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The Formation of Conservation – Based Behaviour of Mechanical Engineering Students through Contextual Learning Approach

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ABSTRACT

This study was aimed to figure out: (1) the implementation of contextual learning approaches; (2) the learning outcome of conservation education using contextual approach on the internship program preparation class; (3) the conservation – based behaviour of the internship program participants; (4) the contribution of conservation education results using contextual approach on the internship program preparation class to the conservation – based behaviour of the participants. The study was conducted at Mechanical Engineering program, Engineering Faculty, UNNES and industries in Central Java in 2016. The implementation of contextual learning approach data were gathered using direct observation. The learning outcome of the conservation education implementation using contextual approach to the internship program preparation class were gathered using a test sheet and the data of conservation – based behaviour of the internship program participants were gathered using the observation sheet. The data were analysed using descriptive and simple regression. This study showed that: (1) the implementation of contextual learning approach carried out at the internship program preparation class was in the form of additional material on the conservation education course; (2) the learning outcome of the conservation education with contextual approach were mostly higher; (3) the conservation - based behaviour of the internship program participants was mostly higher; (4) the contribution of learning outcome of the conservation education carried out using a contextual approach to the internship program preparation class was 0.98 to the conservation – based behaviour of the internship program participants in the Mechanical Engineering program, Engineering Faculty, UNNES.

Introduction

Universitas Negeri Semarang as the Conservation University aims to improve attitudes, behaviour, and participation of all staffs and students in Semarang State University in the effort to develop the nation's character

according to the principles of conservation. The expected benefit is that the alumni can disseminate the principles of conservation to the place where they work. As a consequence, the graduate of Semarang State University is expected to implement environmental conservation which preserves the function of the environmental elements to work as a life support. To form a conservation-based behaviour, UNNES implements conservation education

Mechanical Engineering Department of Engineering Faculty aims to produce Bachelor of Mechanical Engineering. One of the places for graduates to work is the industrial sector. Therefore, the students of Mechanical Engineering have the internship program. This internship program serves as a means of job training in the industry sector to gain experience to apply the theory that they obtain during the learning process including conservation – based behaviour

UNNES curriculum is oriented towards competency – based education, students are expected to demonstrate the science obtained by integrating life skills that they possess. The learning process of environmental education subject emphasizes on experiential learning. The students are assisted in developing process skills such as: observing, hypothesizing, using of materials / tools, inquiring, classifying, interpreting, communicating the findings, sorting/searching for relevant information to test ideas and solve problems.

In teaching, the lecturer is required to gather facts in connection with the subject matter of the scope of everyday life, from various media sources such as a TV and internet. Therefore, it requires more active learning approach to empower the lecturer and students. The approach does not require students to memorize facts, but an approach that encourages students to construct knowledge in their own minds. In the learning process, the lecturer is encouraged by a variety of learning approaches. There are several learning approaches such as: conventional, and contextual approach.

Sudarman et al 2015 found: (1) 74 percent of the conservation education at Mechanical Engineering Department of Engineering Faculty, UNNES majority was conducted using a conventional approach; (2) material has not yet lead to the formation of conservation –based behaviour; (3) conservation –based behaviour of the internship program participants in the Mechanical Engineering Department, Engineering Faculty, UNNES was categorized as low (Sudarman et al, 2015). This means during the learning process of conservation education in Mechanical Engineering Department, UNNES: the lecturers still gave book - oriented examples and were still dominant faculty as the only source of learning. It is certainly different from what was expected at UNNES competency-based curriculum.

Based on above description, contextual approach in conservation education learning process was designed to shape the conservation – based behaviour of the internship program participants in the Mechanical Engineering UNNES. Therefore, the problems of this study can be formulated as follow: (1) How is the implementation of contextual learning approach ?; (2) How are the results of conservation education using contextual approach during the

preparation class of the internship program?; (3) How is the conservation-based behaviour of internship program participants after the conservation education was conducted using a contextual approach ?; (4) Is there a contribution of learning outcomes of the conservation education with contextual approach to the conservation – based behaviour of the internship program participants in the Mechanical Engineering, Engineering Faculty, UNNES?

