Development of Student Worksheets Containing Green/Blue Economy for Prospective Teacher Students

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Abstract. Environmental damage, pollution, management of marine resources, and declining biodiversity indices have become global issues. The results of preliminary studies have shown that learning in education courses (for prospective teachers) has not integrated green and blue economy issues. In fact, the green/blue economy issue is a shared responsibility as a form of education for sustainable development (ESD). This research aims to develop student worksheets that integrate green and blue economies that are valid and practical. The research was carried out using the design research method and the development studies type, which consist of a preliminary study and prototyping stages. The student worksheet contains student learning activities with the learning stages of adapting, searching, interpreting, creating, and communicating (ASICC). Green and blue economy issues are used as a stimulus in the ASICC learning stages. This research reveals that (1) there are four green/blue economy contents that can be integrated into learning strategy courses- (2) the green/blue economy context that can be presented in learning includes data in the form of text, graphs, tables, diagrams, and other forms- and (3) four experts assessed that the worksheet was valid and therefore suitable for used in the next research stage.

Keywords: ASICC, green economy, blue economy, student worksheet.

1 Introduction

This research was motivated by the results of a preliminary study at five universities (East Java, North Sumatra, Jakarta, East Nusa Tenggara, South Sulawesi) which revealed that students with high academic abilities still work together with fellow students with high academic abilities. This is supported by the collaboration score between students which is still low (54.39). On the other hand, students' critical and creative thinking skills scores still need to be improved. Students are not yet accustomed to formulating ideas about biodiversity issues and problems. This is because learning does not yet provide biodiversity and diversity data. Either in the form of research results or official ministry data.

F. Khoerunnisa et al. (eds.), *Proceedings of the 9th Mathematics, Science, and Computer Science Education International Seminar (MSCEIS 2023)*, Advances in Social Science, Education and Humanities Research 860,
https://doi.org/10.2991/978-2-38476-283-5_37

In fact, high-level thinking is the most basic 21st century skill [1, 2, 3] and must be possessed by all levels of society [2,3]. Another finding is that 62% of the courses implemented were problem-based and still did not integrate biodiversity. In fact, Republic of Indonesia Government Regulations Number 57 of 2021 demands that all levels of education (including universities) implement curriculum diversification in the form of integrating regional potential and local biodiversity.

Issues regarding pollution, carbon emissions, alternative energy, environmental responsibility, water and petroleum exploration, marine and underwater mining, marine products, and biotechnology have become national and global issues in sustainable development [3,4]. These issues are of concern to all parties, both globally and nationally [5]. Pollution has a serious impact on reducing the quality of air, water, and soil and reducing local biodiversity

Learning about local biodiversity can be done by presenting problems and issues regarding biodiversity management, biodiversity diversity data, and the good practices of local communities in utilizing biodiversity. This local wisdom includes the Local Ecological Knowledge (LEK) section [6] which aims to increase awareness of liver resource management [7]. The aim of integrating biodiversity into learning is so that the graduate profile has knowledge, insight, skills, and problem-solving competencies regarding important cases and issues regarding various types of biodiversity that have the potential to be alternative raw materials for energy, food, and medicine. This perspective is in line with the implementation of economic development with a green/blue economy concept, which needs to be supported by all parties. The main substance of development with a green economy concept is increasing environmental sustainability [8] and reducing carbon emissions while managing biodiversity on a local, national, and global scale [9]. This concept also intersects with the blue economy concept, which aims to optimize marine biodiversity to improve the community or national economy [8] in a sustainable manner. Therefore, it is necessary to integrate biodiversity into learning and green/blue economy content. This research aims to develop student worksheets that integrate green and blue economy content so that they can be used to improve students' collaboration and high-level thinking skills.

2 Method

This research was carried out from May to August 2023 at seven higher education in Indonesia. They were located in the provinces of East Java, Lampung, Central Java, West Kalimantan, South Sulawesi, East Nusa Tenggara, and North Maluku. This research was collaborative research from superior universities. The aim of this research was to develop stages of student learning activities that integrate green and blue economy content. The integration of green/blue economy content in learning aims to stimulate students' thinking skills so that they can increase learning motivation, metacognition, critical and creative thinking skills, collaboration, and communication (argumentation). Therefore, this research uses design research of the type of development studies. The first stage is pre-study. This first stage is carried out by formulating what the class needs. The class needs to learn how to increase learning

motivation, metacognitive thinking skills, higher-order thinking, and collaboration. This stage is carried out by observing the learning process in class. Including analyzing student worksheets that the teacher already has. The results of the observations were discussed in an *Focus Group Discussion* (FGD) to formulate the needs of students in that class. At this stage, the research team formulated specifications for student worksheets that would be used in class.

The second stage is prototyping. This stage is carried out by drafting a student worksheet that integrates green and blue economy content. Then, the student worksheet draft is evaluated independently (self-evaluation) by comparing the specifications of the student worksheet with the draft that has been prepared. Then, the draft worksheet was discussed by four experts (expert review), namely the government (National Development Planning Agency of The Republic of Indonesia), modern biologists, learning technology experts, and learning evaluation experts. A feasibility assessment was carried out through an FGD. Then, student worksheets that have been declared appropriate by experts are analyzed descriptively.

3 Results and Discussion

The design of the student worksheet in this research consists of a cover, an identity column for students, instructions for use by students, learning objectives or learning outcomes, and student learning activity stages: adapting, searching, interpreting, creating, and communicating. Each stage of student learning activities is described in Table 1.

