EVALUATION ON THE EFFECTIVENESS OF VISUAL LEARNING ENVIRONMENT ON PROGRAMMING COURSE FROM STUDENTS' PERSPECTIVES

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ABSTRACT: This paper discusses the effectiveness of visual learning environment which is used to help students in university to study programming course. The visual learning environment which is used in this study is Greenfoot and Alice. The main goal of this article is to obtain the correlation between students' satisfaction level and their grades in studying programming course using visual learning environment tools. The participants were conducted on 110 students who took programming course during their first year. A survey was sent to students about their satisfaction level in learning programming course. Two-variable correlation analysis, significance test and descriptive analysis were conducted to find out the relationship between students' learning satisfaction level and their grades in programming course. This study discusses the student perspectives that are summarized in ten questions. There is a significant correlation between independent and dependent variables. The β value is 2.09 which proves that the independent variable in the form of student's learning satisfaction level is useful to obtain better assessment of their grades. Based on their perspectives, it is found that visual learning environment tools have more significant influence in improving the students' grade than traditional learning method. Further research is needed to find out other impact factors.

ABSTRAK: Makalah ini membincangkan keberkesanan persekitaran pembelajaran visual yang digunakan untuk membantu pelajar di universiti untuk mempelajari kursus pengaturcaraan. Persekitaran pembelajaran visual yang digunakan dalam kajian ini ialah Greenfoot dan Alice. Matlamat utama artikel ini adalah untuk mendapatkan korelasi antara tahap kepuasan pelajar dan gred mereka dalam mengkaji kursus pengaturcaraan menggunakan alat-alat persekitaran pembelajaran visual. Para peserta telah diadakan pada 110 orang pelajar yang mengambil kursus pengaturcaraan pada tahun pertama mereka. Satu tinjauan telah dihantar kepada pelajar tentang tahap kepuasan mereka dalam pembelajaran kursus pengaturcaraan. Analisis korelasi dua-pembolehubah, ujian penting dan analisis deskriptif telah dijalankan untuk mengetahui hubungan antara tahap kepuasan belajar pelajar dan gred mereka dalam kursus pengaturcaraan. Kajian ini membincangkan perspektif pelajar yang diringkaskan dalam sepuluh soalan. Terdapat korelasi yang signifikan antara pembolehubah bebas dan bergantung. Nilai β ialah 2.09 yang membuktikan bahawa pemboleh ubah bebas dalam bentuk tahap kepuasan pembelajaran pelajar adalah berguna untuk mendapatkan penilaian yang lebih baik dari gred mereka. Berdasarkan perspektif mereka, didapati alat persekitaran pembelajaran

visual mempunyai pengaruh yang lebih besar dalam meningkatkan gred pelajar daripada kaedah pembelajaran tradisional. Kajian lanjut diperlukan untuk mengetahui faktor-faktor kesan yang lain.

KEY WORDS: *Learning Method, Programming Course, Students' Perspective, Visual Learning Environment*

1. INTRODUCTION

Programming course is one of the compulsory subjects that must be taken in the first year of diploma and undergraduate students in the information systems study program at Universitas Airlangga. It is considered the most challenging course. According to Mckee-scott [1], students perceived that programming courses in the first and second semester are difficult to understand. Begosso et al. [2] states that the main concern of lecturers is to find out the effective method or strategies that can help the students understand the course better. The programming course is a basic course in computer science study program in university and it is considered as the most difficult course to be learned by the students. Zumaytis and Karnalim [3] conducted a research about students who studied programming course and the result stated that some students took longer time to understand the algorithm which is the main topic of the programming course. Some students required more detailed information from lecturers than other students. The students were expected to study the algorithm themselves when they were not in the class session.

In addition, new students face difficulty in debugging and writing code because they never write code before college. The programming courses are required in the first year because they are the basic courses before taking more advanced courses. There are many courses in Information Systems Study Program's curriculum including programming, object oriented programming, web programming and mobile programming. In the first semester, the programming course was called logic programming then in the following semester there is an object-oriented programming course. The programming courses are divided into theories and practical programming courses. When the students successfully understand the theory and practice of basic programming courses, it is easier for them to understand the rest of the information systems course. This is supported by Law et al. [4], they taught that one of the key competencies that supported many disciplines were computer programming skills, especially in engineering and computer science. People who work in that field must have good programming skills. Learning programming requires not only intelligence, but also a lot of motivation to learn and practice. Chu and Hwang [5] agreed that if one of the important goals of learning a programming course is to build cooperation and collaboration between students while developing the information system. Although some online forums exist to provide discussion among students, doing learning activities based on case studies is more needed. Chu and Hwang [5] proposed assistance to lecturers on how to conduct case studies based on online learning activities. The results show that the needs of students and lecturers can be fulfilled by the online learning activities and it is quite helpful to improve the effectiveness of learning.