Conventional learning approach is commonly called the lecture method. This approach does not make many changes in learning to adapt to the development of science itself. According to Jacobson (1989), conventional learning is defined as learning which begins by conveying learning objectives, then is continued with the presentation of material or professors ask students to read textbooks, then is ended with a conclusion. When a question and answer session is held, the activity remains centred on the teacher. From this illustration, it is clear that conventional approaches or learning or the lecturing method is more centred on the teacher. As a consequence, the interaction that occurs in the classroom is unidirectional (teacher centred class), interactions among students are less likely even may not occur. In other words, students only do these following activities: listening, taking notes and concluding. According to Kemp (1994), the conventional learning process was passive because students are not engaged in the exchange of ideas with the lecturer and the classical class, the lecturer is usually not able to recognize the individual differences of the students.

Stahl (1994) argues that the characteristics of conventional education: (a) the students are learning individually; (b) student only pay attention to the whiteboard; (c) the students solve problems on their own; (d) students learn only from lecturers /books/worksheets ; (e) the students only passively listen to the lecturer; (f) students concentrate on learning; (g) only the lecturer who makes the class decision; (h) the students are passive.

From the description above, it can be concluded that, the conventional approach: 1) learning planning and management: the learning materials are given classically and the lecturer delivers the lectures, takes notes on the board, question and answer session is held which is then continued with exercises with students' worksheets and the writing board is the primary medium.

Contextual Teaching and Learning (CTL) can be defined as the concept of learning that helps the lecturer to associate between what is taught in real situations and encourage students to make connections between knowledge that they learn with the application the actual context of the daily situation as a member of family/community. The expected learning outcomes of contextual teaching and learning are that learning can be more meaningful for students. The learning process occurs naturally in the form of student experience the learning actively, instead of the transfer of knowledge from the lecturer to the students. Active learning involves seven elements, namely: constructivism, questioning, modelling, learning community and contextual assessment (Anonim, 2002).

In Contextual class, the task of the lecturer is to assist the students to achieve learning objectives. The lecturer is more concerned with the learning strategy instead of only transferring information. The task of the lecturer is to manage the class as a team to find something new for the students in the form of science/skill that comes from the process of active constructing rather than what the lecturer conveys. Contextual learning approaches can be conducted without changing the curriculum. This approach was developed with the aim of creating productive and meaningful learning for students (Anonymous, 2002). The five elements which need to be considered in a contextual lesson are: (a) activation of existing knowledge; (b) acquisition of new knowledge by studying the big picture, then paying attention to the details; (c) Understanding of knowledge by constructing the temporary concept / hypothesis and sharing with others in order to obtain validation; (d) revising the hypothesis based on the validation;(d) applying the knowledge and experience; (e) reflecting on the development of knowledge (Zahorik, 1995).

By reviewing the description above, the pattern of contextual learning approach is a practical approach to environmental education in forming the conservation – based behaviour.

According to Simon (1998), behaviour includes the activity of choosing an action either consciously or unconsciously and most of the behaviour has the purpose and is goal – oriented. The existence of the goal results in the integration of behavioural patterns. Knowledge has a role in the behavioural formation which is to determine the consequences of behaviour which are attached to alternative strategies. The task of the knowledge was to select the entire group of the possible consequences associated with the strategy. Simon shows that the learning process of conservation education has a role in the formation of conservation – based behaviour.

Behavior is defined as the constant act of individuals which tends to be sustained due to circumstances / conditions (Robins, 1988). Behaviours can be categorized into five: (1) the behaviour arises from any cause; (2) goal – directed behaviour; (3) the behaviour can be observed and measured; (4) the behaviour cannot be observed (thinking) is important in achieving the goal; (5) motivated – behaviour (Gibson, 1991). The measurement can be done in terms of processes and results of activities. Behaviour can also be defined as a person's real actions to adjust to the environment in the context of certain personal and social atmosphere (Zimbardo, 1996). Individual's behaviour is specific that individual's action to a phenomenon is varied. Such behaviour is highly dependent on mental development and the environmental factor. Based on the above description, behaviour in this study can be defined as the real action of a person in interaction with the environment.

