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The Evaluation of E-Learning Maturity at Senior High Schools in Yogyakarta

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Abstract. The availability of technology infrastructure and human resources training do not guarantee the success of e-learning, while organizational culture and leadership factors have a major influence on the success of e-learning. The use of e-learning especially information technology in the curriculum of 2013 is compulsory for all subjects in senior high schools. Unfortunately, several observations show that not all the requirements to use e-learning in the learning process optimally has been met yet.

The research aims to determine the maturity level of the implementation of e-learning at several senior high schools in Yogyakarta. The evaluation model used in this research is the improvement of the evaluation model developed by Marshall and Mitchell. The model measures the maturity level of e-learning that consists of five processes, 35 sub processes and five dimensions.

Based on the results of the conducted evaluation, we can conclude that the maturity level of the e-learning implementation senior high schools in Yogyakarta are in the level 2, it can be said that it is on the level of "partially fulfilled". This shows that there are still quite big weaknesses or limitations in the implementation of e-learning at senior high schools in Yogyakarta. Therefore we have to improve the quality of e-learning, not only on the implementation but also on its preparation phase.

1. Introduction

Based on the readiness level scores from the eight categories of Chapnick Model's E-Learning Readiness (ELR), previous research has obtained a total score for e-learning readiness at junior high schools in Yogyakarta city is 114.87 [1]. In other word, junior high schools in Yogyakarta are quite ready to implement e-learning in the learning process based on the Chapnick Model of ELR as overall, and also ready to implement the e-learning in the learning process sociologically or it shows that the interpersonal aspect for the junior high schools' environment, where the program will be implemented, are fully ready [1].

After the ELR have been known then we need a guideline in its implementation to develop e-learning in high schools. This guideline will be used as a basis to develop e-learning such that we can minimize all the problems arise during the further development of e-learning.

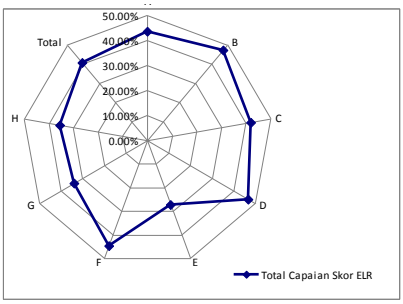

Figure 1. Overall ELR Score Achievement for Yogyakarta's Junior High Schools

2. Research Purposes

In order to achieve the purpose of e-learning implementation in the learning processes at schools, we need an e-learning guideline based on the Evaluation of e-learning Maturity Model (eMM). The evaluation step in eMM is designed to capture the profile and IT capacity of schools which implement e-learning, and to evaluate the adequate of that school to reach the goal. From its evaluation we will derive the information of the maturity of the schools in implementing the e-learning in their teaching learning processes. Thus the objectives of this research are:

1. To develop an e-learning guideline based on the evaluation of e-learning Maturity Model (eMM) for senior school in Yogyakarta.
2. To obtain the information about the maturity level of e-learning high senior schools in Yogyakarta using eMM model.
3. To explore which factors that are in the low level of its maturity and need to be revised, and also which factors that are that succeeded or has a strong maturity to support e-learning in the high senior schools.

3. Literature Review

3.1. *E-learning*

Learning strategy involves teaching, assignment, presentation, discuss, reading, and evaluation in general, its success is depend on one or more basic models of communication: 1) Communication between teacher and student, 2) Communication between student and references, and 3) Communication among students.

When those three aspects can be done in balance composition, then an optimal learning process can be expected. Many education experts propose that a success in achieving the goal of learning is highly determined by the balance of three aspects [1]. Design of learning with a harmony of three communication models as the main goal is the most important factor for the learning and teaching based on Web.

