and communication technologies (ICT) has transformed learning platform and the flexibility in delivering learning content electronically (Bossu, Smyth & Stein, 2007). This change in the learning platform is rapidly generating a growing interest to adopt smart learning technology. Smart technology is effective and efficient to potentially transform the educational sectors and improves academic performance of students. Smart learning environment created new learning/teaching environments system with pedagogical, technological and organizational components [1]. Abundance of research suggests the importance of participating in an interactive learning environment with the interest to increase learning outcome ([2], Brower, 2003; Shea et al. 2004 & Swan, 2003; [3]). Mutual interaction exists when students benefit from each members of the group and shares valuable ideas among themselves.

However, interaction in the learning among learners has a direct impact on individual learning outcome [4,5]. The nature of participant's interaction partly determines the level of success in online environments. In contrary, little attention has been paid to examine the nature of interaction across large sample of participants from different online environments [6]. However, this could possibly be as a result of the emergence of high innovative online learning environment that outperform conventional face-to-face environment.

The flexibility of asynchronous distance education is valued since students and lecturers need not be online at the same moment however, flexibility is advantageous in an international context where time zones necessarily distribute student's responses. Research examining time intervals for discussion responses could be helpful in this context. Studies by Liang et al. (1999) described cultural differences in participation patterns. To account for the differing cultural differences, the learning experience should develop a contextual learning platform such as smart learning environment for culture-specific institutional and organization (Hiltz & Arbaugh 2003; [7]). Online learning platform provide additional international learning opportunities to students. Macfayden and Hawkes [8] tracked six online international education projects and found general satisfaction with the efforts. Troutman (1991) reported that

students who feel secure in their own personal use of computers also feel positive toward the use of computers in the schools.

2. MACRO-LEARNING

Macro learning environment provides instruction teaching to an entire class at an extended period of time exceeding 10 minutes [9]. Macro teaching environment is conducted in lecture format and is used to introduce new learning practice a skill. Macro learning environment conveyed learning material using digital technologies and media. Macro learning has been promoted as being more effective, suitable and expands opportunities for life-long learning. Macro learning provides learning timely platform that reaches wider audience and holistically shares knowledge resource.

While building relationships are constrained by the distances that prevent face-to-face meetings and complicated by cultural differences. Kim and Bonk's [10] studied participation variables among students in Finland, South Korea, and the US and concluded that the range of responses can be seen in students with respect to practices and culture. The study concludes that Finnish students were more likely to compose group email responses, and more likely to post summaries of comments. It has been reported that American students participated in email discussions more than their Finnish peers, a result explained by the authors as Finns tend to keep silent and not to speak too much, whereas silence is not habitual with most Americans (Livonen, Parma, Sonnewald & Poole-Kober, 1998).

Other study asserted that the interactive learning style typical of current classroom conferencing software such as blackboard is most welcomed by peer-oriented learners such as those in the U.S. it was found Asian students relies heavily on direction from their teachers, even in an online environment (Liang & McQueen, 1993). However, participation rates for Asian students were influenced by faculty involvement, while American students sought regular involvement with respect to their peers. These studies confirm that participation behaviours vary with culture and peers. Study by Arbaugh et al. [2] reveals that participation and interaction in distance education formats measures student perceptions of interaction as well as participation. Students can however, underestimate their actual level of participation. Such estimation need not to be the

only source of data for participation studies. Online courses could provide archival records of student and instructor participation during course period together with track participation by individuals and groups over the course [11]. Macro learning environment is not extensive as smart learning however; macro learning environment is an effective learning path to achieve long-term learning outcome.

3. MACRO AND SMART LEARNING CULTURE

Four essential elements of classroom learning community such as spirit, trust, interaction, and learning were described by Rovai (2000) and have been supported by other researchers (Maznevski et al. 2000; [5]). The suggestion were based on the view that online relationships may not be as effective as face-to-face classroom interaction although there are some evidence that personal relationships may develop over time (Desanctis et al. 1999; [12,13]). The elements supporting face-to-face learning environment was based on the fact that relationships develops over time and can be constrained by visual presentation of online environment.

