ACQUIRED SKILL ASSESSMENT AND EFFECTIVENESS MODEL FOR SKILL-BASED E-LEARNING SYSTEMS

MUNESWARY A/P SAMINATHAN

UNIVERSITI TEKNOLOGI MALAYSIA

ACQUIRED SKILL ASSESSMENT AND EFFECTIVENESS MODEL FOR
SKILL-BASED E-LEARNING SYSTEMS

MUNESWARY A/P SAMINATHAN

A thesis submitted in fulfilment of the
requirements for the award of the degree of
Master of Philosophy

School of Computing
Faculty of Engineering
Universiti Teknologi Malaysia

AUGUST 2021

ACKNOWLEDGEMENT

In preparing this thesis, I was in contact with many people, researchers, academicians, and practitioners. They have contributed towards my understanding and thoughts. In particular, I wish to express my sincere appreciation to my main thesis supervisor, **Dr. Norhaida Binti Mohd Suaib,** for encouragement, guidance, critics and friendship. Without her continued support and interest, this thesis would not have been the same as presented here.

I am also indebted to the Ministry of Higher Education for funding my Master's study. Librarians at UTM deserve special thanks for their assistance in supplying the relevant literature and accommodation.

My fellow postgraduate students should also be recognized for their support. My sincere appreciation also extends to all my colleagues and others who have assisted at various occasions. Their views and tips are helpful indeed. Unfortunately, it is not possible to list all of them in this limited space. I am grateful to my entire family members.

ABSTRACT

Learning with a computer-based education system relies heavily on student interaction. Therefore, skill-based E-Learning is also given priority by educators for delivering knowledge and skills to a student. The skill-based E-Learning system is popular in the Technical and Vocational Education and Training (TVET) education sector at present. However, the need for assessment of skill-based E-Learning systems has not been addressed effectively. Issues that often arise during the coordinators' discussion concern the assessment and effectiveness of the skill-based E-Learning system. Moreover, in previous research lower priority has been given to the evaluation of E-Learning and the effectiveness of training programs. These limitations raise some serious concerns on how the skill-based E-Learning system can be assessed in TVET in the future or how the current model evaluation can be fitted to assess a skill-based E-Learning system in terms of effectiveness. This research aims to propose an assessment and effectiveness model for a skill-based E-Learning system called Acquired Skill Assessment and Effectiveness Model for Skill-Based E-Learning Systems (ASKEM). ASKEM was developed with modification from the Kirkpatrick model at the behavioral level to systematically assess the skill-based E-Learning system. The ASKEM model has the potential to assess skill-based E-Learning systems via student-centered learning. The effectiveness of a skill-based E-Learning system was assessed via selective criteria such as satisfaction, learnability, and usefulness to build a deeper and better understanding of human interaction with the system. One group of pre-test and post-test was tested to validate the ASKEM. The result shows that the proposed instrument and techniques gave significant results that made the assessment more effective and provided positive feedback, such as motivation, progress on student achievement, upgraded teaching material, and identification of the most skilled person from the assessment. This research has contributed to the ASKEM model and guidelines in skill assessment and effective model for skill-based E-Learning systems in the TVET education field.

