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# Research based learning conservation critical land in Meru Betiri National Park Indonesia

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**ABSTRACT**

Geography teacher candidates need to build a pro-environmental attitude to solve critical land issues through the construction of appropriate research-based solutions. This study aimed to determine the effect of research-based learning conservation on the pro-environmental attitudes of geography teacher candidates toward the preservation of Meru Betiri National Park. The study applied an experimental research design with one group pre-test and post-test. Students of the Department of Geography Education in the Faculty of Teacher Training and Education, at the University of Jember were selected as research subjects using purposive sampling. A total of 41 students currently enrolled in environmental geography courses took part in this study. The data on pro-environmental attitudes were collected using a 21-item Likert survey with scales: 1 (strongly disagree), 2 (disagree), 3 (agree), and 4 (strongly agree). The data were tested for normality and homogeneity using a t-test. The results implementation of conservation-based learning had a significant effect on the students' pro-environmental attitudes on critical land in Meru Betiri National Park (p 0.000). Research-based learning has an impact on student's scientific abilities and actions. Future research on conservation-based learning for sustainable conservation programs is recommended to involve forest farmers combine ecological and economic aspects of degraded lands.



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## 1. INTRODUCTION

Research-based learning affords opportunities for students to explore environmental problems and engage in designing solutions. This constructivist approach provides opportunities for students to connect scientific environmental problems with real-world facts [1]. A research-based learning approach can guide geography teachers to improve students' knowledge and ability to analyze environmental solutions by referring to empirics. Furthermore, it helps to build students' learning autonomy and academic achievement [2]. Research-based learning conservation uses theoretical content, procedures, and data collection to verify environmental problems through a direct application [3]. Following Brew and Mantai [4], this experience is essential for teacher candidates in higher education in the 21st century by encouraging the understanding of fieldwork methodology, research data, analysis, and theories as emotional and intellectual development.

One context for research-based learning conservation of critical land as a basis for contextual problems in geography courses. Concrete problems serve as the learning pathway for environmental conservation education. This is well aligned with the concern of higher education in developing positive attitudes toward the future of the environment and critical land conservation [5]. The contextual problem of

critical land rehabilitation challenges students to cultivate pro-environmental attitudes. Student awareness describes the need for environmental conservation education for critical land rehabilitation as a new dimension of thinking. They shoulder crucial roles in understanding the needs of the community and stakeholders in addressing environmental problems [6].

The problem of environmental change from national parks in Indonesia is seriously alarming. Environmental issues and deforestation have negative impacts on communities in rehabilitation zones and national parks [7]. Education on the conservation of critical lands in national parks requires public awareness and participation. Collaboration between higher education students, academics, and the community is fundamental to supporting the education of critical land conservation [8]. To this end, learning innovations through community education need to be in place for students to improve environmental awareness. Higher education institutions need to encourage students' environmental awareness and reduce deforestation as a movement toward a sustainable future [9]. Pro-environmental attitudes can be actuated through human-environment interaction. Students require guidance and support to gain the utmost experience in caring for the environment [10]. The change of environmental degradation in Meru Betiri National Park needs to concern students and academics of the university to analyze the deforestation landscape. The data opened forest encroachment activities problem the deforestation area 3.382 hectares of 52.626, 04 hectares total landscape. Research-based learning with spatial problem environmental needs solution and action of all parties in the national park.

Landscape space related to environmental elements cannot be separated from human life. Gendered human activities in terms of physiological functions, production, and consumption are influenced by the physical environment. Changes in the environment and land are problems that require immediate solutions as they can tremendously impact human activities. To make these solutions feasible, education needs to pay heed to the impact of using environmental resources [11]. Changes due to human activities in the conservation area exacerbate environmental degradation [12]-[13]. Prevention of environmental problems in conservation zones must involve universities, students, academics, researchers, stakeholders, and the community. The contribution of future geography teachers and geographers with a multidisciplinary approach supports environmental preservation [14]. Spatial environmental problems in the Meru Betiri National Park are part of the research master plan of Jember University. The role of students and lecturers involved directly in research-based learning was to provide solutions and recommendations. Research activities, as well as learning, provide scientific experience to care about environmental conservation.

The current literature shows that conservation-based learning has an impact on developing student competencies for one semester by 50% [15]. It also leads to an 80% improvement in students' thinking skills and attitudes [16]. The relevance of scientific thinking builds students' understanding of theories based on formative and summative measures [17]. Research-based learning conservation influences cognitive aspects which engage students' attitudes [18]. There are significant differences in student learning achievement before and after research-based learning conservation management [19], which drives innovation in the higher education environment [20]. The difference was that the research focused explicitly on an environmental geography subject, a geography teacher candidate of Jember University, and emphasized contextual case facts problem spatial environment in Meru Betiri National Park. Spatial problems environment conservation in the national park as a nature laboratory for learning and research environmental geography for student university.

The theoretical and empirical studies have elaborated on research-based learning conservation as a learning experience that activates intellectual, cognitive, and scientific processes. Empirical studies integrating research roadmaps offer the potential to improve students' research skills and academic performance. This study aimed to determine the impact of research-based learning conservation on students' performance in environmental geography courses. Such inquiry allows for increasing the pro-environmental attitude and garners empirical evidence of the impact of research-based learning with conservation actions for critical land. In this scenario, this study examined the effect of research-based learning conservation on the pro-environmental attitudes towards the critical land of Meru Betiri National Park. The findings are projected to set the cornerstones to developing students' awareness of sustainable conservation of critical land.