According to [1], internet is a media which is has multi talent performance, in one side internet can be used to communicate within individual such as communication by e-mail and chat (one-to-one communications), in the other side people can use e-mail to make communication with another group (one-to-many communications). Besides that, internet has also the ability to facilitate discussion session and collaboration of many people. Another benefit of internet is the flexibility for users to held a teleconference, so it might be the communication via audio visual support the verbal or non-verbal communication in real-time.

Nowadays, e-learning or electronic learning is become more popular as one of the way to handle education problem in the developing countries. Many people use vary vocabulary in e-learning definition. But in general, e-learning is a learning process where an electronic as a supplementary media.

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Soekartawi in [9] argued that the using of e-learning cannot leave from internet, because discussion about learning which is available in the internet completely, it will affect the role of teacher in the learning process. In the previous time, learning and teaching process is dominated by role of teacher so we call it the era of teacher. Recently, learning and teaching process is dominated by teacher and book so we call this time as the era of teacher and book) and in the future, learning and teaching process is dominated by teacher, book, and technology (the era of teacher, book and technology).

3.2. *E-learning Components*

Principal components for contructing *e-learning* based on [10] are:

3.2.1. E-learning Infrastructure

Infrastructure of e-learning can be shown by personal computer (PC), computer network, internet and multimedia equipment, including teleconference tools when we give synchronous learning service.

3.2.2. E-learning System and Applications

Software system can visualize learning and teaching process conventional, how to manage classroom, prepare material or content, discussion forum, assignment system (report), online test system, and all features that related to management of learning and teaching process. The software system is popular known as *Learning Management System (LMS)*.

According to [10], there are several organizations and consortium that issued in e-learning such as Advanced Distributed Learning (ADL) (http://adlnet.org), Aviation Industry CBT Committee (AICC) (http://aicc.org), IEEE Learning Technology Standards Committee (IEEE LTSC) (http://ltsc.ieee.org), and IMS Global Consortium (IMS) (http://imsproject.org).

One of them is ADL which is familiar in all users; it is Shareable Content Object Reference Model (SCORM). Specification of SCORM combines elements from standard that IEEE issued, AICC and IMS. SCORM enable developer and e-learning contents provider to be more consistent and make it easy in implementation because it's reusable property. Standard of SCORM is developed from SCORM version 1.0, SCORM 1.1, SCORM 1.2, and SCORM 2004. Now, Learning Management System (LMS) that support SCORM is available, including aTutor and Moodle which is open source and intraLearn for commercial one [10]. SCORM is possible to import and export contents that have been made in LMS to LMS easier.

3.3 E-learning Maturity Model

E-learning Maturity Model (EMM) was developed in New Zealand based on two complementary models, Capability Maturity Model (CMM) from Software Engineering Institute (SEI 2002) and SPICE (Software Process Improvement and Capability Determination) [2].

Maturity Model is a success model that used to develop organization process, product, and services. Many education institutions apply online course in learning process, maturity model design and online course to increase the maturity in e-learning application [6]. Maturity Model involves process and high performance and it is proved useful for individual and organization to assess the maturity of themselves from many aspects that is defined at the beginning process. A maturity model can help educational institution to give assessment of e-learning application that focus on maturity level. It can give recommendation about and the priority level to improve its maturity level [6].

Online Course Design Maturity Model (OCDMM) has five levels of maturity [6] such as 1) Level 1 (Initial), 2) Level 2 (Exploring), 3) Level 3 (Awakening), 4) Level 4 (Strategizing), and 5) Level 5 (Integrating Best Practices).

According to [6] the key process areas of OCDMM are from best literaturee review on the course online design. Key process areas are categorized in five areas. Each process area in each level can identify collectively that is useful to reach the goal and performance capability. Key process area can be seen at figure 2.

