

VALIDITY OF NATURE-BASED WORKSHEET TO ENHANCE STUDENTS' RESEARCH SKILL AND ENVIRONMENTAL AWARENESS

Balgis Az Zahra¹, Rini Solihat², Lilit Rusyati³

¹Universitas Pendidikan Indonesia, Bandung, Indonesia

²Universitas Pendidikan Indonesia, Indonesia

³Universitas Pendidikan Indonesia, Indonesia

* Corresponding email: *balgisazzahra@upi.edu*

ABSTRACT

This research was aimed to produce Nature-Based Worksheet on Ecology for grade VII that could improve students' research skill and environmental awareness. This research employed a research and development by adopting modification of four-D (4D) procedure which is 3D. There were three phases of this research model namely define, design, and development phase. The nature-based worksheet consisted of three main activities which are observation, research planning and research conduction. Validity instrument were correspondence with basic competence, content writing and grammar conformity and correspondence with nature-based learning aspect. The result of the research showed valid for relevancy with learning outcomes, suitability of content and grammar, and suitability of nature-based learning.

Keywords: *nature-based worksheet; research skill; environmental awareness*

INTRODUCTION

Nature-based learning has the same root with environmental education. It is defined as "a form of school-based environmental education that uses the environment as a context for integrating subjects and a source of real-world experiences (Ernst & Tornabene, 2012). However, the major different between nature-based learning and environmental education is that it takes places in a natural environment (Ameli, 2022). We can conclude that nature-based learning is an approach of learning that occurs in natural settings where biotic

and abiotic elements of nature have been brought into built environments. It allows learners to learn while exposed by nature and experience nature-based activities.

Emerging evidence suggests that exposure to natural environments can have a profound impact on students' research skills and environmental awareness within the learning (Kuo et al., 2019; Kuo & Jordan, 2019; Speldewinde, 2022; Torquati et al., 2013). Furthermore, the benefits of nature-based learning extend beyond just environmental awareness and engagement. Studies have shown that exposure to natural environments can also enhance students' research skills, such as critical thinking, problem-solving, and observation (Kuo & Jordan, 2019; Speldewinde, 2022). By engaging in hands-on, inquiry-based activities in nature, students can develop a deeper understanding of scientific concepts, improve their ability to gather and analyze data, and hone their skills in formulating and testing hypotheses (Speldewinde, 2022). While valuable, this approach lack of nurturing students' connection to nature that is needed to foster environmental care (Clayton et al., 2019; Harris, 2021; Křepelková et al., 2020; Otto & Pensini, 2017; Whitburn et al., 2019)

Type of activity done in the program is an important factor after the exposure to nature. This whole planned activity is what makes nature-based learning different from usual trip or vacation. The activity done in nature gives impact to the improvement of connectedness to nature (Kleespies et al., 2020; Otto & Pensini, 2017; Talebpour et al., 2020; Whitburn et al., 2019) and other aspect that is expected. Worksheet is one of alternative way to guide students' activity of nature-based learning. It can be used to support the active learning process for students. It helps students discover concept through structured activities according to the needs and competencies expected (Koderi et al., 2020; Nuswawati et al., 2020). There are several benefits from students worksheet, which are 1) making students active in the learning process; 2) assisting students in discovering concepts; 3) training students in improving process skills; 4) being used as a guide for teachers and students to carry out the learning process; 5) being used as an accompaniment of students to record materials learned through the learning activities, and 6) assisting students in looking up for information about the concepts being studied (Ismail et al., 2020). Maintaining students during nature-based learning is hard. The use of worksheet in nature-based learning could help teacher to maintain students' work during class.

METHODS

This reseach was aimed to develop nature-based worksheet that could enhance students' research skill and environmental awareness for 7th grade students in junior high school. The method used in this research was 4-D

development step that has been simplified into 3-D which are define, design and develop (Thiagarajan, 1974).

Define stage aimed to define the nature-based worksheet and set the aspects targeted for this worksheet. This nature-based worksheet is aimed to enhance students' research skill and environmental awareness through nature-based learning activity. It is going to be used for 7th grade students in ecology concept based on *capaian pembelajaran* expected in *kurikulum merdeka*.

After define stage completed, the next step was design which means formulate and construct aspect of nature-based worksheet that suitable to enhance students' research skill and environmental awareness. Lastly, the third step consist of validation and readability test of instrument. Validation was done by expert consist of two lecturer and one science teacher. Readability test was done by five junior high school students.