## 2. METHOD

This experimental research applied one group pre-test and post-test design by obtaining pre-test scores and post-test scores on pro-environmental attitudes based on critical land research in Meru Betiri National Park. The environmental geography course was highly relevant to research-based learning to tackle environmental degradation in the Meru Betiri National Park. The research-based learning for environmental geography focused on the expertise of lectures from the geography research group in the

department. Research-based learning plans were designed to construct an environmentally caring attitude with collaborative learning, research, and recommendations for sustainable student action. The research design is shown in Table 1.

Table 1. One group pre-test post-test design [21]

| Participants | Pre-test | Treatment | Post-test |
|---|---|---|---|
| Students in the environment geography course | $O_1$ | X | $O_2$ |

Table 1 shows that the pre-test scores are collected before the treatment, which is the research-based learning on how to conserve critical land in Meru Betiri National Park (X). Post-test results are obtained after treatment at $O_2$. Students developed proposals and presented research results, followed by data collection. Information on search strategies, research methodology, and oral and written skills paved student collaboration. The research design for this activity can be seen in Table 2.

Table 2. Research design

| Pre-test | Treatment | Post-test |
|---|---|---|
| Measuring students' pro-environmental attitudes towards critical land in Meri Betiri National Park | Research-based learning conservation | Measuring students' pro-environmental attitudes towards critical land in Meri Betiri National Park |

The research subjects were students enrolled in the environmental geography course at the Geography Education Study Program, Faculty of Teacher Training and Education, University of Jember. A total of 41 students in the fifth semester were involved in this study, consisting of 58.98% female and 41.02% male. The treatment through research-based learning aimed at increasing attitudes towards the environment individually, demonstrated by the application of sustainable conservation measures. The f research-based learning aimed to develop the student's understanding of geography education and educational geography.

Quantitative data on pro-environmental attitudes were collected using the environmental attitude scale (EAS) [22]. The scale included 21 indicators to analyze pro-environmental attitudes toward critical land conservation in Meru Betiri National Park. The scale involved four different options, *inter alia*, (4) strongly agree; (3) agree; (2) disagree; (1) strongly disagree, which represented the magnitude of students' perspectives [23]. The internal consistency of the scale as reported EAS is 0.77. Cronbach's alpha value found in this study was 0.82. The measuring attitudes that care about the environment as a result of the scientific process of research-based learning to produce sustainable actions restore critical land with programmed and scheduled conservation.

In the course, the concept of environmental geography was discussed in the first 2 weeks, with a duration of 2 hours each week. In the 3rd meeting, students discussed research-based learning for the conservation of Meru Betiri National Park. Students were divided into 8 groups for conducting and reporting research on a set of pre-determined topics. Throughout the course, students arranged research plans, schedules, and reports according to the time specified in the course outline. The research-based learning activities are described in Table 3. The groups were divided into the following foci of investigation: i) identity of critical land places and spaces, ii) environmental degradation and hydrological condition of critical land, iii) the economic impact of forest ecological damage, iv) environmental changes and damage to critical land rehabilitation, v) environmental and ecological mitigation on critical land, vi) restoration of the ecosystems of critical land through conservation; vii) the role of the national park and community for environmental conservation, and viii) the role of resorts in protecting the ecosystem by educating the community near the national park.

Based on the research roadmap of the department, these topics were widely integrated into all courses. Students collected information on critical land environmental problems in the national park. They prepared research proposals on environmental issues on selected critical lands supported by relevant literature from scientific journals and books. The data were collected by students through observations, investigations, and interviews with the community nearby the national park. These data were processed to determine the solutions to the problems concerned with the conservation of Meru Betiri National Park. The solutions proposed were then compiled and reported by each group. Research results and reports were presented to other groups in class. The research findings of each group became the basis for the conservation activities by planting trees following the provisions of the Meru Betiri National Park office. This was done in tandem with the community and resorts in the 16th meeting.

Table 3. Course activities

| Week | Activity | Duration (hours) |
|---|---|---|
| 1 | Concept of environmental geography. | 2 |
| 2 | Concept of environmental geography. | 2 |
| 3 | The introduction to conservation-based learning with a specific focus on the natural laboratory and ecosystem of Meru Betiri National Park | 2 |
| 4 | Literature review on research concerning the conservation of Meru Betiri National Park | 2 |
| 5 | Group formation and determination of research foci | 2 |
| 6 | The development of a research proposal on the conservation of critical land in | 2 |
| 7 | Data collection in Meru Betiri National Park | 2 |
| 8 | Data analysis and group discussion | 2 |
| 9 | Group work to compose a research report based on the observation in Meru Betiri National Park | 2 |
| 10 | The presentation by groups 1 and 2 | 2 |
| 11 | The presentation by groups 3 and 4 | 2 |
| 12 | The presentation by groups 5 and 6 | 2 |
| 13 | The presentation by groups 7 and 8 | 2 |
| 14 | Review of the research results by each group | 2 |
| 15 | Carrying out tree planting as an environmental conservation measure on critical land involving lecturers, students, student organizations, volunteers, the community, and the Meru Betiri National Park resort. | 2 |
| 16 | Examination | 2 |

The survey was distributed before and after the implementation of research-based learning conservation. Decision-making was made by comparing the probability value ($p$) to the confidence interval $p$ of 5%. A confidence interval $\geq p$ implies the approval of H0 and the rejection of Ha [21]. The data were analyzed using a t-test with the aid of IBM SPSS 23 for Windows. The hypotheses in this study are as follows:

- H0: there is no significant difference in pro-environmental attitudes before and after implementing research-based learning on the conservation of Meru Betiri National Park.
- H1: there is a significant difference in pro-environmental attitudes before and after implementing research-based learning on the conservation of Meru Betiri National Park.

