Research Article doi: 10.12973/eu-jer.9.1.227

European Journal of Educational Research
Volume 9, Issue 1, 227 - 237.
ISSN: 2165-8714
http://www.eu-jer.com/

Implementation Supplementary Book of Green Consumerism: Improving Students HOTS in Environmental Learning

Ilmi Zajuli Ichsan
Universitas Negeri Jakarta, INDONESIA

Diana Vivanti Sigit*
Universitas Negeri Jakarta, INDONESIA

Mieke Miarsyah
Universitas Negeri Jakarta, INDONESIA

Ahmad Ali
Universitas Islam Negeri Alauddin Makassar, INDONESIA

Tri Suwandi
Universitas Pendidikan Indonesia, INDONESIA

Titin
Universitas Tanjungpura, INDONESIA

Received: October 27, 2019 ▪ Revised: December 18, 2019 ▪ Accepted: January 10, 2020

Abstract: Environmental learning in the 21st-century must be contextual and require the ability of Higher-Order Thinking Skills (HOTS) to solve environmental problems such as green consumerism. The purpose of this study was to implement an Android-based Supplementary Book of Green Consumerism (SBGC) to improve 8th-grade students' HOTS in environmental learning. The method used experiment with a sample of 144 students in 8th grade. This research design was a pre-post test with the control group. The treatment given was in the form of using SBGC in the experimental classes. The instrument used 12 items with HOTS questions (analyzing, evaluating, and creating) that contain a green consumerism problem. Analysis of the data used the normality test, homogeneity and continued with the t-test. The results showed that the students HOTS score increased significantly in the pre-test and post-test in the experimental class or compared to the control class. Increased in the experimental classes from a score 15.7 (very low) to 32.73 (low). Meanwhile, comparison between the experimental classes with a score 32.73 (low) and control classes with a score 25.25 (very low). This showed that SBGC is easy to understand and have instruction to solve environmental learning in SBGC menu. SBGC is also interesting so that makes students become active in learning. The conclusion of this study was that SBGC can increased students' HOTS in environmental learning.

Keywords: *Environmental learning, HOTS, supplementary book of green consumerism.*

To cite this article: Ichsan, I. Z, Sigit, D. V., Miarsyah, M., Ali, A., Suwandi, T., & Titin, T. (2020). Implementation Supplementary Book of Green Consumerism: Improving Students HOTS in Environmental Learning. *European Journal of Educational Research, 9*(1), 227-237. http://doi.org/10.12973/eu-jer.9.1.227

Introduction

Environmental learning in the 21st-century focuses on solving environmental problems through education. Problems such as air pollution, soil pollution, reducing waste are the focus to be solved. Usually, these environmental problems occur in big cities because the environment in big cities has many industrial activities that are sources of pollution. Transportation problems and poor waste management become things that worsen the quality of the environment in the city (Chander & Muthukrishnan, 2015; Sodri & Garniwa, 2016; Yedla & Park, 2017). Then if the outline is made, the problem can be summarized into a term called green consumerism. Simply stated green consumerism is a person's habit of using goods and services that are environmentally friendly (Kaiser & Wilson, 2004; Lekakos, Vlachos, & Koritos, 2014; Matthes & Wonneberger, 2014; Shabani, Ashoori, Taghinejad, & Beyrami, 2013).

Green consumerism is important and very influential in the preservation of the urban environment. Some habits that are included in green consumerism are energy conservation, transportation, waste avoidance, daily consumption, recycling and social behavior (Dani, 2011; Jonell, Crona, Brown, Ronnback, & Troell, 2016; Kaiser & Wilson, 2004). Green consumerism is a behavior that must be owned by people, especially in urban areas. This behavior usually arises when the community understands the concept and there are no inhibiting factors. Factors that usually inhibit the

* **Corresponding author:**
Diana Vivanti Sigit, Biology Education Program, Faculty of Mathematics and Natural Science, Universitas Negeri Jakarta, Jakarta, Indonesia.
✉ dianav@unj.ac.id / dianavivanti@yahoo.com

© 2020 The Author(s). **Open Access** - This article is under the CC BY license (https://creativecommons.org/licenses/by/4.0/).

formation of green consumerism are social and economic factors. In the case of students, for example, when students want to use environmentally friendly transportation such as electric motorcycle, the price of an electric motorcycle usually tends to be more expensive. These factors inhibit green consumerism in the community (Arnold, Kibbe, Hartig, & Kaiser, 2018; Diaz-Rainey & Ashton, 2011). Green consumerism knowledge is very necessary for students. The problem was students still have a low understanding of the green consumerism concept (Ichsan, Sigit, & Miarsyah, 2019a). Students must understand and implement environmental concepts, especially green consumerism, students must have the ability one of which is Higher-Order Thinking Skills (HOTS).

