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Implementing Sustainable Development Education in Research-Oriented Courses

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ABSTRACT

Education for Sustainable Development (ESD) equips educators with the tools to integrate sustainability into teaching, focusing on themes such as disaster risk reduction, biodiversity, poverty alleviation, and sustainable consumption. This study investigates the implementation of ESD in research-based lectures, evaluating students' understanding, ability to develop research plans, and articulation of findings in academic articles. A descriptive survey approach was employed, using observational data collection during student research activities, documentation of research outputs, and student interviews. The study involved 85 Islamic Religious Education students at Muhammadiyah University Jakarta enrolled in a learning strategies course. Data were analyzed through triangulation of observations, interviews, and documented outputs. Students demonstrated competency in conducting ESD-focused research, as evidenced by their article preparation and group research outputs. Key indicators of success included the quality and depth of articles, meticulousness in material preparation, and active student involvement in group-based research activities. The integration of ESD into research-based learning fosters critical skills in sustainability research and academic communication. These findings suggest that structured, research-oriented pedagogical models enhance students' ability to engage with and contribute to sustainability goals. Research-based learning models in higher education effectively develop students' ESD competencies, including research planning and academic writing. The study highlights the potential of such models to prepare students as contributors to sustainability-oriented education and research.

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1. INTRODUCTION

Educational institutions worldwide, including those in Indonesia, must respond proactively to the challenges and opportunities presented by the concept of sustainability. These institutions bear a significant responsibility to equip educators and learners with the skills and knowledge necessary to address pressing sustainability issues effectively. Achieving this goal requires a comprehensive and transformative approach that integrates sustainability into learning content, pedagogical methods, and educational environments. Such an approach fosters interactive, student-centered learning that promotes meaningful engagement and deep understanding of sustainability principles (Wulandari et al., 2018).

Educational institutions that face the challenges of advancing education inevitably influence learning outcomes. Meaningful teaching and learning outcomes are exemplified by the implementation of the 2013 curriculum, which emphasizes inquiry-based learning (PBR) aligned with the constructivist paradigm. PBR is considered a powerful tool to enhance education in Indonesia, equipping students to navigate the demands of global competition. This approach aligns with research-based learning strategies aimed at achieving sustainable development. However, its successful implementation requires ensuring that students begin with a solid, well-organized foundation of knowledge to avoid misconceptions or fragmented understanding (Slameto, 2020).

The initial stages of learning are designed to contribute to sustainable development goals, a concept focused on meeting current needs without compromising the ability of future generations to meet theirs. Within this framework, aspects of science education, Islamic values, and cultural diversity are seamlessly integrated to foster a holistic approach to learning. The integration of these elements into education reflects a commitment to sustainability as outlined in the Quran, Hadith, and Indonesia's rich cultural diversity. This approach underscores the importance of sustainable development not only as a global objective but also as a culturally and religiously relevant educational framework (Roth & Lee, 2004).

The incorporation of sustainable development principles in higher education often lacks a clear and cohesive framework. While many institutions claim to address sustainability, their efforts are often fragmented, with "hidden sustainability" elements that fail to provide explicit and impactful outcomes. This ambiguity limits the potential benefits of sustainability integration, particularly in addressing environmental and socio-economic challenges within communities (Roth & Lee, 2004). For higher education to effectively contribute to sustainable development, universities must adopt a deliberate and systematic approach to sustainability, ensuring tangible benefits for both society and the environment.

To achieve this, adopting a research-based learning (RBL) model is highly recommended. This pedagogical approach actively engages students in the learning process by incorporating research-focused content and methodologies. RBL features systematic and measurable stages that guide learners through the processes of inquiry, critical analysis, and the practical application of research findings. This approach not only strengthens students' research skills but also enhances their understanding of sustainability issues, equipping them to tackle complex global challenges with confidence and competence (Liline et al., 2024; UNESCO, 2023). By fostering critical thinking and problem-solving abilities, RBL prepares students to become proactive contributors to sustainable development initiatives and lifelong learners.

