Training Evaluation Models for Skill-Based E-learning System: A Systematic Literature Review

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Abstract—**Training evaluation can be defined as a way of measuring how well users learn and adapt to a system or software. Various methods have been developed to carry out training evaluations of systems or software over the past few decades. A systematic literature review report on the assessment training model was conducted to give different views on the usability aspects of the proposed approach. This study provides a current systematic review of training evaluation on skill-based system or software. The particular purpose of the review is to explore the research as preliminary step that helps in choosing the right type of training evaluation model for skill-based E-learning system or software. There is a lack of appropriate models available through the specific gaps in literature and finding especially for skill-based E-learning system evaluation.**

Keywords—**Training, evaluation, skill-based, model, system and software**

I. INTRODUCTION

Technology is rapidly changing the way students learn and the way instructors deliver the content. Technology plays a big role in many aspects of everyday life, and its importance to education is no different. There are various reasons why the E-learning education industry is growing. Online learning is an e-learning application where learning is done using internet access [1]. The adoption of online or web-based learning system or software is not limited to learning institution such as universities and schools. Government and private sectors also have been implementing such platforms to train the employees [2]. Usability is known as a quality attribute that can assess how easy the user interfaces are using [3]. In addition, training evaluation is also known as an important index for evaluating system quality or software [4]. The word "usability" also refers to the method used to enhance the ease of use during the design process [5]. Based on the above statement, it is proved that usability testing is very important in evaluating a system and software. Currently, more researchers are focusing on knowing how to test usability evaluation for skill-based E-learning or learning systems or software. Thus, there is need on adequate techniques to evaluate these platforms to improve their quality. Skill-based system or software are very popular among learning institution such as schools and universities. Corporations and government teams have been implementing such platforms to train their employees in certain skills programs [6]. Systematic review is a comprehensive examination of systematic ways to critically identify, select, analyse relevant past research and to collect, and analyse data from past studies. Through systematic reviews, researchers can gather enough and relevant information to support their research as well as identify gaps and future research proposals in specific fields. Despite the abundance of studies on usability evaluation, efforts to systematically review studies on usability evaluation on skill-based learning systems are lacking. This article attempts to fill in the gaps in understanding and identify appropriate model for application in usability evaluation, especially in skill-based E-learning systems or software.

The remainder of this paper is organized as follows: Section 2 summarizes the literature review, Section 3 describes the methodology used in the preparation of this systematic

review, Section 4 discussion and finally Section 5 concludes the paper.

II. RELATED WORK

This section presents the literature review related topic on evaluation models used towards skill-based learning/training. From the review paper [7], Kirkpatrick model which have four-level approach such as reaction, learning, behavioural and results declared as most successful and popular that can help to measure the effectiveness of customized corporate training program. The researchers had presented a review evaluation on training programs only. The available proposed model is basically linked to corporation improvements. Each level focuses on increasing the productivity and employee's education of the industry. This report focuses on the evaluation of skill-based E-learning system where the previous study more focused on training skills program in corporation sector for education and training employees targeting on productivity development. This scenario needs for further studies and research on the importance of training program evaluation model on skill-based E-learning system or software to determine type of suitable models applied or modified for usability evaluation on skill-based learning system or software. The aim of this review is to describe systematic review of studies related to training program evaluation models in the context of skill-based E-learning system or software.

Analysis result showed the identified suitable models to evaluate training program for employees. Based on the paper, the usage of existing method is suggested to make skill-based E-learning evaluation easier. There are several proposed models such as Kirkpatrick Model, Kaufman Model, CIPP Model and CIRO Model. Kirkpatrick model is an appropriate model for conducting training evaluation in terms of effectiveness training programs implemented in the industrial sector. Table 1.1 shows the comparison of the methods used by each level to perform the training evaluation by Kirkpatrick Model. Here, this type of model most popular in training evaluation and match to enhance for usability evaluation on skill-based learning system. However, most of the researchers only focused on this type of training program evaluation only which is lacking to find solution for other type of evaluation model for skill-based E-learning system evaluation.

TABLE 1.1. COMPARISON METHODS BY LEVELS

Level	Methods
Level 1 **Reaction**	Questionnaire or a discussion
Level 2 **Learning**	Result of training such as Post-Test, analysis of reports, performance
Leve 3 **Behaviour**	Self-assessment questionnaire form, feedback from, observation, key performance indicators (KPIs)
Level 4 **Results**	Increase business results, Improved productivity and quality, Customer satisfaction index and higher spirit

From the papers [8], [9], [10], the origin of the brief description on usability evaluation on training program was identified. Majority had discussed the importance of usability evaluation on training programs on workers and industrial sector development only. The results showed that most of the respondents were happy with the content of the module, the ease of speaking, the overall effectiveness and knowledge gained. They are also satisfied and confident in the learning activities provided in this exercise. The findings also show some evidence that respondents have increased their knowledge level and are able to apply knowledge and skills learned in training for their tasks. based on evaluation results, there is positive empirical evidence for reaction, learning and transfer of training and skill. Therefore, by using the Kirkpatrick's four levels of evaluation model, the paper specifically examines: (i) the reactions of the employees to the training programs; (ii) the level of employee's learning; and (iii) the employee's transfer of training. According to Lingham [9] four phases in this clinical model and the findings will add value to academics, practitioners and human resource professionals involved in designing training programs for organizations when focused. The discussion in this previous paper has shown that usability evaluation is very important in assessing the quality of a system and the result of implementation program or training towards achieving the organizational motives. The author intended to explain the benefit usability evaluation on training program on certain corporation sector only. This category of evaluation mostly referred to develop employee's knowledge, interest, training and quality of productivity only. By the end of discussion of this paper, the research gap identified is that no suggestion on evaluating usability evaluation for skill-based learning system or software available until current studies.

