Journal of Innovative Technology Convergence
Vol. 4, No. 2 December 2022, pp. 13-22

A Web-Based Training and Evaluation System for Government Institutions with Application of Data Analytics

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Abstract: The study aimed to evaluate the Web-based Training and Evaluation System for use in training workforces. The system was intended to evaluate the ratings given by participants to the training speakers and the training as a whole through survey questionnaires indicating the participant's level of satisfaction with the conducted training. The system was initiated in government institutions and will subsequently be used in educational institutions such as schools and training institutions. The purpose of the study was therefore to describe the effectiveness of the Web-Based Training and Evaluation Systems in identifying, analyzing, and measuring the level of satisfaction of each training and seminar conducted. A K-means algorithm was used to build the system, wherein the data gathered will be clustered and stored in a repository, and the data will be displayed on the system dashboard to give insight into the overall training process and help determine the effectiveness of the training program and the speakers. Precisely, the research study was focused on the level of satisfaction in the aspects of: Functionality, Reliability and Usability which are three of the subsections of the Software Quality Standards defined in ISO/IEC 9126, an international standard for the evaluation of software quality. The data were collected using descriptive and developmental methods. Purposive sampling was used, and fifteen (15) training personnel were the participants of the research. The results showed that in terms of the Functionality aspect, the participants' rating had a weighted mean of 4.43, which was considered highly satisfied, while based on Reliability, the participants were highly satisfied with the system with a weighted mean of 4.27. Meanwhile, in terms of the system's Usability, the participants were highly satisfied, as their ratings' weighted mean is 4.53. It was deduced from the collected data using the three indicators' overall weighted mean of 4.41; thus, the system got a highly satisfactory rating and can be classified as effective for use in the evaluation of the training programs.

Keywords: data analytics, training and evaluation system, web-based, k-means algorithm

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Received [July 29, 2022]; Revised [September 25, 2022]; Accepted [October 17, 2022]

Published by InnoCon Publishing
ISSN 2704-4440

1. Introduction

Training is an organized event or activity which aimed to impart knowledge or information to improve the course of one's performance. Bhasin [1] defined training program as an activity or activities that include undertaking one or a series of courses to boost performance, productivity, skills, and knowledge. Certainly, the goal of conducting training programs was to refine individual's role, talent and capacity over a specific course.

In government institutions, trainings and seminars are being conducted to their employees or in other sectors of the government. Mainly, the purpose, but not limited to, were: (1) to promote a new set of rules or improve level of awareness of a specific or general function of the institution; (2) improve skills and expertise; and (3) sharpen their knowledge on a certain government function. While in educational institutions, trainings are being conducted to offer extensive knowledge to an individual or groups on a certain field or skill. In the newsletter published by India Didactics Association (IDA) in 2020 [2], they note some of the reasons why training in education is essential are: (1) providing excellence; (2) building task understanding; (3) social, intellectual and physical development; and (4) promote new ways of learning.

To be able to achieve a successful training program, it is important to have a well-organized, effectively handled, and remarkable ability of speakers to communicate with the participants. Santa Maria in the article published by LinkedIn in 2021 [3] shared key points on how trainings are more effective by remembering the acronym F.A.S.T. which stands for feedback, application, structure, and technology. The perception of the participants is important in the training and the one conducting the training. To make it more effective, facilitators should also examine their understanding by application. The process and handling of the training is also significant, and lastly, the platforms used is equally important. It is also vital to consider the participant's resources in choosing the right platform.

Despite efforts to attain the objective to effective training programs, some challenges are likely to encounter. Simplify Training published an article in 2022 [4] and note some of the reasons why training programs fail: (1) no training goals are set; (2) training goals are not in line with company goals; (3) no accountability measurements are set up for trainers or trainees; (4) training is regarded as a one-time event and not as an ongoing need; and (5) little or no support is given from upper management. These challenges are often the reason why the objectives of the training itself are not met.

The participants play major roles to improve a specific training course or program. Presently, evaluation sheets or survey questionnaires are widely used tools to assess the facilitation and efficiency of a training. These tools serve as the feedback tool for the participants to evaluate the training program and speaker. It allows the participants to identify their satisfaction and appreciation level through certain criteria. Most often, Likert scale is used for their responses. It is significant to identify and address the reasons why a training fails. It is with the similar importance to evaluate the effectiveness of the training and trainer. That is why the answers of the participants through the survey questionnaires are very important.

