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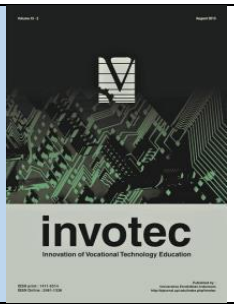

Analysis Level of Understanding Software Engineering Student in Cisarua Vocational High School on Algorithm Materials: A Mini Research

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ABSTRACT

The first objective of this study was to determine the distance level of understanding of students and teachers in software majors at SMKN 1 Cisarua. And for the second purpose, the author wants to know the cause of students who excel or do not understand the yahoo material. The research method used is descriptive-based qualitative. The respondents consisted of 3 people, namely teachers, students who excel, and students who do not achieve. Structured interviews, new interviews, recorders, and test sheets were used as tools for collecting data. Each question posed to the respondent is compiled based on the performance criteria in the Indonesian National Work Competency Standards. The data analysis technique used is in the form of a proportion formula. The results show that the teacher understands better than students who excel and students who do not. Students who do not excel better understand than students who do not perform well. And one of the factors that cause students to understand the material is a discussion with upper-level students in the RPL department of SMKN 1 Cisarua. And one of the factors that cause students to be unable to understand the material is the discomfort of students using cell phones as a learning medium.

1. Introduction

Currently, the digital revolution 4.0 is an important part of the Indonesian people (CIDS, 2018). In completing a considered not automatic job, the job is developed to be automatic (Mitchell, 1997). This provides an opportunity for the Indonesian people, especially in several sectors, to solve problems effectively and efficiently (Brownlee, 2011). One of these sectors is the education sector (Birch, 2011). In the education sector, a teacher must have relevant qualifications to the industry, especially industry 4.0 (Noh et al., 2019). Professor Yandra Arkeman, professor at the University of IPB (Bogor Agricultural Institute), said that the younger generation in 2019 must begin to become proficient in understanding programming languages as capital to face the challenges of the digital

revolution 4.0 (Wijayanto, 2019). In developing or building digital revolution technology 4.0, programming languages are assets to have (Colombo et al., 2017). This cannot be separated by an algorithm (Bryndin, 2018). Algorithms are the foundation for various programming languages (Harper, 2007). Algorithms have an essential role for vocational high schools in Indonesia, especially for the RPL (Software Engineering) and TKJ (Network Computer Engineering) majors (BPPTIK, 2019). However, based on the research conducted by the author, one of the Vocational Schools found it challenging to understand the algorithmic material, the SMKN 1 Cisarua (Vocational High School 1 Cisarua).

SMKN 1 Cisarua is the only school located in West Bandung, West Java Province, Indonesia. The school was founded in 2013 and had six departments, including the RPL department. Based on the author's interviews with the head of the RPL program, some students often complain that they feel confused, worried, and afraid before learning the algorithmic material, UTS (Mid-Semester Examination) algorithm, and UAS (Semester Final Exam) algorithm. The results show that some students have low achievement in the majority, especially in the algorithm material. Also, in practicing algorithmic material in the form of a programming language in a computer laboratory, each student finds it difficult when he is obliged to write a programming language using a cellphone. That is due to the limited computer facilities available in the laboratory, which are not proportional to the number of students available in the class. As when in class, students often complain that the teaching given by a teacher is too fast, which means it gives the impression of being rushed. This caused a program head majoring in RPL to say that every RPL teacher who teaches in the classroom does not fully apply the SKKNI (Indonesian National Work Competency Standards). Students are not ready to proceed to the following material, meaning that a teacher must repeat material that has not yet been completed. Understood by some students. Regarding this problem, prospective RPL students at SMKN 1 Cisarua need to be taken into account for their quality by understanding the primary material, namely algorithms.

Several researchers have conducted previous research that measures the level of understanding of students. Schmidt-McCormack et al. (2019) describe students' problems who find it difficult to distinguish between Bronsted-Lowry and Lewis acid-base chemical theories. So, he aims to measure students' understanding of the concept of organic acid bases. Then Bain, Rodriguez, and Towns (2019) explained students' problems who did not completely understand the relationship between reaction rate and temperature. So, he had the goal of investigating students' understanding in integrating chemical and mathematical knowledge, which in the end, he was able to solve problems concerning chemical kinetics. Then Gaisman, Martínez-Planell, and McGee (2018) found issues in the students in the class in understanding calculus material, namely multivariable differential. He aims to determine the level of knowledge of students in understanding the relationship between tangents and differences. Then Al Faizah and Aminah (2019) got problems for students who have a common understanding of physics concepts. He aims to analyze students' knowledge of physics concepts, namely momentum, and impulses, which are in the form of scientific literacy.