RESULTS AND DISCUSSION

a. Define stage

Learning objective presented in nature-based worksheet was developed from ecosystem chapter based on *kurikulum merdeka* for phase D. River ecosystem was chosen as core material due to its crucial impact for human life. Activity presented in nature-based worksheet was divided into three activities which are observation, planning investigation and investigation. These three activities are expected to enhance students' research skill and environmental awareness. Students' research skill targeted for this worksheet was adopted from research skill aspect developed by Willison et. al (2018). They are embark and clarify; find and generate; evaluate and reflect; organise and manage; analyse and synthesise; and communicate and apply.

- 1) Embark and clarify: Researchers begin research by identifying and clarifying the need to know, taking into account ethical, cultural and social/team considerations.
- 2) Find and generate: Researchers find information and generate data relevant to the research using appropriate methods.
- 3) Evaluate and reflect: Researchers evaluate information and data and reflect on all methods used.
- 4) Organise and manage: Researchers organise information and data and manage the research process of individuals and teams.
- 5) Analyse and synthesise: Researchers analyse information and data and synthesise new knowledge to create a coherent individual and team understanding.
- 6) Communicate and apply: Researchers write, speak, and perform the processes, findings, and applications of research and respond to feedback, taking into account ethical, cultural, and social/team issues.

Students' environmental awareness targeted for worksheet was adopted from Novotny (2021). It consists of three individual factors of environmental environment, which are cognitive, emotional and behaviour factors.

- 1) Cognitive factor represents the thinking, analysis and search for information on environmental issues, i.e., it includes information and knowledge about environmental issues, interest in this information and at the same time their availability and sufficiency.
- 2) The emotional factor represents an emotional response to environmental issues. Specifically, how a person experiences the facts of environmental issues, what attitudes, experiences and emotions evoke environmental issues and how a person can or cannot process them.
- 3) The behavioral factor represents an immediate behavioral response: how a person at the level of behavior reacts to environmental problems, whether he is willing to do something concrete or only monitors the issue passively. Thus, the willingness to participate in the solution of individual environmental problems practically and specifically, the willingness to speak out in public for the protection of the environment, or the determination to join a group fighting for the environment.

1 A - Unsur Fisik dan Kondisinya

Amatilah unsur fisik yang ada di sekitarmu. Gunakan seluruh panca inderamu dalam kegiatan pengamatan ini. Deskripsikan kondisi dari unsur fisik yang kalian amati dalam bentuk tulisan. Catatlah hasil pengamatanmu pada tabel 1.

Tabel 1. Hasil Pengamatan Unsur Fisik

No	Unsur Fisik	Kondisi
1.	Air	
2.	Cahaya Matahari	
3.	Tanah	
4.	Udara	
5.		
6.		
7.		


Unsur fisik yang kalian temukan pada pengamatan tahap 2 A merupakan **faktor abiotik** pada **ekosistem sungai**. Unsur fisik tersebut berfungsi sebagai media untuk berlangsungnya sebuah kehidupan.

Unsur Fisik dapat dijadikan salah satu indikator pencemaran suatu ekosistem. Beberapa unsur fisik yang menandakan adanya **pencemaran sungai** adalah:

1. Air keruh, berwarna hijau atau cokelat kehijauan dan berbau tidak sedap.
2. Terdapat banyak endapan lumpur, pasir atau bahan padat lainnya di dasar sungai.


Contoh Unsur Fisik Sungai Tercemar

Air keruh



Sumber: jejakkasus.co.id

Endapan lumpur



Sumber: gosutsel.com

Kesimpulan: Kondisi biotik yang diamati mengindikasikan bahwa sungai dalam keadaan **tercemar / tidak tercemar**
*Lingkari salah satu

Figure 1. Example of worksheet content

b. Design stage

Nature-based worksheet in ecology topic is titled “*Mengenal Lebih Dekat Ekosistem Sungai*”. This worksheet is divided into three main activity which are observation, planning investigation and investigation. Design of worksheet presented in figure 1. Observation activity guide students to observe real condition of environment (abiotic factor), living things (biotic factor), and activity of human around the river. Planning investigation guide students to plan an investigation including define research question, hypotheses and variable based on given purpose, plan tools and materials that are going to be

use, organize steps of investigation, and how the data will be presented in the form of table and graph. In this activity, students try to develop their own investigation and then consult it with teacher to get a correction and refinement. The last activity is investigation where students rewrite the consulted planning and do investigation. At the end of investigation, students' evaluation and communication skill are sharpened by "ayo evaluasi" and "ayo diskusi" feature.