Recent studies highlight the potential of RBL to foster critical thinking, problem-solving, and interdisciplinary collaboration, which is essential for advancing sustainability in higher education. By embedding sustainability into the research-based learning framework, universities can bridge the gap between academic knowledge and real-world application, aligning their practices with sustainable development goals (Basak & Yucel, 2024). Such a model transforms education into a driver for societal and environmental progress, enabling students to act as agents of change in their communities.

Each step in conducting research in the lecture process requires strategic planning; adaptation to technological updates through innovative cultural practices; partnership-based college network

development; interpersonal modality of college service quality; performance improvement through effective service systems and leadership. competitive advantage strategy model based on the development of college institutional sustainability. The important role of multi-stakeholder networks is as a mediating facilitator between organizational culture and college competitive advantage (Fajri & Sukatin, 2021). This research has benefits if it has references to other authors as long as they work together on research outcomes.

In order to unify the multi-stakeholder network in the situation of education in Indonesia. Therefore, in order to realize the SDGs, special efforts and strategies are needed to improve the quality of Islamic education in Indonesia such as quality education, quality education, justice, and having opportunities for lifelong learning for all ages. (Khaidir Fadil et al., 2023). This is found in Education for Sustainable Development (ESD) in higher education. Thus, it is expected that students will have a positive attitude when carrying out their duties and responsibilities as educators. (Nurmilawati & Santoso, n.d.).

Based on the explanation above, achieving sustainable development goals (SDGs) in education requires educators to implement innovative learning strategies, such as research-based lecture programs. These programs foster critical thinking and contribute to achieving quality education objectives. However, a significant gap exists in higher education regarding the integration of research-based learning into the lecture process. Many educators face challenges in effectively incorporating research elements into teaching, which limits students' ability to develop critical thinking skills and engage in meaningful, inquiry-driven learning experiences.

This research addresses the gap by proposing a novel approach to lectures using Education for Sustainable Development (ESD) principles integrated with research-based learning. The combination of ESD and research-based models is rarely implemented, offering a unique and engaging design that can transform traditional lectures into dynamic, thought-provoking sessions. This approach not only enhances critical thinking but also aligns with SDGs by promoting sustainable education practices.

The aim of this study is to evaluate the effectiveness of a research-based lecture model through the ESD approach in fostering critical thinking and producing high-quality scientific outputs. By advancing the understanding and practice of ESD at the tertiary level, this research has the potential to significantly improve academic outcomes and accreditation assessments. Ultimately, it seeks to provide educators with a practical framework for integrating research into lectures, ensuring that students are better prepared to contribute to sustainable development and achieve academic excellence.

2. METHODS

This study employed a qualitative field research design with a descriptive approach to examine the integration of research-based learning in higher education to support sustainable development. The research subjects consisted of 85 students enrolled in the Islamic Education Study Program at Muhammadiyah University Jakarta. This cohort was selected as the primary sample because the researcher is an Islamic education lecturer and has direct involvement with this group, providing a unique perspective into their academic experiences. Secondary data were gathered from scholarly articles and journals relevant to research-based learning and educational strategies aimed at achieving sustainable development goals.

Data collection involved both primary and secondary methods. Primary data were obtained through open-ended questionnaires, direct observations, and structured interviews with students. The field study began with observing students' engagement during lectures, followed by providing instructional materials on the preparation of scientific articles. Subsequently, students participated in interviews lasting 15–30 minutes during lectures to capture their insights and experiences.

Secondary data were sourced from journals, articles, and studies that discuss research-based learning models or lecture strategies aligned with sustainability objectives. These supplementary materials provided a theoretical foundation to support the analysis of primary data.

The data collection procedure included several systematic steps:

1. Observation: Initial observations were conducted to examine students' participation and engagement in research-based learning activities.
2. Instructional Support: Students were provided with technical guidance on preparing scientific articles related to research-based learning.
3. Interviews: Structured interviews were conducted with students to explore their experiences and perceptions of research-based learning.
4. Open-Ended Questionnaires: Questionnaires were designed to capture students' understanding and application of research-based learning techniques and their alignment with sustainability goals.
5. Triangulation: Data triangulation was used to ensure the validity and reliability of the findings. This involved cross-verifying data collected through observations, interviews, and questionnaires.