And finally, Corner, Murray, and Brett (2019) had problems related to patients experiencing pain, fatigue, weakness, anxiety, fear, lack of motivation, and lack of self-confidence, which became a barrier and the reason for the early termination of the rehabilitation program. It made him aim to explore the patient's physical rehabilitation experience from a critical illness, which has been staying in the ICU (Intensive Care Unit) or the Intensive Care Unit.

Concerning measuring students' level of understanding, the authors analyzed that the main thing to be used as a benchmark is material. Therefore, in this study, the author aims to determine the level of understanding a teacher and RPL student at SMKN 1 Cisarua and determine why a student achieves due to his or her knowledge of the algorithm material.

2. Methods

The research was conducted through a descriptive-based qualitative method. The technique used to collect the data is a non-test in the form of semi-structured interviews. In that case, tools in the form of an interview guide, recorder, and blank paper are needed. Each question posed is in the form of a general inquiry, such as "please write an example of sorting." The answers submitted by participants are written on blank paper. The solutions are emphasized on the essay statement or giving examples, meaning that whatever is in the participant's mind, the participant puts it on blank paper.

The number of participants consisted of 4 participants, including an RPL teacher, a second-grade RPL student who performed well in their class, a second-grade RPL student who did not perform well in their class, and an expert in a technology company. Each student was selected through a purposive sampling technique, meaning that each student who was made an RPL teacher determined a participant. This is done because teachers know more about their students in terms of their students' activeness, intelligence, and skills.

As for an expert, the author includes him to play a role in checking or validating every answer given by an RPL teacher, RPL students who excel, and RPL students who do not perform well. So, in the end, it makes it very easy for writers to make judgments that do not seem random or do not come from experts.

2.1 *Standar Kompetensi Kerja Nasional Indonesia* (SKKNI)

Each question is arranged based on the performance criteria in the competency elements of the SKKNI (*Standar Kompetensi Kerja Nasional Indonesia*) or, in English language, Indonesian National Work Competency Standards. SKKNI used in this research to compile questions refers to SKKNI 2016-282 Programming. The details of the 2016-282 SKKNI can be seen at Table 1.

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Table 1. SKKNI programming

SKKNI	Version	Last Change	Competency Unit	Competency Element
SKKNI 2016-282	KEPMEN Naker No.282 2016 Year	04 December 2018	No 22. J.620100.022.02 Implementing Programming Algorithms	1) Describe variants and invariants 2) Creating a programming logic flow 3) Applying the basic technique of common algorithms 4) Using procedures and functions 5) Identifying the complexity of the algorithm

Each performance is stated in each competency element. One of them is in the first competency element, namely explaining variants and invariants. The performance criteria in these competency elements are whether or not a participant can define data types, variables, and constants. For the rest, the performance criteria in the second to fifth competency elements, readers can access the BPPTIK website (Training and Technology Development Center) to obtain SKKNI 2016-282 Programming files.

2.2 Data collection scenarios

In the data collection scenario, the author's initial stage is structured interviews about one unit of competency elements consisting of 3 questions. After that, the author gives each respondent an essay test sheet to answer the questions posed by the author in oral form, which questions include the second, third, fourth, and fifth competency elements consisting of two to four questions for each component.

After the data was collected through interviews and essay tests which included questions based on the five competency elements, each participant who had previously conducted the essay test was interviewed again based on the same questions. The author did this to find the relevance or failure answers from essays and interviews. So, in the end, the authors knew that the questions answered by the participants did come from their understanding.

Concerning the second objective in this study, the author re-interviewed an outstanding student to state his reasons for understanding or not understanding the algorithm material. The author does this to find out something new in measuring student understanding which causes each student to achieve or not ultimately.

2.3 Question asked

Referring to the five elements of competence, questions are formed by the author based on performance criteria. The author forms the following questions:

- Describe variants and invariants
    a) Can you explain what a data type is?
    b) Can you explain what a variable is?
    c) Can you explain what a constant is?
- Creating a programming logic flow
    a) Can you give me an example of a method in programming logic?
    b) What components are needed in programming logic? Give 1 example!
    c) What do you think about the connectedness of each component in logic programming? Give 1 example!
    d) Can you create a programming logic flow? Give 1 example!
- Applying the basic technique of standard algorithms
    a) Please write an example of sorting!
    b) Please write an example about searching!
- Using procedures and functions
    a) Can you give me an example of re-using a procedure or a function? Give 1 example!
    b) Can you use the procedure? Give 1 example!
    c) Can you use functions? Give 1 example!
- Identifying the complexity of the algorithm
    a) Can you identify the complexity of this algorithm? Please identify!
    b) Can you identify the complexity of using a memory? Please identify!

As previously explained, the above questions will be asked back to the participants to validate the participants' answers through the essay sheet of paper. The questions asked by the author to outstanding students consisted of two questions, in the form of:

- Why are you able to understand the material of this algorithm? With that, can you excel in the previous semester?
- Then, at certain times, why are you unable to understand the algorithmic material?