The feedback gathered from the participants shall be collated, analyzed and interpreted. As observed in the training department, the dilemma with the documents falls with the accuracy of the analysis based on the collated documents because of the traditional way of data collection. Automating the process of evaluating the data gathered from the training will ease all the effort and manual works. More so, accuracy of the data can be ensured.

By incorporating a web-based training and evaluation system, it can easily and effectively gather and evaluate the feedback of the trainees or participants which plays a vital role in the success of a training program. This is the aim of the study, to incorporate automation to the training evaluation.

The developed system used the k-means algorithm [5] wherein data gathered will be clustered and stored in a repository and display the data to the system dashboard to give insight about the overall training process in support to determine the effectiveness of the training program and the speakers.

The purpose of the study was to develop an effective web-based training and evaluation system by measuring and evaluating its functionality, reliability, and usability both for the participants and the trainer to address the issues and challenges encountered in the conduct of training programs.

2. The Developed System

2.1 System Architecture

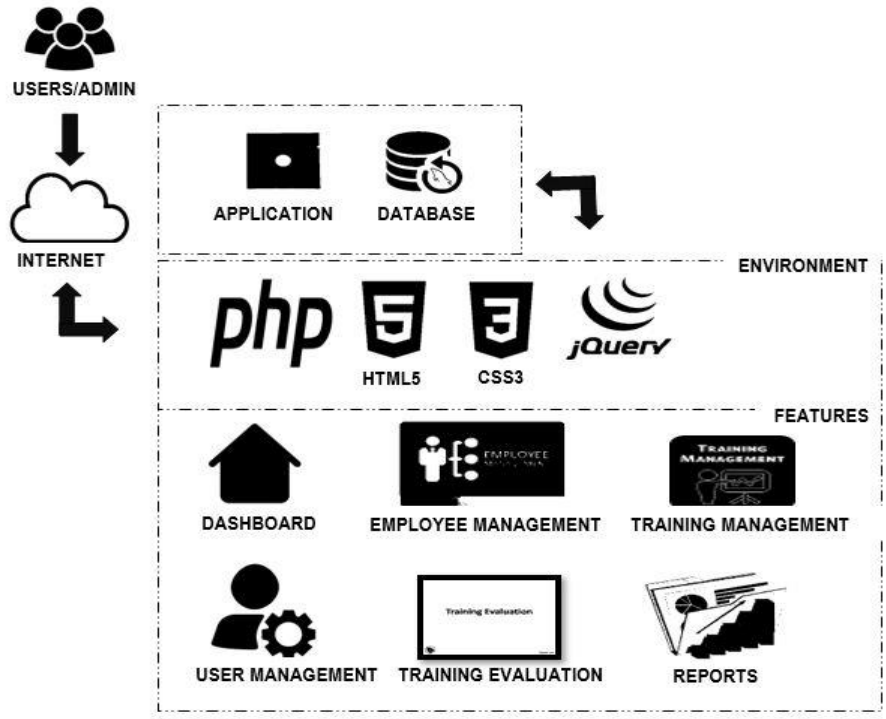

Figure 1. System Architecture of a Web-Based Training and Evaluation System for Government Institutions with Application of Data Analytics

Figure 1 showed how the system subjected to this study was developed in PHP Hypertext Preprocessor, recursive name (PHP) as server-side scripting language and My Structured Query Language (MySQL), an open source relational database management system as the back-end for data storage that run virtually in all platforms, including Lovable Intellect Not Using XP (LINUX), UNiplexed Information Computing System (UNIX), and Microsoft Windows, all are open-source operating systems (OS).

As the front-end, Hypertext Markup Language revision 5 (HTML5) for the structure and presentation of World Wide Web (WWW), Cascading Style Sheet Level 3 (CSS3) for enhancing features and capabilities, Bootstrap, a free open source front-end framework for the creation of websites, and jQuery, an open source JavaScript library that simplifies the creation of web applications were used in developing the system.