HOTS ability is needed because HOTS is a student ability to analyze, evaluate, and create a solution for a problem (Anderson et al., 2001; Garcia, 2015; Saido, Siraj, DeWitt, & Al-Amedy, 2018). The relationship between HOTS and green consumerism is that solving environmental problems requires the ability to analyze, evaluate and create. HOTS is an ability that students must have in 21st-century environmental learning (Istiyono, Dwandaru, Setiawan, & Megawati, 2019; Kivunja, 2014; Sadiqin, Santoso, & Sholahuddin, 2017; Talmi, Hazzan, & Katz, 2018). This is because students who are able to have HOTS abilities will be able to adaptation in 21st–century competition. HOTS becomes something that must be taught by teachers and trained in environmental learning in the classroom. Environmental learning in 21st century, students are taught various environmental concepts. The implementation of environmental learning is usually included in biology or science subjects in junior high schools. The topics taught in class about the environment must be related to the environment around school (Lemus, Seraphin, Coopersmith, & Correa, 2014; Musyaddad & Suyanto, 2019). Students must solve the environmental problem, as an example to overcome the problem of air pollution, students must be able to make an analysis of the causes of air pollution. Then must provide an evaluation in the form of criticism and comments. Then finally create a solution about air pollution, for example by making a simple air filter design.

Previous research has successfully developed a learning media was the Android-based Supplementary Book of Green Consumerism or called SBGC (Ichsan, Sigit, & Miarsyah, 2019b). The supplementary book is a book that contains more in-depth topic about environment. Supplementary books are usually used at the end of environmental learning for the purpose to give supplement topic and concept about environment. The purpose of using a supplementary book is for students to focus learn a topic (Grosch, Berger, Gidion, & Romeo, 2014; Ichsan et al., 2019b; Yavich & Starichenko, 2017). SBGC is an android-based book that can be used on Android smartphones. This book intended to provide a deepening of the concept of green consumerism to students. SBGC also has a menu called *solving an environmental problem*, that has the potential to improve HOTS. This menu was given instructions and guidance to students regarding problem-solving steps. This menu was the advantage of SBGC that contain instruction for students to solve the problem. This menu was the relation with HOTS, because HOTS was the ability to solve a problem and create a solution. This SBGC book was potentially to improve HOTS. This study was an implementation of SBGC to students. This is needed to measure the effectiveness of SBGC in increasing students' HOTS (Ichsan et al., 2019a).

Previous research on HOTS has a lot to do with the HOTS profile of students in learning (Aisyah, Salehuddin, Aman, Yasin, & Mimiko, 2018; Smith & Darvas, 2017; Zohar & Alboher Agmon, 2018). Besides that, there is also a development model or learning strategy to improve students' HOTS (Hamouda & Tarlochan, 2015; Husamah, Fatmawati, & Setyawan, 2018; Knowlton & Sharp, 2015). All the research that has been done, research on green consumerism related to HOTS is still very rarely done. This makes this research an urgent matter and was a novelty.

Methodology

Research goal

The study was conducted in August - September 2019. The purpose of this study was to implement an Android-based Supplementary Book of Green Consumerism (SBGC) to improve 8th-grade students' HOTS in environmental learning. Implementation of SBGC was given in the environmental learning for Biology subjects at the Junior High School. The research question in this research was (1) is there a significant difference between pre-post test in experimental classes? (2) is there a significant difference between the post-test in control and experimental classes?

SBGC is a supplement book that has been previously developed, all content were in Indonesia language (Ichsan et al., 2019b). More details of SBGC can be seen in Figures 1 and 2. This study used an experimental method consisting of 2 control classes and 2 experimental classes. The treatment given was in the form of an Android-based Supplementary Book of Green Consumerism (SBGC) in experimental classes, while the control classes used conventional learning media. SBGC used in environmental learning as a treatment (intervention), students learn with SBGC as a group discussion in experimental classes. The implementation of conventional learning media in this study was used in conventional media which is commonly used daily in learning in the classroom in the form of printed teaching materials. Students in control classes learn with conventional media and did group discussion.

Figure 1. SBGC cover (Source: Ichsan et al., 2019b)

Figure 1 clearly showed that the SBGC cover contains images related to green consumerism. There are 2 buttons to start learning and about this application. Then the main menu displayed consists of 4 menus namely understanding GC, GC type, solving environmental problems, and also group discussion which can be seen in Figure 2

Figure 2. SBGC Main menu (source: Source: Ichsan et al., 2019b)

Sample and Data collection

The study was conducted at State Junior High School 1 South Tambun, Bekasi, West Java, Indonesia. The selection of this school as a research location was because this school one of pilot project for the application environment-based learning in Bekasi city. This implementation for students HOTS in environmental learning in natural science subject. The total sample used was 144 students in 8th grade. This sample divided into 38 students in the first control class and 34 students in the second control class. Then, 36 students in the first experimental class and 36 students in second experimental class. The sample used was selected by simple random sampling, so that the sample obtained was representative.

Analyzing Data

Data analysis used a normality test with Kolmogorov-Smirnov and the homogeneity test with Levene's test using Statistical Package for the Social Sciences (SPSS). The first t-test used the dependent t-test to compare pre-post HOTS scores in the experimental class (pre-post experimental classes). The second t-test used an independent t-test to measure the difference between the post-test of the control class and the post-test of experimental class (post-test experiment versus (vs) post-test control). Furthermore, a descriptive analysis was performed using the gain score (Hake, 1998). The score gain is calculated by the formula as shown here.

$$\text{Gain Score} = \frac{\text{Post test} - \text{Pre test}}{\text{Maximum Score} - \text{Pre test}}$$

After measuring the gain score, the next step was to interpret the gain score. There were 3 categories from high, moderate, and low. The gain score category can be seen in Table 1.