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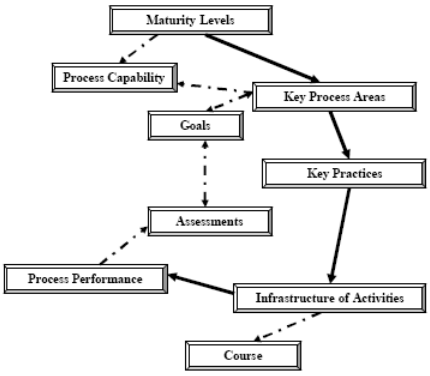

Figure 2. *Relationship of OCDMM Components*.

Marshall in [4] stated that despite the adoption of e-learning is very widespread in education world, but proved that it is good and become an effective way to deliver the education values, and also it is quite efficient in using resources component in the educational institutions, though in its implementation it is very difficult. These difficulties arise because of the creation, use, and support e-learning facility requires a balance between the factors of technical, organizational and pedagogical considerations. These difficulties, if they are not treated properly, can lead to failures in the e-learning implementation. [5] states that there are 33 causes of failure of e-learning, which are divided into eight categories, namely: 1) Poor alignment to needs, 2) Communication, 3) Lack of implementation skill, 4) Poor Implementation Process, 5) Management Commitment, 6) Scalability, 7) Support, and 8)Technology.

According to [5], E-learning Maturity Model (eMM) provides a means by which institutions can assess and compare their ability to sustainably develop, deploy and support e-learning. Capability is perhaps the most important concept that is incorporated in the eMM. This illustrates the ability of the institution to ensure that e-learning design, development and deployment meets the needs of staffs, students and institutions. In this case, capability includes the institution's capability to maintain e-learning delivery and support the learning process because of some demands to improve and staff changes in the institution [5]. eMM has five dimensional capabilities which are:

1. *Delivery*
   Related to the creation and supply of results process. The assessment of this dimension is intended to determine the extent to which the process exists to operate within the institution.
2. *Planning*
   Assessing the use of the set objectives and plans to do the jobs. The use of the set plans potentially make process can be managed effectively and can be reproduced if it is successful.
3. *Definition*
   Covers the definition of the use of e-learning by institutional and documentation standards, guidelines, templates and policies during the implementation process.
4. *Management*
   Relates to how the institution manages the process implementation and ensure the results quality. The ability of this dimension reflects the measurement and control of processing results.
5. *Optimization*
   Captures the extent to which the formal institution uses this model approach to improve the activity process. This capability reflects the culture of continuous improvement.

Furthermore, eMM divides the institution's ability to maintain and provide e-learning into five main categories of processes that demonstrate interdependence process as shown in Table 1.

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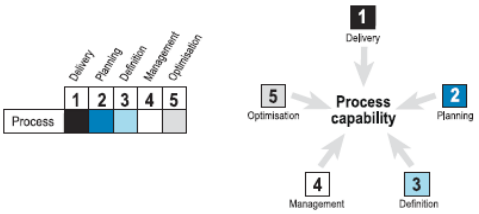

Figure 3. *eMM Process Dimension*

Process category	Brief description
Learning	Processes that directly impact on pedagogical aspects of e-learning
Development	Processes surrounding the creation and maintenance of e-learning resources
Support	Processes surrounding the oversight and management of e-learning
Evaluation	Processes surrounding the evaluation and quality control of e-learning through its entire lifecycle.
Organisation	Processes associated with institutional planning and management

Table 1. *eMM Categories of Processes*

4. Research Methods

This study is a research and development. The research model that was used in this study is a modification from reseach and development model from Borg and Gall version as well as Dick and Carey version.

4.1. Research Stages

The details steps are as follows.