Challenges faced by lecturers often occur when dealing with methods used to teach the students. Not all students have learned programming course before, and most of them have never developed software application before. Ouahbi et al. [6] concluded that there were researchers who had noted some of the problems faced by students in the programming courses. They reveal that some of the problems that arise during the theory and practice of programming learning are codes writing, loop manipulation, and method

structure. In addition, poor teaching methodology, low level students interaction and lack of interest are considered as challenges in learning programming course. Law et al. [4] reported a preliminary study on factors that influenced the learning program at university. They found that students' attitudes and expectations, clear material, rewards and recognition were motivating factors. They suggested e-learning as one of the facilitations that improve learning motivation. After that, evaluation results should be made to the students in the programming course [4], [7], [8],

There are many learning methods and software tools such as Scratch, Greenfoot and Alice that have been built to help students to eliminate the difficulties in learning programming. Visual learning environment has been built to support student learning such as: Scratch, Greenfoot, Alice. All methods introduce the concept of programming through animation. Students are expected to practice programming based on case studies. Students build game projects and animation projects using software tools. Jose-Manuel et al. [9] suggest students to make a simple game using Scratch game environments. Maloney et al. [10] states that Scratch is a visual programming environment that allows young users who are primarily aged 8 to 16 years to learn computer programming. Meanwhile, Dina et al. [11] conducted a comparative study of two groups of students who were taught by educational software tools (Greenfoot and Alice) and traditional method teaching without any educational software tools. Dina et al. [11] only use grades from two student groups to compare the effectiveness of the educational software tools. The result showed that the students' grades who utilized educational software tools were higher than group of students who did not use.

Slightly different with previous study [11], the current study uses not only grades to compare the effectiveness of using visual learning environment, especially Greenfoot and Alice, but also questionnaire which would be completed by the students to measure the students' satisfaction level in studying programming course. Thus, the research question of this article is what is the correlation between the students' satisfaction level and their grades in using visual learning environment in studying programing course? Therefore, the purpose of this study is to discover whether the visual learning environment is effective to be used in programming course based on the students' perspective. The following research hypothesis was expanded from research question:

H_0: There is no positive correlation between the students' satisfaction level and their grades in using visual learning environment in studying programming course.

H_1: There is positive correlation between the students' satisfaction level and their grades in using visual learning environment in studying programming course.

The significance of this study is to promote the use of visual learning environment as an educational software tools in programming course, increase students' grade in programming course and motivate students in learning programming course.

2. METHOD

A survey was conducted on 110 students from information systems study program at Universitas Airlangga. Questionnaires were designed by two academic lecturers who teach programming course and the questionnaires were distributed to students. The questionnaires used 4-point Likert scale as a ranking indicator in the survey form to measure the percentage of respondent's approval from each construction. A Likert score of 1 indicates that respondents strongly disagree and a score of 4 indicates that respondents strongly agree. For assessing the content validity and reliability, the questionnaire was

given to 2 academics who were also lecturers in programming course while to ensure clarity of wording, the questionnaire was given to 5 non-participating students.

In this study, to measure the correlation between students' satisfaction level and students' grades in programming course, three analyses were designed (a) descriptive statistics; (b) correlation analysis and significance testing. There are two variables used: variable X (students' learning satisfaction), and variable Y (students' grades). Pearson correlation is applied to identify the correlation between level of students' satisfaction and students' grades in programming course. Pearson correlation is applied to measure the correlation between those two variables because the Pearson correlation evaluates the linear relationship between two continuous variables. The first step to check the relationship is by Scatter Diagram for linearity [12]. The Scatter Diagram from Fig. 2 shows the linearity so that Pearson correlation is suitable to measure the correlation.

3. RESULT AND DISCUSSION

3.1. Descriptive analysis

Descriptive analysis were used to describe the data used in this study. The data descriptions included mean, median, and mode, and standard deviation (SD), range, minimum and maximum values. Those are shown in Table 1. According to Fig. 1, most data indicate that the students' satisfaction level are directly proportional to the students' grades. It proves that there is a linear relationship between the two variables (students'satisfaction level (X) and students' grades (Y)).