Table 1. Category of gain scores

Gain Score	Category
g ≥ 0,7	High
0,7> g ≥ 0,3	Moderate
g < 0,3	Low

Source: Hake (1998).

Besides the analysis carried out with a gain score, an analysis was performed on each item and each indicator. This was to compare in detail the differences and improvements in each item and indicators. Then the results are interpreted in the form of HOTS categories which consist of 5 categories, from very high to very low which can be seen in Table 2.

Table 2. Students HOTS categories

Category	Interval HOTS Score
Very high	X > 79.00
High	67.00 < X ≤ 79.00
Moderate	43.00 < X ≤ 67.00
Low	31.00 < X ≤ 43.00
Very low	X ≤ 31.00

Instrument

The instrument used consisted of 12 items question with 6 indicators that were made based on 3 aspects of HOTS namely analyze, evaluate, and create (Anderson et al., 2001). The score range of this instrument was 0-10 for each item. The indicators of the instruments were adapted from Ichsan, Sigit, & Miarsyah (2019a) in Table 3.

Table 3. Aspects and indicators of the instruments used

Aspect	Indicator	Item
C4 (analyze)	Analyze the environmental problem because used plastic too much	1,2
C4 (analyze)	Analyze product based on green consumerism concept	3,4
C5 (evaluate)	Evaluate quality product based on environmental concept of green consumerism	5,6
C5 (evaluate)	Criticize behavior of people based on environmental friendly behavior	7,8
C6 (create)	Create Hypotheses based on environmental pollution problem	9,10
C6 (create)	Design an green consumerism product/project	11,12

Source: Indicators of an instrument adapted from Ichsan, Sigit, & Miarsyah (2019a)

Validity and Reliability

Before conducting research, the instrument trial for validity and reliability to ensure that the instrument used valid and reliable. Trial the validity of the instrument using the Pearson product-moment with a significance level of 0.05 which was measured using SPSS software. the measured reliability of the instrument used split-half (spearman brown) with the reliability category in Table 4.

Table 4. Reliability Category

Value of Reliability	Category
$0,80 \leq r_{11}$	High reliability
$0,4 \leq r_{11} < 0,80$	Medium reliability
$r_{11} < 0,4$	Low reliability

Source: Ratumanan & Laurens (2006)

Results

The results of the validity and reliability trial of the instrument showed that the instrument used was valid for 12 items and reliable with the medium reliability category. Then normality and homogeneity test showed there was normal distribution and homogenous. Then, the result of the t-test showed there was a significant increase in students HOTS both in the pre-post experimental class and its comparison with the control class (post-test experiment vs post-test

control). That is because the result of the t-value was higher than the t-table and the value of sig <0.05 indicates that there was a significant difference. The significant difference can be seen in (1) comparison of pre-post in the experimental class (2) comparison of the post-test in experimental class versus (vs) post-test in control class which can be seen in Tables 5 and 6.

Table 5. Dependent t-test for pre-post experimental classes

Mean	Std. Deviation	t-table	t-value	df	Sig. (2-tailed)
16.94	11.47	1.66	12.52	71	.000

Table 6. Independent t-test for post-test experimental vs. post-test control classes

Mean difference	Std. error difference	t-table	t-value	df	Sig. (2-tailed)
7.47	1.74	1.64	4.29	142	.000

Then data analyzed with descriptive, the results showed that when viewed from each item there are differences seen from the gain score. The pre-post comparison of the experimental classes, the biggest gain score was seen in item 11, which was to make a green consumerism bag design. While the lowest gain score on item 1 is analyzing the negative effect of using plastic bags. Besides that, there was a change in the HOTS category from pre-test (very low) to post-test (low) in the experimental class. More details can be seen in Table 7.

Table 7. Comparison students HOTS scores of pre-post experimental classes for each item

No	Item	Pre	Post	Gain score	Category
1	Analyzing negative effect of using plastic bags	3.26	3.63	0.05	Low
2	Analyzing negative effect of using Styrofoam for environment	2.93	3.79	0.12	Low
3	Analyzing product quality based on the green consumerism	1.61	3.54	0.23	Low
4	Analyzing the impact of using various types of insect repellent	1.65	4.47	0.34	Moderate
5	Evaluate a product based on the eco-label concept	1.38	2.57	0.14	Low
6	Evaluate the use of electric vehicles	1.31	2.93	0.19	Low
7	Criticize student behavior that does not save the use of plastic bottles	1.49	3.22	0.20	Low
8	Criticize the behavior of people who do not want to participate in protecting the environment	1.25	3.07	0.21	Low
9	Make hypotheses the cause of environmental pollution in rivers	1.00	2.76	0.20	Low
10	Make hypotheses the impact of dumping acid in the soil	1.06	2.14	0.12	Low
11	Create a green consumerism bag design	1.00	5.03	0.45	Moderate
12	Create a design of a project to manage vacant land for environmental friendly	1.01	2.13	0.12	Low
	Average Score (scale 0-100)	15.79	32.73		
	HOTS Category	Very Low	Low		

Note: maximum score on each item was 10.00 points

Then a descriptive analysis was showed the differences of post-test in the experimental classes and post-test in control classes (post-test experimental vs. post-test control). The results showed that in the experimental classes score in all items were much higher than the control class. This showed that SBGC making the HOTS score of students increased and different from the control classes, the detail results can be seen in Table 8.

