4th ICRIEMS Proceedings
Published by The Faculty Of Mathematics And Natural Sciences
Yogyakarta State University, ISBN 978-602-74529-2-3

The E-Learning Maturity of Mathematics Learning in Yogyakarta's High Schools

Seftika Anggraini[a)], Nur Hadi Waryanto[b)], Nur Insani[c)] and Retno Subekti[d)]

Department of Mathematics Education, Faculty of Mathematics and Natural Science, Yogyakarta State University
Jl Kolombo No 1, Karangmalang, Depok, Sleman, Yogyakarta, Indonesia

Corresponding author: [a)]seftika96@gmail.com
[b)]nur_hw@uny.ac.id
[c)]nurinsani@uny.ac.id
[d)]retnosubekti@uny.ac.id

Abstract. Electronic learning which is abbreviated e-learning is one of Information and Communication Technology (ICT) development products. ICT can support mathematics learning in order to run well. But the existence of e-learning is underutilized, especially by mathematics teachers in Yogyakarta's high school. The purpose of this research is to find out the level of e-learning supporting facilities and the mathematics teachers e-learning maturity in Yogyakarta's high schools. The population of this research is mathematics teachers in Yogyakarta's high school and the sample is 11 state high schools in Yogyakarta. The sampling technique that used is judgmental sampling. The e-learning supporting facilities is observed by "*Panduan Implementasi Pembelajaran Berbasis TIK di SMA*" guideline written by *Direktorat Pembinaan Sekolah Menengah Atas, Kementerian Pendidikan dan Kebudayaan Indonesia.* Meanwhile, the mathematics teachers e-learning maturity is measured by Context, Input, Process, and Product (CIPP) evaluation. It consists of four aspects, namely context aspect, input aspect, process aspect, and product aspect. The result show that the e-learning supporting facilities in Yogyakarta's high schools have a score of 16.54. It means that those are on very high category. Meanwhile for the mathematics teachers e-learning maturity has score 19.034 which is on low category. According to CIPP model, the context, input, process and product aspects of teachers e-learning maturity has a score 36.3, 21.611, 10.43 and 7.796 respectively. It means that context, input, process, and product aspects are on high, low, very low, and high category respectively. So, there is a gap between the e-learning supporting facilities and the mathematics teachers e-learning maturity in Yogyakarta's high schools.

INTRODUCTION

Globalization era is an era where there is no demarcation between countries in the world. Beside that, globalization give impact on Information and Computer Technology (ICT) development too. It has to be used maximally. Electronic learning or e-learning is one of the ICT development product on education. Mathematics learning can be done in everywhere and everytime with e-learning. E-learning [1] is a learning process that use media or electronic devices help service. But the existence of e-learning is underutilized, especially by mathematics teachers in Yogyakarta's high school.

Based on that statement, it is needed to evaluate the mathematics teachers e-learning maturity in Yogyakarta's high schools. By evaluate, it will be known which categories that have reached high maturity and which categories that have reached low maturity, so it needs to be improved [2]. Beside that, it is needed to know too about the e-learning supporting facilities, it is met or not. So, it will be found the relation between those.

Research about e-learning evaluation has been done by Waryanto and Insani [3]. The research evaluated the readiness of implementing e-learning in Yogyakarta's high schools. The result of the research gave a score 103.76 means that Yogyakarta's high schools was ready enough to implement e-learning.

In Government Regulation of Indonesia Year 2008 Number 74 about teachers [4], it explains that teachers are professional educators who have primary tasks to educate, teach, guide, direct, train, assess and evaluate students on early childhood education, formal education, primary education and secondary education. There are four teachers competencies, namely pedagogy, personality, social and professional. Beside that, there is ICT competency for teachers that is established by UNESCO [5]. It is consists of six aspects, understanding ICT in

education, curriculum and assessment, pedagogy, ICT, organization and administration and teacher professional learning.

