# Enhancing the Implementation of Cloud-Based Open Learning with E-Learning Personalization

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*Abstract* — **Indonesia is a developing country that began to utilize information technology in education. A form of its implementation is the use of e-learning. However, in practice there are still some obstacles, such as learning resources are not evenly distributed, limited access to services provided, qualified educators resources are concentrated in specific areas. This led to the emergence of disparities educational process, and technology gap due to differences in ICT infrastructure owned by any educational institution.**

**Therefore this study proposes architecture of cloud-based open learning to solve these problems. The term open learning is used in order to encouraging the development of the concept of Indonesia Open Educational Resources (IOER) and as well as the adoption of concept of cloud computing. There are several phase that we conducted in this research such as analysis, design, implementation, testing, and evaluation phase. The design of the proposed architecture consists of six layers: (1) Infrastructure, (2) Platform, (3) Application, (4) Service, (5) Access, (6) User. As a result of the implementation from this architecture is a prototype of Indonesia - Virtual Open Learning System (iVOLS).**

**In experiment, personalization e-learning runs as a service that need large storage and other shared facilities to conduct the program so the system can delivered different learning materials to different learners. The e-learning personalization in cloud environment classified successful if the learners got the best performance on learning and it shown by their evaluation score. Based on the test results and evaluation showed that the availability on Cloud-Based Open Learning further meet user needs. This is indicated by the presence of a simple infrastructure services, application services with just one stage and the availability of a wider range of data and the resource sharing. In accessibility, Cloud-Based Open Learning provides easy access to the user. By economically, the result of evaluation showed that Cloud-Based Open Learning has an investment of 35.61% efficiency, increase Return On Investment (ROI) of 60.95% and Net Present Value (NPV) of 81.97% from the user's perspective. While from the provider's perspective, Cloud-Based Open Learning has an investment of 200% efficiency, increase Return On Investment (RoI) of 220.4% and Net Present Value (NPV) of 109.55%.**

*Keyword* — **Cloud Computing, E-Learning, Indonesia Open Educational Resources, Personalization.**

## I. INTRODUCTION

E-LEARNING provides many benefits such as flexibility, diversity, measurement, and others [1], even though its implementation still exist many difficulties. The main problem experienced when to start applying e-learning is the high initial cost or in other words is the economic factor [2]. It is becoming a major focus for the institutions that will implement e-learning. The initial cost consists of three main problems: (1) Infrastructure; (2) Human Resources; (3) Maintenance. Another problem might occured when implementing e-learning is access to the learning material. This problem experienced in Indonesia as a country with thousands of islands.

Along with the development of the IT world, cloud computing is gradually become the new paradigm of innovation in the IT world, cloud computing is a computing services that can be used through the Internet in accordance with the needs of users with little interaction between service providers and users. Cloud computing technology as well described as a computing resource that provides a highly scalable as external services through the Internet. Therefore, cloud computing can be considered as an alternative to minimize the cost of infrastructure and human resources for development and maintenance process of e-learning systems [3].

In this paper the author will discussed previous cloud learning architecture and the basic concept of open educational resources. The proposed open learning architecture also will be described in Chapter 4. Further more in this paper also will discuss the approach of the implementation, experiment in personalization learning, and the evaluation. For final chapter author will described the conclusions and discussed the future works of this study.

## II. CLOUD COMPUTING

Cloud Computing is a new paradigm to organize and manage ICT resources. There are various definitions of cloud computing, one of which is the definition according to The National Institute of Standards and Technology (NIST) which defines cloud computing as "model for enabling convenient, on-demand network access to a shared pool of configurable computing resources that can be rapidly

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provisioned and released with minimal management effort or service provider interaction" [22]. Generally speaking, the cloud computing service model consists of three layers [5], among others: (1) Software as a Service (SaaS); (2) Platform as a service (PaaS); (3) Infrastructure as a service (IaaS) [6].

In practice, cloud computing has four implementation models where each model has certain characteristics [7], among others: (1) Private, the model is aimed at an organization where cloud operations are managed by a third party or the organization itself; (2) Public, service on this model is intended for the general public or the industry in which the various services provided by the cloud computing service provider organization (3) Community, this model is managed by several organizations that form a community of practice in which the operations are managed by the community with the division of tasks particular; (4) Hybrid, this model is a combination of various models existing cloud distribution. Typically, this is done with a combination of specific purposes where there is an attachment for example: technological standards and data ownership.