Each activity given in nature-based worksheet is expected to enhance students' research skill and environmental awareness. The outline of activity and its expected skill enhancement regarding was designed as presented in table 1. Meanwhile environmental awareness was expected to be developed as students' interaction with nature increased. This interaction is presented most in observation stage.

Table 1. Outline of Activity and Expected Research Skill Aspect

Research Skill Aspect	Activity Guided by LKPD		
	Observation	Planning Investigation	Investigation
Embark and Clarify	Identify the problem in abiotic, biotic, and human activities factor of river ecosystem. Example of research question, objective and hypotheses is presented	Generate their own research question and hypotheses based on given research objective	Examine the investigation based on planned research question and hypotheses
Find and Generate	Example of independent and dependent variable is presented	Generate independent and dependent variable based on given research objective	Examine the investigation based on planned independent and dependent variable
Evaluate and Reflect	Evaluation feature is given		Evaluation feature is given
Organize and Manage	Organize observation data in given table then convert it into graph	Prepare table and graph for investigation	Organize observation data in planned table then convert it into graph
Analyse and Synthesize	Analyze and conclude the result of observation		Analyze and conclude the result of investigation
Communicate and Apply	Discussion of what is the problem found, what will happen next and how to avoid it		Discussion of what is the problem found, what will happen next and how to avoid it

Design of this worksheet is in line with nature-based learning characteristics defined by (Ameli, 2022), which are 1) facilitate students to directly interact with nature; 2) use nature as learning source; 3) facilitate students to explore nature by all senses; 4) emerge students connectedness with nature; 5) provide real problem occur in nature; 6) involve prior knowledge and experience with nature.

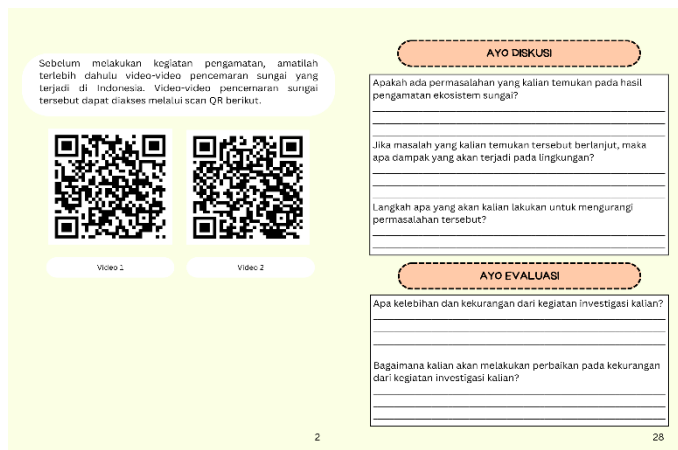


Figure 2. Example of worksheet after refinement

c. Development stage

Nature-based worksheet consisted of 32 pages. There is cover, introduction, learning objectives, user guide, 16 pages of observation stage, 7 pages of planning investigation and 5 pages of investigation stage. After developed, nature-based worksheet then validated by three experts consisted of two lecturers and one science teacher. The result shown valid in all aspects as presented in table 2. However, there are some advice given by expert such as addition of concept representation through QR code; the use of word that sound more familiar for students; and additional question in “*ayo diskusi*” feature which is what will happen to the environment if the problem found ignored? Example of refinement based on validator comment presented in figure 2.

Table 2. Validation result

No	Aspect	Validation Score (%)	Criteria
1.	Relevancy with learning outcomes	83	Valid
2.	Suitability of content and grammar	83	Valid
3.	Suitability of nature-based learning	100	Very valid

This worksheet also been tested to 34 students and gained a very good impression of all aspects. They are agree that activities provided in this worksheet help them to improve both of their research skill and environmental awareness as presented in table 3. In interview session, most of students give positive statements to observation stage of students' worksheet. Student stated “*Saya sangat senang mengikuti penjelajahan kemarin dan ingin mengulanginya lagi. Karena bisa melihat alam, hewan dan pohon-pohon*”. Another student also stated “*senang bisa mengenal alam luas, dan ilmu pengetahuan*”.