Khan [6] states that e-learning framework consists of eight dimensions that interconnect and influence in a system. They are institutional, management, technological, pedagogical, ethical, interface design, resource support, and evaluation. Meanwhile, evaluation of e-learning consists of evaluation of content development process, evaluation of e-learning environment, evaluation of e-learning at the program and institutional levels, and assessment of learners. Moreover, Direktorat Pembinaan Sekolah Menengah Atas, Kementerian Pendidikan dan Kebudayaan Indonesia [7] states that evaluation of e-learning should be done in order school knows the e-learning maturity level is satisfied or not. The e-learning maturity that is unsatisfied tend to be fail on its implementation. There are four aspects of e-learning maturity. They are human resources, learning contents, ICT facilities, and school management. The human resources consist of the headmaster ICT competency, the teachers ICT competency, the staffs ICT competency, learners' participation, and the headmaster's support.

Evaluation is an activity to get or give values by use standars that given before. Results of the evaluation are used to create something new in order to improve something that is exist or to create something that is not exist before. Kaufan and Thomas [8] distinguish evaluation models to eight models, namely:

1. Goal Oriented Evaluation Model
   Focus of this model is on goal of program that is given before. This model is done continuously and constantly to check the extent of the goals have been accomplished. The model was developed by Tyler.
2. Goal Free Evaluation Model
   On this model, evaluators do not need to pay attention on specific program goal but on general program goal. Evaluator just pay attention on how the program works by identifying the performances that occur, either positive things (expected) and negative things (unexpected). The model was developed by Michael Scriven.
3. Formative Summative Evaluation Model
   Focus of this model is on the steps and the object scope is evaluated, namely evaluation is done when the program runs (called formatifve evaluation) and when the program has been completed (called summative evaluation). The model was developed by Michael Scriven.
4. Countenance Evaluation Model
   Focus of this model is on two main points, namely description and consideration. Moreover, this model distinguished into three steps, namely antecendent, transaction and output. The model was developed by Stake.
5. Responsive Evaluation Model
   This model focuses on all components program through different perceptions. It uses instrument to observe directly or undirectly by interpreting data. The model was developed by Stake.
6. CSE-UCLA Evaluation Model
   CSE-UCLA consists of two abbreviations, namely CSE and UCLA. CSE is an abbreviation of Center for the Study of Evaluation, and UCLA is an abbreviation of University of California in Los Angeles. CSE-UCLA model consists of five steps, namely planning, delevopment, implementation, result and impact.
7. Discrepancy Model
   Focus of this model is on view of gaps in program implementation. Evaluator evaluates program to measure gap magnitude in every component. The model was developed by Malcolm Provus.
8. CIPP Evaluation Model
   This model is most widely used by evaluators. CIPP is an abbreviation of Context evaluation, Input evaluation, Process evaluation and Product evaluation. It can be said that CIPP model is an evaluation that look at the evaluated program as a system so that the evaluator must analyze the program based components. The model was developed by Stufflebeam and friends. Below is details of CIPP evaluation model [9].
   - In context evaluations, evaluators assess needs, problems, assets, and opportunities, plus relevant contextual condition and dynamics.
   - In input evaluation, evaluators assist with program planning by identifying and assessing alternative approaches and subsequently assessing procedural plans, staffing provisions, and budgets for their feasibility and potential cost-effectiveness in regeard to meeting targeted needs and achieving goals.
   - In process evaluations, evaluators monitor, document, assess, and report on the implementation of program plans.
   - In product evaluations, evaluators identify and assess costs and outcomes-intended and unintended, short term and long term.

TABLE 1. Details of CIPP evaluation Model [10]

	Context Evaluation	Input Evaluation	Process Evaluation	Product Evaluation
Objective	To define the institutional context, to identify the target population and assess their needs, to identify opportunities for addressing the needs, to diagnose problems underlying the needs & to judge whether proposed objectives are sufficiently responsive to the assessed needs.	To identify & assess system capabilities, alternative program strategies, procedural design for implementing the strategies, budgets, schedules, and program.	To identify or predict, in process, defect in the procedural design or its implementation, to provide information for the preprogrammed decisions, and to record & judge procedural events & activities.	To collect descriptions & judgements of outcomes & to relate them to objectives & to context, input & process information & to interpret their worth & merit.
Relation to decision making in the change process	For deciding upon the setting to be served, the goals associated with meeting needs or using opportunities, & the objectives associated with solving problems, i.e., for planning needed changes. And to provide a basis for judging outcomes.	For selecting sources of support, solution strategies & procedural designs, i.e., for structuring change activities. And to provide a basis for judging implementation.	For implementing and refining the program design and procedure, i.e., for effecting process control. And to provide a log of the actual process for later use in interpreting outcomes.	For deciding to continue, terminate, modify, or refocus a change activity, & present a clear record of effects (intended, positive & negative).