However, need for efficient and timely communication takes precedence over more relational-based classroom communication to deliver learning content more effectively online [14]. Smart learning environment provides broader scope of learning using configurable infrastructure that integrates learning material, tools, and services into a single solution that creates and delivers training or educational content effectively, quickly, and more economically (Zhang et al. 2006; [13]). Online virtual spaces is designed to link with abundant internet resources that very useful and improves learning experience and learning outcomes and are also essential for training and equipping workers with specific knowledge that complies with the organization management [15].

In earlier studies, comparisons have been made between the effectiveness of online learning and face-to-face learning. Russell (1999) made an inventory of many of these media comparison studies and concluded that there is no significant difference between the average performances of learners in the case of face-to-face learning compared to learners exposed to distance learning methods. In addition, Ross and Bell (2007) added that this could be dependent on the level of learning found no significant

difference in performance at lower levels of abstraction among students in the traditional setting compared to online students. Students in the traditional setting outperformed online students with respect to higher order learning through analysis and synthesizing information. Internet-based learning provides opportunities for learners to chosen time and location besides; it allows participants to interact with each other with wide range of online resources (Xu & Wang, 2006; [13]).

With the increasing knowledge online learning platform, student are becoming more constructive in adapting internet resources and are fast developing interest in collaboration with other online group to share knowledge and increase learning scope of traditional classroom learning environment (Benbunan-Fich & Arbaugh, 2006). Collaborative with different online learning group enables learners to gain greater opportunities to increased their social presence and develop greater sense of online community with positive online course outcomes [14]. The combination of knowledge construction with the opportunity of collaborating with online members improves the learning outcome of web-based learning environments. Besides, interacting online with other learners reduces anxiety and encourages learners to communicate more frequently with their colleagues (Hiltz et al. 2002).

4. MOTIVATION TO ADOPT SMART LEARNING SYSTEM

Motivation among student to use smart learning system keep increasing as need for computer skill widens and becomes the main component of the learning environment. Motivation can grouped as intrinsic and extrinsic however; both form of motivation in learning is very important in students' learning experiences. Intrinsic motivation refers to individual supportive interest, self-requirement, self-determination, self-regulation as well as the autonomy of learning while extrinsic motivation is the external factors that stimulate learners such as behaviours of teachers, learning topics, learning-teaching strategies, teaching-learning process, interaction among students and teachers. Report on motivational perspectives to understand behaviour predict the acceptance of technology. Intrinsic and extrinsic motivation has been found to be key drivers of behavioural intention (Vallerand 1997; Venkatesh 1999). Woldkowski defined intrinsic motivation as an evocation, an

energy called forth by circumstances that connect with what is culturally significant to the person. Intrinsic motivation is built in learning theories and is used as a constructive measure for user perceptions of technologies (Woldkowski, 1993; Venkatesh 2003; [16]).

Extrinsic motivation encourages students to commit themselves to instructional goals and however; increases student's achievement earning them reasonable grade or degree. Motivation is a variable that affects student's learning. Students in the virtual learning environment need external motivation in order to stimulate and to support their participation in virtual learning environment. Deci and Ryan [17] defined extrinsic motivation as the performing of behaviour to achieve a specific reward. From student's perspective, extrinsic motivation on learning may include and not limited to higher grade in exams, awards as well as in prizes winning. Extrinsic motivation could be seen as a factor that influences learning and partly determinant factor to student grade.

However, the increasing need to incorporate smart learning platform is motivated by its extensive connectivity that reaches different databases to provide adequate information to enrich learning content. The innovation in online-based learning systems is fast increasing student's autonomy to reach diverse heterogeneous audience. The emergence of online based learning has generated great deal of interest in developing user-specific learning content that are automatically generated upon request by different users. The smart learning platforms have been considered a transformative shift in the way classroom learning is conducted in the education system (Alam & Sadaf, 2015). Smart learning utilizes its design-specific subject selection and dynamic sequencing to provide an interactive learning that makes teaching easier using pre-set hypermedia learning content [18]. The hypermedia document for learning provides descriptive pages and instruction to guide the user on the generated content (Ferretti, et al., 2016).