1. *Preliminary study*
   This stage includes needs analysis, literature study, small-scale research and standard report that are needed.
   a. *Needs Analysis*. This analysis was conducted to determine the urgency of the product to be developed, the availability of human resources, and the time available for the development of these products.
   b. *Literature Study*. Literature study was conducted for temporary introduction to the product that will be developed. The literature study was undertaken to gather the research findings and other pertinent information.
   c. *Small-scale research*. Developers often have questions that cannot be answered with reference to the research study or professional texts. Therefore, developers need to do small-scale research to find out some things about the product that will be developed.
2. *Identification*. This stage includes: a) Identifying ICT facilities and the School Strategic Plan, and b) Identifying the research locations with reference to the determined criteria.
3. *Modification of eMM Model*. This stage includes: a) Determining the eMM model that will be used, b) Determining the modification that will be used, and c) create the eMM model design.
4. *Model Validation*. In this stage, the modification of the eMM model is validated.
5. *Revision*. The model revision after a validation is done in this stage.
6. *eMM Evaluation*. In this stage, the evaluation of e-learning maturity at schools is performed using the modified model of the EMM.
7. *eMM Scores*. In this stage, the e-learning maturity score are evaluated based on the eMM evaluation.

5. Results and Discussions

To inflate an e-learning, there are eight dimensions that must be considered. The dimensions are interrelated and influence each other in a system [3]:

Proceeding ICMETA: Volume 1/2017, June 27th 2017 ISBN 978-602-397058-2

1) *Institutional*. There is an existence of an element managing the administrative issues, academic, and services to students.
2) *Management*. There is an element related to learning and information distribution.
3) *Technological*. There is some infrastructures to support the implementation of e-learning system, which includes planning and infrastructure preparation both hardware and software.
4) *Pendagogical*. The process of teaching and learning that includes content analysis, target analysis, objectives analysis, media analysis, instructional design, organization, and learning strategies.
5) *Ethical*. There is an e-learning ethics in the implementation, which includes social and political influence, cultural diversity, bias, geographical diversity, students diversity, the condition of the ICT progress and copyright issues.
6) *Interface design*. There is a site design, content, navigation, accessibility, and interactivity.
7) *Resource support*. There is online supports and resources that can help e-learning.
8) *Evaluation*. There is an evaluation to determine the success of e-learning which includes the assessment of student and learning evaluation in the e-learning itself.

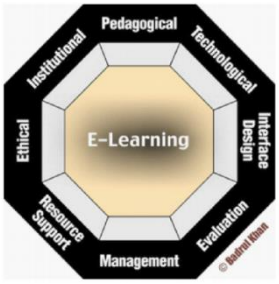

Figure 4. e-Learning Framework

Model Marshall and Mitchell measure maturity level of e-learning that involve 5 process categories, 35 sub process and 5 dimension of capability. The five of process categories are: a) Learning, b) Development, c) Support, d) Evaluation, e) Organization. Meanwhile the five capability dimensions include delivery, planning, definition, management, and optimization. eMM Marshal and Mitchell model consists of five capability assessments: Fully Adequate, Largely Adequate, Partial Adequate, Not Adequate, Not Assessed. The five process category in this model consists of 35 sub processes as shown in Table 2.

Learning: ***Processes that directly impact on pedagogical aspects of e-learning***	
L1.	Learning objectives are apparent in the design and implementation of courses
L2.	Students are provided with mechanisms for interaction with teaching staff and other students
L3.	Student skill development for e-learning is provided
L4.	Information provided on the type and timeliness of staff responses to communications students can expect
L5.	Students receive feedback on their performance within courses
L6.	Research and information literacy skills development by students is explicitly supported
L7.	Learning designs and activities result in active engagement by students
L8.	Assessment of students is designed to progressively build their competence
L9.	Student work is subject to specified timetables and deadlines
L10.	Courses are designed to support diverse learning styles and learner capabilities
Development: ***Processes surrounding the creation and maintenance of e-learning resources***	
D1.	Teaching staff are provided with design and development support when engaging in e-learning
D2.	Course development, design and delivery are guided and informed by formally developed e-learning procedures and standards
D3.	Explict linkages are made in the design rationale regarding the pedagogies, content and technologies chosen
D4.	Courses are designed to support disabled students
D5.	All elements of the physical e-learning infrastructure are reliable, robust and sufficient
D6.	All elements of the physical e-learning infrastructure are integrated using defined standards
D7.	Resources created are designed and managed to maximise reuse