## III. Conventional E-Learning Towards Cloud-Based E-Learning

Based on Carroll et al [9] the main advantage of the adoption of cloud computing is the efficiency to manage the cost that user will spend for the services. This is an interesting point of view that with this advantage we could adopt cloud concept in terms of implementation in e-learning. Conventional e-learning commonly used by the university developed by the university itself tend to cause lots of problems such as time to designing e-learning systems will be developed, costs for infrastructure, selecting commercial or open source e-learning platform, the cost to hire professional staff to maintain and upgrade the system of e-learning, and so on. This process is more likely need more time [7].

The implementation of e-learning based on cloud possibly could help educational institutions to use a single e-learning service that running on cloud environment. This model can reduce the initial costs incurred by the institution for the implementation of e-learning by using cloud computing services, because institutions do not need to pay for the purchase of infrastructure, both in terms of procurement of servers and storage. By the adoption of cloud computing, the educational institution can rent the infrastructure of the cloud computing providers [10]. Likewise with the human resources for the development stage, the cloud environment of e-learning has been provided by the cloud service provider, as well as maintenance of the e-learning [11].

Figure 1 illustrated the conventional e-learning implementation and Figure 2 illustrated the cloud-based e-learning implementation. From both of these pictures explain the paradigm shift in the implementation of e-learning, shifting from conventional e-learning implementation to cloud-based e-learning implementation. By using this approach might help educational institution in implementing e-learning with less cost. Generally, the implementation of conventional e-learning consists of some basic element such as e-learning system development,

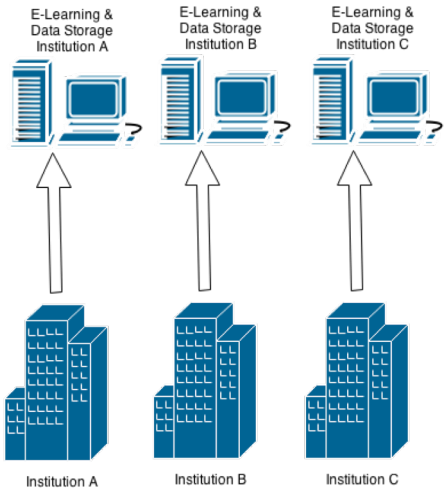


Fig. 1. Conventional E-Learning

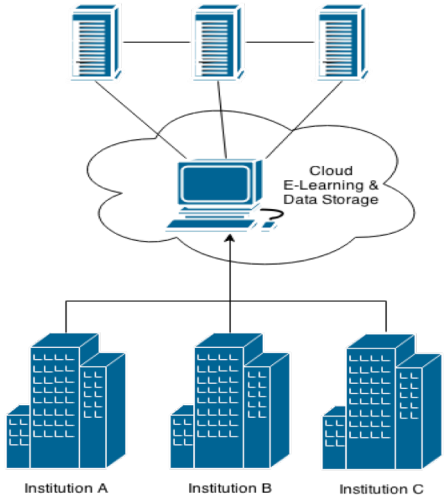


Fig. 2. Cloud-Based E-Learning

system upgrade, and system maintenance [12]. It had a lot of problems, both in terms of flexibility, scalability, and accessibility [13]. According to [14] one of the main important features that can be presented in the use of e-learning in the cloud is scalability, which allows virtualization provide infrastructure layer provided by the cloud service provider. Virtualization helps solve the problem of the physical barriers that are generally inherent in the lack of resources and infrastructure to automate the management of these resources as if they were a single entity through hypervisor technologies such as virtual machine (VM).

## IV. Open Educational Resources

Open Educational Resources (OER) initiative is an initiative that enables to share all educational resources to public domain with open access, open license, open format, and open system. This OER implementation can be seen in many countries in the world like MIT Open Courseware, China Open Resource for Education, or Paris OCW Project.

Many educational resource sharing system implementations have been developed all over the world with many different techniques. Web service architecture

more often used in the recent past year. This implementation uses web service as an integration, retrieval and data exchange application [6]. The newer trend that is often used today is the semantic web technology where the resources were formed in the semantic description [7]. Other researchers also are using P2P technology combined with semantic web technologies and formed a super-peer P2P semantic grid where the semantic metadata retrieved from many educational sources [8].

## V. Cloud-Based Open Learning Architecture

There are several architectural cloud-based e-learning have been proposed by previous researcher. In this paper will discuss three architectural cloud-based e-learning, such as architecture proposed by [4], [1], and [5].