According to Chiras (2001), environment consists of all biotic and abiotic factors / which affects living organisms. Conservation of environment includes using natural resources through increased efficiency, reusing used goods, recycling and reducing the demands. Environmental conservation includes (1)

guaranteeing the quality of the environment in the sense of its beauty, entertainment and also its products; (2) assuring the continuity of crops, animals, and materials to create a balance between harvest cycles with   nature ability to renew itself.

From the description above, the environmental conservation is an effort to preserve the environment to maintain its function as an as life supporting system in the form of either protected region or cultivation area. The efforts environment consist of efficient exploration of natural resources, maintaining living elements, preserving the diversity, restoring the damaged environmental elements to guarantee its beauty, entertainment and products needed or survival of crops, livestock / animal and materials useful to create a crop with a renewal through increased efficiency, reuse of used goods, recycling and reduction of demand.

From the description above, the synthesis of conservation - based behaviour is measures that preserve the function of the environmental elements in order to work as a life support through: 1) the efforts environment consist of efficient exploration of natural resources, 2) maintaining living elements, 3) preserving the diversity, 4) rehabilitating the damaged environmental elements

This study was aimed to figure out: (1) the implementation of contextual learning approaches; (2) the learning outcomes of conservation education learning process using contextual approach during the preparation class for internship program; (3) conservation – based behaviour of the internship program participants after obtaining conservation education learning process using contextual approach; (4) the contribution of conservation education learning process using contextual approach to conservation – based behaviour of the internship program participants in the Mechanical Engineering Department, Engineering Faculty, UNNES.

Methods

The implementation of contextual learning approach was conducted on the preparation class for the internship program participants in the form of additional material on the conservation education subject. The learning process was conducted not only in the classroom but also the students were brought to the field or laboratory, such as: (1) Environmental Agency laboratory at Semarang and the garage of Automotive Department at Mechanical Engineering Department, UNNES to learn about the ambience of air quality standard and emission quality standard (related to air pollution and how to overcome them); (2) to the Centre for Industrial Pollution Prevention Technology laboratory (CIPPT) Semarang to learn about the standard of waste water quality and WWTP (Wastewater Management Installation) (relating to water pollution and how to handle it) ; (3) to the Jatibarang Landfill at Semarang city to study the manufacture of compost, liquid fertilizer and biogas installation with organic waste materials (related to the waste management).

The target population of the study was the students of Mechanical Engineering department, Engineering faculty, UNNES. The population was students of Mechanical Engineering department, Engineering faculty, UNNES joining the internship program. In 2016 students joining the internship program were 71 people, consisting of 36 students at the industry in Central Java province, and 35 students outside of Central Java. Therefore, a total of 35 students in the industry outside of central Java became the subjects for instruments trial and 36 students were the subjects of this study.

The independent variable in this study was learning outcomes of the conservation education conducted at the internship program preparation class in the form of knowledge about air and water pollution (including how to overcome) and waste management. The dependent variable was the behaviour of internship program participants. The conservation-minded behaviour data were gathered using the observation sheet containing 25 questions / statements prepared by referring to the industrial environment management, appropriate utilization of equipment, materials and space; maintenance of equipment, materials and space, rehabilitation of the damaged tools, materials and space are. Ratification of the observation sheet was based on the approval of the supervisor, instructor, and evaluator from Institute for Research and Community Service in Universitas Negeri Semarang.

Data collection of conservation education learning outcomes at the preparation class for internship program was conducted using the test by referring to the pollution: air, water (including how to overcome the problems), and waste management. The test consisted of 45 items and then was tested at 35 participants of internship program outside the Central Java to calculate its validity and reliability. The validity of test items was based on the validity index calculated by the correlation formula bi-serial point (Guilford, JP: 1954).

Out of 45 points, 12 items were invalid and 33 items were valid and representative to all of test guidelines. The index of the reliability was calculated for the valid items using the Kuder Richarson formula (KR 20). The result showed that reliability index of reliability was 0.84 (high enough). Valid and reliable test items were used to gather the data. Data were analysed with descriptive and regression. Regression analysis was conducted after previous normality test data showing that the distribution of the data was normal.

