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BE-RAISE: A BLENDED-LEARNING MODEL BASED ON BALINESE LOCAL CULTURE TO ENHANCE STUDENT'S ENVIRONMENTAL LITERACY

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ABSTRACT

Environmental education through strengthening environmental literacy is needed in the era of technological advances and globalization to ensure environmental sustainability in the future. This study aims to develop the BE-RAISE learning model to improve students' environmental literacy. BE-RAISE is a blended learning model based on the *Tri Hita Karana* culture that the Balinese people embrace. This is research and development using the Plomp development model. The steps consist of preliminary research, prototyping phase, and assessment phase. This research involved two biology learning experts, one learning technology expert, two teachers, and 36 students. Data on the validity, practicality, student responses, and effectiveness of the BE-RAISE learning model were collected in this study. The data collection instruments used were validity and practicality sheets, student response questionnaires, and environmental literacy tests. Data analysis of validity, practicality, and student responses was carried out by descriptive analysis. Meanwhile, the learning model effectiveness was analyzed using t-paired, which had previously been tested for normality and homogeneity. The results showed that the BE-RAISE learning model was declared valid and practical, received a positive response from students, and was effective in improving environmental literacy ($p<0.05$). Therefore, it can be concluded that the BE-RAISE learning model is declared feasible to be used in the learning process to improve environmental literacy. Further research is needed to reveal the effect of the BE-RAISE learning model on environmental literacy by design using a comparison unit and to reveal its effect on students' critical thinking skills and problem-solving skills.

Keywords: Balinese; BE-RAISE; environmental literacy; learning model; local culture; *Tri Hita Karana*

INTRODUCTION

Environmental education is one of the most critical issues of education amid technological advances and globalization (Jickling & Wals, 2008). Environmental literacy is a crucial component in carrying out environmental education in schools. This is because environmental literacy is needed to balance the notion of a sustainable environment amid modernization and the technological revolution that has been and is taking place (Bissinger & Bogner, 2017). Environmental literacy is knowledge, attitudes, and behaviors integrated to solve environmental problems (Kaya & Elster, 2019). Hollweg et al. (2011) divide environmental literacy into four domains, namely knowledge, attitudes, cognitive skills, and behavior. With environmental literacy, a person will be aware of improving the welfare of individuals, communities, and the global environment (Kaya & Elster, 2019) so that environmental sustainability can be maintained in the future.

The world has experienced a rapid increase in global population over the past decade, especially in developing countries (Choudhary et al., 2020). This increase has an impact on decreasing

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the Earth's capacity and increasing pressure on the environment that is prone to exploitation. As evidence of these concerns, currently, the world community is facing the threat of a clean water crisis due to industrialization (Jayaswal et al., 2018) and decreased biodiversity due to land conversion (Marques et al., 2019). In addition, continuous pressure on the environment will facilitate future disease pandemics (Mishra et al., 2021) as a continuation of the COVID-19 pandemic.

As a developing country, Indonesia is also experiencing similar pressures. The problems of land conversion, deforestation, soil, water, air quality, and waste are the biggest challenges in Indonesia (Ministry of Environment and Forestry, 2020). These environmental pressures have not only an impact on the natural environment but also on the development of human resources. UNICEF (2021) reports that children in Indonesia are at high risk of being affected by the environmental crisis. In that report, UNICEF recommends five things to overcome these problems. One of the most critical aspects recommended is to provide adequate environmental education to children for their adaptation and preparation for the effects of climate change (UNICEF, 2021). This recommendation is relevant to environmental literacy strengthening in education.

Empirically, several previous studies have revealed the level of environmental literacy of students in Indonesia. Putra et al. (2021) find that students' environmental literacy in West Sumatra, Indonesia is in the high category of 77.1-79.7%. Meanwhile, Santoso et al. (2021) explain that the level of environmental literacy of students in Central Java, Indonesia is in a good category. However, the aspect of cognitive skills is still in the low category. A similar finding is revealed by Aini et al. (2021), which states that the level of environmental literacy of students in East Java, Indonesia is adequate. The study in Taiwan conducted by Liang et al. (2018) reveals that there is no significant relationship between the knowledge, attitude, and behavior domain of environmental literacy. On the other hand, the study's findings in Greece found different results. Maurer and Bogner (2020) report that there is a significant correlation between knowledge, attitudes, and behavior toward the environment. In Bali, Hermawan et al. (2022) reveal that students' environmental literacy needs to be improved and empowered in an integrated manner between domains.

The previous study's findings indicate that the level of students' environmental literacy in regions in Indonesia and the world is different. In Bali, it is clearly stated that students' environmental literacy needs to be improved as a whole. The difference in research findings in various places occurs because environmental literacy is an interaction between natural and social systems (Kaya & Elster, 2019). The social system, in this case, is categorized into several factors, namely culture, politics, and economy (Hollweg et al., 2011). This social system then causes the differences in these findings due to the different social conditions in each region. Furthermore, Spínola (2021) explains that understanding sociocultural aspects is essential to create a sustainable environment.

