Training and Seminar Recommender System using Rule-Based Algorithm

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Training and seminars play a crucial role in enhancing professional development and keeping up with the latest trends and practices, especially in academe. These training and seminars to be attended by the faculty members should be relevant at all as they provide a mechanism for faculty members to be updated on recent trends and technologies, particularly in the domain of technology and computing. This study focused on the design and development of a Training and Seminar Recommender System Using Rule-Based Algorithm for the College of Information and Communications Technology (CICT). This is to ensure the faculty members receive targeted suggestions that align with their specific needs and provide the best training and seminars that can improve faculty educational competence. The system aims to utilize the rule-based algorithm in providing a decision support mechanism for the administrators in recommending suited training and seminars based on faculty qualification. This is very essential in balancing and sending faculty members to train and the same time to determine what training should be continued based on the perception and evaluation of the faculty member and provide matching results in terms of suited and recommended trainings. The constraints used were specialization, schedule, location, and budget. Descriptive research was used in the study through survey questionnaires. This involved the 77 faculty members from the college, 5 administrators and 5 IT experts. To simulate the software development process, the researcher used Rapid Application Development (RAD) where multiple builds of prototypes are being developed until all functional requirements specifications are being met and considered. The development model produces multiple numbers of prototype versions as the researcher identifies incremental requirements. To assess the level of acceptability of the system, a Technology Acceptance Model (TAM) based on a descriptive Likert model scoring was used. The system got a 4.52 mean average score based on the respondent's evaluation with a verbal interpretation of "Very Acceptable" rating.

Keywords: data mining, machine learning, rule-based algorithm, technology acceptance model, recommender system.

1. Introduction

Training and seminars play a crucial role in enhancing professional development and keeping up with the latest trends and practices, especially in academe. Training and seminars can improve faculty's performance and productivity. A study by the International Journal of

Training and Development found that faculty who participated in training programs had significantly higher job performance ratings than those who did not receive training.

The College of Information and Communications Technology, which consists of seventy-seven (77) faculty members, are encouraged to participate in numerous training, and seminars related to their areas of expertise. Faculty members have the discretion to choose which training to attend to. Some training or seminars are free, others require payment. The selection of specific training and seminars is seen as a major challenge, especially in the midst of a pandemic. There are faculty that accumulated lots of training while others do not. This is because of lack of monitoring by the college.

Addressing this phenomenon is crucial as academic institutions' main goal is to provide the best training and seminars that can improve faculty educational competence. According to Dawley (2015), faculty should be given training that will provide them with the knowledge, skills, and talents they will need in their careers. Training improves faculty's working knowledge and skill, as well as their confidence if properly selected (Omar, 2015). Indeed, training and seminars have become vital for the faculty to stay up to date with the newest trends, technology, and skills in today's fast-paced and ever-changing world. With so many training and seminar options available, it can be difficult for individuals and professionals to select the one that best meets their needs and expectations.

This is where a Training and Seminar Recommender System with Rule-based Algorithm takes place. The researcher will develop a web system that matches faculty with relevant training and seminar programs based on their preferences, skills, and objectives using data mining and machine learning techniques.

Statement of the Problem

1. What are the salient features of Training and Seminar Recommender System Using Rule-Based Algorithm;

2. How Rule-based algorithm provides recommendations in terms of suited trainings in respect to faculty qualifications;

3. How acceptable is the system based on the parameters of Technology Acceptance Model:

3.1 Perceived Usefulness;

3.2 Perceived Ease of Use; and

3.3 Attitude Towards of Use.

2. Literature Review

Training and Seminars Monitoring

Many academic institutions have made faculty development a priority in order to improve the quality of academic programs and take advantage of emerging faculty, student, program, and industry needs. It's critical to acquire faculty members' viewpoints on what's really needed before developing effective faculty development programs. The heart of faculty development is lost without this input and the chance for faculty to cooperate and engage in growth and

dialogue around common subjects of interest (Meyer, 2016). As part of the faculty development, trainings, seminars, and workshops have been integrated as part of the faculty development. In order to fulfill high educational standards, teacher training and professional development are viewed as critical mechanisms for improving teachers' substantive knowledge as well as their teaching abilities and practices (Boudersa, 2016).