ABSTRAK

Pembelajaran menggunakan sistem pendidikan berasaskan komputer sangat bergantung pada interaksi pelajar. Oleh itu, E-Pembelajaran berasaskan kemahiran juga diberi keutamaan oleh pendidik dalam menyampaikan pengetahuan dan kemahiran kepada pelajar. Sistem E-Pembelajaran berasaskan kemahiran terkenal dalam sektor pendidikan dan Latihan Teknikal dan Vokasional (TVET) pada masa kini. Walau bagaimanapun, keperluan untuk penilaian sistem E-Pembelajaran berasaskan kemahiran masih belum lagi ditangani dengan berkesan. Isu yang sering timbul semasa perbincangan penyelaras adalah mengenai penilaian dan keberkesanan sistem E-Pembelajaran berasaskan kemahiran. Selain itu, kebanyakan penyelidikan terdahulu kurang memberi perhatian terhadap penilaian E-Pembelajaran dan keberkesanan program latihan. Batasan ini menimbulkan beberapa kebimbangan serius tentang mengenai bagaimana sistem E-Pembelajaran berasaskan kemahiran dapat dinilai dalam TVET pada masa akan datang atau bagaimana penilaian model semasa dapat disesuaikan untuk menilai sistem E-Pembelajaran berasaskan kemahiran daripada segi keberkesanan. Tujuan penyelidikan ini adalah mencadangkan sebuah model penilaian dan keberkesanan untuk system E-Pembelajaran berasaskan kemahiran yang dipanggil Model Keberkesanan dan Penilaian Kemahiran Terperoleh untuk Sistem E-Pembelajaran Berasaskan Kemahiran (ASKEM). ASKEM dikembangkan dengan pengubahsuaian dari model Kirkpatrick pada tahap tingkah laku untuk menilai sistem E-Pembelajaran berasaskan kemahiran dengan lebih sistematik. Model ASKEM ini berpotensi untuk menilai sistem E-Pembelajaran berasaskan kemahiran melalui pembelajaran berpaksikan pelajar. Keberkesanan satu sistem E-Pembelajaran berasaskan kemahiran telah dinilai menggunakan kriteria terpilih seperti kepuasan, kebolehupayaan pembelajaran, dan kebergunaan untuk membina kefahaman yang lebih mendalam dan baik berkenaan interaksi manusia dengan sistem. Kumpulan ujian pra dan ujian pasca telah diuji untuk mengesahkan model ASKEM. Hasil kajian menunjukkan bahawa instrumen dan teknik yang dicadangkan memberikan hasil yang signifikan yang menjadikan penilaian menjadi lebih berkesan serta mendapat maklum balas yang positif seperti motivasi, kemajuan pencapaian pelajar, bahan pengajaran yang dinaik taraf dan pengenalpastian insan paling berkemahiran melalui proses penilaian tersebut. Penyelidikan ini telah menyumbang kepada model ASKEM dan garis panduan dalam penilaian kemahiran serta model yang berkesan untuk sistem E-Pembelajaran berasaskan kemahiran dalam bidang pendidikan TVET.

TABLE OF CONTENTS

TITLE PAGE

LIST OF TABLES

LIST OF FIGURES

.

LIST OF ABBREVIATIONS

CLO	-	Course Learning Outcome
GUI	-	Graphical User Interface
HCI	-	Human Computer Interaction
HTML	-	Hyper Text Mark-up Language
i-Comel	-	Interactive Computer Maintenance Lesson
KPIs	-	Key Performance Indicators
LMS	-	Learning Management Systems
LnT	-	Learning and Teaching
MOOC	-	Massive Of Online Course
OBE	-	Outcome Base Education
RAM	-	Random Access Memory
SCM	-	Success Case Method
SLO	-	Students Learning Outcome
TVET	-	Technical Vocational Education Training
UX	-	User Experience
RND	-	Research And Development
ASKEM	-	Acquired Skill Assessment and Effectiveness for Skill-Based E-Learning Systems
SD	-	Standard deviation
Q&A	-	Question and Answer

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1 Introduction

Technology is rapidly changing the student learning process and teaching process. Technology plays an important role in many aspects of everyday life, and its importance for education is no different. There are various reasons that's why E-Learning education industry is growing very fast. Online learning is an E-Learning application where learning is done using internet access (Junus *et al.,* 2015). The adoption of online or web-based learning system or software is not limited to learning institutions such as universities and schools. Government and private sectors also are implemented such platforms to train the students and employees (Fu, 2016). E-Learning is an innovative teaching technique among educators. Mostly, E-Learning techniques are also a combination of online and offline, which is suitable for delivering education to students and an excellent strategy to improve the teaching and learning system to a higher quality (Ramakrishnan *et al.,* 2012). E-Learning is divided into six technology-based categories used for learning activities. These categories are psychomotor skills trainers, offline computer-based E-Learning, online and local area network-based E-Learning, digital game-based learning, virtual reality environments and Mobile Learning (M-Learning) (Azhari and Ming, 2015).