Table 8. Comparison students HOTS scores post-test experimental vs. post-test control classes for each item

No	Item	Experiment	Control
1	Analyzing negative effect of using plastic bags	3.63	2.76
2	Analyzing negative effect of using Styrofoam for environment	3.79	3.24
3	Analyzing product quality based on the green consumerism	3.54	2.82
4	Analyzing the impact of using various types of insect repellent	4.47	3.64
5	Evaluate a product based on the eco-label concept	2.57	2.32
6	Evaluate the use of electric vehicles	2.93	2.43
7	Criticize student behavior that does not save the use of plastic bottles	3.22	2.57
8	Criticize the behavior of people who do not want to participate in protecting the environment	3.07	2.54
9	Make hypotheses the cause of environmental pollution in rivers	2.76	2.11
10	Make hypotheses the impact of dumping acid in the soil	2.14	1.86
11	Create a green consumerism bag design	5.03	2.39
12	Create a design of a project to manage vacant land for environmental friendly	2.13	1.63
	Average Score (scale 0-100)	32.73	25.25
	HOTS Category	Low	Very Low

Note: maximum score on each item was 10.00 points

Then to measure the indicator that had the greatest increase, a comparison was also made. The results of the student HOTS score comparison are viewed from various indicators, so it can be seen that the biggest increase was in the 6th indicator. This indicator was about the ability of students to make a product or project related to green consumerism. More details can be seen in Table 9.

Table 9. Comparison students HOTS scores of pre-post experimental classes for each indicator

Aspect	Indicators	Pre	Post	Gain	Category
C4 (analyze)	Analyze the environmental problem because used plastic too much	3.10	3.71	0.09	Low
C4 (analyze)	Analyze product based on green consumerism concept	1.63	4.01	0.28	Low
C5 (evaluate)	Evaluate quality product based on environmental concept of green consumerism	1.34	2.75	0.16	Low
C5 (evaluate)	Criticize behavior of people based on environmental friendly behavior	1.37	3.15	0.21	Low
C6 (create)	Create Hypotheses based on environmental pollution problem	1.03	2.45	0.16	Low
C6 (create)	Design an green consumerism product/project	1.01	3.58	0.29	Low

Note: maximum score on each item was 10.00 points

When viewed further, all scores in the experimental class score higher than the control class in all indicators. This showed that the SBGC media influence HOTS compared with the control class for each indicator. More details can be seen in Table 10.

Table 10. Comparison students HOTS scores post-test experimental vs. post-test control for each indicators

Aspect	Indicators	Experiment	Control
C4 (analyze)	Analyze the environmental problem because used plastic too much	3.71	3.00
C4 (analyze)	Analyze product based on green consumerism concept	4.01	3.23
C5 (evaluate)	Evaluate quality product based on environmental concept of green consumerism	2.75	2.38
C5 (evaluate)	Criticize behavior of people based on environmental friendly behavior	3.15	2.56
C6 (create)	Create Hypotheses based on environmental pollution problem	2.45	1.99
C6 (create)	Design an green consumerism product/project	3.58	2.01

Note: maximum score on each indicator was 10.00 points

Finally, the data presented in the form of comparisons per aspect. This was to see the biggest increase that occurred in this study. Details score aspects of the pre-post experimental class can be seen in Table 11 and a comparison of scores for students' HOTS between the post-test experimental and post-test control classes can be seen in Table 12.

Table 11. Comparison students HOTS scores of pre-post experimental classes for each aspect

Aspect	Pre	Post	Gain score	Category
C4 (analyze)	2.36	3.86	0.20	Low
C5 (evaluate)	1.35	2.95	0.18	Low
C6 (create)	1.02	3.01	0.22	Low

Table 12. Comparison students HOTS scores post-test experimental vs. post-test control for each aspect

Aspect	Experiment	Control
C4 (analyze)	3.86	3.11
C5 (evaluate)	2.95	2.47
C6 (create)	3.01	2.00

Discussion and Conclusion

Based on the results of the study, it can be concluded that the SBGC is suitable for used in environmental learning, in this case at natural science subject in junior high school. In addition, SBGC was a media and teaching material that has been proven to increase students' HOTS. Based on this, several main points can be discussed (1) the biggest increase in HOTS items and indicators (2) the role of the SBGC that makes a significant difference between experiment and control classes (3) The continued strategy of applying SBGC.