In [4] they proposed e-learning architecture based on cloud computing that consists of three layers that are infrastructure, platform, and application layer. They explained that infrastructure layer is a hardware layer that supplies the computing and storage capacity for the higher level and this layer, which is used as e-learning and software virtualization technologies, ensures the stability and reliability of the infrastructure. The second layer is Platform layer, which is a middle layer consisting middleware that is Web service they use here. It purpose is for providing the learning resources as a service. This layer consists of two modules, the first module is Item Classification Module (ICM) and the second module is Course Selection Module (CSM). Main jobs both of these modules are focusing on accessing the items from the item bank and selecting suitable learning content from the content database. The last is the third layer they called it as a Application layer which is responsible for interface provision for the students.

The next architecture proposed by [1]. Their proposed architecture consists of five layers. The First layer is infrastructure layer. It is composed of information infrastructure and teaching resources. Information infrastructure contains internet/intranet, system software, information management system and some common hardware. Teaching re-sources stored up mainly in traditional teaching model and distributed in different departments and domain. The second layer is software resource layer. This layer is composed by operating system and middleware. A variety of software resources are integrated through middleware technology to provide a unified interface for software developers to develop applications and embed them in the cloud. The third layer is resource management layer. In order to effectuate on demand free flow and distribution of software over various hardware resources, this layer utilizes integration of virtualization and cloud computing scheduling strategy. The fourth layer is service layer. This layer has three levels of services namely, SaaS, PaaS, and IaaS. In SaaS, cloud computing service is provided to customers, contrasting to traditional software, cloud customers use software via the internet without any need to purchase, maintain, and upgrade, so they only pay a monthly fee for rent the cloud services that used by the customer. The last layer is application layer. This layer is a specific layer consisting of applications of integrated teaching re-sources, including interactive courses and the teaching resources sharing. The teaching resources include teaching material, teaching information, as well as the full sharing human resources.

The last architectures that we referred in this study is from [5]. They proposed architecture of e-learning-based on cloud computing consists of three layers, namely: (1) infrastructure layer, (2) middleware layer, and, (3) application layer. The first layer is infrastructure layer. It is employed as the e-learning resource pool that consists of hardware and software virtualization technologies to ensure the stability and reliability of the infrastructure. This layer also supplies the computing and storage capacity for the higher level. The second layer is middleware layer. It focuses in providing a sharable platform. The final layer is application layer. At this layer, cloud computing provides convenient access to the e-learning resources.

In this study we propose the architecture that we have designed by modifying previous architectures that we used as references. Our proposed architecture depicted in Figure 3 consists of six layers, namely: (1) infrastructure layer; (2) platform layer; (3) application layer; (4) service layer (5) access layer; and (6) user layer.

We have modified the user layer. Our user layer consists of all stakeholders that might involve to the system. We also add two more layers which is Access layer which is consist of multi-channel access from multi devices for addressing the access issue for Indonesian local context and service layer that describes the services that provided by the system, which is: e-learning as a service, data as a service, and infrastructure as a service.

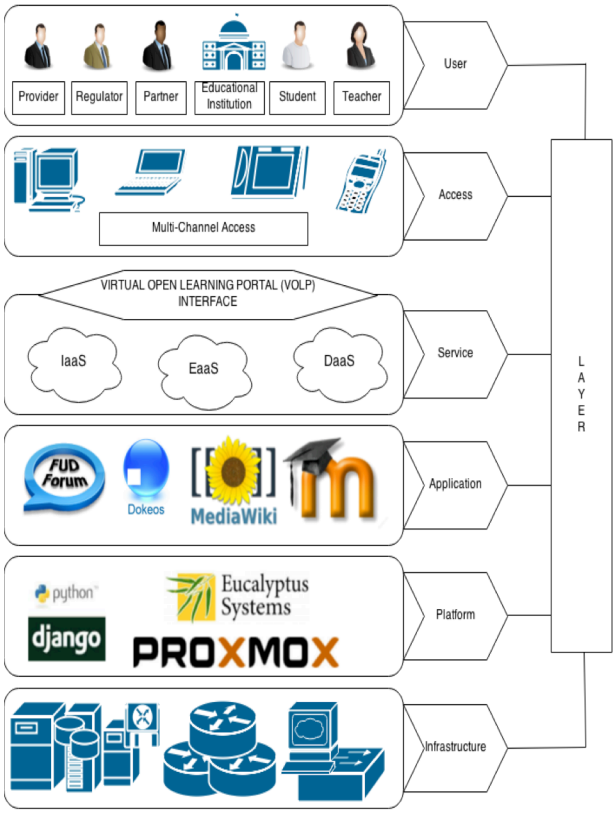


Fig. 3. Cloud-Based Open Learning Architecture

## VI. Implementation

Cloud environment developed using Proxmox platform. Table 1 Describes the Hardware and software specification for the environment.

