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ESBOR: Analysis Students HOTS for Develop Digital Technology in Environmental Learning

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Abstract

Environmental Learning need to be improved in 21st century because need Higher Order Thinking Skills (HOTS). The purpose of this study was to conduct a descriptive analysis and comparison university students HOTS for Developing Environmental Supplement Book of Recycling (ESBOR). The research method used in this research was descriptive method with data collection techniques through surveys. The total sample used was 235 university students, which were divided into 109 Bachelor Students of the Natural Science Faculty (BSF), 103 Bachelor Students of Non-Natural Science Faculty (BNF), 9 Master Students of the Natural Science Faculty (MSF), and 14 Master Students of Non-Natural Science Faculty (MNF). The study was conducted during January-March 2020. The results showed that the average score of HOTS in the context of recycling university students was in the very low category with details of BSF (21.02), BNF (20.04), MSF (21.47), MNF (21.31). The conclusion of this study was that the HOTS score is still low for all categories, ESBOR can be develop for future research.

Keywords: Environmental learning, HOTS, university students

1. Introduction

Learning about the environment, especially on the topic of recycling is one of the focuses to be developed. The number of waste problems and other recycling problems that cannot be overcome makes the environment polluted [1–6]. Waste that is not recycled makes the environment worse and also unhealthy. Environmental education is one way to provide students with an understanding of the importance of waste recycling activities. Environmental learning is a formal educational process in the classroom to be able to provide understanding to students, especially the problem of recycling [7–15].

Environmental learning about recycling began to be taught at elementary school, junior high school, senior high school, and university level. This is because recycling are activities that need to be focused on environmental learning. It needs develop an innovation such as Environmental Supplement Book of Recycling (ESBOR) based on digital technology. The learning process about recycling requires students' abilities, namely Higher Order Thinking Skills (HOTS) and implemented in Attitude and Recycling behavior. The existing learning process must be able to make students understand and be able to think HOTS and implement it in the form of attitude and recycling behavior [16–22].

One of the activities that need attention is environmental learning at the university level. University level environmental learning should be able to measure university students HOTS in order to understand various concepts regarding recycling. HOTS in

university-level, students are not only asked to understand recycling concept but can also solve and create solutions to the recycling process problem [23–27]. After university students can understand the importance of recycling and can create innovation solutions in the form of ideas.

The research conducted is to explain in more detail the profile of HOTS of university students to develop ESBOR as an innovation of digital technology in environmental learning. It becomes urgent because the process of developing learning tools at the university level, previous research showed that environmental attitude and behavior, especially on the topic of recycling requires detailed research data profiles [28–33]. This research becomes a novelty, because develop instructional product in environmental learning can be immediately carried out, especially on the topic of recycling. Based on this, it is necessary to do a survey of HOTS profiles, then the purpose of this study was to conduct a descriptive analysis and comparison of HOTS of university students for developing ESBOR.

2. Method

This research was conducted in January-April 2020. The method used descriptive method with data collection techniques using survey via Google Form. The samples included were from Jakarta, Semarang, Makassar, and Lampung. The total of samples were 235 university students, which are divided into 109 Bachelor Students of Natural Science Faculty (BSF), 103 Bachelor Students of Non-Natural Science Faculty (BNF), 9 Master Students of Natural Science Faculty (MSF), and 14 Master Students of Non-Natural Science Faculty (MNF). Analysis of the data used in this research was a descriptive analysis using the Microsoft Excel Program. The results of the analysis are described in the form of a full profile, and comparative analysis presented in Table. In this study, there were measured HOTS for each item and indicators. Students HOTS instruments used were developed in accordance with HOTS aspects from analyze, evaluate, and create [23].

Table 1. HOTS Instrument Indicators

HOTS Aspect	Indicator	Item
Analyze (C4)	Analyzing problems related to waste that is not recycled	1,2
Analyze (C4)	Analyzing the impact of garbage accumulation	3,4
Evaluate (C5)	Evaluate the use of paid plastic bags policy	5,6
Evaluate (C5)	Critique and comments on people behavior related to recycling	7,8
Create (C6)	Creating a new idea about the process of recycling waste	9,10
Create (C6)	Creating a design of handling plastic waste so that it can be reused	11,12

Source: Aspect adapted from Anderson et al. [23]

The results of the analysis are presented in Table form and entered into certain categories for each score. This study used 3 categories for the HOTS. Each category has a scale of 0-100 starting from the category very high, high, medium, low, very low. HOTS categories can be seen in Table 2.

Table 2. Category of HOTS

Category	Interval Score
Very High	$X > 81,28$
High	$70,64 < X \leq 81,28$
Moderate	$49,36 < X \leq 70,64$
Low	$38,72 < X \leq 49,36$
Very Low	$X \leq 38,72$

Source: Indicator adapted from Ichsan et al. [34]

As for the validity and reliability of the instrument used, it was tested first. Test the validity of using the Pearson product-moment. Meanwhile, the reliability test uses a split half (Spearman-Brown). The results showed that all HOTS instruments are in the valid category and the reliability value for HOTS (0.75).

3. Result and Discussion

The results of this study indicate that University students HOTS scores in the very low category for BSF, BNF, MSF, and MNF. This indicates that the ability of University students HOTS must be improved. Table 3 showed the results where the lowest BSF score is on item 5, namely the ability to give an opinion on the policy of paid plastic bags. This 5th item, the average score of University students HOTS is very low. Meanwhile, the highest score is in item 1, which is to analyzing the impact of the dangers of plastic waste.