## 3. RESULTS AND DISCUSSION

The results showed that the implementation of research-based learning conservation affected the students' pro-environmental attitudes in Meru Betiri National Park Indonesia. The student EAS between boys and girls is 0.124. The data used in this research were the results of the pre-test and post-test. The data analysis began with the normality test and homogeneity test, the results of which are presented in Table 4.

Table 4. The results of the normality test based on EAS

| Attitudes based on EAS | Shapiro-Wilk | | |
|---|---|---|---|
| | Statistic | df | Sig. |
| Pre-test | 1.277 | 41 | .262 |
| Post-test | .031 | 41 | .861 |

As shown in Table 4, the results of the normality test based on the pre-test are indicated by $p$>0.05 (0.262). Results with $p$>0.05 (0.861), the pre-test and post-test data are proven normally distributed. The data was normally distributed if probability comparing values and significance levels ≥5%. The homogeneity test was carried out using the Lavene test. The results of the homogeneity test are presented in Table 5.

Table 5. The results of the homogeneity test based on EAS

| Attitudes based on EAS | Shapiro-Wilk | | |
|---|---|---|---|
| | Lavene statistic | df | Sig. |
| Pre-test | .955 | 41 | .101 |
| Post-test | .947 | 41 | .055 |

Table 5 illustrates that the homogeneity test based on the pre-test marked $p$>0.05 (0.101), and the homogeneity test based on the post-test reported $p$>0.05 (0.055). These findings implied that the scores corresponding to pro-environmental attitudes are homogeneous. Impact positive attitude for students towards

the environment by trying to restore and protect exploration potential resources after implementing research-based learning. In particular, the data from the t-test results for students' pro-environmental attitudes can be seen in Table 6.

Table 6. The results of the t-test based on EAS

| | | t-test for equality of means | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | F | Sig. | t | df | Sig. (2-tailed) | Mean difference | Std. error difference | 95% Confidence interval of the difference | |
| | | | | | | | | | Lower | Upper |
| EAS | Equal variances assumed | .594 | .443 | 5.207 | 41 | .000 | 8.76173 | 1.68270 | 5.41173 | 12.11173 |

The results of the student's EAS obtained a *p*-value of 0.000, leading to the approval of H0. By implication, the learning activities based on research-based learning conservation influenced pro-environmental attitudes towards Meru Betiri National Park. No significant difference was identified between male and female students. The results increase the conceptual understanding and application of conservation in Meru Betiri National Park for all students. Empowering environmental literacy to restore critical land degradation ecosystems becomes a scientific strength and sustainable action for students.

The results of this study are in line with the results of previous studies. Research-based learning conservation increases students' mastery of knowledge and competence by more than 85% in solving environmental and community problems [16]. The research-based learning centered on critical lands attracts students' interest in developing scientific thinking and action as the basis for the ecological restoration of Meru Betiri National Park. The increment of knowledge and skills across disciplines is proven an important innovation as a result of research-based learning [24]. The enthusiasm to do research and think scientifically as well as creatively stimulates collaboration between students and lecturers. The concerted efforts between students and lecturers to address the challenges unraveled through research-based learning conservation are associated with individual cognitive development.

Research-based learning develops students' metacognitive skills to describe causal factors, make predictions, and present constructive arguments through scientific reports and presentations [25]. The research-based learning conservation helps strengthen students' knowledge and skills in geography education [26]. The resultant learning achievements can be seen in student-led activities. Besides, improved research skills are essential outcomes of research-based learning. The quality of thinking students studying literature reference and application research-based learning can construct scientific mental abilities based on data or facts. Scientific process construction can provide environmental geography knowledge with activities and research in the field.

The aim of implementing conservation with research-based learning is to spark learning innovations in higher education. Geography teacher candidates need an understanding of research to convey key ideas for implementing research. Research-based learning conservation in higher education involves various elements and parties [27]. Students are encouraged to understand various disciplines when researching to pave their learning process. The belief in the integration of research into environmental geography content encourages students' multidisciplinary thinking. However, it is imperative to note that research-based learning conservation is highly dependent on lecturers' competencies to teach and understand students' abilities [4], [28].

The formation of groups consisting of 5 to 6 students was carried out face-to-face in class. The themes studied by each group were expected to provide solutions to problem-solving using research data or information. The preparation of proposals triggered students' understanding of critical land environmental issues comprehensively. Literature exploration for identifying relevant content and methodology is a strength in building problem-solving ideas. Students acknowledged that understanding research methodology was a key element in preparing proposals. Equally important was that the relevance of problems and methods used in preparing the proposals for research-based learning conservation required thoughtful consideration and extensive reading of scientific journals. Writing and compiling research proposals are encouraging challenges for students to make a scientific contribution [29]. In this regard, a fine proposal makes a significant contribution to understanding possible solutions to issues surrounding the national park.

To make sure that the proposals were clear and focused, students had to plan data collection and analysis within a specified time. Understanding the proper methodology determines the quality of proposals prepared by students to solve environmental problems in Meru Betiri National Park Indonesia. The amount of time devoted to data collection indicated the data quality. In practice, the students' autonomy manifested the process achievement of students as geography teacher candidates [30]. Clear activities triggered students' learning autonomy as the drive to the sustained learning experience and the development of research skills connecting theories and practices.

