SCIENCE & TECHNOLOGY

Development of Cyberblog Learning Media to Improve Logical Thinking Concepts on Computer Science Students

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ABSTRACT

The aim of this study is to improve the mastery of the concept of students' logical thinking, especially in learning algorithm, applied to a new learning model. It is named the "cyberblog" model, which is a web-based learning model that combines web and blog functions in one weblog concept in the form of text, audio, and video developed with sources from the internet and researchers themselves. Therefore, this research proposes the Cyberblog model and describes its implementation. Some experiments on the concept of logical thinking are conducted. The sample of this study is students of the Department of Computer Science in Bandung city. Data were collected by using a test mastery of the concept of logical thinking and field notes and will grow to a computer network-based media (internet) specialized in the learning algorithm that is considered difficult. The results showed a medium of learning that can improve students' logical thinking skills.

Keywords: Cyberblog, Logical thinking, Model, Research and development, Web based learning, Weblog

INTRODUCTION

There is a need for quality education through improvement and refinement of the learning process in schools.

Conventional learning approaches do not demand much creativity in the learning process. Thus, ICT-based learning strategies are useful to achieve this (Leidner & Jarvenpaa, 1995). This learning strategy has many types, such as Interactive Multimedia (IM), Macromedia, Hypermedia, Hypertext, Weblog, and so forth. Weblog or blog is a kind of learning strategy that has many advantages (Wagner & Longmire, 1999). It can accommodate the needs of individual learning, connecting geographically dispersed learners, and asses the student's performance quickly. Moreover, by using weblog, it can

improve a teacher's knowledge (Ramasamy, Valloo, & Nadan, 2010) and also improve student's reading habit (Yang, 2008). Moreover, Massive Open Online Courses (MOOCs) contain e-learning media which is a product of collaboration among several universities that are designed for large a number of students. Several studies report that MOOCs have become an important technology in universities across Europe (Jansen & Schuwer, 2015), the US (Allen & Seaman, 2015), and Australia (O'Connor, 2014).

The basic theory of all logical thinking is sequential thought (Albrecht, 1984; Dettmer, 2007; O'Brien & Shapiro, 1968). This process involves taking the important ideas, facts, and conclusions involved in a problem and arranging them in a chain-like progression that takes on a meaning in and of it. To think logically is to think in steps (Albrecht, 1984).

Previous studies suggest that learners who have the ability to think logically earn higher grades than the students who don't. The results of the previous studies showed that the ability to think logically affects the learning outcomes of students. It means that by increasing the ability to think logically the learning outcomes of students will be increased (Aminah, 2015).

Albercht (1984) stated the basis of logical thinking is sequential thought where thoughts are united like a chain sequence to arrive at a meaning. Logical thinking is thinking gradually (Milková & Hulkova, 2013). There is a relationship between logical algorithms, which use the concept of sequential thought. This indicates that the algorithm is created by mimicking the logical thinking of humans. In other words, the logical thinking ability of a person affects the development of algorithms: the better the ability to think, the better the algorithm.

Algorithm and programming is difficult to learn (Jenkins, 2002; Gomes, & Mendes, 2007), because it requires not only knowledge but also the ability of logical thinking. Algorithms and programming is an important subject for the student in computer programming because algorithm is a core competency for vocational high students at the Department of Software Engineering. Algorithm and Programming can be defined as processes to build a program. These subjects are difficult for students because most of them have never learned about programming before.

Cyberblog is Cyberblog is web-based software that unifies the functionality of web and blog in the form of video or computer simulation sourced from the Internet or from the researchers themselves (Wihardi & Agustan, 2015). As a product of e-Learning, cyberlog is a rich learning media, highly proficient, adaptable and easy program for a higher level of interaction. Interactive multimedia training materials involving the animation and video clips help learners to gain new capabilities (Breckling, 2012).Wahyudin et al. (2015) recommend learners use cyberblog as a tool for studying algorithm as it could increase understanding of the concept.

Thus, this study focused on developing a new model based cyberblog to improve the student's ability to think logically. In order to evaluate and validate the model, an experiment among a select group of computer science students were conducted. It entailed cyberblog media development for adjusting the characteristics of the sample students.

METHODS

There are two approaches in this study: Research and Development (R&D) to implement the model, and a pre-experimental design using experimental and control groups.