In summary, we did not find any systematic review regarding the usability evaluation on skill-based learning system or software. Therefore, our contribution with this systematic review, is to report, descript and classify the appropriate model to used or match to suggest for usability evaluation on skill-based learning system.

III. RESEARCH METHODOLOGY

Systematic review is one of the most suitable methods for every researcher to identify, evaluate and interpret all relevant publications on specific research questions. This would have avoided the results of one-sided studies and more information on the other hand, more effort from the researcher. Fig. 1.1 shows the plan and mapping stage flow to be defined in the protocol of our study.
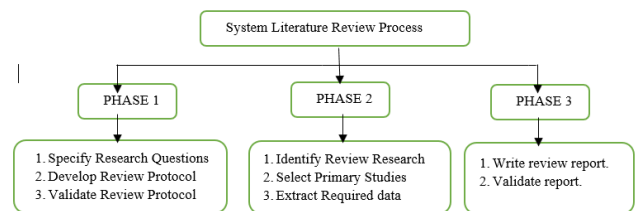

Fig. 1.1. System Literature Review Process

There are 3 phases in this process. Phase 1 was concluded for research questions and developing study protocols. Whereas, for the second phase is to identify survey studies and select primary studies that inclusion and exclusion criteria surveys have occurred at this stage and extract the required data. The final phase is writing and validate the report.

The aim of this research was to explore of the research as preliminary step that leads to choose the right type of model for training evaluation for skill-based E-learning system or software. Our main research question was: "Which training program evaluation model is suitable or closest for evaluate skill-based E-learning system or software?"

In this section, the method used to retrieve articles related to training evaluation on skill-based E-learning system or software were discussed. The search string is presented in Table 1.2 and the search engine was used to obtain relevant literature review: Google Scholar, Scopus, and Web of Science. The search term was divided in two different groups such as skill-based system or software and another group is training program and usability evaluation. Selected articles based on predefined terms make it easier for researchers to identify articles that are relevant to conducting this research. It was decided to restrict the review's focus to the past decade.

TABLE 1.2. SEARCH STRING USED IN THE SYSTEMATIC MAPPING

> *A. TITLE-ABS-KEY ("training" OR "evaluate*" OR "assessment" test*" OR "assessment*" OR "inspection*" OR training evaluation model*" OR "evaluation guideline*" OR "usability evaluation")*
>
> *B. AND*
>
> *C. ("skill-based system*" OR "skill-based software" OR "training system*" OR "training software" OR "e-learning system*" OR "web-based learning system*" OR "skill training system*" OR "skill training software" OR "skill training learning system*" OR "skill training learning software" OR "e-learning platform*")*

VI PUBLICATION SELECTION PROCESS

Two methods were selected in the selection of related articles. Initially the researcher had to select the article by reading the title and content in the abstract. Evaluation in the context of training program and skill-based E-learning system or software. As Table 2.2 shows the inclusion and exclusion criteria in the selection of articles. The second method is to read the selected article in full. Selected articles based on the same criteria were used in the first filter. Regarding exclusion criteria, some consideration must be focus. Certain criteria have to ignore such as Massive Open Online Courses (MOOC), Learning Management System (LMS), publication related to the evaluation non-learning system and software were also not considered.

TABLE 2.2. INCLUSION AND EXCLUSION SET OF CRITERIA

Inclusion Criteria	Exclusion Criteria
The study investigated training evaluation of a learning system	Studies without abstracts.
Publication that describe evaluation on training skill program	Publication related to the evaluation MOOCs
Publication that describe evaluation on skill-based E-learning system or software	Publication related to the evaluation non learning system or software
Article includes in the area of training evaluation models	Duplicated publications

VII DATA EXTRACTION

This section present details the data extraction process. The following information was extracted from each of selected article. From the review paper [13], [14]. [15], the approaches described in the paper reviewed are quite different in terms of goals, approach, design philosophy, techniques for usability modelling, process support and so on. As this paper focuses on the type of evaluation model that can be matched to the training evaluation model on a skill-based E-learning system or software, it is possible to focus on addressing model suitability for the process-based evaluation on skill-based E-learning system or software. Among of the available models, Kirkpatrick model had been chosen as the most suitable one but with some improvements in assessment method to achieve the purpose of assessing for a skill-based E-learning system or software.