Assessment is a very important component of E-Learning. It shows the progress in the course or field of the students, identifies the individual strength and weakness, and measures the instrument of student learning motives achievement. As current learning activities are made up of variation technology-based, the assessment process required an appropriate model or framework to get the effective result. Assessment of each category is divided according to the technology and objectives

used in the development of E-Learning to obtain the accurate results in the assessment. This point supports the suggestion from Sandoval (2016) that the questionnaire's design is modified according to the different levels and characteristics of the course.

Many researchers propose framework for evaluating E-Learning systems, otherwise known as Learning Management Systems or LMSs for the education field and training evaluation of the skill-based training program in the industrial field in previous studies. There are many significant results; however, there is still a need for some improvements for assessment by categorization. Redesigned questionnaires of current E-Learning evaluation design by Zaharas (2008) for different higher education institutions, with students with different course levels and characteristics and different course designs to find the improvement areas and differences between one course's characteristics and another needs to be expanded in future research. This gap is one of the factors leading to this investigation. Based on the literature review (Al-Rahmi, *et al*., 2015) and (Babu and Sridevi, 2018), more emphasis is on the effectiveness of e-learning compared to skill-based E-Learning. This shows that knowledge-based E-Learning is given priority in effectiveness assessment while the skill-based E-Learning assessment category is less emphasized. Therefore, the purpose of this research is to enhance the designed framework of assessment on skill-based learning system in terms of effectiveness.

Several studies are investigated to find a closed model for matching the assessment on skill-based E-Learning system. The model of training program evaluation is most appropriate to improve the learning system based on skill assessment. The reason for developing a training program model is to assess skills for participants including learning improvement. Technology develops a variety of methods and techniques in E-Learning evaluation process. However, researchers mainly depend on training models to evaluate skill-based e-learning (Nagendrababu *et al.,* 2019). In order to make some improvement, modification of evaluation method from training models is required to assess the effectiveness of skill-based e-learning system producing a better result.

1.2 Problem Background

Various sectors of industry recognize the importance of developing a training skills system. Based on this fact, the education sector strongly welcomes educators to develop a skill-based E-Learning system for helping the education sector to be parallel by the technology development. There are various types of E-Learning developed and practiced among people, such as web-based learning. This form of training is accessed via web browsers or through the corporate Intranet, Computer-based training, CD-ROM-based learning, Webinars, Virtual Classroom, Mobile Learning, Video-based Learning, and custom E-Learning. Evaluative skills are used to assess the credibility of the claims people make or post, and to assess the quality of the reasoning people display when they make arguments or give explanations. Based on the explanation above about teaching aids to improve the teaching and learning methods, educators develop many teaching aids such as E-Learning to transfer knowledge and skills. Most of E-Learning is undergone a traditional evaluation process such as questionnaires and interviews, which is used as a basis for evaluating student's performance and achievement while significantly limit the ability to evaluate the effectiveness of skills resolving constraints, especially during practical training. Researchers have conducted evaluations on skill-based E-Learning systems before. Still, researchers are not able to find an appropriate model as a guide to conduct the assessment process of skill-based E-Learning systems in terms of effectiveness. Based on the survey done at National Innovation and Invention Competition Through Exhibition (i-Compex'17), it is found that 90% show positive feedback about skill-based E-Learning system but still has bias in the results due the accurate results for identify skilled participants failed to highlight during the assessment. Furthermore, the effectiveness of the skill-based E-Learning system cannot be detected through the conventional assessment. Although, there are various training evaluation models for evaluating training system and E-Learning system are mentioned in previous studies such as (Ali *et al.,* 2018; Kay, 2011; Alrawashdeh *et al.,* 2013). However, there is still a lack of specification training skill-based system model evaluation to assess the skill-based E-Learning system in terms of effectiveness. Hence, the researcher should emphasize skill assessment and effectiveness for skill-based E-Learning system evaluation to get high effective results.

