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The Conceptual Understanding of Prospective Teachers of Economic Education on Basic Natural Science Through Project-Based Learning Approach

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Abstract. This research aims at determining the relationship between conceptual understanding and the quality of the product through project-based learning in the basic natural science course. This is a quantitative descriptive research with the design of pre-experimental design type on one-shot case study. The population of this research is all students of economic education in the 2nd semester with the number of 175 students (divided into three classes). The purposive sampling technique selected one class as the sample, which was class B with 58 students. The instrument of this research is a concept assessment appraisal sheet with product quality assessment using the rating scale model. Based on the calculations, the average value was 3.4 with 82% of students categorized as good. Moreover, the assessment of product quality had an average score of 3.8 with 94% of students categorized as excellent. Thus, a good process will produce a good result or a good conceptual understanding. It is directly related to the product of students.

1. Introduction

The 21st century is initiated by the increasing access to information and communication in limitless time. The 21st century is also initiated by the rapid development of globalization from all over the world. Globalization means a fundamental change in the order of life in the past. Changes in the life order caused by globalization requires everyone to think creatively and innovatively from every performance and effort made by humans. The demands of the globalization era are about the creation of qualified human resources and human with the futuristic view to respond to these challenges well. The shift in the human resource paradigm of the 21st century can predict the needs in the future. The paradigm is sustained by the thoughts of a person in the past. Khun argues that new challenges can be dealt with using the old paradigm, and then any attempt will surely fail. Failure can be a trigger for every person to make new breakthroughs so that the process can produce a qualified output to compete with the work in today's world [1]. Producing human resources with high competitiveness is highly dependent on the quality of human resource education from elementary, secondary, and higher education levels. At the higher education level, the students are not only required to understand every concept of given material, but they are also expected to have an advanced understanding to produce a product in every learning progress. The creation of such products is unlikely to happen without the deep understanding of a certain topic. The conceptual understanding has a theoretical framework that is sorted by the level of primitive knowing, image making, the image having, property noticing, formalizing, observing, structuring, and discovering (Pirie & Kieren, 1994). Primitive knowing becomes the lowest level of the theoretical framework of student understanding so that it is necessary to have appropriate learning approach to avoid students' confusion of a certain concept.

Having a good conceptual understanding, as a supportive aspect of skill improvement, is necessary for a globalized era and the 21st century learning concept. Report (1996), from the International Commission on Education for the Twenty-first Century, states that aspects of learning are knowledge, understanding, life, and competence to act. In addition, there are four pillars of education, namely learning to know, learning to do, learning to be, and learning to live together [2]. Understanding is the ability to explain and interpret something, which means a person has understood something or has gained understanding and is able to explain back what has been received (Sari,

2017). A concept is a result of thinking of a person or group of people expressed in the definition so that the birth of knowledge products include principles, law, and theory (Sagala, 2005) in (Sari, 2017). A conceptual understanding is an implicit and explicit understanding of the principles governing the domain and the linkage between the knowledge units in the domain [3]. The indicators that can show conceptual understanding are:

1. Redefining a concept.
2. Classifying objects according to certain traits.
3. Giving examples and non-examples of a concept.
4. Presenting the concept in various forms of representation.
5. Developing sufficient terms of a concept.
6. Using, utilizing, and selecting certain procedures or operations.
7. Applying the concept.

In addition, [4] state that indicators of conceptual understanding are supported by learning tools used by teachers in the classroom, which consist of five main criteria, including:

1. Objectives (Awareness, Reflection, Motivation, Behavioural Change)
2. Learning Support (Perceived Usefulness, Recommendation, Activity Classification, and Detection of Students at Risk).
3. Learning Measures and Output (Comparability, Effectiveness, Efficiency, Helpfulness)
4. Data Aspects (Transparency, Data Standards, Data Ownership, Privacy).
5. Organizational Aspects (Availability, Implementation, Training of Educational Stakeholders, Organizational Change).

2. Research Methods

The research method used in this research is a quantitative descriptive research method with pre-experimental research design on one-shot case study as illustrated in table 1. In this research, only one group of samples was used (A). The sample was given a certain treatment, which was then continued by observation or measurement (O) [5].