Table 3. Impression result

No	Aspect	Response (%)			
		Strongly Disagree	Disagree	Agree	Strongly Agree
1.	Nature-based worksheet help me in doing observation	0	0	59	41
2.	Nature-based worksheet help me in planning investigation	0	0	56	44
3.	Nature-based worksheet help me in doing investigation	0	3	59	38
4.	Nature-based worksheet improve my knowledge of environmental problem	0	0	32	68
5.	Nature-based worksheet improve my concern of environmental problem	0	0	44	56
6.	Nature-based worksheet motivate me to care more of environmental problem	0	3	26	71

Result gained in this research is accordance with research done by Kasmini et al., (2023). Students' worksheet makes the learning process more enjoyable and can increase students' cognitive learning outcomes. It also visualizes concepts to be easy to understand and can be used independently anywhere and anytime. Last, by using worksheet, students have higher interest and enthusiasm in learning science.

Inquiry activity presented in nature-based worksheet also help students in improving their ability in observing, planning and investigating. This result is in line with research conducted by Ajijah et al. (2023) that found inquiry activity improve higher improvement rather than control class. It also happened due to improvement of students' internal motivation during nature-based learning.

Nature-based learning provides exposure and time spent in nature that could improve students' connection with nature. This connectedness related to emotional aspect. Numbers of emotional and physical factors occurred during exposure to nature influence the enhancement of connectedness to nature (Braun & Dierkes, 2017; Kleespies et al., 2020; Talebpour et al., 2020). Therefore, emotional aspect is the first factor impacted by nature-based learning. Beside connectedness to nature, another aspect that transferred during implementation of nature-based environmental education is environment knowledge. Harris (2021) explains that students' connectedness to nature arises while gaining knowledge about certain environment. By having good connection with nature and knowledge of environment, human will be able to make a decision that is valuable for both human and nature. By the time students' connection to nature developed, behavioral aspect will also be impacted behavior (Křepelková et al., 2020; Otto & Pensini, 2017; Whitburn et al., 2019).

CONCLUSION

Nature-based worksheet developed and validated in this research consisted of three main activities which are observation, planning an investigation and investigation. Instrument was developed in ecosystem topic, sub topic river ecosystem. Validation result show valid in all aspects. Students' impression also show most students agree and strongly agree that worksheet developed in this research help them to improve their skills related research and environmental awareness. This worksheet was recommended to be used in 7th grade students. Further research about enhancement of students' research skill and environmental awareness through nature-based learning is needed to give more comprehension of this research.

ACKNOWLEDGEMENT

Thank you for Universitas Pendidikan Indonesia (UPI) that has facilitate, guide and assist author in doing this research.

REFERENCES

- Ajjah, M., Juhanda, A., & Setiono, S. (2023). The Influence of Inquiry Lesson Learning on Students' Scientific Reasoning Ability in Ecosystem Material. *https://Eprints.Ummi.Ac.Id/3657/*.
- Ameli, K. (2022). Where is Nature? Where is Nature in Nature and Outdoor Learning in Higher Education? An Analysis of Nature-Based Learning in Higher Education Using Multispecies Ethnography. *Journal of Teacher Education for Sustainability*, 24(2), 113–128. <https://doi.org/10.2478/jtes-2022-0020>
- Braun, T., & Dierkes, P. (2017). Connecting students to nature—how intensity of nature experience and student age influence the success of outdoor education programs. *Environmental Education Research*, 23(7), 937–949. <https://doi.org/10.1080/13504622.2016.1214866>
- Clayton, S., Bexell, S. M., Xu, P., Tang, Y. F., Li, W. J., & Chen, L. (2019). Environmental literacy and nature experience in Chengdu, China. *Environmental Education Research*, 25(7), 1105–1118. <https://doi.org/10.1080/13504622.2019.1569207>
- Ernst, J., & Tornabene, L. (2012). Preservice early childhood educators' perceptions of outdoor settings as learning environments. *Environmental Education Research*, 18(5), 643–664.
- Harris, F. (2021). Developing a relationship with nature and place: the potential role of forest school. *Environmental Education Research*, 27(8), 1214–1228. <https://doi.org/10.1080/13504622.2021.1896679>