Table 1. Stages of Student Learning Activities Containing a Green/Blue Economy

Steps	Activity	Description of Student Activity
1	Adapting	Students examine problems or cases from videos that contain cases, news, or other text forms. Students understand the learning objectives and reflect on themselves regarding learning readiness.
2	Searching	Students form heterogeneous groups based on directions from the teacher. Students seek key information from various sources, including through observation in the laboratory or in the field.
3	Interpreting	Students analyze, answer, and discuss problems based on key information obtained in groups.
4	Creating and communicating	Students formulate ideas, communicate these ideas, and self-reflection.

Based on Table 1, in the initial stage of learning, students pay attention to learning objectives. Then, students pay attention to the stimuli provided by the teacher. There are various types of stimulus forms used by teachers, for example, videos, news texts from mass media, newspapers, scientific articles, and other forms of text. Text contains

data presented in tables, diagrams, graphs, or descriptive descriptions. Next, students must be able to write answers to trigger questions from the teacher, formulate new things obtained from the stimulus provided, or write critical questions on worksheets. In the next stage, students reflect on their learning readiness based on the formulation of learning objectives and learning achievements and the stimulus provided.

That stage is called adapting. This stage was expected to be able to empower students' motivation and metacognitive awareness. Problems or issues related to students' surroundings can increase motivation [3,8,9]. Apart from that, presenting a stimulus that includes a green/blue economy context is expected to increase motivation. Contexts related to strategic global and national issues can increase students' interest and motivation to learn. This steps, also can stimuly the students metacognition [10]. One important dimension of metacognitive awareness is planning. Planning is a dimension that describes students' learning and planning readiness. These dimensions are needed by students to be able to plan effective learning strategies [11].

The second stage of the student learning activity on the worksheet is searching. Based on field notes, students form heterogeneous groups based on the teacher's direction. Groups were formed based on the results of teacher observations during the previous stage, namely grouping students with academic abilities and readiness to learn. Next, students look for key information related to the topic to be studied. Students can look for key information from various sources: papers (papers, scientific articles, reference books, textbooks, reports, infographics, videos, and interview recordings), places (field observations, laboratory practicums, and other outdoor observations), and people (gaining information from experts or practitioners in the form of interviews, filling out questionnaires, or a combination of both).

Based on description of the second stage, students get the opportunity to select abundant information and formulate the essence of key information into meaningful information [2]. The skill of selecting and selecting key information is related to critical thinking abilities [3,13]. Students who are able to find key information means they have good initial concepts and learning objectives [8]. At this stage, students also receive learning scaffolding assistance from the teacher so that the information gathered can be used for the next stage [10,12], namely interpreting the problem.

The third student activity in the student worksheet is interpreting. At this stage, students receive challenging assignments or questions. For example, students are given open-ended essay questions based on case studies related to the green/blue economy. Based on the case studies or challenging questions, students collaborate to formulate answers or solutions to the questions that have been presented. Students use the key information they have gathered in the next stage. In collaborative groups, students exchange opinions or ideas; they learn to be patient and listen; they learn how to use data to form opinions; they learn how to refute arguments based on the data and logic used; and they also learn to respect each other's differences in opinions and points of view [2,3,14,16,17].

At the end of the activity, students formulate ideas to overcome the problem. This stage is called creating. Students do not formulate ideas or conceptual concepts, but ideas that can be followed up in real action in the family, school, or community around the school or home. Therefore, students must be able to communicate these creative

ideas or concepts to get support from family members, school residents, or the community. Therefore, at this stage, students' communication (argumentation) skills are expected to improve through continuous practice [13]. This final stage is called the communication stage. A person's communication (argumentation) skills can be developed by providing sufficient opportunities (time allocation and collaboration groups) [13, 18] so that students practice reading data and determining trends or patterns in a case so that they are able to elaborate on other opinions to the maximum [19].

Table 2. Stages of Student Learning Activities Containing a Green/Blue Economy

Focus Discussion	Expert				Average
	1	2	3	4	
Do the stages of student learning activities stimulate higher order thinking skills?	3.88	4.00	4.00	3.6	3.87
Do the stages of student learning activities stimulate collaboration skills?	4.00	3.72	4.00	4.00	3.92
Do the stages of student learning activities use green or blue economy content?	4.00	4.00	3.8	3.80	3.90

The design of learning activities that integrate green and blue economy content into student worksheets has been discussed by four experts. The results of the worksheet feasibility analysis are presented in Table 2. Based on Table 2, information was obtained that all experts gave very good assessments of the student worksheet design. There are three focuses for assessing the feasibility of the worksheet. First, "do the stages of student learning activities stimulate students' higher order thinking skills?". In this first aspect, all experts provide an assessment of whether the worksheet can stimulate critical thinking skills. In the discussion session, students' level of thinking skills begins to be stimulated at the adapting stage. Students examine a case containing the green/blue economy and then discuss new things, including information that they consider important. Four experts also assessed that the searching stage could train students' critical thinking skills. Students are trained to sort out key information only as needed. The skill to identify and determine key information is also part of higher order thinking skills. The third and fourth stages, namely interpreting and creating, are also able to stimulate students' high-level thinking skills. Students formulating solutions or ideas based on data or cases can practice flexibility in formulating ideas.

4 Conclusion

This research reveals that the content of learning activities for students who integrate green and blue economic content consists of four stages. The four stages of learning activities include: students reflecting on their own readiness to adapt to the goals and

context of the surrounding problems; students looking for key information from various sources; students interpreting problems or challenging tasks; students formulating ideas, including developing product prototypes; and then communicating ideas and products to others. The integration of green/blue economy content in learning is carried out by selecting surrounding issues or problems that are related to aspects of the green/blue economy. Determine the context in the form of regional, national, or global news texts, scientific publications, videos, or other forms of text that contain data. This context is presented in the adaptation and interpretation stages. Four experts have stated that the stage of student learning activities that integrates green/blue economy content is feasible so that it can be used for the next stage.

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