1.3   Problem Statement

Various models and design frameworks assess E-Learning and training programs or systems are identified (Topno, 2012; Tripathi and Bansal, 2017). Based on the review, the Kirkpatrick Model, Kaufman's Model, Anderson's Value of Learning Model, Brinkerhoff's Success Case Method (SCM), CIRO Model and CIPP are identified as skill-based system evaluation models. Also, the effectiveness of the skill-based E-Learning system investigates the importance of effectiveness assessment from the previous studies to support this study (Zammel *et al*., 2018). However, there is a lack specific design framework and model for conducting acquired assessment for skill-based E-Learning systems. This statement is further supported by the argument of (Wu *et al.,* 2012) that evaluation of vocational school teaching processes places a lot of emphasis on class teaching and theory studies. Still, practice is a weak part of the evaluation process, especially in providing internships for students in factories outside or applying knowledge to practice. People do not know whether students have acquired skills through actual practices. Based on the discussion by the coordinators, the issues that often arise are skill-based learning system such as Technical Vocational Education and Training (TVET) education assessments since most of the evaluations are carried out by previous studies in E-Learning and training programs, and lacking an appropriate framework for the evaluation on the skill-based E-Learning system in term of effectiveness. Thus, part of the effort of the study is to fill this specific gap. In previous studies, few papers are focused on assessment of skills-based learning system and showed some limitations in the designed framework by E-Learning category (Farid *et al.,* 2018; Kay, 2011). This study fulfills the research gap by evaluating skills-based E-learning systems.

1.4 Research Question

The following are the research questions to be explored for answering the above problem statement:

i. What is the most appropriate assessment model to evaluating skill and effectiveness for a skills-based E-learning system?
ii. How do the training evaluation model enhancement and effectiveness assessment for skill-based E-Learning system develop?
iii. Which validation approach is most appropriate for measuring the effectiveness of a new model?

1.5 Research Aim

The purpose of this study is to propose an enhanced skill training evaluation model for acquired skill assessment on a skill-based E-Learning System in terms of effectiveness using a case study approach.

1.6 Research Objectives

The objectives of this research study are as follows:

i. To investigate the skill-based training and effectiveness assessment model on skill-based E-Learning system.
ii. To propose the enhancement of the skill-based training evaluation model for acquired skill assessment and an effective model for a skill-based E-Learning system.

iii. To evaluate the proposed skill-based E-Learning evaluation model using a case study approach.

1.7   Scope of Research

These are the scope of research to a specific field.

i.   This research focuses on identify the specific training model which is suitable for acquired skill assessment on skill-based E-Learning system in terms of effectiveness.

ii.   This study is carried out on various training models to compare design or enhance a new assessment model for a skill-based E-Learning system in terms of effectiveness.

iii. Only the training model of a skill-based E-Learning system is analyzed and investigated in this study.

iv.   The analysis of the system efficiency is based on current training skill-based system models.

v.   Interactive Computer Maintenance Lesson (i-Comel) is used as a testbed for this study.

vi.   Pasir Gudang Community College Semester 2 students are selected as respondents for this case study.

1.8   Significances of the Study

This study is essential to assess a skill-based E-Learning system as it provides the researchers with a lot of information about assessment on skill-based E-Learning system. Specification of training model will be identified to evaluate the effectiveness of skill-based E-Learning system. The important and beneficial milestones expected are identified a new training model of the skill-based E-Learning system. Other than

that, an outline of a training model assesses the effectiveness of the skill-based E-Learning system, which provides the systematic method for identifying the system's weakness. Additionally, the skill-based E-Learning system assessment model also provides a recommended guideline for various skill-based E-Learning system assessments in TVET education in the future.