The influence of sociocultural aspects on environmental literacy shows that educational efforts to improve environmental literacy require a local approach. In line with that, Biswas (2019) also explains that social conditions, including socioeconomic, cultural, and political systems, influence the learning process in individuals. In practice, Kaya and Elster (2019) explain that implementing education to improve environmental literacy must be carried out with various innovative learning models and not fixated on direct instruction. The innovative learning models are a project-based learning, collaborative learning, and out-of-school learning. Therefore, efforts to increase environmental literacy require an innovative learning model with a local sociocultural approach.

Several studies with various previous designs have revealed the effect of innovative learning and learning based on local sociocultural conditions on environmental literacy. Sriyati et al. (2022) report that teaching materials based on the ethnobotany of the Anak Dalam tribe in Jambi, Indonesia increased students' environmental literacy in the experimental class with an n-gain of 0.38 compared to the control class. Similarly, Watoni et al. (2022) also reveal that the development of e-modules based on the local potential of Lombok, Indonesia increased students' environmental literacy. Suryawati et al. (2020), who conducted research by applying the local environmental problem-based learning model, find that the learning model was effective in increasing the environmental literacy of students with higher n-gain scores in the experimental class. Ilhami et al. (2019) also reveal that learning based on local wisdom in West Sumatra, Indonesia, significantly improves students' environmental literacy. Angreani et al. (2022) find that virtual laboratory-based online learning improves students' environmental literacy. Furthermore, related to outdoor learning, Amini (2015) states that environmental learning outside the classroom increases students'

knowledge and environmental care. Siddiq et al. (2020) also use problem-based learning to improve students' environmental literacy. The result is that the knowledge aspect has increased, but the attitude and skills do not significantly differ from the control class.

Various recent research findings, as previously described, show that innovative learning models and learning based on local sociocultural conditions can potentially improve environmental literacy. However, based on those findings, it should be noted that there are domains of environmental literacy that have not increased. This is possible due to different sociocultural conditions between regions, as previously described. Therefore, a combination of innovative learning with local and specific sociocultural contexts of students is needed to increase environmental literacy.

In Indonesia, based on a preliminary study conducted by a systematic literature review on environmental literacy topics in journals registered on the Science and Technology Index (SINTA), only a few innovative learning models based on Balinese cultural value were found that specifically aim to increase environmental literacy. In 2018, Hermawan developed the E-RAISE learning model to empower the environmental literacy of students in Bali. E-RAISE is taken from the syntax of the learning model, including 1) Exploration of problems and cultural value, 2) Reading, questioning, and answering 3) Information processing integrated with cultural value to solve the problems, 4) Sharing, and 5) Evaluation. This learning model integrates innovative learning models, namely inquiry-based and cooperative learning, with a contextual approach. The contextual approach is the integration of activities and learning materials with the local culture of the Balinese people.

However, if it is associated with the latest developments in learning technology, the learning model becomes less relevant because it is only designed for face-to-face meetings. According to various scientific sources, blended learning is the current learning approach trend. Blended learning is a combination of face-to-face and online learning. Blended learning is considered relevant because it overcomes various limitations of online learning (Alipour, 2020). Blended learning also increases learning productivity because students are free to study according to their respective learning styles and unlimited learning materials and resources (Kacetl & Semradova, 2020; Sohaya, 2020; Tupas & Linas-Laguda, 2020). In addition, Sohaya (2020) reveals that blended learning can improve students' personal and social skills, communication, the development of new ideas, and critical thinking. Specifically in Indonesia, the trend of blended learning still needs to be improved because, according to Al-Maroof et al. (2021), who conducted a systematic literature review on blended learning, the majority of research on blended learning has been conducted in Malaysia, Taiwan, and Turkey. In addition, the E-RAISE learning model is also designed to implement the 2013 Curriculum, while currently, Indonesia has switched to a new curriculum, Merdeka Curriculum.

Referring to the explanation above, empowering students' environmental literacy through learning should be combined between the local sociocultural context approach and the implementation of innovative blended learning. Therefore, this study aims to develop a blended learning model based on the Balinese sociocultural system that is valid and practical, gets positive responses from students, and is effective in improving students' environmental literacy. This research is limited to modifications to the components of the E-RAISE learning model with a blended learning approach.

METHODS

This research and development were carried out to modify the E-RAISE learning model developed by Hermawan (2018). The Plomp development design was used in this study. According to Plomp (2013), development research has three main stages: preliminary research, prototyping, and assessment. The development stages are presented in Figure 1 and described in detail as follows.