Proceeding ICMETA: Volume 1/2017, June 27th 2017 ISBN 978-602-397058-2

Support: ***Processes surrounding the support and operational management of e-learning***	
S1.	Students are provided with technical assistance when engaging in e-learning
S2.	Students have access to a range of library resources and services when engaging in e-learning
S3.	Student enquiries, questions and complaints are collected formally and managed
S4.	Students have access to support services for personal and learning issues when engaging in e-learning
S5.	Teaching staff are provided with pedagogical support and professional development in using e-learning
S6.	Teaching staff are provided with technical support in the handling of electronic materials created by students
Evaluation: ***Processes surrounding the evaluation and quality control of e-learning through its entire lifecycle***	
E1.	Students are able to provide regular formal and informal feedback on the quality and effectiveness of their e-learning experience
E2.	Teaching staff are able to provide regular formal and informal feedback on quality and effectiveness of their e-learning experience
E3.	Regular formal independent reviews of e-learning aspects of courses are conducted
Organisation: ***Processes associated with institutional planning and management***	
O1.	Formal criteria used to allocate resources for e-learning design, development and delivery
O2.	Institutional learning and teaching policy and strategy explicitly address e-learning
O3.	A documented specification and plan guides technology decisions when designing and developing courses
O4.	A documented specification and plan ensures the reliability, integrity and validity of information collection, storage and retrieval
O5.	The rationale for e-learning is placed within an explicit plan
O6.	E-learning procedures and which technologies are used are communicated to students prior to starting courses
O7.	Pedagogical rationale for e-learning approaches and technologies communicated to students prior to starting courses
O8.	Course administration information communicated to students prior to starting courses
O9.	The provision of e-learning is guided by formal business management and strategy

Table 2. eMM Capability Assessments

eMM Marshall and Mitchell evaluation model comprises 35 sub processes such as in Table 2, are used to determine the level of maturity of e-learning in higher education institutions. Therefore, in the evaluation of the maturity level of e-learning in secondary schools, we need to do a modification of eMM Marshall and Mitchell model.

The modification of Marshall and Mitchell's eMM model has produces 21 sub processes, as shown in Table 3.

Learning: Processes that have a direct impact on the pedagogical aspects of e-learning	
01	The learning objectives appear on the design and implementation of the lessons/subjects.
02	The development of students' ability to use e-learning is available.
03	Students receive feedback from their works.
04	Research and information on the development of student's literacy skills are supported explicitly.
05	Student's works are designed in a schedule and deadlines.
06	The subjects are designed to facilitate a variety of learning styles and different students' abilities.
Development: Processes in the formation and maintenance of e-learning resources	
01	The teaching staff is provided by design and development support while engaging in e-learning.
02	The development of subjects, design and delivery is based on procedures and e-learning standard that has been arranged formally.
03	The subjects are designed to support students with disabilities or disadvantages.
04	Resources are designed and managed to maximize the reuse.
Support: Processes in the investigation and operational management of e-learning	
01	Students are provided by technical assistance when engaging in e-learning.
02	Students can access a variety of sources and library facilities when engaging in e-learning.

03	All questions and complaints from students are accommodated and arranged formally.
04	The teaching staff is provided by pedagogical support and professional development in using e-learning.
Evaluation (Evaluation): Processes in the evaluation and the quality control of e-learning as overall	
01	Students can submit feedback on a regular basis, both formally and informally about the quality and effectiveness of e-learning experiences that they experienced.
02	Review / formal review of e-learning aspects in the subject are performed regularly.
Organization: Processes related to school plans and management	
01	Formal criteria are used to allocate resources for the design, development and delivery of e-learning.
02	Policies and strategies for schools on learning and teaching are explicitly discussed about e-learning.
03	Specifications and plans that are documented ensure the reliability, integrity, and validity of the collection, storage and information retrieval.
04	E-learning procedures and technologies that will be used are communicated to the students before the learning begins.
05	Subject administrator is introduced to the students before the learning begins.