1.9   Research Organization

Below are the brief content descriptions of the subsequent chapters of this thesis. This thesis is divided into five chapters to make this thesis successful. The overall development of this thesis has been described in detail in Figure 1.1 in the following section.

The first chapter covers an advance of the research background. In addition, problem background and problem statement are also described in this chapter for the purpose that the reader knows the reason for this study. The aim and objective of the study are listed in sequence. The scope and significance of the research of the study are also discussed in this chapter.

Chapter 2 discusses existing studies on topics that are relevant to current studies, including the history of E-Learning, skill-based E-Learning system, and training evaluation models. In addition, literature review and methods used for the skill-based training system are identified in previous studies. The previous research was supported by evidence to be read in this chapter. This chapter is beneficial in reinforcing our research from the evidence of previous studies.

Chapter 3 involves the methods and techniques applied in this study. Describes the data source and preparation, software and hardware specification that is used for this research. The research method using three phases that fulfill research objectives

will be discussed in this chapter. Most importantly, this chapter will provide answers for the researchers in producing the data needed to make decisions and conclusions.

Chapter 4 describes the preliminary study design and implementation, and presents a quantitative study's process and outcome. The quantitative study is conducted through the structured quantitative survey questions and the case study on i-Comel across the Pasir Gudang Community College. Research hypotheses are generated and as a result, enhancement of the Kirkpatrick model for the skill-based E-Learning system is developed.

Chapter 5 discusses acquired assessment of skill-based E-Learning system model results of the test by using the method set out in Chapter 3. There are three methods of testing that are discussed. Each test will be discussed and can be compared to the previous study. The findings from the questionnaire are improved, and the findings become more assertive in conclusion.

Chapter 6 describes the discussion and conclusion. Summary of research and provide a contribution of research findings. In addition, discuss limitations and recommendations for future research.
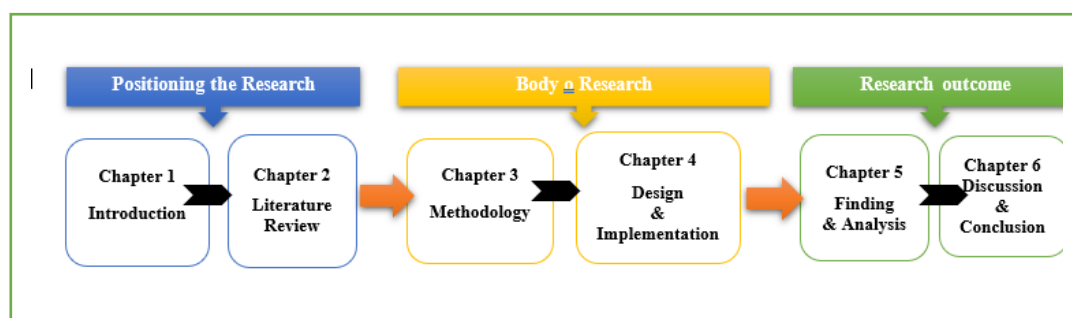

Figure 1.1   Structure of the Research

REFERENCES

Al-Rahmi, W. M., Othman, M. S., & Yusuf, L. M. (2015). The effectiveness of using e-learning in Malaysian higher education: A case study Universiti Teknologi Malaysia. *Mediterranean Journal of Social Sciences, 6*(5), 625-625.

Ali, M., Hossain, S., & Ahmed, T. (2018). Effectiveness of E-learning for university students: Evidence from Bangladesh. *Asian Journal of Empirical Research, 8*(10), 352-360.

Aljawarneh, N. M., Sokiyna, M., Obeidat, A. M., Alomari, K. A. K., Alradaideh, A. T., & Alomari, Z. S. (2020). The Role of CRM fog computing on innovation and customer service quality: An empirical study.