TABLE I
HARDWARE SPECIFICATIONS

| Hardware | Proxmox Minimum | Current Hardware | Remark |
|---|---|---|---|
| CPU | 64 bit | 64 bit | Fulfilled |
| Memory | 1 GB RAM | 2 GB RAM | Fulfilled |
| Hard Drive | Hard Drive | Hard Drive | Fulfilled |
| Network | 1 NIC | 1 NIC | Fulfilled |

Main activity in this process is developing a working prototype portal. Authors used Java Script and PHP programming language to develop the portal. This portal will be the gate for the users to use their e-learning system and the portal illustrated in Figure 4.

This portal main service called as a E-Learning as a Service. The objective is to provide a e-learning system for the users. This service will provide three possible cases, which is: (1) Enable users to request a e-learning system for users who do not have an e-learning system and create a new one for educational purpose only; (2) Enable users to enroll to existing e-learning system for users who do not have an e-learning system or institution; (3) Enable users to migrate their e-learning system to join the e-learning based on cloud environment for users who already have an e-learning system and willing to entrust the maintenance duty to cloud provider.

Two another services that provided by this portal are data and infrastructure services. By joining open learning portal users automatically rewards by free data storage and cloud based infrastructure. Data services consist of multimedia data that uploaded by another users and every user could store and share their data with another users.

Infrastructure service will be provided to the users by using virtual machine. Virtualization helps solve the problem of the physical barriers that are generally inherent in the lack of resources and infrastructure to automate the management of these resources as if they were a single entity through hypervisor technologies such as virtual machine (VM).

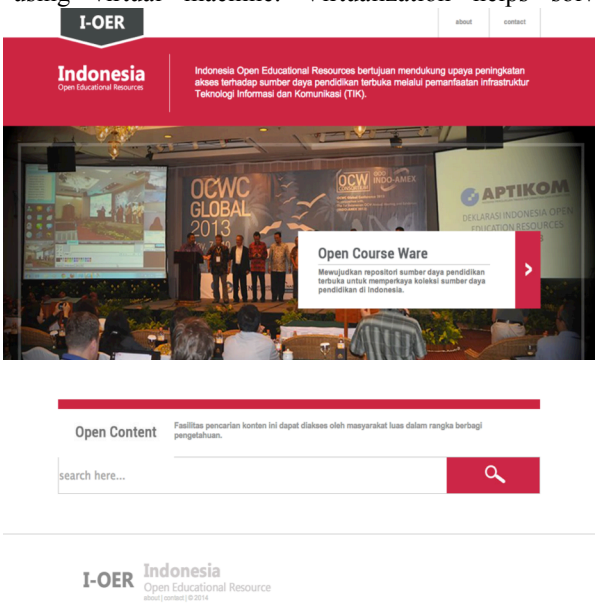


Fig. 4. Prototype of Open Learning Portal

One of the services that run in Open Learning Portal is "*Student-Centered E-learning Environment - Personalization Dynamic E-learning"* or usually called as SCELE-PDE. This service is an e-learning that built from modified Moodle LMS so the system can provide personalization based on triple-factor model concept. The learners that registered use the e-learning to improve their performance in learning. They learn the materials that be given by teachers in the way they like. The e-learning recorded learner's activity such as access to learning material and involved in forums. The learner's activity determined learning behavior patterns of the learner. Learning behavior patterns filled the triple-factor parameter that consists of learning style category, level of motivation, and knowledge ability.

Learning style of the learner determined level of learning material that suitable with the learner preferences. Based on [8], learning style of learner calculated based on mean in frequent table of the group as a threshold. Learning style divide into 3 categories, they are seldom access category for number of access learning materials below the threshold, discipline category for number of access equal with the range of threshold, and diligent access category for number of access greater or equal than the threshold.

Level of motivation determined which forum activity that should be improved by the learner. Level of motivation calculated from mean of activities in frequent table of group as threshold and divide into 3 categories, they are low, medium, and high motivation. Low motivation category gives to learner with number of access to forum discussions is below than the threshold. Medium motivation category gives to learner with number of access to forum discussion equal with the range of threshold. High motivation category gives to learner with number of access to forum discussion is greater than the threshold.

Knowledge ability determined the performance of the learner after they use the e-learning. Knowledge ability calculated based on evaluation score of users. Knowledge ability divide into 4 categories, they are fail for interval score 0-60, fair category for interval score 61-80, good category for interval score 81-90, and very good category for interval score 91-100. The outcomes of the personalization are suitable learning contents for every learner that registered in the system. The architecture of the personalization e-learning illustrated in Figure 5.