METHODS

This research is a descriptive research. Descriptive research is a research that is done to explain phenomenons aspect or characteristics of interested variable or object to be researched [11]. The population of this research is mathematics teachers in Yogyakarta's high school and the sample is mathematics teachers in 11 Yogyakarta's state high schools. The sampling technique that used is judgmental sampling. The e-learning supporting facilities is observed by "Panduan Implementasi Pembelajaran Berbasis TIK di SMA" guideline written by *Direktorat Pembinaan Sekolah Menengah Atas, Kementerian Pendidikan dan Kebudayaan Indonesia* [7]. Meanwhile, the mathematics teachers e-learning maturity is measured by Context, Input, Process, and Product (CIPP) evaluation model. The measurement was done by filling questionnaire by 54 mathematics teachers senior high school in Yogyakarta. This research was done at February 2017.

The data is analyzed by using descriptive analysis that consist of mean and standard deviation [12]. Mean ($\bar{X}$) is obtained by summing all of individual datas in group kelompok ($\sum X_i$) then devided by the total respondents (n) or $\bar{X} = \frac{\sum X_i}{n}$. Meanwhile, standard deviation is average squared deviation each individual scores of group average or $SD = \sqrt{\frac{\sum(X_i - \bar{X})^2}{n-1}}$.

Based on mean and standard deviation, it is made conversion so that the data can be interpreted to determine level of mathematics teachers e-learning maturity and the supporting facilities. Below is guide conversion by using four scales.

TABLE 2. The Guideline Conversion by Using Four Scales

Interval	Category
$X \geq M_i + (1{,}5\ SD_i)$	High
$M_i \leq X < M_i + (1{,}5\ SD_i)$	Low
$M_i - (1{,}5\ SD_i) \leq X < M_i$	Very low
$X < M_i - (1{,}5\ SD_i)$	High

with

X = respondent's score
M_i = mean ideal

SD_i = standar deviation ideal

RESULTS AND DISCUSSION

Mathematics Teachers E-Learning Maturity in Yogyakarta's High Schools

Mathematics teacher e-learning maturity is evaluated based on four aspects, namely context, input, process and product aspects. The results of each aspects are shown in Table 3.

TABLE 3. Mathematics Teacher E-Learning Maturity

No.	Aspect	E-learning Score	Category
1	Context	36.3	High
2	Input	21.611	Low
3	Process	10.43	Very low
4	Product	7.796	High
Mean		19.034	Low

The results show that the context, input, process and product aspects of teachers e-learning maturity has a score 36.3, 21.611, 10.43 and 7.796 respectively. It means that context, input, process, and product aspects are on high, low, very low, and high category respectively. The context aspect is the highest score of other aspects. For more details can be seen at Figure 1.