Table 1: The Percentage of Descriptive Statistic

Variables	Mean	Median	Mode	SD	Range	Min.	Max.	N
X	69.09	75	75	1.57	75	25	100	110
Y	69.94	75	75	2.25	100	0	100	110

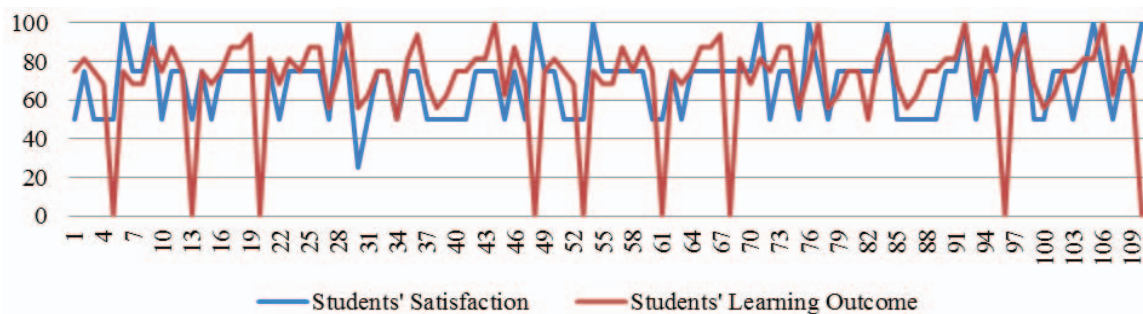Fig. 1. Frequency distribution of research data

3.2. Correlation Analysis and Significance Testing

After compiling the data into the frequency distribution and measuring the distribution to describe the main characteristics of the distribution, then the next stage was to test the correlation between variables *X* and *Y*. The test is used to measure the strength and the weakness of the correlation and whether the direction is directly proportional or inverse proportional. Therefore, a correlation analysis was performed. Then, to check the

linearity of two variables, the Scatter Diagram was used. It was also used to provide a visual representation of the correlation of two variables. Scatter Diagram from data survey can be seen in Fig. 2. The level of student's learning satisfaction is an independent variable while the students' grades is the dependent variable. In Table 2, the strength of the correlation between two variables was calculated using Pearson correlation coefficient (Pearson r). The value of Pearson *r* is 0.197. The Pearson *r* value showed that it is a weak correlation but it is not a zero correlation because the Pearson r value is not between 0 and 0.1. The Pearson r value corresponds to the Scatter Diagram where there is much distribution around the line drawn through the middle of the data.

Table 2: Pearson Correlation

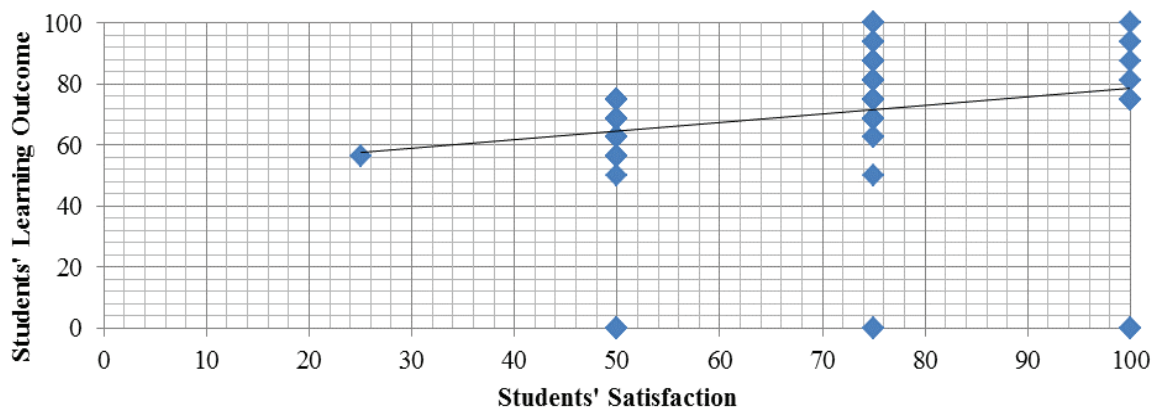|	**Students' Satisfaction**	**Students' Grades**
Students' Satisfaction	1	0.197063581
Students' Grades	0.197063581	1

Fig. 2. Scatter diagram showing students' satisfaction level and students' grades

The next step was to analyze the regression equation by testing the hypothesis. It is used to see the slope of the regression line if it is different from zero value. Hypothesis test is done so that the researcher can conclude whether the independent variable is fit or not to the dependent variable. The null hypothesis which is the slope of the regression line in the population is equal to zero (H_0: $\beta = 0$) whereas the alternative hypothesis which is the slope of the regression line is not equal to zero (H_0: $\beta \neq 0$). The statistical calculation uses statistical software named Excel's Analysis Toolpak whose results can be seen in Tables 3 and 4. In Table 3, the results show that the value of the relation coefficient or multiple R is 0.197. Then, in Table 4 which is the table of Hypothesis Test, the slope of the line's value (b) is 0.281. The intersection is 50.465 and the standard error coefficient (sb) is 0.134. To test the null hypothesis, t distribution is used with (n-2). According to the formula, t value is (b-0) / sb with degrees of freedom n-2. The results of t distribution is (0.281-0) / 0.134 so that the t value is 2.09. After getting the t value, the next step is to compared with t table with 0.05 significance level and 108 degrees of freedom. The degrees of freedom is obtained from n-2 = 110-2. From t table, the value is 1.984. Because t value > t table is 2.09 > 1.984; then null hypothesis (H_0) is rejected. The t value exceeds the t table of