Due to educational changes that are occurring, and will continue to occur, in many areas throughout the world, and which set ambitious and challenging educational goals, teacher training and professional development are getting more attention and interest. However, it is commonly acknowledged that faculty training and practical development are time-consuming procedures. They are demanding because it is expected that they will have a significant impact on the teaching practice of the teachers. Educators of school are concerned about their personal professional growth. As a result, they try to attend and engage in teacher training and professional development programs.

According to Awan and Saeed (2015), training improves faculty's working knowledge and skill, as well as their confidence. Training must be made a continual process in order to instill in faculty the motivation to enhance themselves in their particular fields on their own initiative.

In-service training, according to Omar (2015), acts as a catalyst for teachers' efficacy. It is a method of strengthening instructors' abilities and knowledge to improve teaching and learning, resulting in improved work performance. Faculty members need in-service training to help them deal with new difficulties and changes in the classroom. Improving the professionalism of instructors is also critical.

In the study conducted by Austin (2019), data suggest that teacher education has a significant impact on pupils' academic progress. With the help of a training program, pedagogical skills can be strengthened. This makes the teaching and learning process more convenient. This method should capture the interest of both teachers and students. During the research, it was discovered that a qualified teacher employs a variety of teaching strategies in the classroom. In class, he usually employs audio and video assistance. During the research process, it was also discovered that teacher education institutes confront numerous challenges, including a lack of funding and time.

Rahman (2016) mentioned that training and development can be regarded as practices that aim to improve educators' professional knowledge, abilities, and attitudes so that they can increase students' learning. Although training is an important component of teacher preparation programs, particularly for those components of teaching that are more skill-based in nature, there are many other crucial aspects of teaching that can only be cultivated through reflective tactics and experiences. Diverse practice at all levels of education is more likely to result from teacher training. The goal of training is to provide the conditions that allow for the appropriate selection and application of a practice. There are several important aspects of teacher education that must be addressed. Faculty receives training that equips them with the knowledge, skills, and abilities necessary for their career. Training changes a teacher's personality by reshaping their attitudes, changing their behaviors, and reshaping their personality.

A study conducted by Chin et., al (2022) discussed what Filipino teachers require to simplify learning in the scope of the COVID-19 pandemic's online instruction. Seminars clearly have a good impact on the classroom, as seen by teachers' training preferences. The study shows that both quantitative and qualitative data reveal that instructors require professional development to improve their ICT, online teaching practices, and research skills through proper training that is based on their expertise. Alvarez (2020) conducted a study in the universities in Manila about the problems and challenges experienced by the faculty in blended learning. He mentioned that it is essential for the faculty to engage in workshops or training that deal with their demands and concerns. Baptista et., al (2020) conducted a cohort study about the training assessments of the faculty in Northern Philippines. He said that one component in a teaching-learning process is the faculty's professional responsibility to attend training and seminars that might increase their competences and capabilities to convey knowledge and refine the skills of their students.

Training and seminar / webinar are very important factors to fulfill the needs of the faculty in terms of their professional growth and development. Providing an automated system will surely help them in proper selection of training and seminars / webinars that will suit their expertise and interest.

Recommender System

There is a need to filter, prioritize, and efficiently transmit important information on the Internet, where the quantity of options is overwhelming, to ease the problem of information overload, which has created a potential problem for many Internet users. This problem is solved by recommender systems, which search through a massive volume of dynamically created data to present users with personalized content and services. According to Isinkaye et., al (2017), recommender systems are information filtering systems thataddress the problem of information overload by extracting vital information fragments from a huge volume of dynamically generated data based on the user's preferences, interests, or observed behavior. Based on the user's profile, a recommender system can forecast whether a particular user would like an item or not.