Student autonomy in data collection afforded important learning opportunities to recognize the relevance between core knowledge and field facts while allowing them to gain new knowledge. Data collection on the research topics was designed, developed, implemented, and evaluated in compliance with the research focus [31]. Hereunder are some photographs documenting the data collection in Meru Betiri National Park. As shown in Figure 1, the data collection included observations and interviews with the targeted community. The attitudes present during the data marked an important research experience as a basis for developing individual competencies to construct new knowledge [2], [32]. The research novelty is one of the advantages of data collection and scientific thinking associated with research-based learning conservation.


Figure 1. Data collection in Andongrejo Village of Meru Betiri National Park

The research results were presented in class by each group. The written and oral communication determined the quality of research reports. Students explained research findings to other students according to their respective focus. Communication and collaboration determined the quality of data collection and research reports [33]. Communication aided in evaluating research results about environmental geography and served as the key to a positive academic culture in disseminating research findings [34], [35]. This dissemination enabled students to gain wider recognition of their scientific works beyond the class, such as through writing and publishing research articles. Both scientific and non-scientific communication in environmental geography can impact researchers' performance [36]. Scientific communication provides a logical bond that is academically beneficial for researchers and the public [37], [38], particularly by making robust arguments on their research findings. In line with previous literature, the discussion of research substance contributes 7.2% to students' learning [39]. Communication helps to grasp research findings supported by data, facts, and previous research empirics. When finely harnessed, communication can raise research interest and excitement in research-based learning [40].

The advantages of research-based learning lie in student collaboration and autonomy, such as through discussion and brainstorming on research findings guided by relevant literature. These activities provided a boost to students' scientific thinking during the data collection. Furthermore, they drove the development of knowledge, skills, and mastery of research methods as a result of students' knowledge co-construction [41]. The development of the ability to write scientific articles is another strength of research-based learning conservation through careful planning, composition, and publication of students' works. This enabled students to gain ownership of their learning by sharing their ideas and recommendations grounded within their research findings. The orientation to research methodology related to the university and the environment attracted students' interest [41], [42].

The application of research-based learning on how to conserve critical land of Meru Betiri National Park provides ideas for action that will be carried out by students. The students' ideas were carried out as a follow-up through planting trees, educating the community, and conducting periodic and sustainable evaluations of tree planters. All recommendations were taken as solutions for the community and policymakers. The most important concrete step was strengthening the students' pro-environmental attitudes as a foundation for educating the public. Research-based learning provided real situations to improve prospective geography teachers' competency [43]. The fact case context of the implementation of research-based learning makes participation students give solutions public pro-environmental conservation for literation spatial geography.

Improving students' environmental intelligence and skills helped them to adapt to natural ecology. Environmental intelligence stemmed from research-based learning on the conservation of critical land due to

human activities. Direct experience of environmental conservation, as a form of natural intelligence, has a strong impact on students [44]. Environmental experience influences students' naturalistic intelligence as a result of research-based learning [45]. Naturalistic intelligence emerges to the need for sustained engagement to conserve the environment for the future of critical lands.

Students' naturalistic intelligence determines how well they apply conservation skills. This needs to be well aligned with the ability to understand social and ecological changes as the basis for decision-making. The actions and exploration of university programs define conservation skills in the 21st century [46], [47]. Conservation skills help the anthroposphere overcome the challenges and issues associated with human-environment interaction [48], particularly because the development of conservation skills motivates individuals to learn, be proactive, and think creatively and effectively [49]. Environment conservation also helps to eliminate academic gaps by opening access to knowledge co-construction through collaboration to solve scientific problems and implement academic knowledge [50], [51]. Conservation skills not only focus on the learning process but also emphasize the concept of educating. A prospective geography teacher requires a comprehensive understanding of conservation skills. In educating the community, effective leadership plays a defining role as it possesses interpersonal impact [52].

Time management from the proposal preparation stage and data collection was seen as an obstacle to the implementation of research-based learning conservation, especially given the busy schedule throughout the semester. Research-based learning took a long time, especially during data collection. Terrain conditions with difficult topographic access and the distance to the national park also posed challenges to data collection. The time challenges when collecting data, however, had a motivational effect on sustainable scientific attitudes. Data collection and analysis of environmental problems generated a positive impact on the knowledge and scientific attitudes of prospective geography teachers [53]. Research-based learning conservation accrued pro-environmental attitudes after conducting many interviews and discussions with the community. The engagement in research-based learning provided the changes to directly navigate the social and ecological problems in the national park. The advantages of research-based learning conservation were confirmed throughout the preparation of research proposals, data collection, analysis, report generation, and presentations that give each student ownership of their learning and resultant knowledge. The results of knowledge co-construction can be seen from the development of spatial thinking, spatial analysis thinking, and the application of geography concepts to provide well-informed solutions. The findings implicated the need for developing students' ecological and environmental literacy through participation in a conservation program as a follow-up initiative after the course.

The lecturers' roles in research-based learning were to provide lifelong experiences through problem-solving activities. The conservation-based learning implies careful management of instructional learning planning, research themes, lecturer competencies, individual attitudes and behavior, and individual students' insights and skills. The lecturers' experience and competence in teaching environmental geography courses have had an impact on building students' scientific thinking for research and setting a decent example of a researcher. Research-based learning instilled an understanding of caring for the environment with actions to restore the ecology. Students needed to grasp the values of critical land conservation education for transforming theory and skills as the essence of environmental education.