2.2 Process Flow

The system's process flow is depicted in Figure 2. The permission level determines who can access the features of the system. Each user needs a log-in username to access the system.

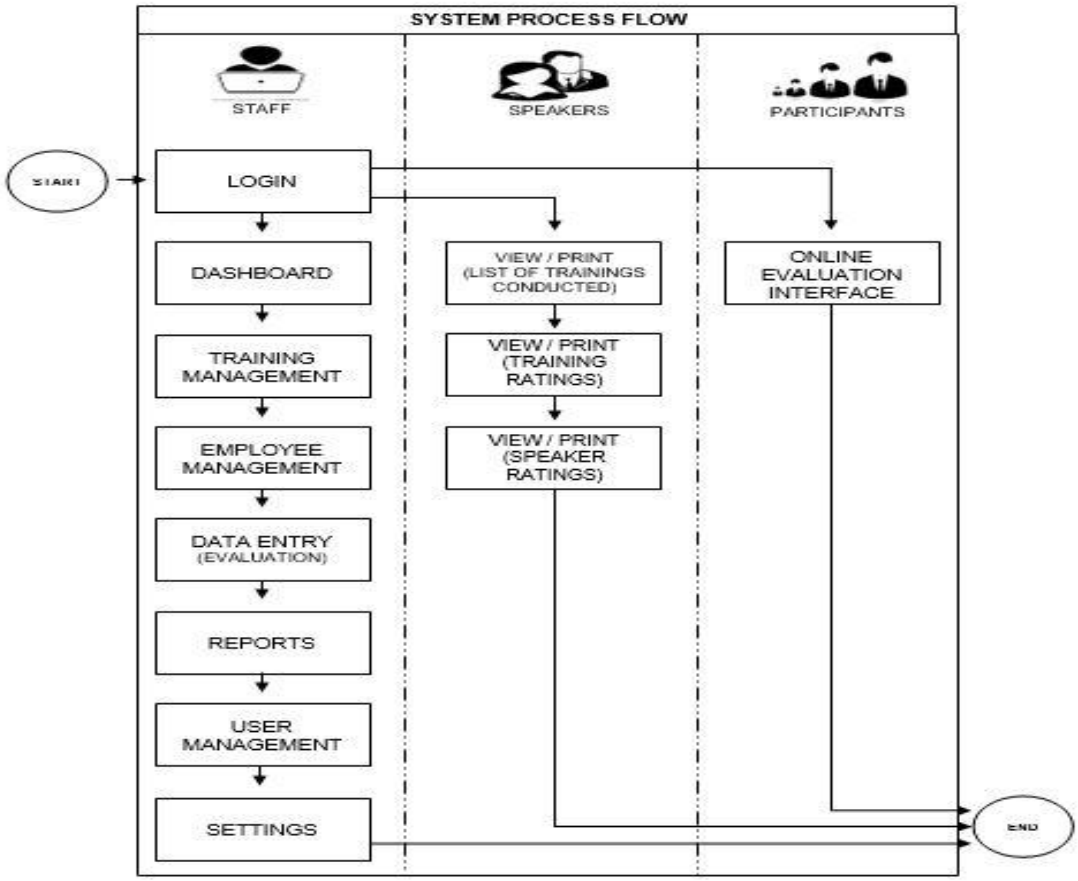

Figure 2. System Process Flow Diagram

Figure 2 illustrates the process flow of the Web-Based Training and Evaluation system. The limitation of whom shall have access to the system depends on who the user is. The staff, being the proponent of the system may access all interfaces and features. The staff once logged in, can have access to the dashboard, training management, employee management, data entry, reports, user management, and settings. While the speakers, can view or print the list of trainings conducted, training, and speaker ratings. Participants on the other hand, can access the online evaluation interface wherein they can evaluate the training program.

2.3 System Features

The study was focused on the development of a web-based training and evaluation system for government, educational and training institutions with application of data analytics [6] to determine the effectiveness of the training programs as well as the speakers and the management of the training details conducted. Figure 3 shows the totality of the system features on the view of the administrator.

