TELTSA - Technology Enhanced Learning: Theories, Systems, and Applications

Special Track along with BUSTECH 2018, February 18 – 22, 2018 – Barcelona, Spain
http://www.iaria.org/conferences2018/BUSTECH18.html

Rawad Hammad
Research and Learning Solutions
King's College London
UK, London
email: Rawad.Hammad@kcl.ac.uk

Kamran Munir
Computer Science and Creative Technologies
University of the West of England
Bristol, UK
e-mail: Kamran2.Munir@uwe.ac.uk

***Abstract*—Due to the rapid evolving theories and technologies supporting Technology Enhanced Learning (TEL), further investigation for this domain is needed. Therefore, a brief review for TEL past and current state-of-the-art has been performed to predict the future of TEL technologies. This has been supported by design science research paradigm as a research framework, which supports development of an automated analysis technique based on text-mining patients' feedback. At the end, a service-oriented architecture for TEL software system is presented in order to support end user(s) requirements; and more specifically, non-functional requirements.**

Keywords-Technology enahnced learning; design science research; e-learning; e-health; learning; SOA.

I. INTRODUCTION

Recent proliferations in Information and Communication Technology (ICT) impacted every single domain such as Technology Enhanced Learning (TEL) / e-learning, e-health, etc. Such impact includes development in technologies, hardware and software systems, more flexible and responsive artifacts, etc. Consequently, this has led to a higher adoption rate for these technologies. More specific to the TEL domain, significant shifts have been noticed in higher education institutes stretching from relatively simple changes such as adopting various TEL software systems through more complex changes such as changing their business models, staff training, moving towards electronic forms of teaching, learning and assessment. Learning is an essential process and it has been practiced in different ways *(e.g., traditional classroom, learning discovery, etc.).*

Investigating TEL domain is dominated to a large extent either by inventing new tools (i.e., practical-oriented) or putting forward new theories to accommodate new inventions (i.e., theoretical oriented). Despite the importance of such investigations, further critical analysis is needed to examine the impact of using TEL on learning. The 'enhancement' claim, which is very centric in all TEL research and practices, needs a precisely measure [1] via proper quantification for gained experiences (students, academics and institutions) [2]. The main aim of this special track is to inclusively investigate the current state-of-the-art research in TEL domain in order to produce novel contributions that could advance both TEL research and practice. This has been reflected on the contributions submitted to this special track as they covered the following three main areas: *First*, the future of TEL domain which briefly summarized TEL past and current situation and predicted its future, in general. *Second*, research methodology adopted for developing TEL-related artifacts, and third is flexible architecture for TEL solutions. Using software engineering software development life cycle analogy, these three different areas represent design, development and evaluation.

II. SUMMARY OF CONTRIBUTIONS

The first contribution presents the future of TEL. To do so, a brief review for TEL past and current situation has been presented. TEL past solutions have been characterized as *the first TEL generation*, which are mainly *monolithic black box systems.* Only few of this generation's applications are online, while the majority are standalone systems. Also, the key underpinning standards and models (e.g., IEEE LOM – Learning Object Model) of this generation are limited to basic, linear and static dictionaries. Finally, a limited adoption rate characterized this generation's application due to reluctant users. The second generation (i.e., current TEL) brings more modular software systems, as many third party or plugin-based applications proliferated. In this generation, a big move toward more comprehensive standards has been noticed. The obvious example of such standard is the Sharable Content Object Reference Model (SCORM), which allows sufficient level of interoperability between different TEL tools. This has led to a higher adoption rate for TEL tools [3]. Finally, the third generation is expected to: (i) opt for more flexible architectures (e.g., service-oriented), (ii) adopts various pedagogical models (e.g., social learning models rather than linear pedagogy), (iii) witness a heavy use of wearable and immersive technologies which will change user experience domain and (iv) embraces user-centered approaches in designing, developing, publishing and consuming learning artifacts.

The second contribution presents an automated text mining analysis of patient experience using design science research approach. Currently, hospitals commonly use online

forums to collect patient feedback on the healthcare they provide to citizens. However, the results of such forums are often unstructured large and free text, which requires various manual time-consuming analysis processes. Therefore, proposing an automated approach to analyze patient experience data would be beneficial for the overall national health system including patients, hospital staff members, and health sector leaders in several ways. Obvious requirement for developing such an approach is following a paper research method. In [4], the author opts for Design Science Research (DSR) paradigm to carry out this research. This research aims at an automated approach to analyze patient experience data using natural languages processing techniques such as Sentiment Analysis, Topic Modelling, and Dependency Parsing. The framework design consists of a three-stage iterative process, where patient feedback is deeply analyzed based on the outcomes obtained from the preceding ones. This iterative approach facilitates the development of a strong, effective patient feedback analysis system.

The third contribution [5] investigates the impact of non-functional requirements on TEL software systems architectures. It proposes a new approach to manage, more specifically elicit and specify, non-functional requirements for TEL software systems, and then presents a flexible service-oriented enabled architecture that can meet these requirements. It explains how TEL software systems complexity increases by time due to the continuous evolving of TEL Functional Requirements. For instance, such functional requirements, in addition to the traditional Virtual Learning Environments/Learning Management Systems capabilities, include: video streaming, plagiarism checker for students' submissions, e-portfolio management, etc. Therefore, institutions opt for combining various e-learning software systems or tools to meet the early-identified requirements. However, a limited effort has been done to investigate and control the impact of combining different solutions on quality attribute, i.e., Non-Functional Requirements (NFRs), of the overall e-learning software system. The key contributions of this paper are explained as follows. *First*, proposing a new approach to elicit, precisely specify, and manage NFRs for TEL software systems. *Second*, to meet these capabilities (i.e., Functional Requirements and Non-Functional Requirements), this paper also proposes a flexible service-oriented architecture for e-learning systems. The proposed list of NFRs is comprehensive and can be customized to various e-learning systems to meet stakeholders' requirements. Moreover, the proposed architecture needs to be further developed to test its impact on TEL software systems in real scenarios.

III. CONCLUSION

This paper summarized contributions submitted and presented in TELTSA special track to innovate and develop advanced Technology Enhanced Learning theories and practices. The constituent contributions are distributed among the following areas: (i) evaluation for the past and current TEL to predict the future of TEL, (ii) research methods used to produce TEL artifacts and finally (iii) the architecture of TEL solutions based on non-functional requirements.

REFERENCES

[1] A. Kirkwood and L. Price, "Technology-Enhanced Learning and Teaching in Higher Education: What is 'Enhanced' and How Do We Know? A Critical Literature Review," Learning, Media and Technology Journal, vol. 39, no. 1, pp. 6-36, 2014.

[2] R. Hammad, M. Odeh and Z. Khan, "eLEM: A Novel e-Learner Experience Model," The International Arab Journal of Information Technology 14 (4A), 2017, pp. 586-597.

[3] E. Scanlon, et al., "Beyond Prototypes: Enabling Innovations in Technology Enhanced Learning", 2013, Retrieved January 4, 2018, from: http://oro.open.ac.uk/41119/1/BeyondPrototypes.pdf.

[4] M. Bahja, "Automated Analysis of Patient Experience Text Mining using a Design Science Research (DSR) Approach," The Eighth International Conference on Businenss Intelligence and Technology, 2018, pp. 21-24.

[5] R. Hammad, "Requirement-driven Architecture for Service-Oriented e-Learning Systems," The Eighth International Conference on Businenss Intelligence and Technology, 2018, pp. 25-30.