The research findings demonstrated no gender differences concerning pro-environmental attitudes. Gender differences can provide motivation, attitudes, and conservation behavior in environmental education across races and social classes in partaking in ecological and political actions. Collaboration between students and various elements of society was the key to conservation. Environmental awareness was influenced by the level of education which helped to build students' individual and collective responsibility [54], one of which is through the study of physical geography and human geography as crucial areas of sustainable environmental education. The multidisciplinary learning expanded students' universal knowledge about critical land environmental conservation education [55]. The findings were in dissonance with the results of another study showing that males have better pro-environmental attitudes than females. The changes in the student's behavior orientated to education on sustainable critical land environment conservation were seen as important outcomes of place-based pedagogy in this study. Integrated environmental conservation education strengthened students' knowledge and actions to solve environmental problems. In addition, this learning experience gave rise to students' social and ecological literacy since human activities involving ecological exploration affect the magnitude of environmental conservation education. Direct and indirect conservation activities were not without challenges in changing the community behavior in environmental management. Direct conservation programs (ecological returns and species management) and indirect measures (policy impact and research results) are two important trajectories to community capacity building.

Growing students' knowledge, attitude, and action to educate the community sustainably is an individual challenge. This has been well addressed through group-led projects in conservation-based learning, where students learned to foment group cohesion and perceptions in cultivating responsible

behavior towards the environment [56]. As revealed in this study, males and females shared equal roles in building positive behavior toward the environment and preserving nature [57]. The social dynamics surrounding individual actions toward environmental concern emphasize the value of integrating local wisdom for community education. Cultivating pro-environmental attitudes requires student involvement by directly analyzing problems in the field. As shown in Figure 2, what follows are several photographs of students' engagement in environmental conservation.

The students demonstrated pro-environmental attitudes by planting trees in Meru Betiri National Park as a form of follow-up and conservation-based learning guided by a geographical approach. Conservation experience is not only present in the pro-environmental attitudes but also in the knowledge of selecting plant species suitable for sustainable conservation programs to avoid conflict between humans and animals. The plant selection influenced the collaboration between students and the community in sustainable conservation education [58]. Coffee and coconut may not be used for conservation in the national park. Coffee is included in the plantation category, while coconut does not represent the vegetation canopy as a natural forest for conservation reserve. The number of trees planted can serve as a sustainable conservation program metric as an evaluation parameter, which helps to strengthen students' social and ecological behavior. The engagement in planting trees and co-construction of conservation knowledge contribute to making a significant return to the environment from humans in an integrated manner.

Figure 2. Environment conservation by planting trees in Meru Betiri National Park

The conservation of the damaged environment through planting and caring for a sustainable ecosystem can offer a spatial advantage in the future. Conservation actions should not only focus on the concept of planting trees but also deal with pro-environmental attitudes by maintaining and evaluating the process of returning the planted ecology. Anthropocentric forms of action and pro-environmental attitudes must involve student collaboration with the community for sustainable restoration of damaged ecology [59]. Environmental conservation education programs in national parks provide a lifelong learning arena where everyone can make a real contribution to long-term sustainable programs [60]. However, environmental conservation education programs have various challenges in the national park. The research results have documented the advantages of environmental conservation education programs in growing students' skills, environmental awareness, attitudes, behavior, and participation as important affective dimensions in ecological literacy. The implication of research-based learning promotes pro-environmental attitudes through the convergence of theories and practices in higher education. The model gives students constructive thinking for learning, research, and practice of content essential geography environment and education geography.

## 4. CONCLUSION

Our findings demonstrated that research-based learning conservation has been proven to generate a significant effect on students' environmental awareness to conserve Meru Betiri National Park. These impacts are manifest in the increased knowledge and skills, quality of scientific thinking, geography skills, ecological literacy skills, and pro-environmental attitudes as the drives to sustainable conservation of critical land. Students as geography teacher candidates gain the opportunity to expand their knowledge of geography education concerning national parks and education geography (learn contextual). The research-based learning conservation motivated students' engagement and autonomy to design solutions to conserve Meru Betiri

National Park by restoring damaged ecosystems in tandem with academia, communities, and resort officials. The distance to the research site was the primary challenge to research-based learning. Future research is advised to examine the environmental awareness of critical land conservation in Meru Betiri National Park by involving forest farmers. Problems with the population pressure of critical land can be solved with collaboration with forest farmers for sustainable conservation. This might extend the research significance by addressing issues pertinent to ecology and the economy.

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## REFERENCES

[1] A. Cetin-Dindar, "Student motivation in constructivist learning environment," *EURASIA Journal of Mathematics, Science and Technology Education*, vol. 12, no. 2, pp. 233–247, Nov. 2015, doi: 10.12973/eurasia.2016.1399a.

[2] A. Brew and C. Saunders, "Making sense of research-based learning in teacher education," *Teaching and Teacher Education*, vol. 87, p. 102935, Jan. 2020, doi: 10.1016/j.tate.2019.102935.

[3] K. Mayolo-Deloisa, A. M. Ramos-de-la-Peña, and O. Aguilar, "Research-based learning as a strategy for the integration of theory and practice and the development of disciplinary competencies in engineering," *International Journal on Interactive Design and Manufacturing (IJIDeM)*, vol. 13, no. 4, pp. 1331–1340, Dec. 2019, doi: 10.1007/s12008-019-00585-4.

[4] A. Brew and L. Mantai, "Academics' perceptions of the challenges and barriers to implementing research-based experiences for undergraduates," *Teaching in Higher Education*, vol. 22, no. 5, pp. 551–568, Jul. 2017, doi: 10.1080/13562517.2016.1273216.

[5] M. Evert, H. Coetzee, and W. Nell, "Environmental attitudes among undergraduate students at a South African University," *Interdisciplinary Journal of Environmental and Science Education*, vol. 18, no. 1, p. e2260, Nov. 2021, doi: 10.21601/ijese/11330.