Results

The contextual approach in shaping the conservation – minded behaviour of the internship program participants was conducted during conservation education during the internship program debrief. The learning process took place in the classroom. In addition, students were also taken to 1) the laboratory / workshop) for practice / observation of testing ambient air and emissions (associated with air pollution and how to overcome them) in Environmental Agency, 2) the manufacture of biogas, compost and liquid fertilizer from organic waste in the Jatibarang landfill (related to waste management), the observation of wastewater testing and how to treat it took place in waste water Treatment

Plant in the laboratory of the Centre for Industrial Pollution Prevention Technology (BBTPPI) Semarang (related to water pollution and its treatment).

Description analysis found that: 1) the conservation-minded behaviour data (the dependent variable Y) has a score of 56 to 73, the mean = 65.52; standard deviation = 4.63; median = 65.5 and mode = 65.5. Because the median, the mean, and mode is almost the same, then the average score is used as a measure of the central tendency. It meant that there was 50 percent of the data with a minimum score = 65.52 and 50 percent longer have the maximum score = 65.52. Nineteen participants of the internship program achieved conservation-minded behaviour score above average 65.52 or 53 percent. It meant that the conservation-minded behaviour of the internship program participants was mostly higher; 2) the learning outcome of conservation education data at the internship program preparation class(independent variable (X)) obtained a score of 13 to 30, the average = 20.80, standard deviation = 5.018, median = 20.50, and mode = 20.50. Because the median, the average and mode is almost the same, then the average score is used as a measure of the central tendency. It meant that there were 50 percent of the data which has a minimum score = 20.8 and 50 per cent had a maximum score = 20.8. 19 participants or 53 percent of the internship program obtained above average score of 20.8 during conservation education at the internship program preparation class. That means the learning outcome of conservation education at the internship program debrief was mostly higher.

The results of simple regression analysis are summarized in table 1 below

Table 1. Summary of Regression Analysis

Variation resources	Db	JK	RJK	Fhit	Ftabel
Total	36	155331	155331		
Regression (a)	1	154580			
Regression (b/a)	1	733,55	733,55	*1438	4,13
Residu (res)	34	17,45	0,51		

* significant

Based on the summary table, Table 1. Based on the Table 1, F statistic is bigger than F table or 1438> 4.13. Student's Tstatistic = 40.6 and the t table (t with p = 0,05 and df = 34) = 2.04. The result of regression of Y on X showed that tstatistic is greater than t table (40.6> 2.04). It means that the variation in the variable Y can be explained by the variable X by 98 percent by the equation Y = 46.42 + 0.91 X.

The results of the analysis showed that 1) the majority (53 percent) of the field work practice participants obtained above average score for the conservation education at the internship program preparation class which means they have a high conservation knowledge. 2) 53 percent of the students obtained the conservation-minded behaviour score above the mean score, which meant that they have a high conservation-minded behaviour. The contribution of learning outcomes of conservation education at the internship program

preparation class to the conservation – minded behaviour of the internship program participants was 98 percent.

Discussion

Conservation education using contextual approach which was conducted at the internship program preparation class was intended not to change the existing curriculum. However, it still achieved the learning objectives. It refers to the concept of contextual learning approach which states that the contextual approach can be carried out without changing the curriculum. This approach was developed so that learning can be more productive and meaningful for students (Anonymous, 2002). In conducting contextual learning in the classroom, the task of the lecturer is to help the students to achieve the learning objectives. Lecturer is more concerned with learning approach than providing information. The task of the lecturer is to manage the class as a team working together to find something new to students. The new insight can take form as the knowledge and / or skills that come from the process of self – discovery than what the lecturer said.