In order to develop learning media based on Cyberblog, the processes used are based on Far West Laboratory (see Figure 1) (Gall, Borg, & Gall, 1996). It consists of 10 phases.
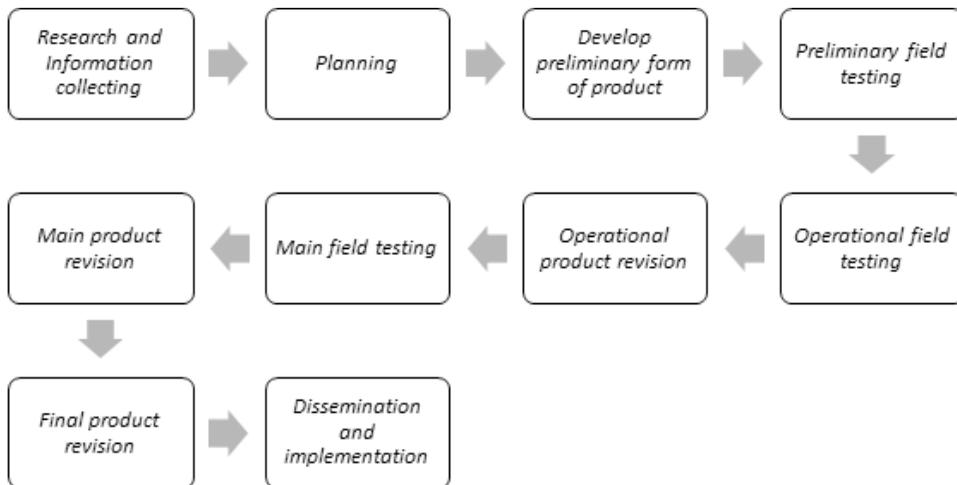

Figure 1. R&D Steps based on Gall et al. (1996)

Additionally, the students were assigned randomly, in the pre-experimental design, to experimental and control groups. A cluster random sampling technique was used after the two classes were tested for normality and homogeneity. The experimental group was exposed to cyber-blog learning with multimedia-based system, while the control group conventional learning.

The study population was 30 students randomly selected from Department of Computer Science Education in Universitas Pendidikan Indonesia. The study phase involved: preparation, implementation of the preliminary studies, planning and strategy, implementation and development.

Location and study sample

The study was conducted in Department of Computer Science Education, University of X, and Bandung. Subjects were lecturers (teachers) and students (learners). A snowball technique was used to select the sample as it allows researchers to determine the subject of research based on the needs of research.

Techniques and Data Collection

Data was collected utilising the following techniques: observation, documentation study, interview, and questionnaire to seek the student's opinion of cyberblog learning.

Research Instrument

Research instrument was used to calculate validity and reliability. Validity test is used to determine consistency and accuracy of data collected (i.e., 30 respondents) by using product moment correlation, while the reliability of an instrument is tested using Cronbach Alpha.

Data Analysis

Two kinds of data analysis are used: qualitative and quantitative. Quantitative data analysis in this study considers the following approaches: analysis descriptive statistics to calculate Description Percentage and hypothesis testing to show the influence (positive or negative) of the independent variables.

RESULTS AND DISCUSSIONS

Below are the findings of this study based on the interviews and discussions with the sample:

a. Students are constrained in logical thinking because they do not understand the process/sequence of the material being taught and end up regurgitating what the teachers have taught them.

b. Students' ability depends on how well they understand what is being taught by their teachers.

c. The facilities available in the department of computer science education in University of X are sufficient and the classrooms and internet connection are capable of supporting ICT-based learning.

Based on the potential and problems that have been identified previously, the authors propose solutions to overcome problems that occur by utilizing existing facilities in the department of computer science education. The solutions can be described as follows:

a. Required media learning that encourages students to understand the concept of logical thinking independently so that students can understand the sequence of instructional material taught in class to ensure they really understand the content and not just imitate their teachers. Algorithms and programming are difficult subjects because the concepts are difficult to grasp requiring multimedia intervention.

b. By utilising the facilities available in the department of computer science education, researchers conducted cyberblog development specifically designed to assist students in logical thinking so that they are able to understand the material sequentially.

Therefore, this study proposed and developed multimedia based learning with cyber-blog system using IMSDD (Interactive Multimedia System of Design and Development). It also requires developing optimal software engineering. The IMSDD is used to develop the waterfall method adapted to the needs of multimedia application development.

Cyberblog Product

Figure 2 shows the redeveloped Cyberblog. Its aim is to assist students in logical thinking with some adjustments as seen in Figure 3. There are two types of users, students and teachers (see Figure 4). Students have access to select subjects in which there are course materials and tests as a form of evaluation. Teachers determine where the material will be displayed and the matter of what will be used in the test and see the value generated by the students.