First discussion, the biggest increase in the indicator of the design environmentally friendly bags. This point explained that SBGC can make students from those who have low HOTS (create aspect / C6) abilities become higher. This indicates that media can stimulate students' creativity in making and designing objects that can solve environmental problems (Hidayati, Pangestuti, & Prayitno, 2019; Khoiriyah & Husamah, 2018; Oncu, 2016; Rindah, Dwiastuti, & Rinanto, 2019; Sener, Turk, & Tas, 2015). Even though it is still limited to the design, students are asked to write in detail about the bag product they are designing. The goal was for students to really think of various aspects of the solution. This stage for the ability to create a design. This ability must continue to be trained. Other abilities such as analyze and evaluate important too and be trained as well.

The second discussion was about the role of the SBGC in improving students HOTS and making a significant difference between experimental and control classes. SBGC as a learning media and teaching material has a role to send information and concepts to students related to the topic of green consumerism. The attractive appearance of SBGC also makes students enthusiastic and active in learning. Besides that, SBGC has advantages of the menu that contain instruction for students to solve the problem. This menu have a role to improve HOTS. Learning in control classes was not active, because it used conventional media that was traditional. So that students are not too interested (Buber & Coban, 2017; Lemus et al., 2014; Ningsih, Rusdi, & Miarsyah, 2019; Nugraini, Choo, Hin, & Hoon, 2013; Yousefi, 2014). Based on media appearance, conventional media also does not have a display that can be easily understood by students. Students were monotonous learning and difficulty in understanding various concepts. Apart from the different forms of media and display, in the control class, there were no training activities to solve environmental problems and there were only a few group discussions. The experimental classes were more active in group discussions and were also given exercises to solve environmental problems because the SBGC has a menu containing instructions for students to solve the problem.

The third discussion was about continued strategies in implementing SBGC. The implementation of SBGC cannot stand alone. SBGC must be supported by a variety of learning models, learning strategies, worksheets, and other learning enhancements. An example such as problem-based learning models and projects based learning are highly recommended for use (Gunduz, Alemdag, Yasar, & Erdem, 2016; Jewpanich & Piriyasurawong, 2015; Nabilah, Anwar, & Riyanto, 2019; Seechaliao, 2017; Sung, Hwang, & Chen, 2019; Vidergor & Krupnik-Gottlieb, 2015). That is because both the characteristics of the problem-based model and the project-based learning strongly support efforts to improve HOTS. This model is not limited to problem-based learning and project-based learning but can use other learning models and strategies that have principles to solve a problem.

Based on this study also found an interesting result that is related to C6 aspect in the post-test in the experimental classes. This condition for the aspect score of C6 is higher than C5. This indicates that students must continue to train C5 ability such as giving comments and criticize in order to evaluate a problem in accordance with HOTS (Narayanan & Adithan, 2015; Ramadhan, Mardapi, Prasetyo, & Utomo, 2019; Taft, 2015). In this study also SBGC must be combined with worksheets that can stimulate students' ability to evaluate something. It could be by giving more problems that they can solve and they should giving their opinions in class.

The increase of HOTS in the experimental classes was indeed only able to increase HOTS from the very low category to low. This was because the treatment given should be longer time. Based on these findings reinforce the existing theory that knowledge is not transferred but is formed based on levels start from remember to create (Anderson et al., 2001). In addition to being able improve significantly, students must also be given regular training to solve environmental problem for one semester. This is because HOTS is an ability that cannot be upgraded instantly. HOTS is an ability that must be trained every day. Students can practice their ability to do an assignment but must be HOTS-based questions. Example, by giving a project to recycle waste, they must record the activity and report it to the teacher (Buzov, 2014; Goldman, Yavetz, & Pe'er, 2014; Lai, 2018; Pratama, 2018; Suhendar & Wahyuni, 2018). Besides that, exercises that are lighter such as getting used to bringing refillable drinking bottles. This can be done by the teacher as a facilitator in the class.

The last discussion was about increasing HOTS of students in environmental learning requires support from various parties. Responsibility of society and parents to provide education about green consumerism at home, not only at school. The learning media used in schools are only additional facilities, but the main key remains in the community (Bronfman, Cisternas, Lopez-Vazquez, De la Maza, & Oyanedel, 2015; Samoot, Prawit, & Sudharm, 2015). Students who study the environment in his school but his community environment teaches poor environment behavior, so it will be difficult for these students to have good environmental behavior.

Based on the results of this study, it can be concluded that implement SBGC in environmental learning was improving 8th-grade students HOTS. Scores in the experimental class group were also different significantly when compared to the control class. This was because of SBGC a learning media that can make students become more active in environmental learning. It is better for further research to also measure other variables when learning using SBGC.

Suggestions and Limitation

Future studies are suggested to measure other variables such as environmental behavior, student motivation, and others. The limitation of this study was a number of samples only 144 students. The results obtained in this study could have been different if the SBGC was implemented on a wider scale. The increase in HOTS is still moderate and low when seen from the gain score, therefore SBGC is recommended for teachers to use more intensively for students.