A recommender system is characterized as a way enabling people to make decisionsin complex information environments. In addition, a recommender system was defined inthe context of E-commerce as a tool that assists consumers in searching through knowledge data linked to their interests and preferences. A recommender system was defined as a method of supporting and supplementing the social process of making decisions based on the recommendations of others when personal knowledge or experience of the alternatives is insufficient (Roy, 2018). Users' information overload is alleviated by recommendersystems, which provide them with individualized, exclusive content and service recommendations. Several ways for developing recommendation systems have recently been developed, including collaborative filtering, content-based filtering, and hybridfiltering. Recommender systems can be utilized in a variety of settings, including the educational setting. Such systems are primarily concerned with offering a high educational level and attempting to improve the teaching and learning process. They can assist with finding appropriate web resources, recommending good solutions to improve students' understanding, or analyzing data from quizzes and providing feedback to the instructor sothat the quiz can be modified

(Lee, 2015).

In the study conducted by Lin et., al (2018), they present a revolutionary recommendation system for course selection in the specialty of information management in Chinese University. To put this system in place, they first need to gather the course enrolment data for a specified group of students. The sparse linear method (SLIM) is introduced in our framework to generate the top-N recommendations of courses appropriate to the students.

According to Lynn and Emanuel (2020), recommender systems are programs that are specifically built to recommend the next action to the user based on a range of characteristics such as the user's preferences and history. To put it another way, these systems or programs assist people in making decisions about the things they enjoy. In general, all recommender systems strive to provide users with useful recommendations for goods that they might be interested in. As a result, recommender systems must be able to determine which features consumers prefer and group related features together. Recommender Systems are widely utilized to meet the demands of users in a variety of industries, including education, medical, film, music, e-commerce, television programming, and tourism.

Caliwag, et al (2020) developed a recommender system for pre-school in Quezon City named TrackMe. Utilizing a Content-based Filtering technique, the recommender mobile application can provide preschool information, location, and guidance. The association between the information of the objects and the user's preferences enables content-based filtering. Ojacastro (2017) developed a recommender system using item-based collaborative filtering for Graduate School Library in Central Philippine University. To promote library material utilization, the system used an Item-based Collaborative Filtering Recommendation to recommend titles to other patrons with similar interests. Natividad, et al (2019) designed a recommender system for senior high school students in K12 education. The study's objective is to assist not just the guidance counselor but, more importantly, senior high school students in examining several elements linked with their decision on what vocation they will pursue. Various filter methods are utilized to choose the best qualities, which are subsequently used as precise inputs.

Recommender system is proven to provide a big help to anyone in terms of recommending shared interests, thus, the researcher incorporated recommender system to the developed system to give help to the administrator and faculty in suggesting or recommending seminars and training appropriate to everyone.

Rule-based Algorithm

Rule-based algorithms extract knowledge from the categorization model in the formof rules, which are simple to understand and explain. This method is best for assessing data amix of numerical and qualitative characteristics (IGI Global, 2020). The rule-basedsystem consists of a set of rules that can be used for a variety of purposes, including decision assistance or predictive decision making in real-world scenarios. The ways of generating regulations can be divided into two categories: conquer and separate (Aubaid, 2020).

A collection of rules is learned from data in the rule-based learning methodology. Han Liu (2015) presented an integrated framework for the creation of rule-based systems to carry out categorization missions, which comprised the rule representation, rule production, and rule

simplification processes. The study emphasized the need of using ensemble learning to combine different types of rule learning algorithms.

In machine learning and data mining, rule-based algorithms are a common technique (Fürnkranz et al. 2015). They all have the same purpose in mind: to uncover regularities in data that may be stated as an IF-THEN rule. One can distinguish between association rule discovery and predictive rule learning depending on the type of rule that needs to be found. In the latter case, learning a set of rules that collectively cover the instance space in the sense that they can make a forecast for every potential occurrence isfrequently desired.