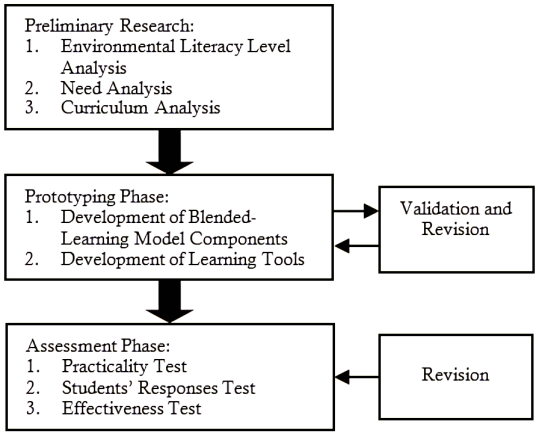

Figure 1. Research Stages

Preliminary research consists of three activities: environmental literacy level analysis, needs analysis, and curriculum analysis. The research was initiated by analyzing the level of students' environmental literacy, which was carried out using a survey to determine the level of environmental literacy of high school students in Denpasar City. This analysis involved 154 students.

Data was collected by the Indonesian Students' Environmental Literacy Assessment (ELAIS) developed by Rahmawati (2017). The data obtained were then analyzed descriptively to obtain students' environmental literacy levels.

After analyzing the level of students' environmental literacy, a needs analysis was carried out using a survey method using a questionnaire to biology teachers in all public high schools in Denpasar City. Needs analysis aims to find empirical facts about the blended-learning approach in biology learning integrated with the sociocultural conditions of Balinese society to increase students' environmental literacy. Data was collected using a Likert scale 1-4 questionnaire with a choice of responses from strongly agree to disagree. The data obtained were analyzed descriptively to find the percentage of teachers' needs regarding blended learning and learning based on sociocultural conditions.

The preliminary research was followed by curriculum analysis. This analysis was conducted to map high school biology subject matter that can be integrated with the sociocultural conditions of the Balinese people and is relevant to the concept of environmental literacy. This activity was carried out by analyzing biology class X textbooks in the Merdeka Curriculum. Data collection was carried out using a checklist form from the results of interviews with two biology learning experts and two biology teachers. The data obtained were then analyzed by matching the checklist sheet with the material in the textbook.

After carrying out the first phase, the research continued with the product development phase. The product development phase consists of two activities: the development of prototypes and product validation. The development of the learning model prototype includes adjusting the components of the E-RAISE learning model with blended learning. The components of the learning model in question include syntax, the social system, the principle of reaction, the support system, and instructional and nurturant effects (Joyce et al., 2014). The selection of the blended learning model used is also carried out at this stage. In addition, adjustments were made to the set of lesson plans and student worksheets.

After the draft learning model is completed, validation is carried out on the model and learning tools. The validation phase involved two biology teachers, two biology learning experts, and one learning technology expert. In this stage, the validator also suggests learning models and device improvements. Validity data was collected with a 4-scale Likert questionnaire with very good to poor response options. The data that has been collected is analyzed descriptively to get the validity percentage of the learning model. The product validity category refers to Table 1.

After the validation and revision processes were completed, the research continued in the assessment phase. The assessment phase is part of the development design, whose role is to evaluate the product that has been developed. At this stage, a trial of the learning model was carried out by implementing classical learning. Practical data and student responses to the learning model were collected at this stage. Practicality data and student responses were collected using a practicality and student responses questionnaire. The questionnaire uses a 5-scale Likert with very good to very bad response options. At this stage, teachers and students also provided suggestions for improvements to the learning model. The data that has been collected is then analyzed to find the percentage of product practicality and student responses. Practical category and student responses refer to Table 1.

Table 1. Criteria of Validity, Practicality, and Students Response

	Percentage	Description
Validity and Practicality	100%	Very valid/practical and can be used without revision
	80.01% - 99.99%	Valid/practical and can be used with minor revision
	60.01% - 80%	Quite valid/practical and can be used with major revision
	40.01% - 60%	Less valid/practical and recommended not to use
	20.01% - 40%	Invalid/impractical and can not use
	0% - 20%	Very invalid/impractical and can not use
Students Responses	80.01% - 100%	Very Good
	60.01% - 80%	Good
	40.01% - 60%	Fair
	20.01% - 40%	Poor

(Adapted from: Akbar, 2013; Riduwan, 2016)

In addition, the measurement of the effectiveness of the learning model to improve environmental literacy was also carried out. ELAIS was used to collect environmental literacy data. The product's effectiveness was analyzed by the t-paired test, which begins with normality and homogeneity tests with a significance level of 0.05. Subjects in this stage amounted to 36 people. The design for measuring the effectiveness of the BE-RAISE learning model is presented in Table 2.