In Figure 4, blocky in cyberblog is a puzzle piece that contains the program code that must be compiled by the students appropriately so as to form a complete piece. If students have paired the whole piece of the puzzle, the program's source code will be displayed to give the correct answer. After the program's source code is displayed, the user can view the execution results in the form of CMD.
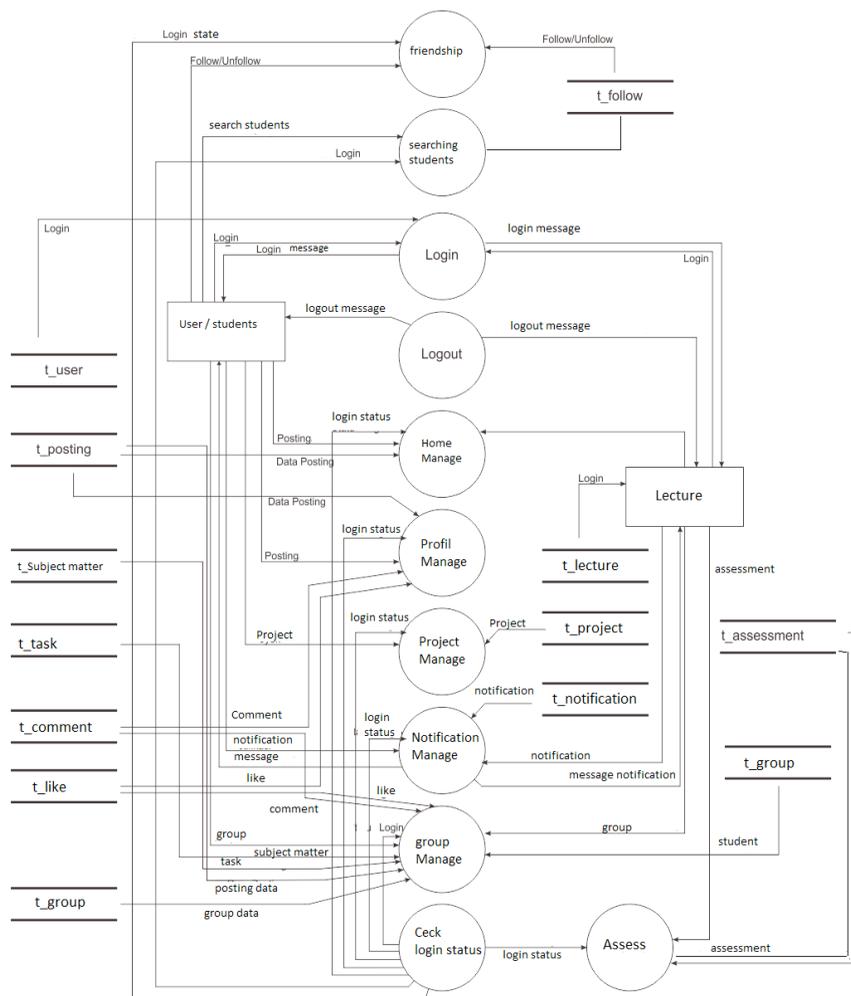

Figure 2. Software architecture on cyberblog
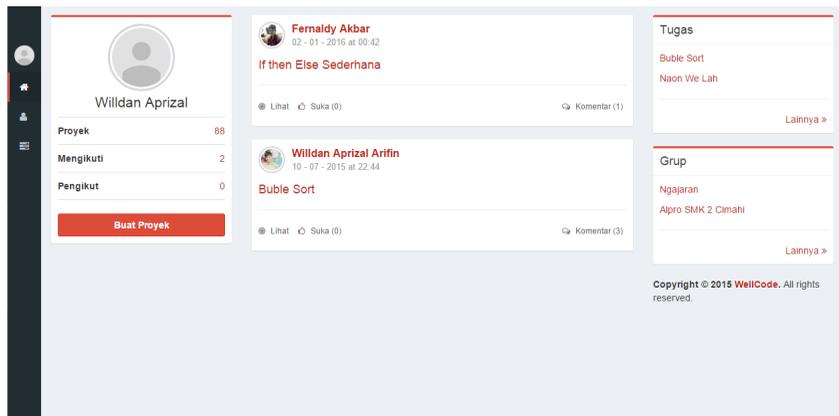
Figure 3. ERD cyberblog
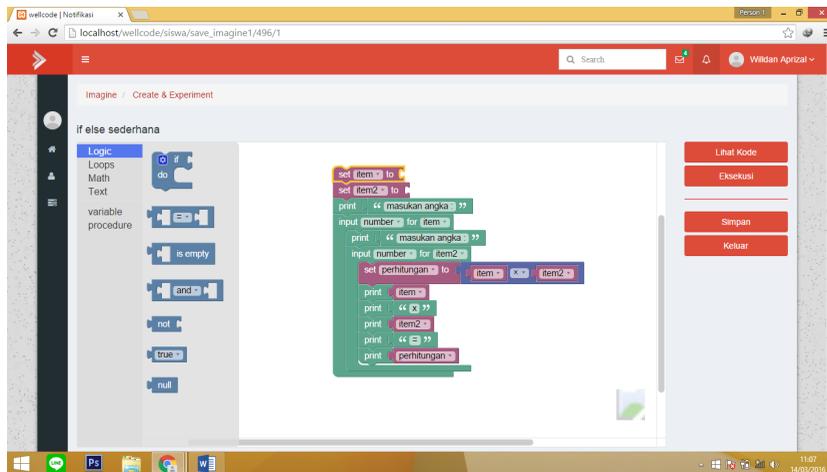
Figure 4. Redeveloped cyberblog
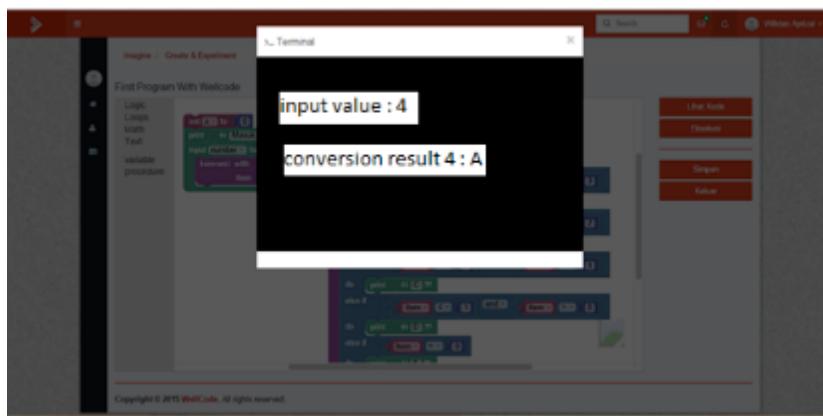