- Ismail, R. N., Arnawa, I. M., & Yerizon, Y. (2020). Student worksheet usage effectiveness based on realistics mathematics educations toward mathematical communication ability of junior high school student. *Journal of Physics: Conference Series*, 1554(1). <https://doi.org/10.1088/1742-6596/1554/1/012044>
- Kasmini, L., Mardhatillah, Munandar, H., & Mukhroji. (2023). THE DEVELOPMENT OF E-LKPD (STUDENT WORKSHEET) IN SCIENCE LEARNING IN GRADE V AT SIEM PRIMARY SCHOOL. *Visipena*, 13, 114–129. <https://doi.org/10.46244/visipena.v13i2.2173>
- Kleespies, M. W., Gübert, J., Popp, A., Hartmann, N., Dietz, C., Spengler, T., Becker, M., & Dierkes, P. W. (2020). Connecting High School Students With Nature – How Different Guided Tours in the Zoo Influence the Success of Extracurricular Educational Programs. *Frontiers in Psychology*, 11. <https://doi.org/10.3389/fpsyg.2020.01804>
- Koderi, K., Latifah, S., Fakhri, J., Fauzan, A., & Sari, Y. P. (2020). Developing Electronic Student Worksheet Using 3D Professional Pageflip Based on Scientific Literacy on Sound Wave Material. *Journal of Physics: Conference Series*, 1467(1). <https://doi.org/10.1088/1742-6596/1467/1/012043>
- Křepelková, Š. D., Krajhanzl, J., & Kroufek, R. (2020). The influence of interaction with nature in childhood on future proenvironmental behavior. *Journal of Baltic Science Education*, 19(4), 536–550. <https://doi.org/10.33225/jbse/20.19.536>
- Kuo, M., Barnes, M., & Jordan, C. (2019). Do experiences with nature promote learning? Converging evidence of a cause-and-effect relationship. *Frontiers in Psychology*, 10(FEB). <https://doi.org/10.3389/fpsyg.2019.00305>
- Kuo, M., & Jordan, C. (2019). Editorial: The natural world as a resource for learning and development: From schoolyards to wilderness. In *Frontiers in Psychology* (Vol. 10, Issue JULY). Frontiers Media S.A. <https://doi.org/10.3389/fpsyg.2019.01763>
- Novotný, R., Huttmanová, E., Valentiny, T., & Kalistová, A. (2021). Evaluation of Environmental Awareness of University Students: the Case of the University of Presov, Slovakia. *European Journal of Sustainable Development*, 10(2), 59–72. <https://doi.org/10.14207/ejsd.2021.v10n2p59>

- Nuswowati, M., Azzahra, A., & Purwanti, E. (2020). The effectiveness of nature-based practicum worksheet on acid-base titration material towards students' science process skills. *Journal of Physics: Conference Series*, 1567(2). <https://doi.org/10.1088/1742-6596/1567/2/022040>
- Otto, S., & Pensini, P. (2017). Nature-based environmental education of children: Environmental knowledge and connectedness to nature, together, are related to ecological behaviour. *Global Environmental Change*, 47, 88–94. <https://doi.org/10.1016/j.gloenvcha.2017.09.009>
- Speldewinde, C. (2022). STEM Teaching and Learning in Bush Kinders. *Canadian Journal of Science, Mathematics and Technology Education*, 22(2), 444–461. <https://doi.org/10.1007/s42330-022-00207-4>
- Talebpour, L. M., Busk, P. L., Heimlich, J. E., & Ardoin, N. M. (2020). Children's connection to nature as fostered through residential environmental education programs: Key variables explored through surveys and field journals. *Environmental Education Research*, 26(1), 95–114. <https://doi.org/10.1080/13504622.2019.1707778>
- Thiagarajan, S. (1974). *Instructional Development for Training Teachers of Exceptional Children: A Sourcebook*. Center for Innovation in Teaching the Handicapped. National Center for Improvement of Educational Systems (DHEW/OE).
- Torquati, J., Cutler, K., Gilkerson, D., & Sarver, S. (2013). Early Childhood Educators' Perceptions of Nature, Science, and Environmental Education. *Early Education and Development*, 24(5), 721–743. <https://doi.org/10.1080/10409289.2012.725383>
- Whitburn, J., Linklater, W. L., & Milfont, T. L. (2019). Exposure to Urban Nature and Tree Planting Are Related to Pro-Environmental Behavior via Connection to Nature, the Use of Nature for Psychological Restoration, and Environmental Attitudes. *Environment and Behavior*, 51(7), 787–810. <https://doi.org/10.1177/0013916517751009>
- Willison, J., O'regan, K., Kuhn, S. K., Willison, J. ;, & O'regan, K. ; (2018). *Researcher Skill Development Framework (US English Edition)*. www.rsd.edu.au.