Table 2. Design of Effectiveness Test

O_1	X	O_2
Pre-test	Treatment (BE-RAISE)	Post-test

RESULTS AND DISCUSSION

Analysis of the students' environmental literacy in Denpasar City shows that students' environmental literacy, as categorized by Maulidya et al. (2014), is in the moderate category. Specifically, the knowledge and cognitive skills domains are in the high category, while the attitudes and behavior domains are in the moderate category (Table 3). Empowerment between environmental literacy domains, including knowledge, attitudes, cognitive skills, and behavior, has also not been carried out thoroughly (Hermawan et al., 2022). The results of this analysis indicate that students' environmental literacy still needs to be improved and fully empowered in each domain.

Table 3. Students' Environmental Literacy Level

Components	M	Category
Knowledge	40.40	High
Attitude	44.31	Moderate
Cognitive Skills	42.05	High
Behavior	39.62	Moderate
Environmental Literacy	166.39	Moderate

(Source: Hermawan et al., 2022)

In 2017, Hermawan et al. conducted a needs analysis of innovative learning models based on the Balinese sociocultural system to improve students' environmental literacy. The study found that teachers have a perception that Balinese sociocultural values are essential to be integrated into a learning model as a means of cultural transmission. Furthermore, respondents revealed that so far, there has been no learning model that accommodates these needs significantly to improve students' environmental literacy. Based on these findings, the E-RAISE learning model was then developed.

The E-RAISE learning model is a Balinese culture-based learning model. This learning model integrates the cultural values of *Tri Hita Karana*. *Tri Hita Karana* is a value held by Balinese people, which means three causes of happiness. *Tri Hita Karana* has components of *parhyangan* (harmonious relationship between humans and God), *pawongan* (harmonious relationship between humans), and *palemahan* (harmonious relationship between humans and the environment). The relevance of the value of *Tri Hita Karana* with environmental literacy lies in the components of *pawongan* and *palemahan*, where environmental literacy is an interaction of social and natural aspects. Meanwhile, the social aspect of Balinese society cannot be separated from the concept of divinity (*parhyangan*). This learning model was developed based on constructivism theory with a contextual approach that adapts the principles of inquiry and cooperative learning.

Considering that currently, there has been a shift in the trend of learning with technology integration, a preliminary study was conducted to determine the teacher's perception of the application of the blended E-RAISE (BE-RAISE) learning model. The preliminary study results revealed that the respondents stated that teachers in the implementation of learning still need the E-RAISE learning model. Modification of the E-RAISE learning model to BE-RAISE is also deemed necessary to make the learning process more innovative with the application of technology. These results are supported by Kharb and Samanta (2016) and Minhas et al. (2021), who state that teachers have a positive perception of implementing blended learning. Moreover, in terms of content, Fitria and Kenedi (2020) also supported these results by stating that blended learning is needed in developing students' ecoliteracy in the era of the industrial revolution 4.0. Kocyk (2021) and Tahir et al. (2022) also suggested using blended learning in biology to instill material concepts in students.

Furthermore, the respondents also stated that they had experienced difficulties in implementing blended learning, especially in determining the distribution of learning syntax, which was carried out online and face-to-face. The preliminary study results conclude that teachers need the BE-RAISE learning model, which includes the blended-learning model used and technically explains the online and face-to-face stages in the learning process. This finding is also supported by Minhas et al. (2021), stating that implementing blended learning must pay attention to the content and the design of the learning stages to achieve effective results.

The results of the curriculum analysis conducted using an interview with checklist techniques also show that adjusting the E-RAISE learning model to the applicable curriculum is necessary. This is supported by Ngoasong (2022), who states that it is necessary to adjust blended learning with the applicable curriculum content so that learning can take place effectively. Previously, the E-RAISE learning model was developed to be implemented in the 2013 Curriculum. Meanwhile, Indonesia is currently in the process of switching to the Merdeka Curriculum. The results of the Merdeka Curriculum analysis show that environmental topics are contained in biology content for class X. The Merdeka Curriculum has included competence in environmental topics. This can be seen in students' learning outcomes. The expected learning outcomes for students are having the ability to be responsive to global issues and play an active role in providing solutions to environmental problems related to alternative energy, global warming, environmental pollution, waste management, and disease pandemic to achieve sustainable development goals (SDGs). Based on the results, the material relevant to the BE-RAISE learning model and environmental literacy includes two chapters: 1) Diversity of Living Things, Interactions, and Their Roles in Nature and 2) Global Warming: Concepts and Solutions.

The prototyping phase is carried out by analyzing and designing the components of the BE-RAISE learning model, including syntax, social system, the principle of reaction, support system, and instructional and nurturant effects. In addition, analysis and development of learning tools were also carried out, including lesson plans and student worksheets. This stage is followed by validating and revising the learning model based on the validator's suggestions (Saenab et al., 2021).