Data analysis involved several stages:

1. Data Reduction: The collected data were reviewed and condensed to focus on key themes and findings relevant to the research objectives.
2. Thematic Analysis: Responses from interviews and questionnaires were analyzed to identify recurring themes, particularly those related to research-based learning and its role in fostering sustainable development competencies.
3. Synthesis and Interpretation: Observational and interview data were synthesized with secondary data to provide a comprehensive understanding of the research findings.
4. Conclusion Drawing: Insights gained from the analysis were summarized to draw meaningful conclusions about the effectiveness of research-based learning in achieving sustainable education goals.

By employing a rigorous data collection and analysis process, this research provides a nuanced understanding of how research-based learning can be effectively integrated into higher education to foster sustainability competencies. The methodology ensures that findings are grounded in both empirical evidence and theoretical frameworks, offering practical recommendations for educators and institutions.

3. FINDINGS AND DISCUSSION

The findings and discussion section outlines the outcomes of this study, which significantly impacted students' preparation and problem-solving abilities, particularly in developing writing skills essential for thesis preparation. The results highlight several key areas: the process of designing thesis titles, behavioral changes resulting from the application of the research-based lecture model, and a measurable improvement in students' ability to craft scientific articles.

Through the implementation of research-based lecture activities, students demonstrated substantial progress in their research skills. After being provided with material on scientific article preparation techniques and applying these techniques in their assignments, students exhibited enhanced focus and active participation during lectures. This engagement was evident in their thoughtful questions and discussions about scientific writing processes. These activities not only strengthened their understanding of research and writing but also prepared them for the demands of sustainable development.

In a landscape where educators are increasingly required to possess competencies in scientific article preparation, this study underscores the value of equipping students with these skills. The findings reflect how integrating research-based approaches into teaching can foster critical skills that align with both academic and professional sustainability challenges.

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essential for thesis preparation. The results highlight several key areas: the process of designing a thesis title, the behavioral changes resulting from the implementation of the research-based lecture model, and the measurable improvement in students' ability to write scientific articles.

Through the implementation of research-based lecture activities, students showed substantial progress in their research skills. After being provided with materials on scientific article drafting techniques and applying these techniques in their assignments, students showed increased focus and active participation during lectures. This engagement was evident in their questions and discussions about the scientific writing process. This activity not only strengthened their understanding of research and writing, but also prepared them for the demands of sustainable development.

In a landscape where educators are increasingly required to be competent in the preparation of scientific articles, this study underscores the importance of equipping students with these skills. The findings reflect how integrating research-based approaches into teaching can foster critical skills that are aligned with the challenges of academic and professional sustainability.

3.1 Steps in Research-Based Scientific Article Writing

The findings reveal that research-based scientific article writing activities follow a systematic process consisting of five key steps. The process begins with identifying the problem through a preliminary study to establish the research focus. Next, a research title is determined, ensuring it aligns with the identified problem. Field studies are then conducted, involving data collection through interviews, observations, and documentation. The gathered data is verified to ensure accuracy, unnecessary information is reduced, and conclusions are drawn. Finally, the results are refined and presented, culminating in the publication of the research in seminar forums or scientific journals.

Despite this structured approach, many students encounter significant challenges in understanding and adhering to the characteristics of scientific articles. These challenges include difficulties in using objective and precise scientific language, adhering to academic conventions such as proper citation practices, and understanding the systematic structure of a scientific paper. Students often struggle with key components such as crafting an introduction, selecting appropriate research methods, presenting results and discussions, and drawing coherent conclusions. Additionally, mechanical errors are common, including issues with writing titles, author details, formatting paragraphs, and correctly using in-text citations, footnotes, and bibliographies.

In terms of content development, students often face difficulties articulating factual findings from their fieldwork. Many are unable to create a theoretical framework that aligns with their research title. A prevalent issue is the reliance on copying material from the internet rather than generating original scientific content, leading to a lack of depth and authenticity in their work.

The practice of writing research-based scientific articles has been increasingly incorporated into coursework as a response to educational challenges and to prepare students for sustainable living. This approach integrates climate-based education and sustainable development, equipping students with the competencies needed for life beyond the classroom (Arwan, 2022). Writing such articles fosters essential life skills, such as critical thinking and problem-solving, and supports career readiness by providing students with tools to succeed academically and professionally.