Table 3. University Students HOTS Scores for each Item

No	Item	BSF	BNF	MSF	MNF
1	Analyzing the dangers of plastic waste	2.48	2.36	2.33	2.29
2	Analyzing the impact of the absence of recycling paper	2.14	1.93	2.11	2.21
3	Analyze the impact of wood that are not reused	2.06	2.05	2.22	2.00
4	Analyzing the impact of plastics bottles	2.17	1.92	2.22	2.21
5	Provide opinions regarding the policy of paid plastic bags	1.82	1.66	1.67	2.00
6	Write down alternative solutions to the paid plastic bag policy	1.95	1.89	2.33	2.07
7	Criticize the behavior of friends who don't reused paper	1.85	1.93	2.11	2.07
8	Give criticism and advice to friends who don't want to recycle paper	2.00	1.94	2.00	2.00
9	Creating ideas to solve recycling problems	2.07	2.06	2.22	2.29
10	Creating a recycle program design for environment	2.27	2.07	2.22	2.29
11	Making steps to recycle plastic waste	2.35	2.27	2.11	2.14
12	Creating innovation programs to reduce plastics	2.06	1.97	2.22	2.00
Average Score of All Item (scale 0-100)		21.02	20.04	21.47	21.31
Category		Very Low	Very Low	Very Low	Very Low

Note: HOTS score ranges for each item are 1-10

The next explanation is university students HOTS scores based on each indicators. The results showed that university students HOTS score on the third indicator is evaluating the lowest-paid plastic bag policy. Meanwhile, the highest score is shown in the first indicator, which is to identify problems related to waste that is not recycled. More can be seen in Table 4.

Table 4. University Students HOTS Scores for each Indicator

Indicator	BSF	BNF	MSF	MNF
Analyzing problems related to waste that is not recycled	2.31	2.15	2.22	2.25
Analyzing the impact of garbage accumulation	2.11	1.99	2.22	2.11
Evaluate the use of paid plastic bags policy	1.89	1.78	2.00	2.04
Critique and comments on people behavior related to recycling	1.93	1.94	2.06	2.04
Creating a new idea about the process of recycling waste	2.17	2.06	2.22	2.29
Creating a design of handling plastic waste so that it can be reused	2.20	2.12	2.17	2.07

Note: HOTS score ranges for each indicator are 1-10

Then when seen in more detail, the aspect with the lowest score is the evaluate (C5) aspect. This is shown in Table 5, which means that the average scores for BSF, BNF, MSF, and MNF are in the lowest category at C5. This showed that the ability of university students to analyze problems was still low.

Table 5. University students HOTS scores for each aspect

Aspect	BSF	BNF	MSF	MNF
Analyze (C4)	2.21	2.07	2.22	2.18
Evaluate (C5)	1.91	1.86	2.03	2.04
Create (C6)	2.19	2.09	2.19	2.18

Note: HOTS score range for each aspect are 1-10

Based on the results of the analysis above showed that there are 3 main points to be discussed, University students HOTS at all levels had a low score. These main points are new findings and can be said as a novelty from this research. That was because the previous research has not revealed how big the categories of HOTS. This result showed ESBOR can be an innovation for environmental learning.

Discussion of the first point is the University students HOTS had a low score at all levels in BSF, BNF, MSF, and MNF. This showed that HOTS-based learning, especially regarding recycling was still lacking. Environmental learning at the university level should be done by practicing the ability to analyze university students. Various aspects start from analyze (C4), evaluate (C5) and create (C6) need to be improved. Specifically in the C5 domain the aspect with the lowest score (see Table 5). In this aspect, university students are asked to be able to evaluate various policies and behavior related to the waste recycling program. This C5 aspect is still considered low because, in reality, university students have not been able to provide opinions and criticisms on the paid plastic bag policy. Besides being asked to give opinions and critique, university students are also asked to provide solutions to these problems. This ability is very necessary because it is in accordance with the demands of the 21st century for critical thinking [35–42]. ESBOR have potency to improve this HOTS, because can be used an learning media.

The low C5 showed that the ability of university students to make arguments needs to be improved. The problem solution that might be used to improve the ability of C5 is to increase group discussion activities among university students. Specifically, discussions about various recycling activities and programs. This discussion among colleagues will enable university students to better understand and be able to evaluate policies regarding recycling programs. In addition to having discussions with peers, another solution is to develop a media or educational model based on recycling to improve HOTS capabilities. The development of this learning is important because the ability of University students HOTS is still low [43-49].

Based on the results of this study, the important result that can be studied further is related to environmental learning about recycling at the university level and developing ESBOR in future. That is because environmental learning is a means to convey various environmental concepts to university students [50-54]. Based on the results of this study HOTS scores are still very low. This indicates that the use of learning media, learning models, learning strategies, students worksheets, teaching materials and others is still not based on HOTS. Develop learning innovation was 21st century need on learning [55-65]. Based on this, it is necessary to further develop learning media, learning models, learning strategies, students worksheets, teaching materials on recycling topics based on HOTS. This showed ESBOR can be develop for future research as an innovative digital learning media.

4. Conclusion

Based on the results of this study it can be concluded that the profile of University students HOTS at all levels and faculties is in the very low category. Based on the findings in this study, in the next research, all learning tools about recycling and environmental learning in other topic should be developed in the form of learning media, learning models, learning strategies, students worksheets, teaching materials based on HOTS and the potential to improve HOTS of university students. ESBOR can be develop as an learning media in 21st century learning.

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