First, syntax. The BE-RAISE learning model has the following syntax: 1) Exploration of problems and cultural value, 2) Reading, questioning, and answering (RQA), 3) Information processing integrated with cultural value to solve the problems, 4) Sharing, and 5) Evaluation. Furthermore, the blended-learning model used is the station rotation model (Staker & Horn (2012). Station rotation is an implementation of rotating blended learning, online and face-to-face, in the syntax of the learning model. In its operation, the syntax of reading, questioning, and answering (RQA) is carried out as a pre-learning activity to provide adequate initial knowledge to students before proceeding to the next stage of learning. Details of learning activities for each syntax are presented in Table 4.

Table 4. BE-RAISE Syntax and Learning Activities

Syntax	Activities	Type of Learning
RQA (pre-learning activities)	Students read the material to be studied; Compose and answer questions independently based on the reading process that has been done	Online via Learning Management System (LMS) conducted before the learning activity is started
Exploration of problems and cultural value	Students explore the phenomena given by the teacher	Face-to-face (collaborative activities)
	Students formulate problems following the given phenomena	
	Students formulate investigation procedures	
	Students conduct investigations to answer the problems	
Information processing integrated with cultural values to solve the problems	Students discuss investigation findings	Face-to-face (collaborative activities)
	Students construct the relationship between investigation findings and Balinese cultural value	
	Students formulate the conclusion of the investigation	
Sharing	Students present the result of the investigation	Online via virtual meeting
Evaluation	Students make self-evaluations during learning activities	Online via LMS

Three syntaxes in this learning model are implemented online: RQA, Sharing, and Evaluation. These syntaxes have characteristics that are relevant to the implementation of online learning. RQA is implemented online with the aim that students can read material from a wide variety of sources on the internet and increase their self-regulated learning. Bahri et al. (2021) state that RQA integrated learning implemented in a blended-learning manner enhances self-regulated learning. In addition, the implementation of online RQA also improves students' critical and creative thinking skills (Tarigan & Tarigan, 2022). Sharing is conducted online to provide wider opportunities to disseminate investigation findings. In this stage, students also carry out online discussions and can upload the findings on social media. Sharing the online method is also reported to be effective in interacting and practicing communication skills (Martin et al., 2020). As a consideration for teachers, Wu (2020) explains that online discussion requires intensive guidance by the teacher so that the discussion becomes focused. Evaluation is implemented online for students' flexibility and train students' independence in compiling self-evaluations which are then uploaded to the LMS so that the evaluation results are well documented and can describe students' learning developments and problems. This explanation is supported by Aderibigbe (2021) that online self-evaluation activities allow students to find their learning experiences.

Meanwhile, two other syntaxes, exploration of problems and cultural value and information processing integrated with cultural value to solve the problems, are implemented face-to-face. Exploration of problems and cultural values is a learning stage that facilitates students to explore, formulate problems, and conduct investigations. These activities require intensive teacher guidance to ensure students can formulate problem formulations and conduct investigations appropriately by the learning objectives to be achieved. In addition, investigative activities are carried out in environments outside the school, such as rice fields, rivers, forests, garbage dumps, and others.

Several previous studies reported that investigative activities carried out outside of school would increase students' competencies (Molderez & Fonseca, 2018), strengthen connections with nature (Berg et al., 2021), and increase students' learning independence (Correia & Harrison, 2020). Information processing integrated with cultural values to solve problems is a learning stage to integrate investigative findings with Balinese cultural values. This activity aims to enable students to construct a holistic understanding of subject matter concepts, the Balinese sociocultural system, and environmental literacy. This activity is complex. Therefore, direct teacher guidance through face-to-face activities is essential. This is supported by Kang and Keinonen (2017), who reports that in complex inquiry learning activities, teacher guidance has a significant influence on student achievement.

Second, social system. The two social systems of the BE-RAISE learning model are democratic and collaborative. Democratic means that all students have equality to be actively involved in the learning process and are treated equally by teachers. Collaborative in this context means that during learning activities, students work together with one another with their respective responsibilities to complete investigative activities. This is also supported by the application of blended learning, which has flexible characteristics (Tahir et al., 2022). In a democratic context, students are given the freedom to explore unlimited learning resources. Meanwhile, blended learning also opens a broader collaboration space because students can collaborate with parties outside the school that are relevant to the investigation carried out.

Third, principle of reaction. Based on the democratic and collaborative social system adopted by the BE-RAISE learning model, the teacher acts as a facilitator in learning activities. The teacher places students as active subjects and is given the freedom to determine the direction of learning activities carried out collaboratively with teacher guidance. This aspect is to the characteristics needed by teachers in implementing blended learning, according to Bruggeman et al. (2019).