The basic mechanism works with the steps:

- Captures and coordinate learning content digitally;
- Track all the reference points of the data and;
- Provide virtual information with the combined real environment and display.

5. SMART LEARNING TECHNOLOGY

Smart learning environment (SLE) entails physical space incorporated with context-specific and digitalized components that enhance the effectiveness and efficiency of learning outcome. The innovation in smart learning is a hybrid learning platform that operates independently and virtually unlike the conventional class learning that requires physical presence [19]. Smart learning technology is not confined to classroom learning but extensively accessible at different location and time and is available in analog and digital learning format [20]. The learning scenario of smart learning is flexible and provides learning options to meet learner's intended needs by processing available and abundant information from the environment to initiate learning through one or multiple steps shown in the Fig. 1.

5.1 Design Based on User' Need

The design concept of a smart learning environment is to specifically meet intended needs of its users. At this stage, the associate needs of users are taken into consideration individually to cater for the activities to carry out. The ability to comprehensively analyze individual needs contextually makes smart learning environment suitable a personalized learning that is compatible with formal learning.

5.2 Learning and Work Methods

The learning approach of smart learning environment is compatible with innovation in digital methodology of media and information communication technology. The incorporation of information and communication technology into teaching makes learning increasingly convenient and complementary in meeting a life-long demand across the globe. These transformative changes in the learning methodology will improve the way formal training is conducted in conventional classrooms. The new independent learning technique represents an efficient learning strategy for mentoring capable of merging physical learning environment with informal activities outside classroom. With the ability of smart learning system to use a personalized learning material across learning boundaries, it can be refer to as a hybridized learning environment that can be replicated in the work environment and to improve private life.

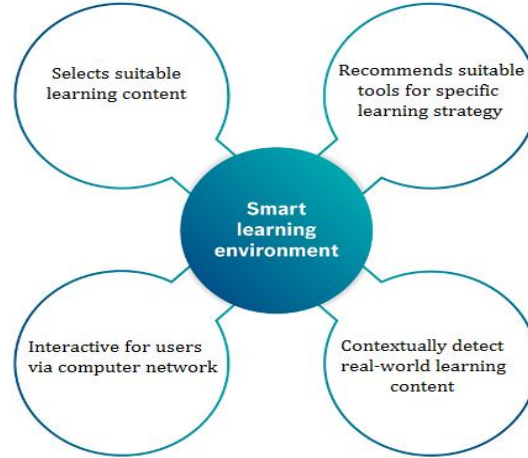


Fig. 1. Dissemination of learning content in the smart learning environment

5.3 Learning and Corporate Culture

The design concept of smart learning environment can be used to organizational practices and culture. As the innovative learning scenarios smart learning environment is context-specific, different work approach and processes can be presented individually relative to organizational culture. This form of learning platform is suitable to maintain a high sense of individualized responsibility.

5.4 Smart IT Infrastructure

Smart IT infrastructure is the heart of the system framework that supports learning environment and comprises of specific-designed hardware and software components at the interfaces to facilitate smart data exchange. This component of a smart learning environment generates and stores all the relevant information for used by the system in the cloud, automatically process them and make them accessible for users. The incorporation of semantic concepts makes it easier to present learning materials with relevant search category and data from online sources. Provision of access to streams of high-quality online learning content and online libraries with specialist databases enables smart IT infrastructure to access different datasets and extract relevant information that meets user's needs.

5.5 Digital and Physical Equipment

The size and space for equipment such as computers, projectors, conference systems and

other smart devices such tablets, 3D printers, smart TVs, smart pens, smartphones, power walls and smart boards can be combined in a co-working spaces as in Fab Lab Berlin and Impact HUB. Smart learning applications software supports sharing of learning outcomes and allows its users to create and edit graphics and videos during learning. The digital and physical equipment supports the processing of information that contributes to learning and work practice.

5.6 Workplace Architecture

The context-specific design concept of smart learning makes it suitable for academic and workplace learning culture and provides the right balance with the innovation in technology by combining key elements of modern multifunctional range of learning and work scenarios. Learning processes of a smart learning environment can be explained from six main areas as shown in Fig. 2.