Figure 5. Blocky feature in cyberblog

Figure 6. The results of program execution

Data Analysis

Quantitative data was a pre-test score and post-test score of the control group and experimental group.

Pre-test data analysis. Before being subjected to the experiment, students should accomplish the first pre-test to measure their initial ability. After that they perform post-test to determine the increase students' understanding of the concept. Table 1 is the descriptive results of the control and experimental group pretest.

Table 1
Student initial ability

Value	Experiment	Control
Mean Value	73,78	71,22
Standard Deviation	9,36	8,05
Variance	86,45	62,74
DK	58	
t_{count}	1,58	
t_{table}	2,00	
$t_{count} \leq t_{table}$	There is no difference	
$t_{count} > t_{table}$	There is a difference	

The experimental group's mean initial capability was 73.78 while the control group's mean initially capability reached 71.22. From the table, it is clear that there is no significant difference between the students' initial capabilities in both groups.

Table 1 also shows T_{count} of 1.38, which is less than T_{table} of 1.86 indicating the two groups had the same variance (homogeneous).

Based on the differences of two mean of the pretest value data obtained, the value of T_{count} is 1.58. If the value of T_{count} (i.e., greater than T_{table}), then there are differences in the student's ability as seen from the initial tests. In Table 1, the value of T_{table} is 2.00. Because T_{count} is less than T_{table}, there is no difference in the ability of students in the initial tests.

Post test data analysis. Post-test is done to gauge the level of logical thinking of the student followed by data processing to obtain descriptive statistics for both experimental and control groups.

Table 2
Students' mastery of the concept of logical thinking after the learning/research

Value	Experiment	Control
Mean Value	82,23	74,22
Standard Deviation	8,86	8,65
Variance	80,22	76,58
DK		58
t_{count}		1,05
t_{table}		1,86
$t_{count} \leq t_{table}$		There is no difference
$t_{count} > t_{table}$		There is a difference

Based on Table 2, 30 students from the experimental group attained 82.23 in terms of capability while 30 from control group attained 74.22.

Analysis showed T_{count} of 1.05, which is less than T_{table} of 1.86. It means that both groups have the same variance (homogeneous). Moreover, it can be seen that T_{count} are in the reception area H1 (i.e., $t > T_{table}$) and there is an increased understanding of the concept of logical thinking by students in the experimental group

Student logical thinking mastery test. Tests to determine the increase in student's logical thinking mastery using a normalised gain showed mean gain between the groups. Table 3 shows the test results of student's mastery in logical thinking:

Table 3
Student logical thinking mastery test

Data	Class	N	Mean	Standard Deviation
Post-test	Control	30	65,22	8,65
	Experiment		77,22	8,99

Improve understanding of the concept in the experimental group because the students do not merely passively receive materials, but actively construct their understanding of the stages of learning using redeveloped cyberblog.

Effectiveness is related to comparison between the objective of the study and the results. Thus, the study showed logical thinking is improved as a result of redeveloped cyberblog.

CONCLUSION

The main findings of this study:

1. Interactive multimedia learning in the form cyberblog which is a tool delivers algorithm material. Multimedia development happens in several stages: analysis, design, development, implementation, and the assessment stages.

2. Student ability in logical thinking is increased as a result of 'redeveloped' cyberblog in learning.

3. Positive responses regarding e-learning using cyberblog because there is a blocky that helps them in sequence algorithms to view each case/problem.

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