Fourth, support system. As a blended learning model, in addition to understanding aspects of *Tri Hita Karana*'s cultural values, sources, and learning tools, the support system for the BE-RAISE learning model also lies in technological literacy. Rasheed et al. (2020) explain that one of the biggest challenges in implementing the blended learning model is teacher fluency in using technology that will support the implementation of learning. Therefore, to apply the BE-RAISE learning model well, teachers must have adequate skills to use technology tools such as LMS and video conferencing applications.

Fifth, instructional and nurturant effect. The instructional effect of the BE-RAISE learning model is to increase students' environmental literacy. Furthermore, related to its characteristics, the BE-RAISE learning model also has the

potential to improve 21st-century competencies. Meanwhile, the accompanying impact caused by implementing the BE-RAISE learning model is an increase in teacher and student technological literacy in learning, student self-regulated learning, and cultural awareness. Experts in biology and technology learning carried out the validation of the BE-RAISE learning model. Validation includes several learning aspects, which are detailed in Table 5.

Table 5. The Result of Validation Test

Evaluated Aspects	Experts			Average Score	Max. Score	%	Criteria
	I	II	III				
The suitability of the learning model with the national curriculum	3	3	4	3.33	4	83.33	Valid
The suitability of 21st-century learning	4	4	3	3.67	4	91.67	Valid
The suitability of the constructivism learning theory	4	3	4	3.67	4	91.67	Valid
The suitability of the inquiry learning principle	3	4	4	3.67	4	91.67	Valid
The suitability of the contextual learning principle	4	4	4	4.00	4	100.00	Valid
The suitability of the cooperative learning principle	4	4	3	3.67	4	91.67	Valid
The suitability of the concept and blended learning model	4	3	4	3.67	4	91.67	Valid
The clarity and systematics of the syntax	4	3	3	3.33	4	83.33	Valid
The logic of syntax	4	4	3	3.67	4	91.67	Valid
Syntax describes student and teacher activities	3	3	4	3.33	4	83.33	Valid
The syntax practicality	4	3	3	3.33	4	83.33	Valid
The suitability of syntax and the social system	4	4	3	3.67	4	91.67	Valid
The suitability of syntax and the principle of reaction	4	3	3	3.33	4	83.33	Valid
The suitability of the support system and learning model	4	4	3	3.67	4	91.67	Valid
The suitability of syntax and instructional and nurturant effect	4	4	3	3.67	4	91.67	Valid
Average Overall Validity (%)						89.44	Valid

Table 5 shows that the BE-RAISE learning model has met the validity criteria for aspects of the learning model with a cumulative percentage of 89.44%. However, product revisions are needed based on expert input. Experts suggest adding the practical concept of *Tri Hita Karana* culture to the model book so that teachers can more easily integrate it into the learning process. In addition, blended learning operations must also be included in the learning model book. Furthermore, lesson plans and students' worksheets have also been categorized as valid with percentages of 93.2% and 95.8%, respectively.

The assessment phase was conducted to determine the practicality, student responses, and effectiveness of the BE-RAISE learning model to improve students' environmental literacy.

Table 6. The Result of Practicality Test

Evaluated Aspects	Observers		Average Score	Max. Score	%	Criteria
	I	II				
Syntax	5	4	4.5	5	90	Practical
Social System	4	5	4.5	5	90	Practical
Principle of Reaction	5	4	4.5	5	90	Practical
Support System	4	4	4.0	5	80	Practical
Instructional Effect	5	4	4.5	5	90	Practical
Average Overall Practicality (%)					88	Practical

Table 6 shows cumulatively that the BE-RAISE learning model is categorized as practical with a percentage of 88%. This practical category illustrates that each component of the learning model can be applied, and its characteristics in the learning process are observable. The practical syntax category shows that all stages of the BE-RAISE learning model are implemented. Furthermore, social systems, principles of reaction, and support systems are categorized as practical because they can be observed in the learning process. Meanwhile, the instructional effect can be seen in the effectiveness of the BE-RAISE learning model in increasing students' environmental literacy. This is supported by Asri et al. (2020), who explain that the practicality test of the learning model includes implementing syntax and observing the components of the learning model during the learning process. On the other hand, the observers also provided input on implementing the BE-RAISE learning model, namely that students must be guided more intensely to formulate problem formulations to follow the learning objectives.

Table 7. The Result of Students Responses

Evaluated Aspects	Average Score	Max. Score	%	Criteria
Learning Activities	3.94	5	78.80	Good
Engagement in Learning Activities	3.88	5	77.60	Good
Learning Motivation	4.00	5	80.00	Good
Social System of Learning	4.32	5	86.40	Very Good
Media and Learning Resources	3.88	5	77.60	Good
Principle of Reaction to Learning	4.33	5	86.60	Very Good
Nurturant Effect of Learning	4.19	5	83.80	Very Good
Average Overall Students' Responses (%)			81.54	Very Good

Students' responses to the learning model presented in Table 7 show a very good category with a percentage of 81.54%. The very good category shows that the BE-RAISE learning model has learning aspects, including activity, students' involvement and motivation, social interaction, media, learning resources, reaction principles, and nurturant effects that improve student learning performance. Students also provide input on implementing the BE-RAISE learning model, which simplifies the systematics of reports or final learning projects.