References

Aisyah, A., Salehuddin, K., Aman, I., Yasin, R. ., & Mimiko, N. (2018). Eliciting elements of higher order thinking skills in the higher secondary examination question structure in japan and malaysia aznur. In *Proceedings of the Regional Conference on Science, Technology and Social Sciences (RCSTSS 2016)* (pp. 455–464). https://doi.org/10.1007/978-981-13-0074-5

Anderson, L. W., Krathwohl, D. R., Airiasian, W., Cruikshank, K. A., Mayer, R. E., & Pintrich, P. R. (2001). *A taxonomy for learning, teaching and assessing: a revision of bloom's taxonomy of educational outcomes: complete edition*. New York, NY: Longman.

Arnold, O., Kibbe, A., Hartig, T., & Kaiser, F. G. (2018). Capturing the environmental impact of individual lifestyles: evidence of the criterion validity of the general ecological behavior scale. *Environment and Behavior*, *50*(3), 350–372. https://doi.org/10.1177/0013916517701796

Bronfman, N. C., Cisternas, P. C., Lopez-Vazquez, E., De la Maza, C., & Oyanedel, J. C. (2015). Understanding attitudes and pro-environmental behaviors in a chilean community. *Sustainability*, *7*(10), 14133–14152. https://doi.org/10.3390/su71014133

Buber, A., & Coban, G. U. (2017). The effects of learning activities based on argumentation on conceptual understanding of 7th graders about "force and motion" unit and establishing thinking friendly classroom environment. *European Journal of Educational Research*, *6*(3), 367–384. https://doi.org/10.12973/eu-jer.6.3.367

Buzov, I. (2014). Social network sites as area for students' pro-environmental activities. *Procedia - Social and Behavioral Sciences*, *152(1)*, 1233–1236. https://doi.org/10.1016/j.sbspro.2014.09.304

Chander, P., & Muthukrishnan, S. (2015). Green consumerism and pollution control. *Journal of Economic Behavior and Organization*, *114*(1), 27–35. https://doi.org/10.1016/j.jebo.2015.02.013

Dani, D. (2011). Sustainability as a Framework for Analyzing Socioscientific Issues. *International Electronic Journal of Environmental Education*, *1*(2), 113–128.

Diaz-Rainey, I., & Ashton, J. K. (2011). Profiling potential green electricity tariff adopters: green consumerism as an environmental policy tool? *Business Strategy and the Environment*, *20*(7), 456–470. https://doi.org/10.1002/bse.699

Garcia, L. C. (2015). Environmental science issues for higher- order thinking skills (hots) development: a case study in

the philippines. *Biology Education and Research in a Changing Planet* (pp. 45–54). https://doi.org/10.1007/978-981-287-524-2

Goldman, D., Yavetz, B., & Pe'er, S. (2014). Student teachers' attainment of environmental literacy in relation to their disciplinary major during undergraduate studies. *International Journal of Environmental and Science Education*, *9*(4), 369–383. https://doi.org/10.12973/ijese.2014.222a

Grosch, M., Berger, R., Gidion, G., & Romeo, M. (2014). Which media services do students use in fact? Results of an international empirical survey. *Procedia - Social and Behavioral Sciences*, *141*(1), 795–806. https://doi.org/10.1016/j.sbspro.2014.05.139

Gunduz, A. Y., Alemdag, E., Yasar, S., & Erdem, M. (2016). Design of a problem-based online learning environment and evaluation of its effectiveness. *The Turkish Online Journal of Educational Technology*, *15*(3), 49–57. https://doi.org/10.1017/CBO9781107415324.004

Hake, R. R. (1998). Interactive-engagement versus traditional methods: A six-thousand-student survey of mechanics test data for introductory physics courses. *American Journal of Physics*, *66*(1), 64–74.

Hamouda, A. M. S., & Tarlochan, F. (2015). Engaging engineering students in active learning and critical thinking through class debates. *Procedia - Social and Behavioral Sciences*, *191*(1), 990–995. https://doi.org/10.1016/j.sbspro.2015.04.379

Hidayati, N., Pangestuti, A. A., & Prayitno, T. A. (2019). Edmodo mobile: developing e-module biology cell for online learning community. *Biosfer: Jurnal Pendidikan Biologi / Biosphere: Journal of Biology Education*, *12*(1), 94–108. https://doi.org/10.21009/biosferjpb.v12n1.94-108

Husamah, H., Fatmawati, D., & Setyawan, D. (2018). Oidde learning model : improving higher order thinking skills of biology teacher candidates. *International Journal of Instruction*, *11*(2), 249–264.

Ichsan, I. Z., Sigit, D. V., & Miarsyah, M. (2019a). Students ' higher order thinking skills in environmental learning : develop assessment based on green consumerism. *Journal of Educational Science and Technology (EST)*, *5*(1), 9–19. https://doi.org/10.26858/est.v5i1.7848

Ichsan, I. Z., Sigit, D. V., & Miarsyah, M. (2019b). Supplementary book of green consumerism : an innovation of environmental learning based on hots. *Tadris: Jurnal Keguruan Dan Ilmu Tarbiyah / Tadris: Journal of Education and Teacher Training*, *4*(2), 135–144. https://doi.org/10.24042/tadris.v4i2.4689

Istiyono, E., Dwandaru, W. S. B., Setiawan, R., & Megawati, I. (2019). Developing of computerized adaptive testing to measure physics higher order thinking skills of senior high school students and its feasibility of use. *European Journal of Educational Research*, *9*(1), 91–101. https://doi.org/10.12973/eu-jer.9.1.91