Figure 1. Research Design

In Figure 1, (A) is a group that was given a project-based learning treatment in the Basic Natural Science course. At the end of the learning, there was a measurement on students' conceptual understanding on what they got from the class and the quality of their product. The population in this research were students who enrolled on Basic Natural Science course of economic education. They were 175 students grouped into three classes. The sampling of the research was conducted with certain objectives with various considerations of the researcher so that the sampling technique was done by purposive sampling with the number of 58 students.

Data collection techniques used in this research was carried on by measuring the instrument assessment of the concept and assessing the quality of the product. The instrument is calculated using a rating scale to facilitate the researchers in classifying the students' grades on conceptual understanding and the quality of the products by using the criteria [5].

3. Result and Discussion

3.1 Results

The results showed that, based on cognitive assessment, the students had a excellent conceptual understanding. Knowledge of the concept consists of an understanding related to the natural

environment that is often discovered in everyday life so that the problems are relevant to the students' life in economic education courses.

The results also showed that students' achievement on the cognitive aspect of the Basic Natural Science course in the treatment group with the number of 58 students was in relatively good conceptual understanding. The results can be seen in Table 1.

Table 1. Conceptual Understanding

No	Number of Students	Conceptual Understanding Score	Total Value per Student	Percentage	Category
1	4	2,9	6,9	6.08	Not Good
2	8	3,2	25,6	8	Average
3	32	3,5	112	13	Good
4	14	3,8	53,2	79	Excellent

Based on the data, of cognitive value of students, from the total number of 58 students, there were 32 students with good conceptual understanding with the average score of 3.5. There were 14 students with excellent category with the average score of 3.8. The data also showed that 79% of students had excellent conceptual understanding of basic natural science material. Furthermore, 13% of students were in good category with the average score of 3.2. Then, 8% of students were in average categories. Finally, 6.08% of students were in not good category by having the average score of 2.9.

After the values were analyzed with the rating scale and the use of the revised researcher's standard value, it was known that 82% of students had mastered the concept with excellent category. The details of the findings can be seen in table 2.

The result of the previous analysis was the initial standard that researchers can use for the individual project achievement. From 58 students who became the centre of the assessment of the research, there were 39 students who had excellent quality and very qualified product to be shown to the general public.

Perfect score was given for some aspects, namely the suitability of the concept, the use of tools and materials, and the aesthetic of the product. There were 39 students with perfect score 4.00, as it was hard to find any error on the product. Therefore, it was reasonable to give that score. 15 students had a qualified product. However, there were still some imperfections on it, so the researchers give an average score of 3.55 with good category. In addition, tools and materials aspects contributed to the different score for each product. Three students with average score of 3.10 were considered to average category as there was a misconception between concept and tool in the product. There was one student with the lowest score of 2.90 as there were too many aspects which were not suitable to the criteria. Moreover, late submission issue was also considered by the researchers. The details of these findings can be seen in the table of achievement on product quality value.

Table 2. Achievement on Product Quality Value

No	Number of Students	Product Quality Score	Total Value / Student	Percentage (%)	Category
1	1	2,90	2,90	1	Not Good
2	3	3,10	9,30	3	Average
3	15	3,55	53,25	2	Good
4	39	4,00	156	94	Excellent

From the adjustment of the categories undertaken by the researcher, it was known that 94% from 58 students were in excellent category, 3% of students were in average category, 2% of students were in good category, and 1% were in not good category. Value analysis can be measured from

various aspects of the assessment. It was related to the use of the rating scale to see the value. The obtained result is depicted in the following graph:

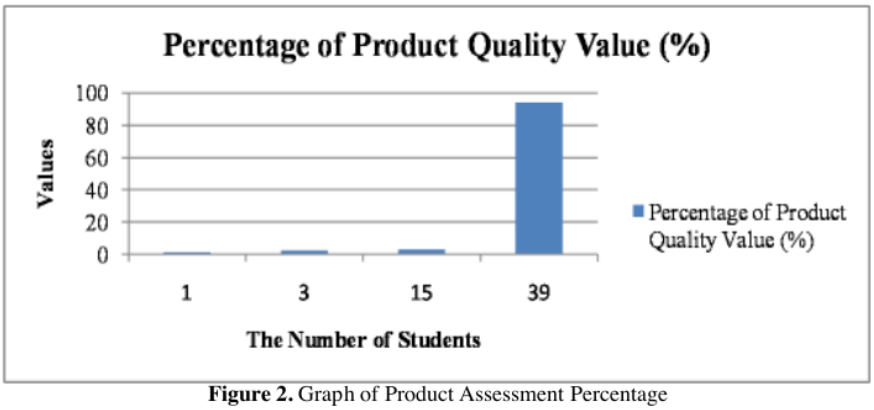

Figure 2. Graph of Product Assessment Percentage

Assessment criteria**:**

1. Systematic (list of contents, preface, library, glossary, and index)
2. Attractiveness (layout, colouring, harmony)
3. Clarity of information
   - Visible
   - Structured
4. Substance (goals, methods, results)