1.984; thus it rejects the null hypothesis (H_0) and accepts the alternative hypothesis (H_1). Also, it is supported by p-value in Table 4 which shows that the value is under 0.05; thus, it rejects the null hypothesis (H_0) and accepts the alternative hypothesis (H_1). Therefore, it can be concluded that the slope of the regression line (β) is greater than zero, and the independent variable in the form of student's satisfaction level is useful to obtain a better students' grades in programming course.

Table 3: Regression Statistic

Regression Statistic	
Multiple R	**0.197063581**
R Square	0.038834055
Adjusted R Square	0.02993437
Standard Error	23.33998462
Observations	110

Table 4: Regression Slope Test

	Coefficients	Standard Error	t Stat	P-value
Intercept	**50.46542553**	9.586257887	5.264351	0.000000721
Students' Satisfaction Level	**0.281914894**	**0.134958101**	2.088907	0.039066039

Table 5: Consensus Matrix

No.	Questions	Strongly Disagree (%)	Disagree (%)	Agree (%)	Strongly Agree (%)	No Response (%)
1	Have you ever heard of Greenfoot and Alice?	45.83	25	22.92	4.17	2.08
2	Do you understand the concept of programming by using Greenfoot and Alice?	0	27.08	68.75	4.17	0
3	Do you understand the concept of programming by self-study?	10.42	35.42	43.75	6.25	4.17
4	Do you agree if learning programming does not need visualization like Greenfoot and Alice?	31.25	50	18.75	0	0
5	Do you find it confusing when learning programming using Green and Alice for the first time?	16.67	52.08	31.25	0	0
6	Do you find it helpful learning programming using Greenfoot and Alice to understand the concept of programming?	0	29.17	62.5	8.33	0
7	Do you understand if-else well using Alice and Greenfoot?	4.17	20.83	68.75	6.25	0
8	Do you understand looping well using Alice and Greenfoot?	6.25	35.42	50	8.33	0
9	Do you understand the use of function well using Alice and Greenfoot?	6.25	22.92	62.5	8.33	0

Significant testing is generated to calculate the contribution of students' satisfaction level to visual learning given by lecturer through Alice and Greenfoot and correlate it with students' grades at end of semester. From the analysis result, the independent variable that

is student satisfaction level (X) has significant contribution to each students' grade (Y) for each student. The results are consistent with Williams and Williams [13] who mentioned that the four main keys that motivate students were students themselves, faculty, lecture materials, and learning methods. Yukselturk et al. [14] argued that the level of students' learning satisfaction is one factor that affected the success and quality of the learning experience. The level of students' learning satisfaction is influenced by the ability of lecturers, facilities and infrastructure, the learning environment and the quality of the material taught [15][16]. A factor about the learning method has a fairly high contribution. Halawah [17] also agreed that the learning method has an important role in motivating students to obtain higher score because during study, students understand the lecture materials well. Interesting learning method makes students be motivated to learn independently [18] and will certainly contribute a big impact with the grades, especially in courses which are avoided by students such as programming courses.

In the second part, students were asked to compare learning programming course using visual learning environment (Alice and Greenfoot) or without it. Table 5 shows that students tend to choose study programming course using visual learning environment although 70.38% of them have never learned or even heard about visual learning environment like Alice and Greenfoot. The main concept in programming such as the concept of looping, if-else and the function is understood very well by students. It is shown by the percentage of an average of 70% of students understand the concepts.

As a recommendation, lecturers should change the teaching style according to the needs of the students. This can be identified by evaluating teaching methods at the end of semester by taking the perspective of the students so that the lecturers are able to plan the learning style/methods and obtain good results at the end of the lecture. The assumption of programming course which is considered difficult by students can be overcome by introducing visual learning environment. In short, visual learning environment assists students better in enjoying programming course than traditional method.

4. CONCLUSION REMARKS

This research yields some conclusions among them: (1) Students' satisfaction level significantly influences the students competency achievement which is proved by students' grades; (2) Student perspective is one of the best ways to access the needs of students in teaching and learning activities; (3) Visual learning environment, in this case, Alice and Greenfoot manages to improve students' satisfaction level. This motivates the students to learn independently thus the quality of learning is also getting better.

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