VIII DISCUSSION

The particular purpose of the review is to explore on the training evaluation studies in order to look for the most suitable type of model to be implemented as evaluation for skill-based E-learning system or software other than providing experience in searching and reviewing the past studies in order to assist in developing this research. The results show there are several studies regarding the models used to evaluation in online learning system or software. However, there are still gaps in the literature and findings that can be explored by further studies.

- Among the evaluation models, none of them considered the Human Computer Interface (HCI) evaluation during evaluation on skill-based E-learning system.
- There were lack of studies relating the influence of the usability improvement in the skill-based learning system or software.
- There are no studies involving identified experts during evaluation progress or after evaluation.
- Most models focus only for corporate improvement apart focus on learning system.

IV. EVALUATION MODELS

There are various evaluation models related to skill-based training in previous studies. Below are listed the popular evaluation model among researchers.

A. Kirkpatrick Model

Kirkpatrick Evaluation Model developed by University of Wisconsin Professor Donald Kirkpatrick on 1950s. This model has four level approach which is most successful and popular models than can help to measure the effectiveness of customized corporate training program [7]. This model can be as one of guidelines to outline design framework for evaluate training skill system/software for education sector. From the paper [5] stated that Kirkpatrick model is the simplest method and the most commonly used technology in usability evaluation. The four levels of measurement and key indicators to look for at each level. The Table 1.1 below shows the methods used for each level in the Kirkpatrick model. Among the methods used in level 1 are questionnaires and discussion. This method can provide feedback from the user for discussion. Second level, results of training will be used as method to evaluate learning level. For level 3, method is used is self-assessment form, observation, feedback form to evaluate behaviour of users. Finally, level 4, results evaluate by percentage of increment of business income, improved productivity, and quality.

B. Kaufman's Model

Kaufman model is one of the models of learning evaluation developed in response to Kirkpatrick's model [11]. There are two significant changes to Kirkpatrick's model [7]. The Kaufman model has been modified so that it is a two-section input and process operation. At the input level, the Kaufman Model identifies the learning resources and resources available to students while the process level is related to the actual learning experience. Motive level five in Model Kaufman is for the benefit of an organization is to look at the community as a whole or to business customers. The Kaufman's model has six levels (i.e., input, process, acquisition, application, organization result, societal/customer consequence) [12].

C. Anderson's Value of Learning Model

Anderson's model argues that it is important to evaluate the coordination between organizational learning goals and organizational goals. According to [17] it has been proven that it can evaluate the success of a learning program in meeting organizational goals using Anderson's method of evaluation.

D. Brinkerhoff's Success Case Method (SCM)

This model discusses that a training program results in success or failure. This model involves identifying unsuccessful cases in the learning program and reviewing them in detail. Thus, according to [18] it is said that a comparison between success and failure can provide suggestions for improving or improving the training system's skills in the future.

E. CIRO Model

This CIRO model was introduced in 1970 by Warr, Bird and Rackham. Through the publication of the Management Training Assessment book, CIRO stands for input, reaction, and output contexts. The difference between Kirkpatrick and CIRO is that CIRO will focus on measurements taken before and after training has been practiced [19]. Context evaluation focuses on correct identification of training needs, input evaluation is concerned with the design and delivery of training activity, reaction evaluation focus on gaining and using information about quality of training experience and finally the outcomes focuses achievement gained from the activity and assessed by three level such as immediate, intermediate, and ultimate.

F. CIPP Model

CIPP model was developed by Daniel Stufflebeam and colleagues at 1960. This model is requiring context assessment, inputs, processes, and products in assessing program value. It aims to provide analytical and rational basis for program decision-making, based on planning cycles, restructuring, implementation and reviewing and reviewing decisions, each being examined through different aspects of assessment-context, input, process, and product evaluation. It is a systematic framework guiding the concept, design, implementation, and evaluation of service-learning projects and providing feedback and judgment of project effectiveness for continuous improvement. There are four aspects of the CIPP assessment such as context, input, process, and products.

V. SUMMARY

Based on theory of the previous researchers, we are also able to look for the weaknesses in the system that being developed, understanding the reestablishment processes of the test and also the implementation of the training skill system or software. In the training evaluation on skill-based E-Learning system in term of effectiveness, talented learners and groups of students who are less well-aware of the content model can be detected. Additionally, the strengths and weaknesses of the system can be traced to provide opportunities for future improvements. This research is carried out by enhance Kirkpatrick model to evaluate skill-based E-learning system or software. Based on literature review, only four level approach reach the most successful and popular models than can help to measure the effectiveness of customized corporate training program. For this kind of training skill system or software, an improvement required from Kirkpatrick model.

IX CONCLUSION

In this systematic review, finding of the research is an initial step leading to choose which training evaluation models is more suitable for evaluate on skill-based E-learning system.

The finding mostly focuses on training program evaluation models and not in learning system or software. Although several studies had been conducted regarding the training evaluation on training program, but still a need more focus in learning system or software. Among the identified models for evaluate on training program, there is no sufficient evidence of which models is best suited for this skill-based E-learning system evaluation. For future research will focus on the strength and weakness of training evaluation approaches which can be applied to skill-based E-learning system. I hope that findings may contribute to the development and improvement of the training evaluation and skill-based E-learning system or software.

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