2.4 Data analysis techniques

Based on the non-test data collection technique, the data analysis used is a percentage formula. The percentage formula is as follows:

$$P = \frac{F}{N} \, x \, 100\%$$

F symbol expressed as frequency, meaning the number of correct answers. Every answer is declared correct if an expert has validated it. While N symbol expressed as the number of participants. Participants who answered the questions posed by the authors in this study amounted to 3 people.

The result of the calculation of the number of frequencies and the number of participants will be expressed as P symbol, means the percentage value of the level of understanding of participants, both a teacher and two students.

3. Results and Discussion

Based on the fourteen questions asked, about 46% obtained a teacher in his ability to answer eight questions. Obtaining these results made a teacher unable to answer as many as six questions. The question relates to *sorting*, *searching*, and the complexity of the algorithm. More precisely, in question numbers: 3a, 3b, 5a, and 5b. The first analysis concerns the material *sorting* and *searching*. The inability of a teacher is based on the forgetting factor. When the teacher wants to teach, the teacher only needs to understand what is in the learning material, without any continuous understanding, only at that time. The author conducted the second analysis of question numbers 5a and 5b regarding the algorithm's complexity. It can be explained that a teacher has not been able to deliver the material because it has not been taught in class, even though it is included in the SKKNI performance criteria. The head of the RPL program explained that this happened because of the student factor. He said that in the teaching was carried out, a teacher always adjusted to the conditions of his students. If students could not understand material one, it would not be passed on to the following material. Because what is called matter, the more it continues, the more complex the problem.

Students who excel get a percentage of 24%, which means lower than the teacher. It cannot be ascertained. Is the percentage of students with achievement more fantastic than students who do not achieve? Or vice versa?. The number of unanswered questions is nine questions. The number of questions that the student with achievement failed to answer consisted of 1b, 2a, 2b, 2c, 2d, 3a, 4a, 4c, and 5a. In question numbers 2a to 2d, students did not understand what the question meant, more precisely, about programming logic. In question number 1b, by definition, students always feel confused between their understanding of variables and constants. And the last for question numbers 3a to 5a, the student feels that he has forgotten about understanding the question being asked because he sees the current condition that the student is already in grade 2, while the algorithm material is delivered in class 1.

Unexpectedly, students who do not perform well get a superior percentage compared to students who excel, which is 28%. The number of unanswered questions is 8 questions, consisting of: 1c, 2b, 2c, 2d, 3a, 4c, 5a, 5b. Regarding variables and data types, it is quite familiar to students who do not excel, but for constants such as in question number 1c, he has only heard about it and

rarely needs to be explored further. As for question number 2, the student is fortunate because it is true for question number 2a. He understands it, but his understanding is limited, without knowing the connection with questions number 2b, 2c, and 2d. Question numbers 3a and 4c could not be answered by the student because they did not understand. Likewise, with the question numbers 5a and 5b, this is a novelty for these students, more precisely just hearing and knowing about the algorithm's complexity, so the student is unable to answer questions number 5a and 5b.

After completing the test, as previously mentioned, the writer began to interview an outstanding student about the reason, namely what made him understand and did not understand the algorithmic material delivered in class 1. The following questions and short answers when conducting the interview:

Author: "*Why are you able to understand the material of this algorithm? With that, can you excel in the previous semester?*"

Student: "*If I like to question excessively, it is done outside of the lesson, namely to seniors, if, for example, there is confusion, discuss together.*"

Author: "*Then, at certain times, why are you unable to understand the algorithmic material?*"

Student: "*Yes, constrained by factors, building a program using a cellphone, sometimes I already understand the material, but when building a program, I find it difficult because the teacher only told me through the cellphone.*"

The writer draws the point that the factor for him to understand so that he achieves his relationship with people who understand better, for example, seniors. And the factor that made him unable to comprehend was pressure from a teacher who forced him to program using a cell phone.

4. Conclusion

The level of understanding between high achieving students and non-achieving students is considered to have a very slight difference, namely between 24% and 28%. Maybe it can be said that it is luck for students who do not excel because they only understand one problem, which the student with achievement does not understand. This is a phenomenon where a student who does not excel can understand it because he remembers the material presented through the question, to be precise in question number 2a, namely "*Could you please give me an example of a method in programming logic?*". However, in the end, it is an RPL teacher who is superior to the two students. He has an understanding rate of 46%. He revealed that sometimes it was only when he needed it in understanding teaching materials for classroom learning materials. Sometimes, there were indeed one or two materials that were inherent in him.

And lastly, the conclusion that can be drawn is that the factor that makes a student achieve is through association that grows seeds of understanding that increase a student's insight, both in discussion and personally. Meanwhile, the factors that occur at SMKN 1 Cisarua when students

have obstacles to understanding the material that impacts student achievement, namely the pressure from a teacher to apply programming languages via cellphones, not computers in general.

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