Table 3. eMM Sub Processes

In this research, we still used the 5 capability assessment from Marshall and Mitchell's as shown in Table 4.

Level 4	Level 3	Level 2	Level 1	Level 0
Fully Adequate	Largely Adequate	Partial Adequate	Not Adequate	Not Assessed

Table 4. Capability Assessments

Learning Process Category

Based on the assessments, the results of the learning process categories are shown as below.

Learning (L)	**1**	**2**	**3**	**4**	**5**
01					
02					
03					
04					
05					
06					

Table 5. Learning Process Category

Based on the results and evaluation, in the Learning process category, the level of maturity is at level 2 (adequately fulfilled). From the table above, in the Learning process category, most sub processes are at level 2 (adequately fulfilled). The sub process that has the highest level is sub process 05 in dimension 3 (Definition). It shows that the assignments given for students have been well arranged and the information is well documented, and also there is a guideline for it.

Development Process Category

Based on the results, we obtained the development process category as below.

Development	**1**	**2**	**3**	**4**	**5**
01					

Proceeding ICMETA: Volume 1/2017, June 27th 2017 ISBN 978-602-397058-2

02					
03					
04					

Table 6. Development Process Category

In the development process category, the maturity level is at level 2 (adequately fulfilled). It can be seen as mostly of the sub processes from all dimension are at level 2. Unfortunately, there is a sub processes that is still at level 0 (not fulfilled): sub processes 03 for dimension 1 (delivery). It means that the available human resources have not been prepared yet for re-use. As it has not been well prepared, thus this process is not visible in the program implementation.

Support Process Category

Based on the results, we obtained the support process category as below.

Support	1	2	3	4	5
01					
02					
03					
04					

Table 7. Support Process Category

In the Support process category, the maturity level is also at level 2 (adequately fulfilled). It can be seen as mostly of the sub processes from all dimension are also at level 2. There is a sub processes that is at level 4 (fully fulfilled): sub processes 02 for dimension 2(Planning), sub processes 03 and 04 for dimension 5 (Optimization).

Evaluation Process Category

Based on the evaluation, we obtained the evaluation process category as in Table 8.

Evaluation	1	2	3	4	5
01					
02					

Table 8. Evaluation Process Category

In the Evaluation process category, the maturity level is also at level 2 (adequately fulfilled). It can be seen as mostly of the sub processes from all dimension are also at level 2. There is a sub processes that is at level 4 (fully fulfilled): sub processes 02 for dimension 2 (Planning). Means that the planning has already been well done, in terms of giving formal review for e-learning aspect in the subject/lesson.

Organization Process Category

Based on the evaluation, we obtained the organization process category as in Table 9.

Organization	1	2	3	4	5
O1					
O2					
O3					
O4					
O5					

Table 9. Organization Process Category

Proceeding ICMETA: Volume 1/2017, June 27th 2017 ISBN 978-602-397058-2

In the Organization process category, the maturity level is also at level 2 (adequately fulfilled). It can be seen as mostly of the sub processes from all dimension are also at level 2. There is a sub processes that is at level 4 (fully fulfilled): sub process 02 for dimension 5 (Optimization), sub process 02 for dimension 4 (Management), sub process 04 for dimension 3 (Definition), sub processes 05 for dimension 1 (Delivery).

Based on all processes in the evaluation, the level e-learning maturity at Yogyakarta senior high schools is at level 2 (adequately fulfilled). It means that there are still many processes need to be improved for its maturity, so that the implementation of e-learning will be in the desired level (fully fulfilled). Thus, the implementation of e-learning can be more effective and efficient in improving the learning process at schools.

6. Acknowledgement

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