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Effectiveness of development of diva learning management system models on Algorithm and Programming Mathematics Course

Lita Sari Muchlis[1], Kasman Rukun[2] and Krismadinata[3]

[1] Department of Informatics Management, Institut Agama Islam Negeri Batusangkar, **INDONESIA**
[2] Department of Electronic and Informatics Engineering, Faculty of Engineering, Universitas Negeri Padang, **INDONESIA**
[3] Department of Electrical Engineering, Faculty of Engineering, Universitas Negeri Padang, **INDONESIA**

*Corresponding author: litasari.m@iainbatusangkar.ac.id

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Abstract— he development of the DIVA Learning Management System learning model is an increase in student understanding based on problems because learning algorithms and programming is indicated to be low in students' understanding that is abstract in the subjects of algorithms and programming. For this reason, the purpose of this study is to develop a DIVA Learning Management System model that has effectiveness. The methodology used is quasi experimental design in the form of nonequivalent pretest-posttest control group design. This study found the DIVA Learning Management System learning model with the syntax: a) Display; b) Information Search; c) Virtual Problem Solving; and d) Appraisal, and products from: (1) DIVA learning management system learning model (2) learning tools; (3) modules; and (4) learning media. Analysis of research data shows the learning model DIVA Learning Management System In the effectiveness test of media use for lecturers 92.3% is effectively used and for student learning outcomes with pre-test and post-test test scores can be seen from the achievement score of each respondent. The gain score results indicate the achievement score is at the level of 0.486 with the interpretation that overall an increase in scores after being given treatment to respondents. Based on the results of the data analysis above, it can be concluded that the model developed meets the feasibility to be used.

Keywords: *DIVA, Learning management system, Learning model, Algorithms and programming*

I. INTRODUCTION

Globalisation, which touches all aspects of life today, requires people to compete in different areas of life. If you are not able to compete, you will automatically be excluded from the global arena of life. One of them is the realisation of the Industrial Revolution 4.0, which was officially born in Germany during the Hannover Fair in 2011 (Kagermann, etal, 2011), so it requires great efforts to prepare for this challenge (Zhou, et al, 2015). In response to this, it is expected that the curriculum will be able to anticipate the needs of graduates with jobs waiting in the wings. One of the areas of computer science management. This field must have graduate competencies or skills equivalent to learning outcomes in the informatics and computer science family, namely: being able to know the specialisation of designing and developing applications for information systems or websites, programmers or web programmers, designing e-business and database management (Aptikom, 2016).

Programming has become a skill and a strategic force in the 21st century, with all activities surrounded by programming devices such as smartphones, tablets, PCs and technologies used in everyday life. However, learning and developing programming is not easy, even with the different types of programming languages that are widely used (Areias, et al, 2007) (Tan, et al, 2009), it is not necessarily able to become a reliable programmer. It takes 10 years to become an expert programmer (Winslow, 1996). A student who has just started to learn a programming language will face many difficulties in terms of programming skills, understanding programs and debugging. Therefore, before understanding programming languages,

students must first understand the concepts and syntax of programming languages by developing problem and algorithm skills (Tan, et al, 2009) (Rsoy, et al, 2006) (McGill, 1997).

Learning algorithms and programming is a core course that every student must master, where students are able to understand algorithms by analysing basic logic and then implementing it in programming languages. Based on the results of the researcher's initial observation, the data shows that many students were not able to compile program codes and analyse what they have designed because students are not used to using structured thinking patterns in analysing abstract programming logic and low student understanding of the course and each student has a different way and motivation in learning so it affects the absorption of programming learning material (Jenkins, 2002) (Lahtinen, 2006) (Roebling, 2010) (Tuparov, et al, 2014).

Based on the problems in the Problem Based Learning model, it needs to be integrated with the Creative Problem Solving model, which emphasises students' creative problems that can be solved using many pedagogical strategies in designing quality learning in problem solving (Pepkin, 2004) (Arends, 2012). From the results of the integration of Problem Based Learning and Creative Problem Solving models by applying the LMS concept, the DIVA Learning Management System model was designed as a learning model resulting from the integration of a variety of problem solving models, which is the development of a new model in vocational education. DIVA Learning Management System is a model that aims to transform the acquisition of knowledge into critical and creative thinking in solving problems. These two models also have weaknesses, namely the difficulty of students with different abilities to analyse problems with the ability to create creative ideas, so it is necessary to develop with interactive interaction with virtual learning-based learning, whose learning process is in the DIVA Learning Management System learning model.