[6] S. Sousa, E. Correia, J. Leite, and C. Viseu, "Environmental knowledge, attitudes and behavior of higher education students: a case study in Portugal," *International Research in Geographical and Environmental Education*, vol. 30, no. 4, pp. 348–365, Oct. 2021, doi: 10.1080/10382046.2020.1838122.

[7] L. Tacconi, R. J. Rodrigues, and A. Maryudi, "Law enforcement and deforestation: Lessons for Indonesia from Brazil," *Forest Policy and Economics*, vol. 108, no. May, p. 101943, Nov. 2019, doi: 10.1016/j.forpol.2019.05.029.

[8] R. Szczytko, S. J. Carrier, and K. T. Stevenson, "Impacts of outdoor environmental education on teacher reports of attention, behavior, and learning outcomes for students with emotional, cognitive, and behavioral disabilities," *Frontiers in Education*, vol. 3, no. June, pp. 1–10, Jun. 2018, doi: 10.3389/feduc.2018.00046.

[9] A. Shafiei and H. Maleksaeidi, "Pro-environmental behavior of university students: Application of protection motivation theory," *Global Ecology and Conservation*, vol. 22, p. e00908, Jun. 2020, doi: 10.1016/j.gecco.2020.e00908.

[10] M. E. Ibáñez, D. M. Ferrer, L. V. A. Muñoz, F. M. Claros, and F. J. O. Ruiz, "University as change manager of attitudes towards environment (the importance of environmental education)," *Sustainability*, vol. 12, no. 11, p. 4568, Jun. 2020, doi: 10.3390/su12114568.

[11] T. Ogunbode, O. Omotayo, J. Asifat, P. Ogunbile, I. Olatubi, and V. Oyebamiji, "Challenges of degradation in the tropical environment: causes, footprints and remedies," *Aswan University Journal of Environmental Studies*, vol. 2, no. 4, pp. 218-239, Dec. 2021, doi: 10.21608/aujes.2021.89948.1035.

[12] R. Halbac-Cotoara-Zamfir, D. Smiraglia, G. Quaranta, R. Salvia, L. Salvati, and A. Giménez-Morera, "Land degradation and mitigation policies in the mediterranean region: a brief commentary," *Sustainability*, vol. 12, no. 20, p. 8313, Oct. 2020, doi: 10.3390/su12208313.

[13] P. K. Maurya *et al.*, "An introduction to environmental degradation: Causes, consequence and mitigation," in *Environmental Degradation: Causes and Remediation Strategies*, Agro Environ Media - Agriculture and Ennvironmental Science Academy, Haridwar, India, 2020, pp. 1–20. doi: 10.26832/aesa-2020-edcrs-01.

[14] M. Thornbush, "Physical Geography and environmental sustainability," *Sustainability*, vol. 9, no. 12, p. 2195, Nov. 2017, doi: 10.3390/su9122195.

[15] J. Noguez and L. Neri, "Research-based learning: a case study for engineering students," *International Journal on Interactive Design and Manufacturing (IJIDeM)*, vol. 13, no. 4, pp. 1283–1295, Dec. 2019, doi: 10.1007/s12008-019-00570-x.

[16] U. Usmeldi, R. Amini, and S. Trisna, "The development of research-based learning model with science, environment, technology, and society approaches to improve critical thinking of students," *Jurnal Pendidikan IPA Indonesia*, vol. 6, no. 2, p. 318, Oct. 2017, doi: 10.15294/jpii.v6i2.10680.

[17] M. Haviz, "Development of research-based learning model in biology education: what is relevance, concystency and practicality?," *Journal of Education and Learning (EduLearn)*, vol. 12, no. 1, pp. 143–149, Jan. 2018, doi: 10.11591/edulearn.v12i1.6555.

[18] Z. Arifin, A. Sukristyanto, J. Widodo, and M. R. Rahman, "Implementation, outcomes, and effectiveness of research-based learning: a systematic literature review," *International Journal of Education and Literacy Studies*, vol. 10, no. 4, pp. 153–163, Oct. 2022, doi: 10.7575/aiac.ijels.v.10n.4p.153.

[19] W. Worapun, "The development of research-based learning management in the curriculum design and development course for teacher students," *Journal of Education and Learning*, vol. 10, no. 6, p. 62, Oct. 2021, doi: 10.5539/jel.v10n6p62.

[20] M. H. Camacho, M. Valcke, and K. Chiluiza, "The effect of "research based learning activities" on students' intention to do research in graduate courses," in *EDULEARN17 Proceedings*, Mar. 2017, pp. 6571–6579. doi: 10.21125/edulearn.2017.2497.

[21] J. W Creswell and J. David Creswell, *Research design: qualitative, quantitative adn mixed methods approaches*, vol. 53, no. 9. SAGE Publications, 2018.