Rule-based algorithms can also be used in different fields like in farms. A study conducted by Morco (2107) developed an e-Rice, an expert system that can detect, diagnose, and give prescribed control for rice plants diseases in the Philippines. e-RICE was created as a mobile application to introduce farmers to some instances of rice plant diseases and disorders, as well as prescription options such as natural and chemical solutions. To construct rules using the gathered knowledge and skills of rice specialists, the system has used Rule-Based algorithm as a classifications approach.

Since Rule-based algorithms are a common class of machine learning and data mining techniques and best for assessing data amix of numerical and qualitative characteristics, the researchers used this algorithm to easily help the administrator for their decision making in selecting the right faculty to attend the appropriate training or seminar.

Research Instrument

The researcher created a well-prepared document containing set of questions about the study, which will be designed to capture the responses from respondents for collecting data or information. TAM was originally proposed by Davis in 1986. It is one of the information system theories that the main objective is to determine behaviors of users on a particular technology by using two cognitive beliefs: understand its usefulness and understand its ease of use. TAM has proven to be easier to use and a more powerful model of the determinants of user acceptance, while being specifically suited to the domain of information technology. The researcher designed a questionnaire patterned from Technology Acceptance Model (TAM) instrument consists of the Perceived Ease of Use, Perceived Usefulness and Attitude Toward of Use.

Data Gathering Procedure

This study was undertaken within the sphere of operation of Bulacan State University College of Information and Communications Technology (CICT) in Malolos City, Bulacan. After the researcher designed the questionnaires patterned to TAM, the respondents were asked to fill up the necessary information needed and asked to evaluate the system using defined criteria and parameters.

Aside from the questionnaires to be used for evaluating the system, data gathering was also done using surveys and interviews. The data collected was demographic information like age, gender, status, position, year of service, and subjects taught. Understanding the user's background, skills, and expertise were also included. The researcher ensured compliance with the data protection regulations.

Population and Sample

The researcher used a total population of 87 respondents (N=87). These are composed of five (5) administrators, five (5) information technology experts and 77 CICT faculty members.

Statistical Treatment

The data to be gathered was tabulated, organized, and analyzed using statistical methods and techniques. Descriptive analysis was applied in interpreting the result of the system evaluation. The mean statistical analysis was used to determine the level of acceptance of the proposed system using Technology Acceptance Model instrument.

All items are presented in random order and respondents are asked to respond on a Likert-type scale to determine the level of awareness, competency, importance, and acceptability of the respondents to the automated system, ranging from "Very Not Acceptable" as the lowest (1) to "Very Acceptable" as the highest (5). The scale for scoring the response of the respondents is as follows:

Table 1. Verbal Interpretations of Likert Model

Rating Scale	Range (Mean)	Descriptive Evaluation
5	4.50 – 5.00	Very Acceptable
4	3.50 – 4.49	Acceptable
3	2.50 – 3.49	Neither
2	1.50 – 2.49	Slightly Not Acceptable
1	1.00 – 1.49	Very Not Acceptable

3. Results and Discussion

Salient features of Training and Seminar Recommender System Using Rule-Based Algorithm

The salient features of the developed recommender system include (1) Faculty Information Registration Module, (2) Training Module (3) Training Approval and Workflow Module and (4) User Dashboard.

Faculty Information Registration Module as shown in Figure 1, includes adding faculty's profile and other information. The Faculty Module is a password protected web portal which enables faculty members to encode relevant academic information. This is where the specialization and skills, professional information and class schedule were added and saved.