In order to improve their performance, level of learning material has been proposed. Level of learning materials that delivered to learner consists of three level, they are LV1 is short material (M), LV2 are short and explanation material (M+P) and, LV3 is short, explanation, and additional material (M+P+T). Short materials delivered in slide form. Explanation materials delivered in audio, video, and multimedia form such as slide-audio mixing and video-slide mixing. Additional materials delivered in link, example, and other references form. Many form of learning materials need large repository and cloud environment used as a solution to

store and delivered it. In the experiment, there are 118 learners that registered in Science Writing subject during a semester. In the subject there are 40 learning materials with different format and size that have been delivered. The composition of learning materials describe in Table 2.

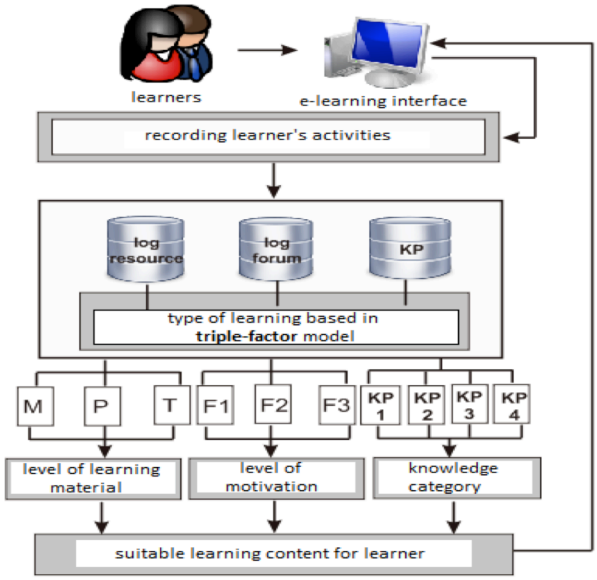


Fig. 5. Architecture of Personalization Learning Content in E-learning

When learner login into personalization e-learning, the system will record the activities. In experiment, learning process with e-learning divided into 2 step. Step 1 is identification step and Step 2 is personalization step. The step 1 held from week 1 unttill 7. The learner used e-learning without personalization and learning content delivered in many form but in limited amount. Based on step 1, learning activities that have been recorded describe in Table 3 and the scenario of personalization learning illustrated in Figure 6.

TABLE II
LEARNING CONTENT THAT DELIVER IN EACH WEEK IN INDENTIFICATION STEP

| Week | Topic | slide | audio | forum | animation | video | trigger | reference | outline | assignment | feedback |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | What is scientific writing | x | x | x | - | - | - | x | - | - | - |
| 2 | Fundamental concept of reserach | x | - | x | x | - | - | - | x | - | x |
| 3 | Scientifi Inquiry and Logical Thinking | x | x | x | - | x | x | - | - | x | - |
| 4 | Writing and developing paragraph | x | x | x | - | x | x | x | - | x | - |
| 5 | Problem Identification & Hypothesis | x | x | x | - | x | - | x | - | - | - |
| 6 | How to Review Literature | x | x | x | x | x | - | x | - | - | - |
| 7 | Quantitative Analysis | x | x | x | - | x | - | x | - | - | x |
| 8 | Quanlitative Analysis | x | - | - | - | - | - | x | - | - | - |
| 9 | Writing Research Proposal | x | x | x | - | - | - | - | - | x | - |
| 10 | Plagiarsm & Bibliography | x | - | - | - | - | - | x | - | - | - |

There are so many activities in a week. Both of activities need a large storage. Based on experiment, number of activities will increase equally with number of users and learning materials. Cloud environment as a service gives the facilities to enjoy the learner when they use personalization e-learning.

In order to improve performance of learners when use personalization e-learning in cloud environment, relation between level of learning materials and knowledge ability of learners has been observed. The relation in step 1 will be compared with the relation in step 2. Tabel IV shows the distribution of learners about relation between level of learning materials and knowledge ability in identification step.