Alrawashdeh, T. A., Muhairat, M., & Althunibat, A. (2013). Evaluating the quality of software in erp systems using the iso 9126 model. *International Journal of Ambient Systems and Applications (IJASA), 1*(1), 1-9

Anderson, V. (2007). The value of learning: a new model of value and evaluation. Chartered Institute of Personnel and Development.

Azhari, F. A., and Ming, L. C. (2015). Review of E-Learning Practice at the Tertiary Education level in Malaysia. *Indian Journal of Pharmaceutical Education and Research, 49*(4), 248-257.

Babu, G. S., & Sridevi, K. (2018). Importance of E-learning in Higher Education: A study. International Journal of Research Culture Society, 2(5), 1-8.

Barry, C. L., & Schamber, L. (1998). Users' criteria for relevance evaluation: a cross-situational comparison. Information processing & management, 34(2-3), 219-236.

Booth, P. A. (1989). *An introduction to human-computer interaction*: Psychology Press.

Brinkerhoff, R. O. (2005). The success case method: A strategic evaluation approach to increasing the value and effect of training. Advances in Developing Human Resources, 7(1), 86-101.

Calvo, S., Morales, A., and Wade, J. (2019). The use of MOOCs in social enterprise education: An evaluation of a North–South collaborative FutureLearn program. *Journal of Small Business and Entrepreneurship, 31*(3), 201-223.

Caputi, V., and Garrido, A. (2015). Student-oriented planning of E-Learning contents for Moodle. *Journal of Network and Computer Applications, 53*, 115-127.

Choudhury, G. B., and Sharma, V. (2019). Review and comparison of various training effectiveness evaluation models for R and D Organization performance1.

Chiew, T. K., and Salim, S. S. (2003). Webuse: Website usability evaluation tool. *Malaysian Journal of Computer Science, 16*(1), 47-57.

Chopra, G., Madan, P., Jaisingh, P., & Bhaskar, P. (2019). Effectiveness of e-learning portal from students' perspective. Interactive Technology and Smart Education.

Constantine, L. L., & Lockwood, L. A. (1999). Use cases in task modeling and user interface design. Paper presented at the CHI'99 extended abstracts on Human factors in computing systems.

De Angeli, A., Sutcliffe, A., & Hartmann, J. (2006). Interaction, usability and aesthetics: what influences users' preferences? Paper presented at the Proceedings of the 6th conference on Designing Interactive systems.

Farago, P., Shuffler, M. L., and Salas, E. (2019). The Design, Delivery, and Evaluation of Crew Resource Management Training. In *Crew Resource Management* (pp. 251-282): Elsevier.

Farid, S., Ahmad, R., Alam, M., Akbar, A., & Chang, V. (2018). A sustainable quality assessment model for the information delivery in E-learning systems. Information Discovery and Delivery.

Frey, B. B., Schmitt, V. L., & Allen, J. P. (2012). Defining authentic classroom assessment. Practical Assessment, Research, and Evaluation, 17(1), 2.

Fu, J. (2016). Usability evaluation of software store based on eye-tracking technology. In Proceedings of the *Information Technology, Networking, Electronic and Automation Control Conference*, IEEE.

Islam, G., Kahol, K., Li, B., Smith, M., and Patel, V. L. (2016). Affordable, web-based surgical skill training and evaluation tool. *Journal of biomedical informatics, 59*, 102-114.

Hewson, C. (2012). Can online course-based assessment methods be fair and equitable? Relationships between students' preferences and performance within online and offline assessments. *Journal of Computer Assisted Learning, 28*(5), 488-498.

Holzinger, A. (2005). Usability engineering methods for software developers. Communications of the ACM, 48(1), 71-74.

ISO, I. (2001). IEC 9126-1: Software Engineering-Product Quality-Part 1: Quality Model. *Geneva, Switzerland: International Organization for Standardization*, 27.