Jewpanich, C., & Piriyasurawong, P. (2015). Project-based learning using discussion and lesson-learned methods via social media model for enhancing problem solving skills. *International Education Studies*, *8*(6), 24–31. https://doi.org/10.5539/ies.v8n6p24

Jonell, M., Crona, B., Brown, K., Ronnback, P., & Troell, M. (2016). Eco-labeled seafood: determinants for (blue) green consumption. *Sustainability*, *8*(9), 1–19. https://doi.org/10.3390/su8090884

Kaiser, F. G., & Wilson, M. (2004). Goal-directed conservation behavior: the specific composition of a general performance. *Personality and Individual Differences*, *36*(7), 1531–1544. https://doi.org/10.1016/j.paid.2003.06.003

Khoiriyah, A. J., & Husamah, H. (2018). Problem-based learning: creative thinking skills, problem-solving skills, and learning outcome of seventh grade students. *JPBI (Jurnal Pendidikan Biologi Indonesia)*, *4*(2), 151–160. https://doi.org/10.22219/jpbi.v4i2.5804

Kivunja, C. (2014). Teaching students to learn and to work well with 21st century skills: unpacking the career and life skills domain of the new learning paradigm. *International Journal of Higher Education*, *4*(1), 1–11. https://doi.org/10.5430/ijhe.v4n1p1

Knowlton, D. S., & Sharp, D. C. (2015). Students' opinions of instructional strategies in a graduate-level creativity course. *International Journal for the Scholarship of Teaching and Learning*, *9*(2), 1–12. Retrieved from http://digitalcommons.georgiasouthern.edu/ij-sotl/vol9/iss2/6

Lai, C.-S. (2018). A study of fifth graders' environmental learning outcomes in taipei. *International Journal of Research in Education and Science*, *4*(1), 252–262. https://doi.org/10.21890/ijres.383171

Lekakos, G., Vlachos, P., & Koritos, C. (2014). Green is good but is usability better? Consumer reactions to environmental initiatives in e-banking services. *Ethics and Information Technology*, *16*(2), 103–117. https://doi.org/10.1007/s10676-014-9337-6

Lemus, J. D., Seraphin, K. D., Coopersmith, A., & Correa, C. K. V. (2014). Infusing traditional knowledge and ways of knowing into science communication courses at the university of hawai'i. *Journal of Geoscience Education*, *62*(1), 5–10. https://doi.org/10.5408/12-416.1

Matthes, J., & Wonneberger, A. (2014). The skeptical green consumer revisited: testing the relationship between green consumerism and skepticism toward advertising. *Journal of Advertising*, *43*(2), 115–127. https://doi.org/10.1080/00913367.2013.834804

Musyaddad, A., & Suyanto, S. (2019). Evoking the four dimensions of student knowledge in ecosystem: effectiveness of real object, web, and blended learning. *Biosfer: Jurnal Pendidikan Biologi / Biosphere: Journal of Biology Education*, *12*(2), 194–210. https://doi.org/10.21009/biosferjpb.v12n2.182-193

Nabilah, S., Anwar, Y., & Riyanto, R. (2019). Motoric mechanism with problem-based learning: impact on students' higher-order thinking skills. *Biosfer: Jurnal Pendidikan Biologi / Biosphere: Journal of Biology Education*, *12*(2), 182–193. https://doi.org/10.21009/biosferjpb.v12n2.182-193

Narayanan, S., & Adithan, M. (2015). Analysis of question papers in engineering courses with respect to hots (higher order thinking skills). *American Journal of Engineering Education*, *6*(1), 1–10.

Ningsih, L. R., Rusdi, R., & Miarsyah, M. (2019). Exploring respiratory system to improve biological learning motivation: resysmart media application. *Biosfer: Jurnal Pendidikan Biologi / Biosphere: Journal of Biology Education*, *12*(2), 211–222. https://doi.org/10.21009/biosferjpb.v12n2.211-222

Nugraini, S. H., Choo, K. A., Hin, H. S., & Hoon, T. S. (2013). Students' feedback of e-av biology website and the learning impact towards biology. *Procedia - Social and Behavioral Sciences*, *103*(1), 860–869. https://doi.org/10.1016/j.sbspro.2013.10.408

Oncu, E. C. (2016). Improved creative thinkers in a class: a model of activity based tasks for improving university students creative thinking abilities. *Educational Research and Reviews*, *11*(8), 517–522. https://doi.org/10.5897/ERR2015.2262

Pratama, A. T. (2018). Improving metacognitive skills using problem based learning (pbl) at natural science of primary school in deli serdang, indonesia. *Biosfer: Jurnal Pendidikan Biologi / Biosphere: Journal of Biology Education*, *11*(2), 101–107. https://doi.org/10.21009/biosferjpb.v11n2.101-107

Ramadhan, S., Mardapi, D., Prasetyo, Z. K., & Utomo, H. B. (2019). The development of an instrument to measure the higher order thinking skill in physics. *European Journal of Educational Research*, *8*(3), 743–751. https://doi.org/10.12973/eu-jer.8.3.743

Ratumanan, T. ., & Laurens, T. (2006). *Evaluasi hasil belajar yang relevan dengan kurikulum berbasis kompetensi*. Surabaya City: Unesa University Press.