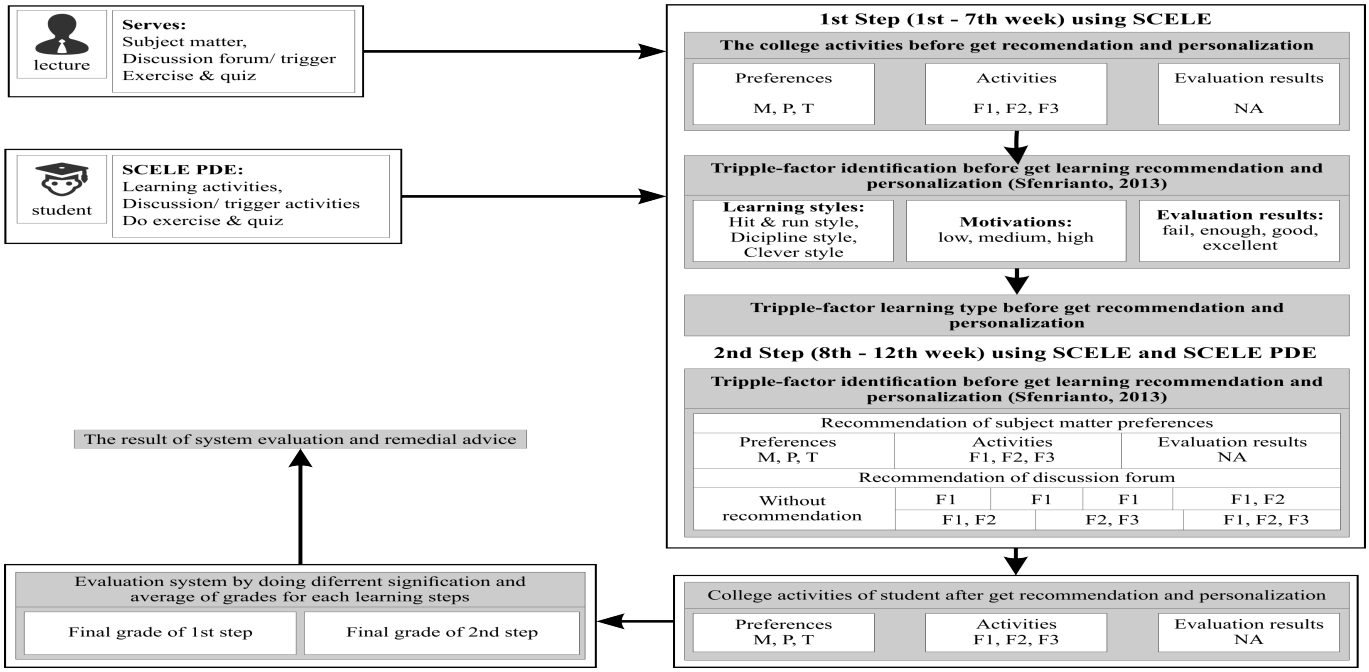

TABLE III
LEARNING ACTIVITES IN IDENTIFICATION STEP

| Week | Amount of access to learning materials | Amount of access to forum discussions | Evaluation Score | | | |
|---|---|---|---|---|---|---|
| | | | Fail | Fair | Good | Very Good |
| 1 | 451 | 1162 | | | | |
| 2 | 236 | 118 | | | | |
| 3 | 372 | 197 | | | | |
| 4 | 219 | 477 | 6 | 55 | 53 | 4 |
| 5 | 247 | - | | | | |
| 6 | 268 | 409 | | | | |
| 7 | - | 441 | | | | |
| **Sum** | **1793** | **2804** | **118** | | | |

TABLE IV
DISTRIBUTION OF LEVEL OF LEARNING MATERIALS AND KNOWLEDGE ABILITY IN IDENTIFICATION STEP

| | LV1 (M) | LV2 (M+P) | LV3 (M+P+T) | Sum |
|---|---|---|---|---|
| **Fail (0-60)** | 4 | 1 | 1 | 6 |
| **Fair (61-80)** | 43 | 4 | 9 | 56 |
| **Good (81-90)** | 46 | 0 | 6 | 52 |
| **Very Good (91-100)** | 2 | 1 | 1 | 4 |
| **Sum** | **95** | **6** | **17** | **118** |

Based on the table IV, the distribution of learners focus on LV 1. There are 6 learners which belong to fail category, 4 of them are in LV1 who only access short learning material but fail to gain more information because lack of knowledge ability. In fair category there are 43 learners that only access short material and gain enough information. The others in this category distributed to different level of learning materials but in small number. In good category, 46 learners have preference to access short learning materials too. They have higher knowledge ability than the category before, so their evaluation score belong to interval 81-90. In very good category there are only 4 learners, 2 learners belong to LV1 and the others belong to LV2 dan LV3.

The experiment continues to step 2 or personalization step. Based on preferences and calculation of means from frequent table of access learning materials, the personalization of learning materials delivered to learners. The step 2 held from week 8th until week 12th. The learner used personalization e-learning and got more different form and size of learning materials. 40 learning materials delivered in the system got the feedback such as number of access and other learning activities. Number of learning activities in learning step 2 describe in tabel V.