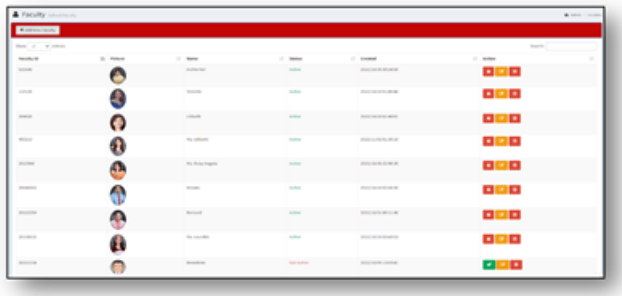

Figure 1. Faculty Information Registration Module

Figure 2 shows the Training Module.

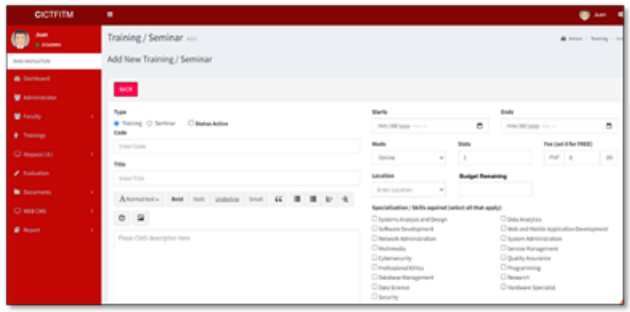

Figure 2. Training Module

This module provides a venue for college secretary or administrator to add or register training that faculty members may attend with. The administrator can use this module to add new training and seminars, as well as change their status and details. The mode, payment, location, and budget monitoring can also be seen in this module. The administrator should determine the skills needed by the faculty to attend the training / seminar.

Once the administrator added the training / seminar to the system, the system will display this to select faculty account that meets the recommended qualifications. Under the Training Approval and Workflow Module as seen in Figure 3, the administrator can view the training and seminar requested by the faculty.

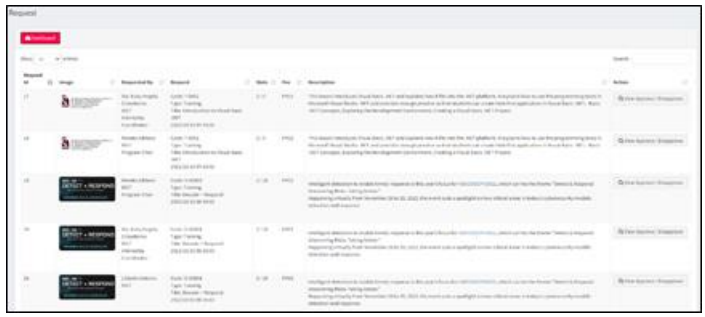

Figure 3. Training Approval and Workflow Module

Figure 4 shows the User Dashboard.

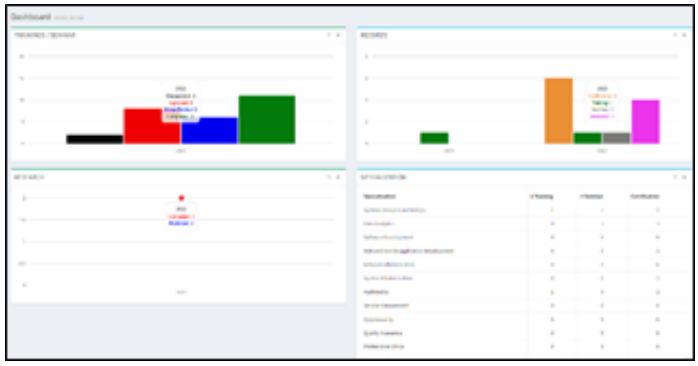

Figure 4. User Dashboard

This module shows the graphical presentation of the total number of training and seminars requested and completed of the faculty.

Recommendations of suited training / seminars using Rule-based algorithm

To provide matching results in terms of suited and recommended training, based on the qualifications encoded by the faculty members. Table 3 shows the parameters / constraints used.