Table 8. The Result of Effectiveness Test

Aspects	N	Mean	SD	p	Criteria
Pre-test	36	132,11	9,72	0,0001	Significant
Post-test	36	145,00	9,38		

The results of the learning model's effectiveness in improving environmental literacy are presented in Table 8. Before the paired t-test was carried out, the Kolmogorov-Smirnov normality test was first carried out, which showed the pre-test p value = 0.200 and post-test p = 0.172. Levene homogeneity test showed p value = 0,591. The p-value of the normality and homogeneity

test is > 0.05, indicating that the data is normally distributed and homogeneous. The paired t-test shows a p-value (0.0001) < 0.05, meaning there is a significant difference between the pre-test and post-test. This revealed that the BE-RAISE learning model significantly improves students' environmental literacy.

This study shows that the BE-RAISE learning model is stated to be valid and practical, gets positive responses from students, and is effective in increasing students' environmental literacy. This learning model specifically integrates activities and subject matter of biology with the sociocultural context of Balinese society based on *Tri Hita Karana*. Materials relevant to this learning model are 1) Diversity of Living Things, Interactions, and Their Role in Nature and 2) Global Warming: Concepts and Solutions.

The validity of the learning model and tools shows that the BE-RAISE learning model has met the requirements as a learning model. The feasibility of a learning model shows that the BE-RAISE learning model is constructed from a clear learning theory, has a clear goal, and is composed of coherent learning model components. This follows Arends' (2014) statements that every learning model must have a basic philosophy or theory and the goals to be achieved. First, in terms of learning theory, the BE-RAISE learning model is constructed with a constructivist learning theory that adopts the principles of inquiry and cooperative learning. Second, the BE-RAISE learning model also has a clear goal, to improve students' environmental literacy. However, the BE-RAISE learning model can be used to improve several variables derived from environmental literacy, such as critical thinking and problem-solving skills. Third, the construction of the components of the learning model forms a coherent relationship, and there is no internal contradiction. The components of the learning model are arranged systematically based on the syntax of the learning model, and other components can be observed in the syntax.

According to the teachers involved in this study, the BE-RAISE learning model has been declared practical through a practicality test. This practicality explains that the syntax of the BE-RAISE learning model can be implemented consistently according to its operational description in the learning process. Furthermore, in its implementation, the BE-RAISE learning model also receives a positive response from students. This positive response indicates that the BE-RAISE learning model provides students with a fun and meaningful learning experience.

In the effectiveness aspect, the study's results indicate that the BE-RAISE learning model is declared effective for significantly increasing students' environmental literacy. This shows that the BE-RAISE learning model can improve students' environmental literacy in the learning process. The effectiveness of the BE-RAISE learning model in improving students' environmental literacy is supported by the BE-RAISE learning model syntax, which has a good influence on environmental literacy as a whole as well as on each environmental literacy domain. This aligns with Saenab et al. (2021), who state that the learning model is the main aspect that influences the effectiveness of a learning model.

First, RQA syntax has a positive influence on environmental literacy, especially in the knowledge domain. RQA activities are carried out before learning activities begin. In this activity, students read the material, arrange questions from the reading results, and answer the questions. This activity aims to provide adequate initial knowledge to students, so they are ready to carry out core learning activities. Adequate initial knowledge is essential in the learning process because it can increase student retention (Tangge et al., 2018; Zambrano et al., 2019) so that it has a positive impact on student learning performance because students have more sources of knowledge (Seufert, 2018). In addition, this argument is supported by previous studies which state that RQA positively correlates with students' cognitive performance (Hariyadi et al., 2018) and can improve students' thinking skills (Nasrudin & Azizah, 2019).

Second, the syntax exploration of problems and cultural value and information processing integrated with cultural value to solve the problems is a syntax adapted from the 7E inquiry learning cycle, especially in two parts, exploration and elaboration. In the exploration of problems and cultural values stage, students explore the phenomena presented related to subject matter and Balinese cultural values, formulate problem formulations, develop investigative procedures, and carry out investigations outside the classroom. Furthermore, at the stage of Information processing integrated with cultural values to solve the problems, students elaborate knowledge by integrating investigative findings with the cultural values of *Tri Hita Karana*. For example, investigation findings like problems in the rice field ecosystem correlate with how traditional Balinese farmers solve these problems with parhyangan, pawongan, and palemahan. In this case, students examine the customary rules (awig-awig) of the

Subak community, the traditional Balinese agricultural organization system. In this activity, students deepen their knowledge that traditional Balinese people have a set of traditional social systems to preserve the ecosystem of rice fields. They do not get this knowledge from the subject matter at school. This deepening of understanding contributes positively to improving students' critical thinking and problem-solving skills.