TABLE V
LEARNING ACTIVITES IN PERSONALIZATION STEP

| Week | Amount of access to learning materials | Amount of access to forum discussions | Evaluation Score | | | |
|---|---|---|---|---|---|---|
| | | | Fail | Fair | Good | Very Good |
| 8 | 221 | 564 | | | | |
| 9 | 554 | 344 | | | | |
| 10 | 252 | 609 | 4 | 45 | 61 | 8 |
| 11 | 728 | 1113 | | | | |
| 12 | 380 | 1301 | | | | |
| **Sum** | **2135** | **3931** | **118** | | | |

Table V shown that learning activities in personalization step increased more than learning activities in identification step. Number of access to learning materials increased from 1793 to 2135 activities and number of access to forum discussions increased from 2804 to 3931 activities. It shown that personalization e-learning is able to improve learner's participation when they learnt because system deliver type of learning materials that suitable with the learner's need. So the learners will be focused on their exploration to get the information when they learn.

In personalization step, distribution of learners in relation between level of learning materials and knowledge ability was observed and describe in table VI below.

TABLE VI
DISTRIBUTION OF LEVEL OF LEARNING MATERIALS AND KNOWLEDGE ABILITY IN PERSONALIZATION STEP

| | LV1 (M) | LV2 (M+P) | LV3 (M+P+T) | Sum |
|---|---|---|---|---|
| **Fail (0-60)** | 1 | 0 | 3 | **4** |
| **Fair (61-80)** | 26 | 5 | 14 | **45** |
| **Good (81-90)** | 27 | 5 | 29 | **61** |
| **Very Good (91-100)** | 5 | 1 | 2 | **8** |
| **Sum** | **59** | **11** | **48** | **118** |

Tabel VI shown that learners in fail category decreased into 4 learners. 45 learners in fair category distributed to LV1, LV2, and LV3 in 26, 5, and 14 respectively. In good category, there are 61 learners. This number increase from 52 in identification step. The last category is very good that increased from 4 to 8.

In addition, this study also observed the activities of learners in discussion forums The main purpose of the activity observed in the discussion forums are to be used as a benchmark for determining the level of motivation of the learner. The discussion forum is divided into three categories of discussion include: lounge F1), self add post (F2), and trigger forum (F3). The observation is divided into two Steps: Step 1 is identification and Step 2 is personalization (see Figure 5). In Step 1, the lounge (F1) is a forum with the highest activity, there is about 2,567 (91.55%) of the 2,804 discussion activities for 7 weeks. Activity on trigger forum there are only 153 (5.45%) of the overall activity in the existing forums. Then for the self add post activity is the lowest activity with only 84 events (2.99%) of the total 2.804 activities. The Observation result of discussion forum activity in step 1 can be seen in Figure 7 below.

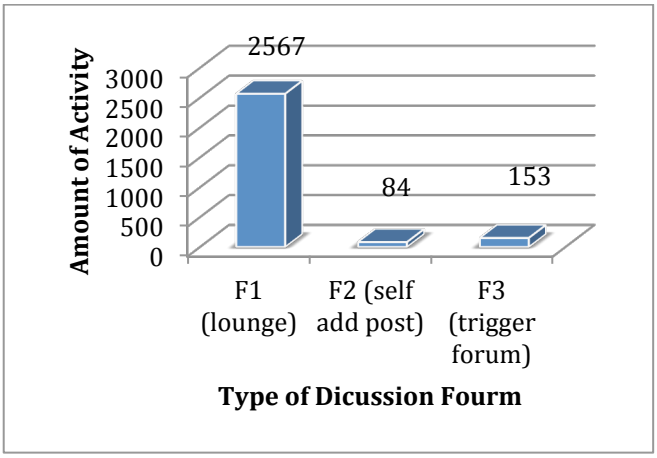


Fig 7. Learner's Discussion Activities in Step 1 : Identification

Then, the special treatment given to all learners who still have low activity discussion forums through the suggestions given in the e-learning during step 2 of personalization. At the end of step 2, the observation of the activity in discussion forums carried back. The comparisons between the activity of step 1 and step 2 in learning activity conducted to determine the increased activity of learner discussion. The observation is illustrated in the Figure 8 as follows.