Table 3. Parameters

Constraint	Description	Example
Specialization	The specialization serves as a computing area that the faculty members are perceived to be proficient.	Networking, Data Analytics, Software Development, Web and Mobile Application, System Administration, Multimedia, Service Management, Cybersecurity and Quality Assurance, System Analysis and Design
Schedule	The schedule refers to the number of teaching hours faculty members rendered in a specific day.	Monday – 6 hours Tuesday – 3 hours Wednesday – 6 hours Thursday – 4 hours Friday – 2 hours
Location	This refers to the venue of the trainings and seminars that classify as face to face or online.	UP Diliman Zoom
Budget	This refers to budget provided by the university per faculty for trainings and seminars.	Php 20,000

Figure 5 shows the Rule-based model.

```
location = f2f
|   specialization = systemsanalysis
|   |   budget = yes
|   |   |   schedule = affected : notrecommended (8/3)
|   |   |   schedule = notaffected : recommended (2/0)
|   |   budget = no : notrecommended (3/1)
|   specialization = networking
|   |   schedule = affected : recommended (5/2)
|   |   schedule = notaffected : recommended (2/1)
|   specialization = multimedia
|   |   budget = yes
|   |   |   schedule = affected : recommended (7/2)
|   |   |   schedule = notaffected : recommended (2/1)
|   |   budget = no : recommended (1/0)
|   specialization = programming : recommended (0/0)
|   specialization = cybersecurity : recommended (0/0)
|   specialization = hardware : recommended (0/0)
|   specialization = dataanalytics : recommended (1/0)
location = online
|   specialization = systemsanalysis : recommended (7/0)
|   specialization = networking : recommended (9/0)
|   specialization = multimedia : recommended (0/0)
|   specialization = programming : recommended (0/0)
|   specialization = cybersecurity : recommended (0/0)
|   specialization = hardware : recommended (0/0)
|   specialization = dataanalytics
|   |   budget = yes : recommended (2/0)
|   |   budget = no : notrecommended (6/2)

Size of the tree : 29

Time taken to build model: 0 seconds
```

Figure 5. Rule-based Model

A sample model was produced based on the data encoded. Figure 5 shows the following if-else condition to come up with the set of rules.

(1) If the location of the training is face to face > else if the specialization is System Analysis and Design > else if budget is yes > else if the schedule is affected then, not recommend, else recommend> if the budget is no, then not recommend.

(2) if the location is face to face > else if the specialization is Networking > else if budget is yes > else if the schedule is affected then, recommend, else recommend> if the budget is no, then not recommend.

(3) if the location is face to face > else if the specialization is Multimedia > else if budget is yes > else if the schedule is affected then, recommend, else not recommend. These set of rules are based on 55 instances.

Acceptability of the system based on the parameters of Technology Acceptance Model

An evaluation instrument was formulated anchored from the Technology Acceptance Model. The respondents rated the using the following criteria: (1) perceived usefulness and (2) perceived ease of use and (3) attitude towards using the system. The gathered data were processed using the Statistical Packages for Social Sciences (SPSS). These data were analyzed using the succeeding statistical methods and techniques.

To describe the respondents' ratings in each criterion, a 5 –point Likert Scale for the responses was used. Arithmetic average was used to evaluate the overall performance of each indicator. The results of the System's perceived usefulness (PU), perceived ease of use (PEOU), and Attitude toward using (ATU) were interpreted using the Likert Scale.

Table 4. Respondents Evaluation in Terms Perceived Usefulness

Indicators	Mean	Interpretation
The user can easily understand the interface of the system.	4.86	Very Acceptable
The system is user-friendly and promotes convenience.	4.26	Acceptable
Navigation promotes an extensive user experience.	4.28	Acceptable
Using the system is more flexible when encoding and uploading documents	4.11	Acceptable
The system does not require rigid training before using it.	4.10	Acceptable
Mean	4.32	Acceptable

As gleaned in Table above, in terms of the perceived usefulness criterion, the respondents rated an overall mean performance of 4.32 which has an interpretation result of "Acceptable". In addition, the highest mean in terms of criterion indicator highlights that the interface of the system can be easily understood. However, the system should improve the flexibility of attaching documents to improve extensive user experience.