For students, this process significantly enhances career prospects by developing skills critical to their success in academia and beyond. For lecturers, facilitating research-based writing activities promotes scientific productivity, accelerates academic achievements, and contributes to career advancement (Samodra Wibawa, 2017).

In conclusion, research-based scientific article writing activities provide a structured pathway through identifying problems, determining research titles, conducting field studies, reproducing and verifying data, and revising and publishing findings. This approach not only fosters meaningful academic contributions but also equips students with critical skills for lifelong learning, professional success, and active participation in sustainable development.

3. 2 Progression and Improvement in Scientific Article Writing Through Iterative Cycles

The research findings reveal a progression in students' ability to write scientific articles across three cycles of implementation, demonstrating gradual improvement in specific aspects of article writing.

In the first cycle, students' abilities were notably low, particularly in defining research objectives, adhering to scientific article writing systematics, and applying proper writing techniques. Specific weaknesses were observed in formulating research objectives, structuring theoretical frameworks, and understanding the overall systematics of scientific articles. Additionally, students struggled with citation techniques, word choice, sentence construction, and proper use of spelling and grammar. These gaps highlighted a lack of foundational understanding necessary for effective scientific writing.

In the second cycle, students showed positive developments in their article-writing abilities as the research-based scientific article writing model was implemented. Improvements were observed in areas such as crafting the background, discussion, and conclusion sections, as well as understanding the structure of scientific articles. Students demonstrated the ability to formulate and address research problems through a combination of literature and field research. Field research activities included the use of observation, interviews with various sources, photographic documentation, and intertextual studies leveraging literature from books and online journals. However, linguistic challenges persisted, particularly in word choice, sentence construction, paragraph structure, and the application of proper spelling and punctuation.

By the third cycle, students made significant progress in addressing the linguistic weaknesses identified in the earlier cycles. These included improving the effectiveness of sentences, accuracy in word formation, logical paragraph structure, and correct use of spelling and punctuation. Students were guided through revision processes and assumed the role of editors to refine their work. This iterative process enabled them to systematically improve the linguistic and structural quality of their scientific articles. The improvements observed align with findings from previous studies by Kusumawardana et al. (2021) and Sri Haryati and Fifit Firmadani (2018), which emphasize the importance of iterative learning and targeted guidance in developing scientific writing skills.

In conclusion, the preparation of scientific articles through iterative cycles of data collection and writing activities proved essential for identifying and addressing weaknesses in students' writing skills. This process not only helped students better understand research problems but also allowed them to refine their skills systematically, leading to meaningful improvements in the quality of their scientific articles. This approach highlights the importance of iterative, guided learning in fostering the competencies required for effective research-based scientific writing.

3.3 Purpose of Writing Scientific Articles by realizing SDG-based education

The progress of nations comes from education. One such radical concept includes a new vision of education that seeks to empower people of all ages to take responsibility for creating and enjoying a sustainable future. The process of making citizens intelligent, creative problem solvers, socially aware, determined, and responsible for acting individually or collaborating with others is found in the activities.

This is reinforced by research results that explain that one of the successful learning outcomes needed in the 21st century is critical thinking skills. However, there is still very little research related to case-based studies to improve critical thinking skills. This shows that case- based learning is quite effective in supporting critical thinking skills. In addition, the dominance of achieving student independence in conducting research to solve problems and improve critical thinking skills at the university level (Haryati, S. et al., 2022; Widodo Wahono, 2022; Pertiwi et al., 2024). Based on the findings through one of the learning methods, namely the scientific debate technique, it has benefits in improving students' critical thinking skills (Harefa, 2024). In this era of the industrial

revolution, education at the university level emphasizes higher order thinking skills (Liline, S., et al., 2024).

However, in today' world, there are often challenges to high-quality and sustainable teacher professional development. And importantly, the need for supportive teacher professional development is often overlooked (Stutchbury Kris, 2024). To improve critical thinking skills, policy makers at universities or educational institutions can provide support by designing curricula that encourage and develop critical thinking and creative thinking skills through curricula that encourage and develop critical thinking and creative thinking skills through specific educational strategies (Basak Rasim and Eda Yucel, 2024). The developed learning design is feasible for use in learning, which can effectively improve the creative problem-solving process in the context of blended learning (Nurijal et al., 2023).