In step 2, there are 3,237 activities in a public forum (F1). This represents an increase of step 1 which only 2,567 learning activities. In self add post (F2), a very high amount of increased activity at the step 2 where there are 1,401 compared with step 1 with only 84. In the triggers forum, the activity also increased from the previous 153 to 193 activities. This increased activity is assumed to be caused by given recommendations.

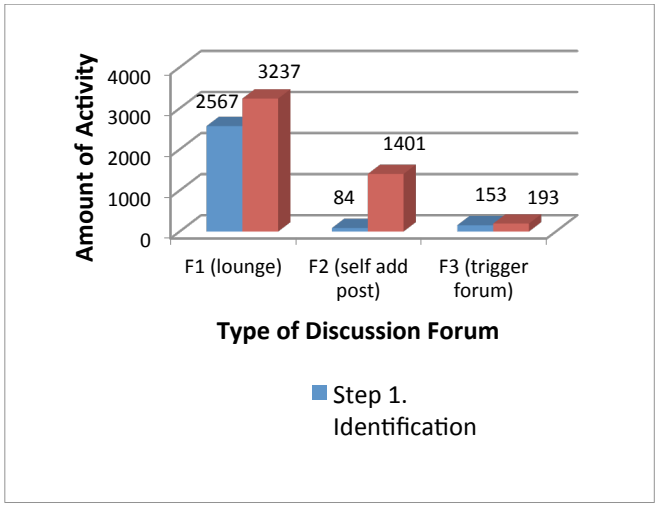


Fig 8. The Comparison about Discussion Forum Activity in Step 1 and Step 2 of Learning Activities

In general, personalization e-learning success to improve performance of the learners. Many learners moved from low category to higher category in knowledge ability, dicussion activity, and get the higher score. It can be happened because in environment level, personalization e-learning runs in cloud computing environment which can provide wide access to broad storage of learning materials, facilities, and others services that support personalization.

## VII. Evaluation

The evaluation process for technical system will be used functional testing method. The system will be tested by input scenario and the output will be recorded and matched by the expected output. This scenario aimed to tested that the system will be running properly.

After making sure that the system has running properly by evaluated the functional system, the next evaluation process is concerning to economical aspect. Authors approach for this evaluation is by comparing two cases: non-cloud e-learning and cloud e-learning. This two cases will be evaluated by two approach: (1) Cost (Capex & Opex) analysis; (2) Net Present Value (NPV).

Cost anaylsis is measured by calculating sum of Capex and Opex between non-cloud and cloud open learning then the result will conclude the cost efficiency. The formula for calculating cost analysis (for NC stands for Non Cloud-Based system and C stands for Cloud-Based system could be describes as follows :

$$Cost\ Analysis\ (\%) = \frac{\sum NC_{expense} - \sum C_{expense}}{\sum NC_{expense}} \quad (1)$$

The simulation process with this approach conclude that by using cloud-based system could decrease the investation cost up to 35.61%.

Net Present Value (NPV) is measured by calculating the the difference between the present value of cash inflows and the present value of cash outflows. In this case NPV non cloud based formula could be describes as follows [6]:

$$NPVnc = -CaPex + \sum_{t=0}^{N} \left(\frac{C_t - OpEx}{(1+r)^t}\right) \quad (2)$$

and NPV for cloud based formula described as follows:

$$NPVc = \sum_{t=0}^{N} \left(\frac{C_t - OpEx}{(1+r)^t}\right) \quad (3)$$

The simulation process needs several assumptions such as salary of programmer, analyst, and server procurement cost. Furthermore, the result by calculating the NPV approach shows that the value of NPV is positive (greater than 0) by using NPV percentage formula :

$$NPV\ Percentage = \frac{NPVc - NPVnc}{NPVnc} x\ 100\% \quad (4)$$

with the results shows positive value (43,9%) of NPV that means by using cloud based system could give more benefits than using non cloud based system.

## VIII. Conclusions and Future Works

This paper discussed the problems while developing and implementing the e-learning system stressing the initial cost issue. Authors proposed a solution for these problems by adopting cloud technology and the concept of open educational resources to implement the e-learning and expected become a cloud based open learning system.

Authors steps for solved the initial cost problem are designing a architecture of cloud based open learning and implementing this architechture to a working prototype system. Final step is evaluating the prototype system by stressing the initial cost using the Net Present Value method.

The results of the evaluation shows that by implementing the cloud based open learning portal could decrease the infestations cost up to 59% in compares to non cloud e-learning systems and with NPV approach shows that the results is 43,9% of NPV percentage that means by using

cloud based system could give more benefits than using non cloud based system.

In our future work, we will design and develop a semantic based search engine for enhanced the system and integration it with personalization e-learning.

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