ISO. (9241-11: 1998). Ergonomic requirements for office work with visual display terminals (VDTs)-Part 11: Guidance on Usability. *ISO 9241-11:1998*.

Jeng, J. (2005). Usability assessment of academic digital libraries: effectiveness, efficiency, satisfaction, and learnability.

Jones, C., Randall, S., and Fraser, J. (2020). *Evaluation of Nurse Training Using Kirkpatrick's Model: A Mixed-Methods Approach*: SAGE Publications Ltd.

Junus, I. S., Santoso, H. B., Isal, R. Y. K., and Utomo, A. Y. (2015). Usability evaluation of the student centered E-Learning environment. *International Review of Research in Open and Distributed Learning, 16*(4), 62-82.

Kay, R. (2011). Evaluating learning, design, and engagement in web-based learning tools (WBLTs): The WBLT Evaluation Scale. Computers in Human Behavior, 27(5), 1849-1856.

Kirinic, V., Vidacek-Hains, V., & Kovacic, A. (2010). Computers in education of children with intellectual and related developmental disorders. International Journal of Emerging Technologies in Learning (iJET), 5(2010).

Khomokhoana, P. J. (2011). Using mobile learning applications to encourage active classroom participation: Technical and pedagogical considerations. University of the Free State,

Kirkpatrick, J. D., and Kirkpatrick, W. K. (2016). *Kirkpatrick's four levels of training evaluation*: Association for Talent Development.

Liaw, S.-S. (2008). Investigating students' perceived satisfaction, behavioral intention, and effectiveness of e-learning: A case study of the Blackboard system. Computers & education, 51(2), 864-873.

Liu, Y., Osvalder, A.-L., & Dahlman, S. (2005). Exploring user background settings in cognitive walkthrough evaluation of medical prototype interfaces: a case study. International Journal of Industrial Ergonomics, 35(4), 379-390.

Moehead, A., DeSouza, K., Walsh, K., and Pit, S. W. (2020). A Web-Based Dementia Education Program and its Application to an Australian Web-Based Dementia

Care Competency and Training Network: Integrative Systematic Review. *Journal of medical Internet research, 22*(1), e16808.

Moon, H., Ryu, D., and Jeon, D. (2019). The evaluation of learning transfer of industry skills council (ISC) training programs using success case method: Reinforcing role and function of ISC. *European Journal of Training and Development*.

Mtebe, J. S., & Raisamo, R. (2014). A Model for Assessing Learning Management System Success in Higher Education in Sub-Saharan Countries. The Electronic Journal of Information Systems in Developing Countries, 61(1), 1-17.

Mulaudzi, F. M., and Chyun, D. A. (2015). Innovation in nursing and midwifery education and research. *Rwanda Journal, 2*(2), 21-25.

Nagendrababu, V., Pulikkotil, S., Sultan, O., Jayaraman, J., Soh, J., and Dummer, P. (2019). Effectiveness of technology-enhanced learning in Endodontic education: a systematic review and meta-analysis. *International endodontic journal, 52*(2), 181-192.

Ngure, S. W. (2015). An Empirical Evaluation of Technical, Vocational, Education and Training (Tvet) Processes In Kenya.

Nielsen, J. (1994). Enhancing the explanatory power of usability heuristics. In Proceedings of the *SIGCHI conference on Human Factors in Computing Systems*.

Palm, T. (2008). Performance assessment and authentic assessment: A conceptual analysis of the literature. Practical Assessment, Research, and Evaluation, 13(1), 4.

Patton, M. Q. (2012). A utilization-focused approach to contribution analysis. *Evaluation, 18*(3), 364-377.

Paull, M., Whitsed, C., and Girardi, A. (2016). Applying the Kirkpatrick model: Evaluating an'interaction for learning framework'curriculum intervention. *Issues in Educational Research, 26*(3), 490.

Plantak Vukovac, D., Kirinic, V., and Klicek, B. (2010). A comparison of usability evaluation methods for E-Learning systems. *DAAAM International Scientific Book*, 271-288.