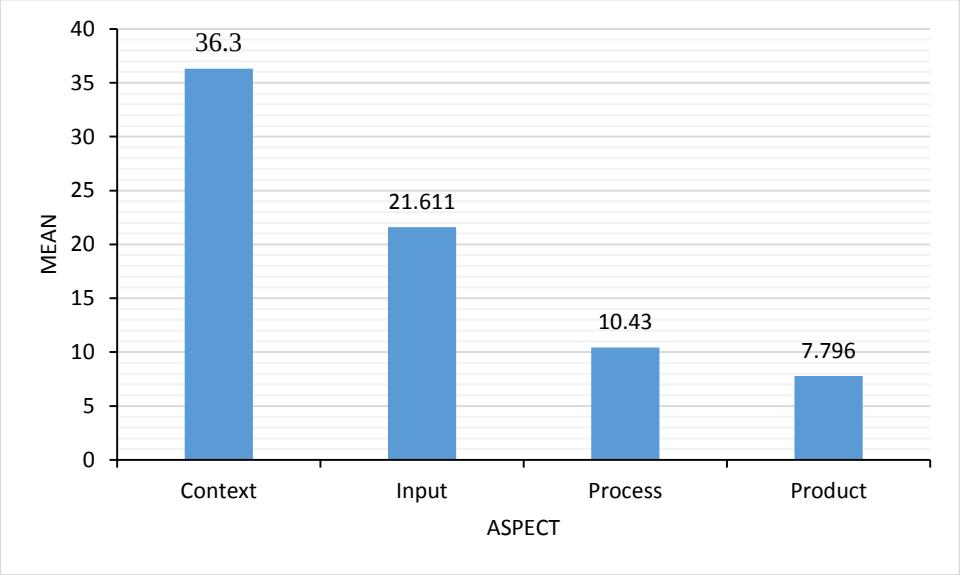

FIGURE 1. Diagram of Mathematics Teacher E-Learning Maturity

Context aspect has a score 36.3 and standard deviation 6.325 that means it is on high category with percentage 62.96%. This score indicates that mathematics teachers in Yogyakarta's high schools have been able to implement e-learning on mathematics learning. Context aspect will has higher score if mathematics teachers improve their ICT capability by coming on training or workshop about e-learning based mathematics learning. Syukur [13] states on his research that teachers should improve awareness about the importance of ICT in mathematics learning

by attending training, workshops, courses, or peer teachers tutor. Syukur explain that senior high school's teachers need training about supporting learning applications.

Input aspect has a score 21.611 and standard deviation 5.378 that means it is on low category with percentage 48.15%. This score indicates that the e-learning content management is performed by mathematics teachers in Yogyakarta's high schools is not good. Increased input aspect is done by increasing the ability of mathematics teachers in developing e-learning content. Because every teacher has opportunity to upload teaching material in e-learning. However, the opportunity is not used by teacher to the fullest. Moreover, online assessment by mathematics teachers can increase input aspect too. Online assessment is designed based on: a) technology afffordances, b) alignment of objectives with assessment, c) discipline-specific practices and approaches, d) meaningful and timely feedback, e) authenticity and transferability and f) transparency of assessment criteria [14].

Process aspect has a score 10.430 and standard deviation 3.51 that means it is on very low category with percentage 48.15%. This score indicates that transaction and the use of features in e-learning are performed by mathematics teachers is very bad. The transaction that is performed by teacher is still limited on outside school hours. Teachers also rarely manages e-learning through computer, laptop or smartphone. Crichton, Pegler & White [15] suggest that teachers should manage e-learning contents. Teachers should be able to apply e-learning when school hours very well because the supporting facilities has been provided completely in school. In this research, e-learning supporting facilities in Yogyakarta's high schools has a very high score. It means that schools serve facilities to implement e-learning in schools.

Product aspect has a score 7.796 and standard deviation 1.698 that means it is on high category with percentage 61.11%. This score indicates that implementing e-learning in mathematics learning has good effects. Although input and process aspects are not good, but teachers believe that implementing e-learning in mathematics learning gives good effects. Moreover, Buus [16] in his research states that integrating e-learning (tools) and practices (activities) into a Problem Based Learning (PBL) approach makes good sense, highlight more social, student-centered, collaborative and production-oriented pedagogical strategies.

In overall, mathematics teacher e-learning maturity in Yogyakarta's high school has a score 19.034. This score is on low category, which means that mathematics teacher e-learning maturity is not good. Teachers have not taken advantages of e-learning features maximally. It gives effect that implementation of e-learning can not go as desired.

Supporting Facilities

Supporting facilities is evaluated based on three components, namely ICT tools (hardware), network tools and computer laboratory. The result of each components are shown on Table 3.

TABLE 2. ICT Supporting Facilities in Yogyakarta's High Schools

No.	Komponen	Skor	Kategori
1	ICT tools	20	Very high
2	Network tools	12	Very high
3	Computer laboratory	17.636	Very high
mean		16.54	Very high

ICT devices component has a score 20 and standard deviation 2 that means it is on very high category with percentage 90.91%. This score indicates that the availability of ICT tools in Yogyakarta's high schools are very good. Unavailability of smartboard in several high school is a major cause of ICT tools component does not reach maximum value. There are only three of eleven schools that have smartboard.