3.2 Discussion

The concept of knowledge given by the students has quite a lot of implications on students, both in terms of scientific attitude and the implementation of conceptual knowledge for their life. Basic natural science is directed to help learners gain an in-depth understanding of the environment so as to foster their ability to think, work, and be scientific and be able to communicate it as an important aspect of life skills [6]. The percentage of basic knowledge of basic natural science concepts held by economic education students is actually derived from their own experience guided by such knowledge by the teaching of the teacher. Project-based learning in understanding basic natural science is relevant to some of the benefits of learning when it sees the mastery of concepts that tend to be at excellent levels with a percentage gain of 82%. Some of the advantages are (a) Increasing motivation, (b) Increasing problem-solving ability, (c) Improving library research skills, (d) Increasing collaboration, and (e) Increasing resource-management skills. The satisfactory achievement of this project-based learning also requires the learner to continue further learning at the project-making stage in accordance with the concept the student has acquired. The quality of the products produced by the students with the excellent level of quality apart from the understanding of the concept that most students understand but also comes from the soft skills they have mastered as well. During the process of project work, the students are required to work on their own and take an active role during the process of work so that students can directly combine or can link the elements of knowledge and skills in the learning of knowledge and skills to plan an activity, problem solving, and communication of the results or products that have been made [7]. Assessment of product quality includes several judgments done thoroughly both in terms of assessment of conceptual understanding and product quality. Assessment of product quality includes several judgments done carefully in terms of assessment of the concept of understanding and product quality. The products that must be made by students are teaching materials with predetermined criteria, ranging from the assessment of the cover page, the contents of the contents list, the content of the teaching materials, the substance or purpose of the content presented.

The graph shows that the overall assessment of the product produced the first assessment lies in the aspect of the beauty and suitability of the cover page. The assessment consists of the size and type of letters, images according to the content of the material, and the selection of attractive colors and images. The average score of the four aspects included in the cover page assessment was included in excellent category with a percentage value of 95%. The cover page was important as it belonged to the criteria as a substantial requirement of a teaching material. On this cover page, the students generally obtained the average score of 4.00 or in excellent category. The suitability and drawing of the cover page included the criteria of graphics that were part of the teaching material relating to physical form and format. Physical form and format played a role to attract students to interest in reading, studying, and having the teaching materials [8].

In addition to the cover page that should be arranged in an interesting, the appropriateness of the contents that was presented also facilitated students in reading the textbook. The rules of making a textbook written for a particular instructional purpose were arranged in a systematic and run based on a particular flow and logic. Preparation of teaching materials was also made based on several things including the initial knowledge of students and understanding of student concepts so that the content of the textbook material was rationally arranged and not too difficult to understand by the students themselves so that the content assessment becomes the largest percentage of valuation. In the aspect of the content of the content of the overall content of the students had an average value of 3.85 with excellent category because the process of compiling the material had followed the rules of preparation of teaching materials that came from understanding the concept that students had. Understanding the concept that students had on basic natural science materials had a fairly good percentage of assessment, so that understanding became more meaningful if compiled in a teaching materials, because basically the science or understanding of the concept that students had was the result of abstraction and reduction, but teaching science included on how to make the theory of science understandable and useful for students. One of the most important things in the reconstruction process is that the reconstructed content should be simpler than the scientific content and can be easily understood by the students [9].

The last aspect of the assessment was the substantial aspect of the teaching materials. The substance includes on (objectives, methods, outcomes) that students arranged on the teaching materials. It was also a consideration of the researchers in assessing the quality of teaching materials products that students arranged because basically teaching materials is a set of materials systematically arranged so that teachers and students can use it in the learning process [10]. The suitability of the substance can also support learning effectively to understand and apply the norms (rules, attitudes, and values), take action or motor skills, and master knowledge (facts, concepts, principles, procedures, and processes) so that learning competencies can be achieved [8].

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