The emergence of digital technology has brought a transformation in the world of education, from traditional face-to-face learning to distance learning, which has success in improving Critical Critical Thinking (CT) skills (Lubna et al., 2023). The main factors that influence the development of critical thinking skills include the learning environment, lecturers, and students (Yefang Wu et al., 2024).

Education for Sustainable Development. So far, its implementation has been understood partially, so it lacks synergy in supporting physical development and social welfare. The implementation of education for sustainable development is reviewed from three educational pathways in Indonesia. Each pathway has a unique contribution and a different role for the progress of the nation (Shantini et al., 2014). (Shantini et al., n.d.).

So to answer another challenge faced in order to meet the need for quality lecturers is to attract the best university graduates to become lecturers. Those who have five qualifications and competencies of lecturers are needed, including (1) educational competence; (2) research competence; (3) technology commercialization competence; (4) globalization competence; and (5) future strategy competence, one of which is towards SDG's education (I Ketut Sariada, 2019).

The path to national progress comes from education. One such radical concept includes a new vision of education that seeks to empower people of all ages to take responsibility for creating and enjoying a sustainable future. The process of making citizens intelligent, creative problem solvers, socially aware, determined, and responsible for acting individually or collaborating with others is found in lifelong learning activities (Eliaumra, 2017).

Lifelong learning activities through education as a basis for achieving sustainable goals are expected to help change the attitudes and behavior of graduates as individuals, professionals, or consumers, producers, and society in general to carry out common duties and responsibilities. Therefore, students need to be equipped with knowledge and understanding of sustainable development from the universities where students study, Higher Education Stakeholders have programs to be able to help improve competencies in the areas of knowledge and understanding, skills and abilities and attitudes that must be possessed by universities in supporting sustainable efforts, Higher Education must reorient the curriculum to support education in sustainable development (Ganesha & Singaraja, n.d.).

To advance education for sustainable development (ESD), a nation's competitiveness must shift from reliance on natural resources to being driven by innovation, technology, and human creativity in leveraging science. While the intellectual capital approach has gained traction in universities, its application appears inconsistent. There is greater progress in valuing and managing intellectual assets within larger businesses than in higher education institutions (Ode et al., 2018). This disparity highlights the need for a more structured approach to intellectual capital in academia.

Universities play a pivotal role in embedding the spirit of ESD, requiring a collaborative effort to formulate effective strategies. One promising approach is transformational learning, which aligns with ESD's core principles. As educators, the goal extends beyond imparting knowledge to

fostering moral development and sharpening emotional intelligence. Graduates must be equipped to embrace concepts, values, and practices that promote sustainable development with a forward-looking perspective. Addressing future challenges over the next decade requires nurturing both cognitive and emotional intelligence in students. This involves synergizing their creativity, emotions, and willpower to optimize their potential for innovative and sustainable contributions (Retno Peni Sancayaningsih, n.d.).

To address the challenges, the role of education is needed to prepare and humanize people to understand their roles and develop their competencies for sustainable living. All aspects of subjects including the curriculum can be expanded with climate-based education related to sustainable development. (Arwan, 2022). This course has an impact on students' life skills in this case there is usefulness and has important things for the smooth and successful career of students. The smoothness and success of students' careers after graduating in the future. As for the lecturer himself, this is a process that can also help him to be more scientifically productive. Scientifically productive through scientific works. and can accelerate the achievement of his academic career for the achievement of his academic career (Samodra Wibawa, 2017).

The process of building a knowledge-based society should focus on learners and quality as an important strategy for the sustainability of educational institutions including education. Such as understanding the issues of what they need to learn, how they learn, what kind of learning support they need, how much time they spend learning, what media they use and what learning styles they have. Learning attitudes that accept the wealth of information available and the relatively easy access to different types of information. And are increasingly critical of the services provided by institutions and have greater flexibility in choosing the best available services according to the needs and circumstances of. (Suparman et al., 2004).

To meet the needs of stakeholders, of course, pay attention to the quality of university services, such as performance that can be done from the point of view of the learning process, academic assistance, extracurricular support resources, communication with institutional managers, and administrative services. Various suggestions and messages as a form of information can be used as an evaluation tool. So it is expected to produce quality graduates through the technique by revitalizing (Furqon, n.d.).