6. BENEFITS OF SMART LEARNING

Smart learning environment promotes interactive learning and collaboration in the learning process. To achieve pedagogical improvements through online learning for teaching and promoting learning, instructors should empower themselves through the use of assessment tools that monitor student's progress [21]. The learner-centered strategy helps students develop critical thinking skills and allows instructors to assess students' progress (Odin 1997). Video serves as a sophisticated medium in smart learning

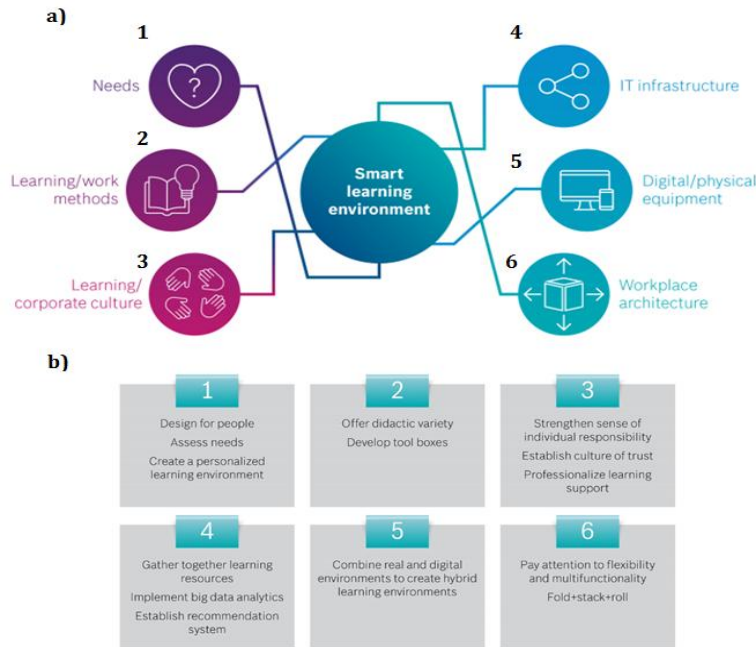


Fig. 2. Dissemination: Internet-connected smart learning design concept showing; 2a) components of smart learning process; 2b) Recommended design concept of a smart learning environment that complement an extensive design concept in Fig. 2a.Source: Klaus Burmeister, 2019

platform because; it is capable of presenting information in an attractive manner. Studies by Wieling (2010) confirm that using video for learning is an effective medium to improve learning outcomes.

However, instructional video is very effective for learning and training than face-to-face instruction (Zhang et al. 2006). Online video recordings of lectures allow students to view lectures note they have missed and also review lectures they have difficulties with to improve understanding. Chiu, Lee, and Yang (2006) investigated the viewing behavior of students in a Chinese grammar course when online post class lecture videos were made available. They divided students in two groups based on their viewing activity (top 50% and bottom 50%) and found no difference in course grades between the two groups corrected for their GPA. Additionally, they found that students had a preference for recordings of their own lectures as compared to lectures of a parallel group.

Ross and Bell (2007) compared the performance of students in a quality management course with access to face-to-face lectures as well as the online lecture video recordings to students who

only had access to the online lecture recordings. Using a regression analysis they found that the course score of students in the first group with access to the face-to-face lectures was predicted positively by their GPA, negatively by their age, positively by their homework performance and negatively by the number of lectures they viewed online. For students who did not have access to the face-to-face lectures, the course score was positively predicted by their GPA, negatively by their age, positively by their homework performance and positively by the number of lectures they viewed online. Perceived learning outcome is the observed results in connection with the use of learning tools. Perceived learning outcome was measured with performance improvement, grades benefit; and meeting learning needs. Previous studies shows that perceived learning outcomes and satisfaction are related to changes in the traditional instructor's role in an online learning environment. The recent advances in computer networking technologies and the World Wide Web (Web) break the physical and temporal barriers of access to education. The online learning environment frees students from the constraints of time and place, and it can be made universally available.