Rindah, M. A. K., Dwiastuti, S., & Rinanto, Y. (2019). Excretory system learning in senior high school: comparative analysis of students' problem-solving skills. *Biosfer: Jurnal Pendidikan Biologi / Biosphere: Journal of Biology Education*, *12*(2), 249–257. https://doi.org/10.21009/biosferjpb.v12n2.249-257.10.21009/biosferjpb.v12n2.249-257

Sadiqin, I. K., Santoso, U. T., & Sholahuddin, A. (2017). Students ' difficulties on science learning with prototype problem-solving based teaching and learning material : a study evaluation of development research. *Advances in Social Science, Education and Humanities Research*, *100*, 279–282.

Saido, G. A. M., Siraj, S., DeWitt, D., & Al-Amedy, O. S. (2018). Development of an instructional model for higher order thinking in science among secondary school students: a fuzzy delphi approach. *International Journal of Science Education*, *40*(8), 847–866. https://doi.org/10.1080/09500693.2018.1452307

Samoot, S., Prawit, E., & Sudharm, D. tad sa na non. (2015). The development of professional learning community in primary schools. *Educational Research and Reviews*, *10*(21), 2789–2796. https://doi.org/10.5897/ERR2015.2343

Seechaliao, T. (2017). Instructional strategies to support creativity and innovation in education. *Journal of Education and Learning*, *6*(4), 201–208. https://doi.org/10.5539/jel.v6n4p201

Sener, N., Turk, C., & Tas, E. (2015). Improving science attitude and creative thinking through science education project: a design, implementation and assessment. *Journal of Education and Training Studies*, *3*(4), 57–67. https://doi.org/10.11114/jets.v3i4.771

Shabani, N., Ashoori, M., Taghinejad, M., & Beyrami, H. (2013). The study of green consumers ' characteristics and available green sectors in the market. *International Research Journal of Applied and Basic Sciences*, *4*(7), 1880–1883.

Smith, V. D., & Darvas, J. W. (2017). Encouraging student autonomy through higher order thinking skills. *Journal of*

Instructional Research, *6*, 29–34.

Sodri, A., & Garniwa, I. (2016). The effect of urbanization on road energy consumption and co2 emissions in emerging megacity of jakarta, indonesia. *Procedia - Social and Behavioral Sciences*, *227*, 728–737. https://doi.org/10.1016/j.sbspro.2016.06.139

Suhendar, S., & Wahyuni, A. (2018). Achievement and response of students at favorite junior high schools in sukabumi on trends in international mathematics and science study (timss) questions. *Biosfer: Jurnal Pendidikan Biologi / Biosphere: Journal of Biology Education*, *11*(2), 126–133. https://doi.org/10.21009/biosferjpb.v11n2.126-133

Sung, H. Y., Hwang, G. J., & Chen, S. F. (2019). Effects of embedding a problem-posing-based learning guiding strategy into interactive e-books on students' learning performance and higher order thinking tendency. *Interactive Learning Environments*, *27*(3), 389–401. https://doi.org/10.1080/10494820.2018.1474235

Taft, M. M. (2015). Higher - order critical thinking in teacher preparation. In J. M. Paraskeva, & T. LaVallee (Eds.), *Transformative Researchers and Educators for Democracy* (pp. 57–73). Rotterdam, The Netherlands: Sense Publishers.

Talmi, I., Hazzan, O., & Katz, R. (2018). Intrinsic motivation and 21st-century skills in an undergraduate engineering project: the formula student project. *Higher Education Studies*, *8*(4), 46-58 . https://doi.org/10.5539/hes.v8n4p46

Vidergor, H. E., & Krupnik-Gottlieb, M. (2015). High order thinking, problem based and project based learning in blended learning environments. In *Applied Practice for Educators of Gifted and Able Learners* (pp. 217–232). https://doi.org/10.1007/978-94-6300-004-8_11

Yavich, R., & Starichenko, B. (2017). Design of education methods in a virtual environment. *Journal of Education and Training Studies*, *5*(9), 176. https://doi.org/10.11114/jets.v5i9.2613

Yedla, S., & Park, H. S. (2017). Eco-industrial networking for sustainable development: review of issues and development strategies. *Clean Technologies and Environmental Policy*, *19*(2), 391–402. https://doi.org/10.1007/s10098-016-1224-x

Yousefi, S. (2014). Comparison of traditional and video mediated learning of english: tracking a new approach. *Procedia - Social and Behavioral Sciences*, *98(1)*, 1940–1944. https://doi.org/10.1016/j.sbspro.2014.03.626

Zohar, A., & Alboher Agmon, V. (2018). Raising test scores vs. teaching higher order thinking (hot): senior science teachers' views on how several concurrent policies affect classroom practices. *Research in Science and Technological Education*, *36*(2), 243–260. https://doi.org/10.1080/02635143.2017.1395332