Quality graduates can be achieved through organizations that consistently contribute positively to their environment and society, setting examples for others to follow. Universities, as key institutions, play a pivotal role in encouraging the realization of the Sustainable Development Goals (SDGs) across all sectors in Indonesia (Muhammad Miqdad, 2019). Education, as a cornerstone of human resource development, serves as a critical tool in fostering competence to manage natural resources and drive the achievement of SDGs. By aligning educational goals with the SDGs framework, universities can integrate Islamic principles that prioritize *mashlahah* (benefit) as a central objective, promoting sustainable and equitable development (Mohamad Anang Firdaus, 2018).

One effective way to realize SDGs in the modern era is through research-based educational activities. These initiatives enhance the sustainability of education and contribute to achieving quality education, a key SDG target. Research-based learning strengthens students' critical thinking, problem-solving, and decision-making skills while maintaining a thematic focus on SDGs. Educators can further guide students to engage with relevant scientific publications, thereby expanding their knowledge and fostering creative and analytical thinking (Imam Bukhori et al., 2023; Esti Mutia Hayati et al., 2023).

The integration of Islamic education into the broader SDG agenda is essential to shaping intelligent, comprehensive, and competitive individuals. Islamic education not only fosters academic growth but also builds character and instills strong moral values in students, equipping them to face the challenges of globalization while resisting negative influences from global culture (State University of Jakarta, 2019; Suprastowo, n.d.). To thrive in the 21st century, students need

critical thinking, communication, creativity, and collaboration skills. These competencies are best developed through innovative teaching models, such as problem-based learning modules that emphasize research activities (Imam Setiawan, 2022).

The findings of this study suggest that research-based learning models can be effectively implemented across various study programs. These models encourage faculty members to engage in research derived from their lectures, providing students with practical insights and fostering a deeper understanding of scientific inquiry. However, challenges remain, including limited time for implementation and insufficient collaboration among lecturers. These factors contribute to students' limited understanding of scientific article preparation. Addressing these challenges requires more robust collaboration among faculty members and active support from university leadership to promote research-based teaching practices.

In conclusion, lecturers in higher education must adapt teaching techniques and models to accommodate the diverse learning styles and needs of students. By summarizing research findings into scientific articles, students can develop foundational research skills, even if they require additional guidance and direction. For PAI students, the ability to engage in ESD-based research demonstrates their potential to produce meaningful contributions, though continuous mentoring is necessary. Research-based learning in higher education is a valuable recommendation to enhance students' research capabilities and support sustainable development goals effectively.

4. CONCLUSION

The findings of this study demonstrate that research-based lectures significantly contribute to enhancing students' research skills, particularly in determining research themes and composing articles based on research findings. This preparation equips students to develop thesis proposals and complete their theses effectively and accurately. The rapid advancement of science and technology plays a crucial role in this process, offering digital innovations that facilitate faster, more efficient, and accessible services. These advancements highlight the necessity for both students and lecturers to possess strong research skills. Research-based lecture methods, emphasizing critical thinking, problem-solving, cooperative learning, contextual learning, and inquiry approaches, are shown to improve students' scientific writing abilities and readiness to conduct research. This readiness directly supports the development of Education for Sustainable Development (ESD), showcasing the pivotal role of universities in fostering research competencies among students.

The implications of these findings extend to the broader academic culture, suggesting that research-based learning can serve as an indicator of a university's success in building a research-oriented foundation. Furthermore, these methods encourage the integration of authentic and practical learning approaches, enabling students to gain deeper insights and knowledge. However, the study faced limitations, including the need for greater integration of research-based practices across all lectures and a stronger alignment between theoretical and practical learning.

To address these limitations, future research should explore the application of research-based learning methods across diverse disciplines and in various practical contexts. This would provide a more comprehensive understanding of its impact on student learning outcomes. Additionally, it is recommended that higher education institutions implement structured programs to train lecturers in research-based teaching methodologies. Such initiatives would ensure the consistent and effective application of research-based learning, fostering a robust academic culture and equipping students with the skills necessary for academic and professional success.

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