[22] A. Hedlund-de Witt, J. de Boer, and J. J. Boersema, "Exploring inner and outer worlds: A quantitative study of worldviews, environmental attitudes, and sustainable lifestyles," *Journal of Environmental Psychology*, vol. 37, pp. 40–54, Mar. 2014, doi:

10.1016/j.jenvp.2013.11.005.
[23] R. A. Asún, K. Rdz-Navarro, and J. M. Alvarado, "Developing multidimensional Likert scales using item factor analysis," *Sociological Methods & Research*, vol. 45, no. 1, pp. 109–133, Feb. 2016, doi: 10.1177/0049124114566716.
[24] M. Healey, A. Jenkins, and J. Lea, "Developing research-based curricula in college-based higher education Mick Healey, Alan Jenkins and John Lea," 2014. [Online]. Available: https://s3.eu-west-2.amazonaws.com/assets.creode.advancehe-document-manager/documents/hea/private/resources/developing_research-based_curricula_in_cbhe_14_1568037034.pdf.
[25] A. Al-Maktoumi, S. Al-Ismaily, and A. Kacimov, "Research-based learning for undergraduate students in soil and water sciences: a case study of hydropedology in an arid-zone environment," *Journal of Geography in Higher Education*, vol. 40, no. 3, pp. 321–339, Jul. 2016, doi: 10.1080/03098265.2016.1140130.
[26] G. Westwell and J. Ingle, "Mapping contemporary cinema: blending critical pedagogy and research-based learning in undergraduate curriculum design," *Teaching in Higher Education*, vol. 25, no. 7, pp. 842–857, Oct. 2020, doi: 10.1080/13562517.2019.1612356.
[27] M. Puustinen, J. Säntti, A. Koski, and T. Tammi, "Teaching: A practical or research-based profession? Teacher candidates' approaches to research-based teacher education," *Teaching and Teacher Education*, vol. 74, pp. 170–179, Aug. 2018, doi: 10.1016/j.tate.2018.05.004.
[28] W. Silviarza, S. Sumarmi, and B. Handoyo, "Using of spatial problem based learning (SPBL) model in geography education for developing critical thinking skills," *Journal for the Education of Gifted Young Scientists*, vol. 8, no. 3, pp. 1045–1060, Sep. 2020, doi: 10.17478/jegys.737219.
[29] M. Monrroy, H. Franco, and J. R. García, "Criteria of formality and structural elements of research proposals," *Education Research International*, vol. 2022, pp. 1–6, Sep. 2022, doi: 10.1155/2022/9447931.
[30] M. Duarte, C. Leite, and A. Mouraz, "The effect of curricular activities on learner autonomy: the perspective of undergraduate mechanical engineering students," *European Journal of Engineering Education*, vol. 41, no. 1, pp. 91–104, Jan. 2016, doi: 10.1080/03043797.2015.1056101.
[31] V. I. Marín, "Research-based learning in education studies: design inquiry using group e-Portfolios based on blogs," *Australasian Journal of Educational Technology*, vol. 36, no. 1, pp. 1–20, Jan. 2020, doi: 10.14742/ajet.4523.
[32] S. Sumarmi, S. i Bachr, A. Baidowi, and M. Aliman, "Problem-based service learning's effect on environmental concern and ability to write scientific papers," *International Journal of Instruction*, vol. 13, no. 4, pp. 161–176, Oct. 2020, doi: 10.29333/iji.2020.13411a.
[33] A. J. Timiyo and N. Sriram, "Role of research-based learning on graduates' career prospects," *Higher Education Studies*, vol. 11, no. 3, p. 10, Jun. 2021, doi: 10.5539/hes.v11n3p10.
[34] A. Valinciute, "Lithuanian scientists' behavior and views on science communication," *Public Understanding of Science*, vol. 29, no. 3, pp. 353–362, Apr. 2020, doi: 10.1177/0963662520907001.
[35] S. Ridha, S. Utaya, S. Bachri, and B. Handoyo, "Students' geographic skills in Indonesia: Evaluating gis learning material questions using taxonomy of spatial thinking," *Journal of Social Studies Education Research*, vol. 10, no. 4, pp. 266–287, 2019.
[36] H. Jonker, F. Vanlee, and W. Ysebaert, "Societal impact of university research in the written press: media attention in the context of SIUR and the open science agenda among social scientists in Flanders, Belgium," *Scientometrics*, vol. 127, no. 12, pp. 7289–7306, Dec. 2022, doi: 10.1007/s11192-022-04374-x.
[37] M. Burns and F. Medvecky, "The disengaged in science communication: How not to count audiences and publics," *Public Understanding of Science*, vol. 27, no. 2, pp. 118–130, Feb. 2018, doi: 10.1177/0963662516678351.
[38] Sumarmi, N. Wahyuningtyas, A. Sahrina, and M. Aliman, "The effect of environmental volunteer integrated with service learning (EV_SL) to improve student's environment care attitudes and soft skills," *Pegem Journal of Education and Instruction*, vol. 12, no. 1, pp. 168–176, Jan. 2022, doi: 10.47750/pegegog.12.01.16.
[39] R. Watermeyer and J. Chubb, "Evaluating 'impact' in the UK's research excellence framework (REF): liminality, looseness and new modalities of scholarly distinction," *Studies in Higher Education*, vol. 44, no. 9, pp. 1554–1566, Sep. 2019, doi: 10.1080/03075079.2018.1455082.
[40] I. Wessels, J. Rueß, C. Gess, W. Deicke, and M. Ziegler, "Is research-based learning effective? Evidence from a pre–post analysis in the social sciences," *Studies in Higher Education*, vol. 46, no. 12, pp. 2595–2609, Dec. 2021, doi: 10.1080/03075079.2020.1739014.
[41] L. Brennan, T. Cusack, E. Delahunt, S. Kuznesof, and S. Donnelly, "Academics' conceptualisations of the research-teaching nexus in a research-intensive Irish university: A dynamic framework for growth & development," *Learning and Instruction*, vol. 60, no. August, pp. 301–309, Apr. 2019, doi: 10.1016/j.learninstruc.2017.10.005.
[42] S. Sumarmi, S. Bachri, L. Y. Irawan, M. Aliman, and W. I. Wan Ahmad, "Project-based research learning (PBRL) Integrated With E-Learning in Projects Completion," *International Journal of Emerging Technologies in Learning (iJET)*, vol. 16, no. 07, p. 16, Apr. 2021, doi: 10.3991/ijet.v16i07.21193.
[43] I. Agud and G. Ion, "Research-based learning in initial teacher education in Catalonia," *Center for Educational Policy Studies Journal*, vol. 9, no. 2, pp. 99–118, Jun. 2019, doi: 10.26529/cepsj.564.
[44] J. Linuesa-Langreo, P. Ruiz-Palomino, and D. Elche-Hortelano, "Integrating Servant leadership into managerial strategy to build group social capital: the mediating role of group citizenship behavior," *Journal of Business Ethics*, vol. 152, no. 4, pp. 899–916, Nov. 2018, doi: 10.1007/s10551-018-3823-4.
[45] S. Reshadat, A. Zangeneh, S. Saeidi, R. Teimouri, and T. Yigitcanlar, "Measures of spatial accessibility to health centers: investigating urban and rural disparities in Kermanshah, Iran," *Journal of Public Health*, vol. 27, no. 4, pp. 519–529, Aug. 2019, doi: 10.1007/s10389-018-0966-9.
[46] T. L. Teel *et al.*, "Reenvisioning the university education needs of wildlife conservation professionals in the United States," *Conservation Science and Practice*, vol. 4, no. 2, pp. 1–14, Feb. 2022, doi: 10.1111/csp2.610.
[47] L. Y. Irawan *et al.*, "Exploring conservation education and learning activities in Bajulmati Sea Turtle Conservation area," *IOP Conference Series: Earth and Environmental Science*, vol. 986, no. 1, p. 012051, Feb. 2022, doi: 10.1088/1755-1315/986/1/012051.
[48] H. Ma *et al.*, "Integrating biodiversity conservation and local community perspectives in China through human dimensions research," *People and Nature*, vol. 4, no. 6, pp. 1461–1474, Dec. 2022, doi: 10.1002/pan3.10408.
[49] T. A. C. Loffeld, T. Humle, S. M. Cheyne, and S. A. Black, "Professional development in conservation: an effectiveness framework," *Oryx*, vol. 56, no. 5, pp. 691–700, Sep. 2022, doi: 10.1017/S0030605321000648.
[50] A. Karasov-Olson *et al.*, "Bridging the knowledge-implementation gap between agency and academia: A case study of a graduate research experience," *Conservation Science and Practice*, vol. 2, no. 12, pp. 1–10, Dec. 2020, doi: 10.1111/csp2.286.
[51] P. A. Kamil, E. Putri, S. Ridha, S. Utaya, Sumarmi, and D. H. Utomo, "Promoting environmental literacy through a green project:

a case study at adiwiyata school in Banda Aceh City," *IOP Conference Series: Earth and Environmental Science*, vol. 485, no. 1, p. 012035, May 2020, doi: 10.1088/1755-1315/485/1/012035.
[52] E. Englefield, S. A. Black, J. A. Copsey, and A. T. Knight, "Interpersonal competencies define effective conservation leadership," *Biological Conservation*, vol. 235, no. February, pp. 18–26, Jul. 2019, doi: 10.1016/j.biocon.2019.03.043.
[53] S. M. Al-Balushi and S. S. Al-Aamri, "The effect of environmental science projects on students' environmental knowledge and science attitudes," *International Research in Geographical and Environmental Education*, vol. 23, no. 3, pp. 213–227, Jul. 2014, doi: 10.1080/10382046.2014.927167.
[54] A. Gökmen, "The effect of gender on environmental attitude: A meta-analysis study," *Journal of Pedagogical Research*, vol. 5, no. 1, pp. 243–257, Mar. 2021, doi: 10.33902/JPR.2021167799.
[55] O. Fisenko, V. Nikitina, and T. Satina, "Natural scientific thinking in foreign students of pre-university courses in the context of integration into the Russian educational environment," *Jurnal Pendidikan IPA Indonesia*, vol. 10, no. 4, pp. 544–559, Dec. 2021, doi: 10.15294/jpii.v10i4.31741.
[56] S. Triantafyllidis and L. Darvin, "Mass-participant sport events and sustainable development: gender, social bonding, and connectedness to nature as predictors of socially and environmentally responsible behavior intentions," *Sustainability Science*, vol. 16, no. 1, pp. 239–253, Jan. 2021, doi: 10.1007/s11625-020-00867-x.
[57] S. Collado, H. Staats, and P. Sancho, "Normative influences on adolescents' self-reported pro-environmental behaviors: the role of parents and friends," *Environment and Behavior*, vol. 51, no. 3, pp. 288–314, Apr. 2019, doi: 10.1177/0013916517744591.
[58] S. Birdsall and T. Kelly, "Conservation education in Aotearoa-New Zealand: a values perspective," *Australian Journal of Environmental Education*, vol. 38, no. 2, pp. 178–191, Jun. 2022, doi: 10.1017/aee.2022.19.
[59] Y. Gan, J. Gao, J. Zhang, X. Wu, T. Zhang, and M. Shao, "University students' knowledge, attitudes, and behaviors related to marine environment pollution," *International Journal of Environmental Research and Public Health*, vol. 19, no. 24, p. 16671, Dec. 2022, doi: 10.3390/ijerph192416671.
[60] K. E. Lukas, A. Leeds, M. A. Slavin, J. Tinka, and C. J. Kendall, "Impact of teacher training in conservation education on student learning in primary schools adjacent to Kibale National Park, Uganda," *Oryx*, vol. 53, no. 3, pp. 497–504, Jul. 2019, doi: 10.1017/S0030605317000965.

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