Table 5. Respondents Evaluation in Terms Attitude Towards Using

Indicators	Mean	Interpretation
The system is valuable as it can be used to different academic related matters	4.74	Very Acceptable
The system is practical to use.	4.73	Very Acceptable
The system is valuable and important in these uncertain times.	4.83	Very Acceptable
The system promotes adaptability in terms of using new trends in technology.	4.33	Acceptable
Mean	4.65	Very Acceptable

As gleaned in Table above, in terms of the perceived usefulness criterion, the respondents rated an overall mean performance of 4.65 which has an interpretation result of "Very Acceptable". In addition, the highest mean in terms of criterion indicator highlights that the system is valuable as it can be used to different academic related matters. This means that the system can provide needed reports and relevant report generations that can be used by the college and the university in terms of academic profiling and accreditation. However, the system should improve its adaptability in terms of using new trends in technology.

Table 6. Respondents Evaluation in Terms Intention of Use

Indicators	Mean	Interpretation
The system is utilized to provide faculty information repository	4.78	Very Acceptable
The system serves as a platform to apply and evaluate attended trainings	4.8	Very Acceptable
The system is utilized to encode faculty	4.89	Very Acceptable

information and upload relevant faculty information that can be used for academic purposes.		
The system provides comprehensive report generation in terms of faculty qualifications and relevant pertinent academic information needed by the University	4.04	Acceptable
Mean	4.57	Very Acceptable

As gleaned in Table above, in terms of the intention of use criterion, the respondents rated an overall mean performance of 4.57 which has an interpretation result of "Very Acceptable". In addition, the highest mean in terms of criterion indicator highlights that the system is utilized to encode faculty information and upload relevant faculty information that can be used for academic purposes. However, the system should improve in providing comprehensive report generation in terms of faculty qualifications and relevant pertinent academic information needed by the University.

To assess the perceived usefulness, its ease of use and attitudes toward the usage of Faculty Information and Training Monitoring and Evaluation Platform with Document Management System Using Rule-Based and Matching Algorithms, the summary of results per criterion is presented below.

Table 7. Summary of Evaluations using the Technology Acceptance Model Criteria

Criteria	Mean	Interpretations
Perceived Usefulness	4.32	Acceptable
Attitude Towards Using	4.65	Very Acceptable
Intention of Use	4.61	Very Acceptable
Total	4.52	Very Acceptable

As gleaned in Table presented above, the grand mean of the respondent's evaluation in the Technology Acceptance Model instrument is 4.52 with a verbal interpretation of "Very Acceptable". The result of the evaluation reveals that all criteria present in the instrument also have a verbal interpretation of "Very Acceptable" which means that system is designed suited to the needs of the users and ready for deployment.

4. Conclusions

In summary, the study highlighted the salient features of the developed system that can be used to successfully recommend training and seminars for the CICT faculty. The system includes Faculty Information Registration Module, Training Module, Training Approval and Workflow Module and User Dashboard. The system used rule-based algorithm that provides decision support for the administrator. The rules were extracted from the system using if-else statements. The results of the rule-based served as the basis for the administration to decide whether to approve or not the application for seminar or training. The result of the evaluation reveals that all criteria present in the instrument have a verbal interpretation of "Very Acceptable" which means that system is designed suited to the needs of the users and ready

for deployment.

5. Recommendations

Based on the findings and conclusions, this study presents the following recommendations:

1. Mobile application integration in terms of updating faculty profile and training applications.
2. Notification of the system in terms of approved training thru email or SMS feature.
3. Improve the rule-based algorithm by adding new constraints and parameters.

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