The internship program preparation class in form of conservation education was conducted in the classroom. In addition, the students were also taken to the laboratory / workshop) for practice / observation of testing ambient air and emissions (associated with air pollution and how to overcome them) in Environmental Agency, the manufacture of biogas, compost and liquid fertilizer from organic waste in the Jatibarang landfill, the observation of wastewater testing and how to treat it took place in waste water Treatment Plant in the laboratory of the Centre for Industrial Pollution Prevention Technology (BBTPPI) Semarang. This is consistent with the concept of contextual approach stating that a contextual approach whose learning examples of which are associated with real – world issues. In addition, the learning process conservation education at the the internship program preparation class with a contextual approach was corroborated by Squires et al (2003) stating that bringing the students out of the classroom (workshops, field / laboratory) means that students can observe objects in their natural state and experience the ongoing phenomena directly. It actively involves the students during learning activities, and this active involvement is very supportive of the effectiveness of learning.

Learning outside the classroom (workshops, laboratory / field) does not require too much lecture to describe an object, because the students is able to observe the real object directly. Learning media in the form of a real object leads to greater motivation for students to learn. Students will be easier to recall what they have learned when they see or experience the real object directly, compared to just listen to the lecture verbally without observing the real object (Heinich et al., 1999). Therefore, it was much more beneficial for students to observe or experience how to make compost or liquid fertilizer from organic waste outside the classroom, to observe or experience detect levels of CO in analysis tools emissions that pollute the air, and to observe or experience how to detect

contaminants of water in the laboratory rather than just hear a lengthy explanation from the lecturer verbally in class.

Arturo (1997) corroborated that learning conservation education should be conducted with a view to its original state, the dimensions of plants, animals and the like. Real life experience was very valuable knowledge for the students. The diverse situations outside the classroom can be used to effectively develop the knowledge and the concept of environment for the students. The students' score of conservation education at the the internship program preparation class using a contextual approach which includes practice tests: Ambient Air, emissions, making: compost, liquid fertilizer and biogas from organic waste and wastewater testing and Treatment Plant in the laboratory of the Centre for Industrial Pollution Prevention Technology showed high score.

Conservation education at the internship program preparation class using contextual approach was followed by a discussion guided or facilitated by lecturers. Learning was centred on the student. Student-centred learning encourages that learners play an active role and have unlimited potential to be developed. In this student – centred learning, construction of knowledge is conducted jointly and learning is achieved through students' involvement in various activities. Kilic (2010) revealed that through student-centred learning, the formation of creative thinking, reflective and critical thinking skills can be easily performed. Student-centred learning also provides benefits such as student's active involvement in learning, encouraging students to become more autonomous in learning (Berdrow & Evers, 2010).

The contribution of conservation education using contextual approach to the field work practice participants' conservation – minded behaviour was 90 percent which can be considered as high. This suggests that conservation education at the internship program preparation class with contextual approach strongly supports the shaping of conservation-minded behaviour of field work practice participants. It shows that conservation education with a contextual approach has high efficacy against the establishment of conservation-minded behaviour of field work practice participants in the Mechanical Engineering Department, Universitas Negeri Semarang. These findings are in line with Simon (2002) stating that knowledge has a role in shaping behaviour. The role is to determine the consequences of which are attached to alternative strategies. The task of knowledge is selecting the entire group of possible consequences associated with alternative strategies. Simon (2002) corroborates that the learning outcomes of conservation education contribute to the conservation-minded behaviour of field work practice participants.

The high learning outcomes of conservation education at the internship program preparation class with contextual approach implies that the high intensity of conservation-minded behaviour field work practice of participants. During conservation education in the internship program preparation class, students directly practiced detecting pollution: air, water and managing waste (composting, liquid fertilizer, biogas from organic waste). With

these activities, students more easily remember what has been learned that the result would be a higher learning.

Students were also touched in their hearts. Consequently, their concern with the environment was embodied in the conservation – minded behaviour such as arranging industrial environment, utilizing the equipment, materials, practice room appropriately, maintaining equipment, materials and practice room as well, rehabilitating the damaged equipment, materials and practice room. As a result, the level of conservation-minded behaviour of the internship program participants was high.

Conclusion

Conservation education with contextual approach was conducted during the internship program preparation class. Learning was conducted inside and outside the classroom, the learning outcomes were mostly higher. Conservation-minded behaviour of the internship program participants was mostly higher. Conservation education during the internship program preparation class with contextual approach contribution 98 percent to conservation-minded behaviour in the students as the internship program participants.

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Disclosure statement

No potential conflict of interest was reported by the authors.

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