Network tools component has a score 12 and standard deviation that means it is on very high category with percentage 100%. This score indicates that the availability of network tools in Yogyakarta's high schools are very good.

Computer laboratory component has a score 17.636 and standard deviation 1.027 that means it is on very high category with percentage 100%. This score indicates that the existence of computer laboratory Yogyakarta's high schools are very good. Unavailability of wide laboratory room that does not meet standard is a major cause of computer laboratory component does not reach maximum value. There are only three of eleven schools that have wide laboratory that meet standard.

In overall, the availability of supporting facilities to apply e-learning in Yogyakarta's high schools has a score 16.54. This score is on very high category, which means that the availability of supporting facilities is very good.

The Owned assets should be utilized as much as possible. Because the school will be lose if the asset that is only used on the minimally.

Based on the obtained data, e-learning maturity of mathematics teachers is on low category and the supporting facilities is on very high category. So, there exist a gap between both of them. Therefore, it is needed to improve the quality of human resources in ICT capability of mathematics teachers so that e-learning can go on as planned.

CONCLUSION AND SUGGESTION

The result show that the e-learning supporting facilities in Yogyakarta's high schools have a score of 16.54. It means that those are on very high category. Meanwhile for the mathematics teachers e-learning maturity has score 19.034 which is on low category. According to CIPP model, the context, input, process and product aspects of teachers e-learning maturity has a score 36.3, 21.611, 10.43 and 7.796 respectively. It means that context, input, process, and product aspects are on high, low, very low, and high category respectively. So, there is a gap between the e-learning supporting facilities and the mathematics teachers e-learning maturity in Yogyakarta's high schools.

Based on the result of research, it is suggested to schools and goverment to give training or workshop for teachers. Moreover, goverment is also suggested to define ICT standard competency for teachers.

REFERENCES

1. Munir, *Kurikulum Berbasis Teknologi Informasi dan Komunikasi* (Alfabeta, Bandung, 2008).
2. N. H. Waryanto, "E-Learning Readiness to E-Learning Maturity," in *Seminar Nasional Penelitian, Pendidikan dan Penerapan MIPA*. (UNY, Yogyakarta, 2012).
3. N. H. Waryanto and N. Insani, *Jurnal Pendidikan Matematika dan Sains*, **2**, 117-124, (2013).
4. Government Regulation of Indonesia Year 2008 Number 74 about teachers.
5. UNESCO, *UNESCO ICT Framework for Teachers* (UNESCO, Paris, 2011).
6. B. Khan, *Managing E-Learning: Design, Delivery, Implementation and Evaluation* (Information Science, Hershey, 2005).
7. Direktorat Pembinaan SMA, *Panduan Implementasi Pembelajaran Berbasis TIK di SMA* (Kemdikbud, Jakarta, 2011).
8. S. Arikunto and C. S. A. Jabar, *Evaluasi Program Pendidikan* (Bumi Aksara, Jakarta, 2007).
9. D. L. Stufflebeam and C. L. S. Coryn, *Evaluation Theory, Models, and Applications* (Jossey-Bass, San Fransisco, 2014).
10. D. L. Stufflebeam and G. Zhang, *The CIPP Evaluation Model* (The Guildford Press, New York, 2017).
11. Sudaryono, S. Guritno, and U. Rahardjo, *Theory and Apllication of IT Research* (ANDI, Yogyakarta, 2011).
12. S. Badri, *Metode Statistika untuk Penelitian Kuantitatif* (Ombak, Yogyakarta, 2012).
13. I. A. Syukur, *Jurnal Pendidikan dan Kebudayaan*, **2**, 200-210, (2014).
14. J. McCracken, S. Cho, A. Sharif, B. Wilson, and J. Miller. *Electronic Journal of e-Learning*, **10**, 107-119, (2012).
15. S. Crichton, K. Pegler, and D. White. *Electronic Journal of e-Learning*, **10**, 23-31, (2012).
16. L. Buus. *Electronic Journal of e-Learning*, **10**, 13-22, (2012).