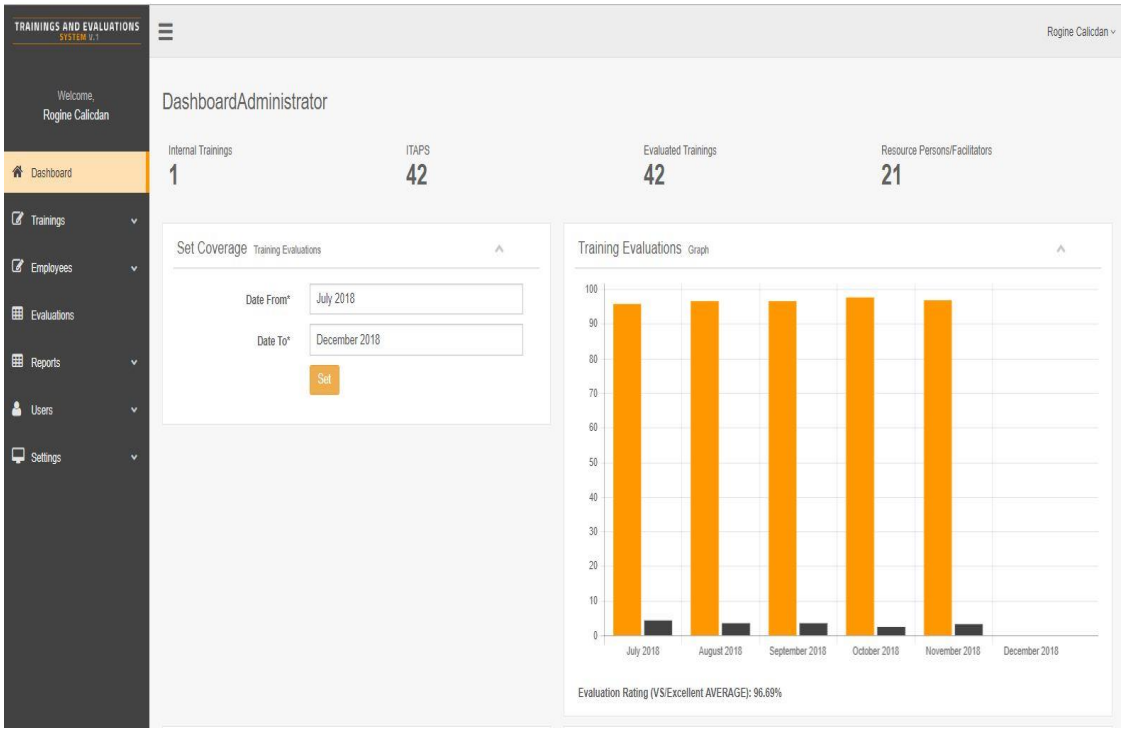

Figure 3. Dashboard of Administrator

Defined below are the functions of each category of the system interface.

- *Dashboard*. Displays data analytics such as training evaluations, speaker evaluations, and training assessment. Additional information includes the number of internal trainings, number of external trainings, number of evaluated trainings, and the number of speakers/trainers.
- *System Login*. The authenticity of the user can be ensured by logging the username and password.
- *Trainings*. Maintains the list of all training information. You can view the details of the training, add and edit training, add participants, delete information details, and add speakers for the training.
- *Employees*. Maintains the list of all the employees' information. You can view the details of the employee, also, you can add and edit employee data.
- *Evaluation*. Provides the online feedback on the training program and to the speakers.
- *Reports*. Reports include, training details, employee details, training summary, evaluation per training, all employees, participant's training conducted and speaker's training conducted.
- *System Users*. Maintains the list of users who can log-in to the system. There are three types of accounts. The staff account which serves as the administrator of the system, the speaker account which contains only its ratings, and the participant account which uses the online feedback evaluation environment.
- *Settings*. Serves as a portal for adding training information such as designation, departments, office and bureau.

3. Research Method and Techniques

The descriptive and developmental methods [7] were used in developing the proposed system. This method was utilized by identifying the issues and challenges concerning the management of training program's effectiveness and speaker evaluation as well as the management of all related trainings. With the additional ideas gathered with respect to the related studies, articles, and literature, a procedural tool and design was formulated to address and innovate the process and evaluations of all trainings.