The integration between PBL and CPS models resulted in a new model called DIVA Learning Management System. The result of the development of the DIVA Learning Management System model consists of four steps (syntax), namely (1) display, (2) information search, (3) virtual in problem solving and (4) evaluation (Muchlis, et al, 2017). In essence, the learning steps applied to develop students' thinking are critical and creative thinking in problem solving, so that students are able to think meaningfully, work alone, find themselves, and construct new knowledge and skills they have. Based on the above, the researchers believe that the DIVA Learning Management System learning model can be used as a solution to overcome students' problems in understanding learning algorithms and programming. DIVA Learning Management System model with mobile learning management system from LMS.

Theoretically, learning with the DIVA Learning Management System is influenced by psychological aspects such as (a). Student intelligence; (b) Student attitude; (c) Student talent; (d) Student interest; and (e) Student motivation (Syah, 2003). Theories that support learning consist of: (a) cognitive theory; (b) constructivism; (c) learning styles; (e) andragogy. In order to increase the understanding of algorithmic and programming learning with this model, students are guided to solve problems in order to be able to express creative ideas in virtual learning. This is possible because the DIVA Learning Management System model performs a mobile control system for learning values, adding material and some interactive enrichment that can increase and deepen the understanding of programming logic by constructing the knowledge they have in real life.

The study aims to determine the effectiveness of the DIVA Learning Management System learning model can be used as a solution to overcome student problems in understanding learning algorithms and programming in the Diploma III Informatics Management Department of IAIN Batusangkar as a research site with the aim to comprehensively see the effectiveness of the DIVA Learning Management System learning model in algorithm and programming courses.

II. METHODS

The research used quasi-experimental design in the form of Nonequivalent Pretest-Postest Group Design This method uses a design to see a comparison of student progress before and after the effectiveness of the Diva Learning Management System model between the experimental class and the control class for students Research data obtained through tests, in the form of questions given to students to measure problem-based creativity ability skills with the concept of learning system management.

To analyse the effectiveness test data with statistics on the n-gain test research data. N-gain is used to determine whether there is an increase between pre-test and post-test. The amount of data level is calculated using the normalised n-gain formula shown in equation 1.

$$< g >= \frac{Posttest - Pretest}{Maximum\ score - pretest} \quad (1)$$

The N-gain results were then translated using the classification mentioned in Table 1.

Table 1. N-Gain Classification (Meltzer, 2002)

Category	Criteria
Low	N-g < 0.3
Medium	0.3 ≤ N-g ≤ 0.7
High	N-g ≥ 0.7

III. RESULTS AND DISCUSSION

The effectiveness of the DIVA Learning Management System model is seen in the test results of the students and the responses of the lecturers. Student test results are obtained through several processes, namely pre- and post-tests. The DIVA Learning Management System development model with a mobile learning based device was carried out by researchers with the aim of learner-centred education using mobile devices with the characteristics of mobile learning that the media has additive characteristics, namely the ability of the media to record, store, preserve and reconstruct an object or event through photos and videos (Murhaini, 2016).

The effectiveness of the use and ease of use of mobile-based learning media can be seen from the lecture process and the usefulness of lecturers and students. According to the lecturers' perception, this can be seen in Table 2.

Table 2. Results of the Effectiveness Questionnaire on the Use of Mobile-Based Learning Media according to Lecturers' Perceptions

No	Lecturer	Total	Percentage	Category
1	1	89	89	Effective
2	2	95	95	Very effective
3	3	97	97	Very effective
4	4	95	95	Very effective
5	5	90	90	Effective
6	6	94	94	Very effective
7	7	95	95	Very effective
8	8	93	93	Very effective
9	9	80	80	Moderately effective
10	10	95	95	Very effective
Average		**92.3**	**92.3**	**Very effective**

Based on the results of the effectiveness questionnaire on the use of mobile-based learning media (Table 2), when looking at the perceived ease of use on lecturer users, the conclusion that can be drawn is that the average of the items asked by 92.3% of respondents answered 'yes', this means that this system is easy to use. This effectiveness test was conducted to determine the increase in students' pre- and post-test scores. In addition, it also knows the difference between students by comparing the normalised gain value (N-gain) between the pre-test and post-test scores, with the N-gain classification having an average value of medium with a total score of 18.