As online courses improves in educational institutions, assessing students' learning in an online environment is one of the challenges faced by lecturers [13]. The Exam Online is currently being improved on the basis of the two live pilots, for future work however, Inclusion of differentiated mark schemes for individual questions, integrated into the marking interface and Offline marking supports personal computers and laptops with later synchronization however; the main system are helpful. Other useful modifications include the integration with back end system for outputting results. Support for drawing diagrams when answering questions, potentially on-screen with options for hand written and paper based submission of calculation steps (Thomas 2004). In addition, simple question and answer measures into the marking process enhances accessibility for sight impaired students areas requiring modification.

7. ISSUES WITH ONLINE LEARNING ENVIRONMENT

Online learning platform provides learning content and allows its users to download files via the internet and thus requires an interface to prevent access to third party and unauthorized person. Installing a keyboard hook could help in trapping browser hot-keys that opens new browser windows and launches Internet Explorer in kiosk mode with buttons visible or available at the online learning login page. The approach is similar to commercial secure browsers such as Respondus Lock down Browser (Respondus, 2007) which prevents re-login without password.

Furst et al. [22] and Heninger et al. [23] highlighted that challenges such as personal relationship, adding new members restart the team development process which could disrupt the effort in expended by the original team members to develop a team identity and resolve conflicts early in their development. A number of earlier studies reported that participation patterns in online courses decline as the course progresses (Berger 1999; Arbaugh 2000). This could be as a result of limited knowledge of ICT infrastructure [24,7]. Innovation in ICT has shown to provide wide range of solution to earlier technological learning platform with the emergence of smart learning environment incorporated with cloud system.

Active participation through the program period requires extensive effort. In addition, it was pointed out that increase in the class size makes

it more difficult to develop a sense of online community while most studies conducted at American institutions show strong relationship between learner and instructor, learner's interaction and online learning outcomes [4]. The perceptions and expectations of the German students towards online learning platform suggest that the role of participant interaction may not be as strong in German institutions in meeting particular need for multi-national studies in online courses (Arbaugh & Hiltz, 2003). The instructors are often challenged with designing online discussion and assignments that encourage students to evaluate information, assimilate information as well as making comparisons and connections (Odin 1997; [24,3]). An assessment tool that monitors student's progress enhances the learning process however; assessment should be a continuous in an online learning environment.

For assessment to be useful as part of a learning process, it must be visible and related to the learning goals with assigned grades or marks for the data collected to measure student progress [14]. Educational material and online learning has challenged the effectiveness of the traditional educational approach in universities and other education institutions. Consequentially, these institutions struggle to restructure their strategies in providing education and delivering knowledge. There are great expectations surrounding the development and use of online courses owing to its versatility, flexibility and personalization potential. Online learning environment should have access to the learning resources for different course from online database.

8. CONCLUSION

Smart learning platform supports learning and teaching process using computer-enabled network. The learning platform is flexible and provides access to rich-information internet data system that are inter-connect and useful in improving learner's knowledge and experience. The emergence of ICT has transformed learning platform and increase flexibility in delivering learning content electronically. As learning platform is rapidly changing with the emergence of smart learning system, its adoption is generating a growing interest. Smart learning environment is designed to link with abundant internet resources and improves learning experience. Smart learning environment created new learning system with pedagogical,

technological and organizational components that are essential for context-specific training and equipping workers with special knowledge. Macro learning environment provides and efficient and effective instruction teaching but not extensive as smart learning environment although but share similar advantages. Smart learning environment is designed to meet specific need and it compatible with cultural differences where learning experience is contextual and culture-specific. The learning platform of smart system captures and coordinates learning content digitally. Information and data can be tracked from the cloud network to provide virtual learning/training information. Smart learning system design concept is modeled to deliver learning content and it is compatible for organization training for specific cultural practices. This because the learning environment has appropriate setting that supports digital cohort that is flexible to operate using multi-functional search. Smart learning innovation is autonomy and reaches diverse heterogeneous audience through its extensive connectivity that links to information-enriched online databases. Although there are handful of security issues to prevent unauthorized access; smart learning platforms has been considered an innovative transformative shift in the learning environment.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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