Given that this study was initiated in a government institution, the subject of the study were anti-corruption advocates who handle the basic and developmental training programs for the employees. Target respondents were comprised of fifteen (15) personnel who are eligible in answering the survey questionnaire in the study. The purposive sampling, which is a sampling technique based on characteristics of a population and the objective of the study was utilized. It is also known as judgmental, selective, or subjective sampling.

A survey questionnaire was used to collect the necessary data for the proposed system. The survey questionnaire was modeled from the standards of International Organization for Standardization/ International Electrotechnical Commission (ISO/IEC) 9126 software quality characteristics (*i.e.*, an international standard for the evaluation of software) [8][9]. Through the survey questionnaire, input from the respondents in terms of encoding and tabulating feedback assessment surveys which take one to three days, generating reports that are not accurate, tedious inputting of training details, redundancy of inputting data, erroneous and redundant information, unsecured data, reports are not immediately available upon request, and generating reports is time consuming from the current methods were collated. Also, inputs from the respondents as to the level of satisfaction of using data analytics tool on the proposed system were gathered. Moreover, the perceived level of satisfaction on the proposed system was collected in terms of functionality, reliability, and usability. The last part of the survey questionnaire was intended to gather suggestions and recommendations from the respondents on areas of improvement in the proposed system in terms of any additional necessary features.

Likert scale was used to measure and evaluate the responses in the survey questionnaire. It is a scale which numerically and objectively obtains participants' preferences with a set of statements. Most commonly, it is seen in a 5-point scale which usually asked the respondents to indicate their level of satisfaction with the statement.

The survey questions were based on the software quality characteristics defined by the ISO/IEC 9126 standard. Specifically, the Functionality, Reliability and Usability subsection were used as the designed system is focused on the assessment of the internal quality of the software product.

Particularly, in terms of **functionality**, it ought to satisfy the (1) accuracy of the data; (2) the compliance to the training needs; (3) the security of the data stored in the system; and (5) the interoperability of the system in terms of easing the process of evaluating the system. While in regard to **reliability**, the system should manifest the function to: (1) tolerate system's failure; (2) recover from the failure of the system and able to recover the data; and (3) establish maturity to stand despite uncontrollable factors. Finally, **usability** aims that the system will: (1) easily be learned by the user; (2) user-friendly; and (3) compliant depending on its innovating environment.

4. Results and Discussion

The study was conducted to assess the perceived level of satisfaction by the respondents on the proposed web-based training and evaluation system in terms of functionality, reliability, and usability.

Table 1. Summary of the Perceived Level of Satisfaction of the Respondents in the Proposed System according to **Functionality**

Indicators	Mean	Int.	Rank
1. The software provides accurate results in the evaluation of training and training details.	4.60	VS	1
2. It conforms to the set of defined needs such as management of internal and external trainings.	4.33	HS	3.5
3. It has security features to prevent unauthorized access to the system.	4.47	HS	2
4. The software has an acceptable response and processing time.	4.33	HS	3.5

Legend: 4.60-5.00 Very Satisfied (VS); 3.60-4.59 Highly Satisfied (HS); 3.00-3.59 Satisfied (S); 2.00-2.99 Less Satisfied (LS); 1.00-1.99 Not Satisfied (NS)

Table 1 shows the weighted mean of the respondents' ratings based on the proposed system's functionality by rank. In terms of providing accurate results, the respondents were very satisfied with the perceived system as it acquired a weighted mean of 4.60 and ranked 1st, followed by "*It has security features to prevent unauthorized access to the system*" interpreted as '*Highly Satisfied*' with a mean average of 4.47 and lastly, "*it conforms to the set of defined needs such as management of internal and external trainings*" and "*the software has an acceptable response and processing time*", both got a '*Highly Satisfied*' interpretation with a weighted mean of 4.33, respectively.