Ramakrisnan, P., Jaafar, A., Razak, F. H. A., and Ramba, D. A. (2012). Evaluation of user interface design for leaning management system (lms): Investigating student's eye tracking pattern and experiences. *Procedia-Social and Behavioral Sciences, 67*, 527-537.

Rohayani, A. H. (2015). A literature review: Readiness factors to measuring E-Learning readiness in higher education. *Procedia Computer Science, 59*, 230-234.

Rusalam, N. R., Munawar, W., & Hardikusumah, I. (2019). Development of Authentic Assessment in TVET. Paper presented at the Proceedings of the 5th UPI International Conference on Technical and Vocational Education and Training (ICTVET 2018).

Sandoval, Z. V. (2016). The re-design process of an instrument to evaluate usability in online courses. *Issues in Information Systems, 17*(3).

Santos, A., and Stuart, M. (2003). Employee perceptions and their influence on training effectiveness. *Human resource management journal, 13*(1), 27-45.

Schmidt, D. A., Baran, E., Thompson, A. D., Mishra, P., Koehler, M. J., and Shin, T. S. (2009). Technological pedagogical content knowledge (TPACK) the development and validation of an assessment instrument for preservice teachers. *Journal of research on Technology in Education, 42*(2), 123-149.

Srivastava, V., and Walia, A. M. (2018). An analysis of various training evaluation models. *International Journal of Advance and Innovative Research, 5*(4), 276-282.

Tripathi, J., and Bansal, A. (2017). A literature review on various models for evaluating training programs. *IOSR Journal of Business and Management, 19*(11), 1.

Tennant, C., Boonkrong, M., and Roberts, P. A. (2002). The design of a training programme measurement model. *Journal of European industrial training, 26*(5), 230-240.

Topno, H. (2012). Evaluation of training and development: An analysis of various models. Journal of Business and Management, 5(2), 16-22.

Tsai, H.-T., Chien, J.-L., and Tsai, M.-T. (2014). The influences of system usability and user satisfaction on continued Internet banking services usage intention: empirical evidence from Taiwan. *Electronic Commerce Research, 14*(2), 137-169.

Tsakonas, G., & Papatheodorou, C. (2006). Analysing and evaluating usefulness and usability in electronic information services. Journal of information science, 32(5), 400-419.

Tseng, M. L., Lin, R. J., & Chen, H. P. (2011). Evaluating the effectiveness of e-learning system in uncertainty. Industrial Management & Data Systems.

Thowfeek, M. H., & Jaafar, A. (2012). instructors' view about implementation of e-learning system: An analysis based on hofstede's cultural dimensions. Procedia-Social and Behavioral Sciences, 65, 961-967

Whiteside, J., Bennett, J., & Holtzblatt, K. (1988). Usability engineering: Our experience and evolution. In Handbook of human-computer interaction (pp. 791-817): Elsevier.

Wu, X., Chen, Y., Zhang, J., & Wang, Y. (2012). On improving higher vocational college education quality assessment. Physics Procedia, 33, 1128-1132.

Yaniawati, R., Kartasasmita, B., & Saputra, J. (2019). E-learning assisted problem based learning for self-regulated learning and mathematical problem solving. Paper presented at the Journal of Physics: Conference Series.

Yang, Y., Stafford, T. F., & Gillenson, M. (2011). Satisfaction with employee relationship management systems: the impact of usefulness on systems quality perceptions. European Journal of Information Systems, 20(2), 221-236.

Zaharias, P. (2008). Cross-cultural differences in perceptions of E-Learning usability: An empirical investigation. *International Journal of Technology and Human Interaction (IJTHI), 4*(3), 1-26.

Zammel, I. B., Najar, T., & Belghith, A. (2018). Determinants of e-learning effectiveness: the case of Tunisian virtual school of post office. Paper presented at the International Conference on Digital Economy.