Table 3. Effectiveness test results of pre- and post-test scores

Pretest	Posttest	Gain	N-Gain
60	78	18	0.45
73.33	86	12.67	0.48
73.33	84	10.67	0.40
46.67	78	31.33	0.59
73.33	92	18.67	0.70
53.33	70	16.67	0.36
86.67	90	3.33	0.25
66.67	84	17.33	0.52
66.67	78	11.33	0.34
66.67	80	13.33	0.40
66.67	84	17.33	0.52
66.67	78	11.33	0.34
73.33	92	18.67	0.70
80	90	10	0.50
73.33	80	6.67	0.25
73.33	94	20.67	0.78
73.33	86	12.67	0.48
66.67	92	25.33	0.76
20	76	56	0.70
73.33	84	10.67	0.40
73.33	98	24.67	0.93
66.67	84	17.33	0.52
46.67	76	29.33	0.55
86.67	90	3.33	0.25
60	70	10	0.25
60	70	10	0.25

Table 4. Number of respondents based on N-Gain score classification

Category	Criteria	Total
Low	N-g < 0.3	5
Medium	0.3 ≤ N-g ≤ 0.7	18
High	N-g ≥ 0.7	3
	Completed	3
	Not completed	2

The results of the gain score show that respondents' achievements are generally at the level of 0.3 - 0.7 with a moderate category, this can be interpreted that in general there is an increase in scores through the application of the model as measured by the post-test. The strength of the score achievement is also indicated by the achievement of N Gain in general which is at the level of 0.486 with the interpretation that overall there is an increase in score after giving the treatment to the respondents.

It is known that based on the average score of learning outcomes with the post-test is 85.15 while the pre-test group has an average of 66.41 there is a score difference of 18.73 which states that the post-

test group is superior. Table 4.1 below explains the difference in the average scores of the two groups.

Table 5. Mean scores of both groups pre- and post-test

Descriptive Statistics					
	N	**Min.**	**Max.**	**Mean**	**Std. Deviation**
Pretest	26	20.00	86.67	66.4101	13.65932
Posttest	26	76.00	96.00	85.1538	6.88588
Valid N (listwise)	26				

The difference between the scores of the two groups of student activities can be seen in the histogram in Figure 1.

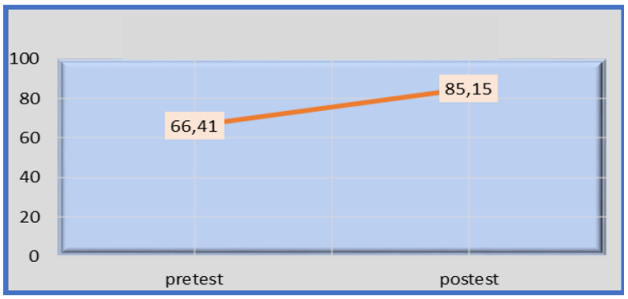

Figure 1. Differences in learning outcomes between pre-test and post-test

The results of using the Diva Learning Management System model of students' ability to analyse problems based on mobile learning have increased. The products developed enable students to solve problems through systematic steps.

IV. CONCLUSION

The learning model developed can be explored with learning innovations that can improve the achievement of learning objectives in Algorithms and Programming courses using the DIVA Learning Management System model:

1. The effectiveness of the learning model development test using the DIVA Learning Management System model can improve student learning outcomes with the results of the gain score showing the achievement of respondents in general at the level of 0.3 - 0.7 with a moderate category, then the strength of the score achievement is also indicated by the achievement of N gain in general which is at the level of 0.486 with the interpretation that overall there is an increase in scores after being given treatment to respondents.
2. The effectiveness of the use of mobile learning media in the learning model of the DIVA Learning Management System can be seen in the perception of the user-friendliness for lecturer users. The average result of the questions asked was 92.30% of the respondents answered very effectively, which means that this system is easy to use.
3. Based on the above, the use of the DIVA Learning Management System learning model as an alternative solution for lecturers in the implementation of learning that can increase interest and motivation to learn, especially in algorithm and programming courses. With the variation of the DIVA Learning Management System learning model that can improve student learning outcomes and strategies proven effective in improving student learning outcomes.

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