Table 2. Summary of the Perceived Level of Satisfaction of the Respondents in the Proposed System according to **Reliability**

Indicators	Mean	Int.	Rank
1. It has the ability to respond to unexpected hardware or software failure.	4.20	HS	3
2. It has the ability to recover quickly from a system failure or disaster.	4.33	HS	1
3. The software still established when altered.	4.27	HS	2

Legend: 4.60-5.00 Very Satisfied (VS); 3.60-4.59 Highly Satisfied (HS); 3.00-3.59 Satisfied (S); 2.00-2.99 Less Satisfied (LS); 1.00-1.99 Not Satisfied (NS)

As shown in Table 2, the statement "*It has the ability to recover quickly from a system failure or disaster*" ranked 1st with a mean of 4.33, verbally interpreted as '*Highly Satisfied*' followed by "*The software still established when altered*" with a mean of 4.27, interpreted as '*Highly Satisfied*', and lastly, the statement "*It has the ability to respond to unexpected hardware or software failure*" ranked 3rd with a mean of 4.20, interpreted as '*Highly Satisfied*'.

Table 3. Summary of the Perceived Level of Satisfaction of the Respondents in the Proposed System according to **Usability**

Indicators	Mean	Int.	Rank
1. The software model is easy to understand its related functions.	4.47	HS	2.5
2. The software is user-friendly.	4.67	VS	1
3. The software has the ability to adapt to any environment solely to its purpose.	4.47	HS	2.5

Legend: 4.60-5.00 Very Satisfied (VS); 3.60-4.59 Highly Satisfied (HS); 3.00-3.59 Satisfied (S); 2.00-2.99 Less Satisfied (LS); 1.00-1.99 Not Satisfied (NS)

Table 3 presented that the statement "*The software is user-friendly*" got the 1st rank with a mean of 4.67, verbally interpreted as '*Very Satisfied*' followed by the statement "*The software model is easy to understand its related functions*", and "*The software has the ability to adapt to any environment solely to its purpose*", both with a mean of 4.47, verbally interpreted as '*Highly Satisfied*'.

Table 4. Summary of the Perceived Level of Satisfaction of the Respondents in the Proposed System

Indicators	Mean	Verbal Interpretation	Rank
1. Functionality	4.43	Highly Satisfied (HS)	2
2. Reliability	4.27	Highly Satisfied (HS)	3
3. Usability	4.53	Highly Satisfied (HS)	1
Overall Mean	**4.41**	**Highly Satisfied (HS)**	

Legend: 4.60-5.00 Very Satisfied (VS); 3.60-4.59 Highly Satisfied (HS); 3.00-3.59 Satisfied (S); 2.00-2.99 Less Satisfied (LS); 1.00-1.99 Not Satisfied (NS)

Table 4 demonstrated the summary of the perceived level of satisfaction of the respondents in the proposed system. The respondents gave a mean of 4.41 which is verbally interpreted as '*Highly Satisfied*' in the proposed system in terms of functionality, reliability and usability. Usability ranked first with a mean of 4.53 which proved that the system is easy to understand its related functions, user-friendly, and has the ability to adapt to any environment solely to its purpose. This was followed by functionality with a mean of 4.43 and reliability with a mean of 4.27; all were interpreted as highly satisfied.

It can be deduced that the indicators' overall mean is 4.41, thus, the system got Highly Satisfied overall rating.

5. Conclusion and Future Works

The purpose of the study is to perceive the developed Web-based Training and Evaluation System for Government Institutions with Application of Data Analytics. The study aims to create an effective system to determine the effectiveness of training programs as well as the speakers, and the management

of the training details conducted. It is a tool to address the challenges and difficulties encountered in the evaluation and management of the current training conducted.

Based on the results, it was concluded that the system is functional, reliable, and usable. Using data analytics tool, it is proven to be a useful and effective tool in the institution when it comes to the importance of monitoring the trainings and speaker's evaluation, aid in decision making process, viewing historical data, and generating evaluation results. K-means algorithm used fitted the objective of the system.

Since this system was developed and currently being utilized in government institutions, it is recommended that it can also be adapted in educational institutions and even training institutions. The innovative way of web-based evaluation of the training programs and/or educational trainings is definitely timely and relevant in this new normal way of life. The role of training to each individual involved is significant for their growth, development, and confidence. Thus, having a well-evaluated training will result to a well-handled training and better-skilled speakers and facilitators.

For future researchers, it is highly recommended to consider the use of mobile application in the facilitation of the evaluation process for portability.

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