The two learning activities are correlated with overall environmental literacy, and each domain of environmental literacy includes knowledge, attitudes, cognitive skills, and behavior. Environmental learning activities outside the classroom improve overall environmental literacy (Cincera et al., 2022). In each domain, investigative learning outside the classroom based on the natural environment increases understanding of ecological concepts (Cheeseman & Wright, 2019), attitudes, environmental care behaviors (Genc et al., 2017; Collado et al., 2020), critical thinking skills, and problem-solving skills (Komala et al., 2020) which are derived from the cognitive skills domain. Furthermore, regarding the cultural integration of *Tri Hita Karana*, learning integrated with the local culture can improve students' cognitive performance (Suardana et al., 2018; Hermawan et al., 2020) and environmental care attitude (Agusta & Noorhapizah, 2018).

Third, the sharing activity positively influences the domain of knowledge and cognitive skills of environmental literacy. At this stage, students present their investigation findings and elaboration results. Students are also allowed to discuss collaboratively and receive input from other students to improve their investigative reports. It aims to develop constructive social interaction in students. The process of collaborative interaction and discussion has a positive influence on students' cognitive development (Supena et al., 2021), knowledge construction (Ouyang & Chang, 2018), and the development of critical thinking skills (Oh et al., 2018; Al-Husban, 2020).

Fourth, the evaluation syntax has a good impact on the domain of knowledge and cognitive skills of environmental literacy. Learning activities in this syntax means students are trained to compile self-evaluations, including developments and obstacles encountered during the learning process. Self-evaluation activities are correlated with knowledge of when, why, and what to learn (Kallio et al., 2018). Knowledge of when, why, and what students learn has a positive impact on student knowledge. In addition, self-evaluation activities are also positively correlated with students' cognitive learning performance (Papanthymou & Darra, 2018; Ramirez-Arellano et al., 2018; Anthonysamy, 2021).

The fulfillment of the aspects of validity, practicality, student response, and the effectiveness of the BE-RAISE learning model based on research findings shows that this learning model is feasible to use in the learning process to improve students' environmental literacy as the characteristics of the BE-RAISE learning model which combines blended learning with Balinese culture can be interpreted as a blend of modern-traditional contexts in learning. The feasibility of a learning model in integrating modern-traditional contexts is an essential aspect of the learning process. This is because students can have deep-rooted knowledge about real-life contexts in their environment by following technological developments.

Apart from the validity, practicality, and effectiveness aspects of the BE-RAISE learning model, as described above, this study has several limitations. First, the design of the effectiveness test has not used a unit of comparison. Although internally, the BE-RAISE learning model has been proven to be effective in improving students' environmental literacy, a unit of comparison is needed to obtain more specific research findings. Second, the effectiveness of the BE-RAISE learning model in improving critical thinking and problem-solving skills, which are derived from the domain of environmental literacy cognitive skills, has not been revealed. Therefore, further research is needed to test the effectiveness of the BE-RAISE learning model with a research design using a unit of comparison to improve environmental literacy. Furthermore, other research is also needed to reveal the effect of the BE-RAISE learning model on students' critical thinking and problem-solving skills.

CONCLUSION

The study results indicate that a blended learning model is needed that is relevant to the trends and curriculum of Indonesian education to improve students' environmental literacy by considering local sociocultural aspects. For this reason, the BE-RAISE learning model was developed. This learning model comprises syntax, the principle of reaction, the social system, the support system, and the instructional and nurturant effect. This learning model and tools have been declared valid, practical, and effective in improving students' environmental literacy.

The validity aspect shows that the BE-RAISE learning model has met the requirements

as a learning model with a clear theoretical basis and goals. The practical aspect indicates that the syntax of the BE-RAISE learning model can be implemented consistently in the learning process. In its implementation, students responded positively to this learning model, which indicated that students were fun and had a meaningful learning experience. The effectiveness aspect shows that the BE-RAISE learning model effectively improves students' environmental literacy, which is supported by each learning activity in its syntax.

The study results also show that implementing the BE-RAISE learning model in the learning process has a positive impact on teachers' and students' learning activities. By applying this learning model, besides increasing environmental literacy, students and teachers can also develop technological literacy, self-regulated learning, and cultural awareness. On the other hand, further research is needed to test the effectiveness of the BE-RAISE learning model in improving students' environmental literacy with a unit of comparison. Furthermore, other research is also needed to reveal the effect of this learning model on critical thinking skills and problem-solving skills as a derivative of the environmental literacy cognitive skills domain.

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