Hyled 5.0: An Education 5.0-Based Hybrid Laboratory Model for Environmental Issue-Based English Learning

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Abstract. This study aims to develop and evaluate the effectiveness of the HYLED 5.0 (Hybrid Laboratory based on Education 5.0) learning model in improving students' English writing skills through environmental issue-based learning. The HYLED 5.0 model integrates project-based learning, virtual laboratory technology, and Education 5.0 principles to create an innovative and interactive learning environment. The research was conducted at SMK Nusaputera Semarang involving eleventh-grade students. The research applied a Research and Development (R&D) method combined with an experimental design to test the effectiveness of the developed learning model. The population of this study consisted of 180 students, while the sample included 74 students divided into experimental and control groups using cluster sampling techniques. The experimental group was taught using the HYLED 5.0 learning model supported by a virtual laboratory and environmental project activities, while the control group received conventional learning instruction. The results of the study indicate that the HYLED 5.0 learning model significantly improved students' English writing skills. The average pre-test score of the experimental group was 58.7 and increased to 77.1 in the post-test, with an improvement of 18.4 points. Meanwhile, the control group showed a smaller improvement, from an average pre-test score of 58.9 to a post-test score of 65.9, with an improvement of 7.0 points. These findings demonstrate that the HYLED 5.0 model is more effective than conventional learning methods in improving English writing skills. The study concludes that the HYLED 5.0 hybrid laboratory model provides an innovative learning approach that integrates technology, environmental awareness, and collaborative learning. The implementation of HYLED 5.0 can enhance students' motivation, engagement, and learning outcomes in English writing. Therefore, HYLED 5.0 is recommended as an effective learning model for English education in the Education 5.0 era..

Keywords: Education 5.0, Hybrid Learning, Environmental Learning, English Writing, Virtual Laboratory, HYLED 5.0

1 Introduction

The rapid development of digital technology has significantly transformed educational practices worldwide. Modern education requires innovative learning models that combine technology integration, collaborative learning, and real-world problem solving. Education 5.0 emphasizes human-centered learning supported by advanced technologies, enabling students to develop both academic competence and social awareness. English plays an important role as an international language in education and professional communication. However, many students still experience difficulties in developing English writing skills. Writing requires complex cognitive processes including grammar mastery, vocabulary development, idea organization, and critical thinking. Traditional teaching methods often fail to provide engaging and meaningful writing experiences. The conceptual model of human-centered learning supported by digital tools for writing instruction is presented in Figure 1.

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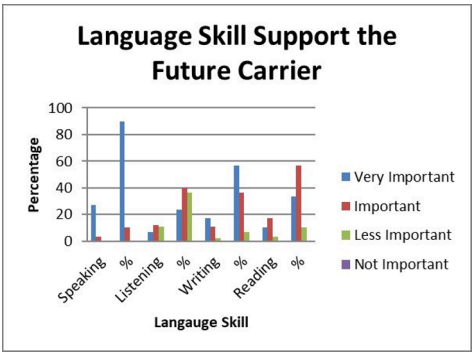

FIGURE 1. Language Skill Supports the Future Carrier

Environmental issues have become global concerns that affect modern society. Problems such as climate change, pollution, and waste management require increased public awareness and education. Integrating environmental topics into English learning can help students develop language skills while increasing their understanding of environmental sustainability. Environmental-based learning provides meaningful contexts that encourage students to explore real-world problems. Students can develop writing skills through activities such as writing reports, essays, and reflections related to environmental topics. This approach promotes both language development and environmental awareness.

However, environmental-based English learning still faces several challenges. Many schools lack innovative learning models that effectively integrate environmental topics with technology-based learning. In addition, conventional teaching methods often limit students' creativity and active participation. To address these problems, this study proposes an innovative learning model called HYLED 5.0 (Hybrid Laboratory Based on Education 5.0). HYLED 5.0 integrates hybrid learning, project-based learning, and virtual laboratory technology into a structured learning model.

HYLED 5.0 provides a hybrid laboratory environment where students can conduct learning activities both physically and digitally. The model allows students to collaborate, explore environmental issues, and develop English writing skills through project-based activities.

The objectives of this research are:

1. To develop the HYLED 5.0 learning model based on Education 5.0 principles.
2. To implement environmental-based learning for English writing improvement.
3. To evaluate the effectiveness of HYLED 5.0 in improving students' writing skills.

This study is expected to contribute to the development of innovative English learning models in Education 5.0 environments.

2 Literature Review

2.1 Education 5.0 in Modern Learning

The development of digital technology has led to significant changes in educational systems worldwide. Modern education is no longer focused only on knowledge transfer but also on the development of human-centered skills supported by technology. Education 5.0 represents a learning paradigm that integrates technological innovation with human values and social responsibility. This concept emphasizes creativity, collaboration, critical thinking, and problem-solving skills supported by digital tools [1]. Education 5.0 promotes personalized learning experiences where students actively participate in the learning process. Technology is used not only as a supporting tool but also as an essential component that enables flexible and adaptive learning environments [2]. This approach allows students to access learning materials anytime and anywhere, which increases learning efficiency and independence.

In the context of language learning, Education 5.0 encourages the use of digital platforms to support interactive learning. Students can collaborate through online platforms, share ideas, and develop communication skills more effectively. The integration of technology also allows teachers to monitor student progress in real time and provide immediate feedback [3]. Education 5.0 also supports interdisciplinary learning where academic subjects are connected with real-life problems. This approach allows students to apply theoretical knowledge in

practical situations. Environmental issues represent one of the most relevant interdisciplinary topics that can be integrated into language learning.

2.2 Environmental-Based Learning

Environmental education has become an important component of modern education systems. Environmental-based learning aims to increase students' awareness and understanding of environmental issues while developing their academic skills. This approach integrates environmental topics into classroom activities to create meaningful learning experiences [4]. Environmental-based learning provides real-world contexts that enhance student engagement. Students learn more effectively when they work on authentic problems that are relevant to their daily lives. Environmental topics such as waste management, pollution, and climate change provide meaningful content for language learning activities [5].

Research has shown that environmental-based learning improves student motivation and participation. Students become more interested in learning when they are involved in solving real-life problems. This approach also promotes critical thinking and problem-solving skills [6].

Environmental topics are particularly suitable for English writing activities. Students can develop writing skills through essays, reports, and project documentation related to environmental problems. Writing about environmental issues allows students to express ideas, analyze problems, and propose solutions. Environmental-based English learning also supports sustainable education goals. Students not only improve language skills but also develop environmental responsibility. This dual benefit makes environmental-based learning highly relevant in modern education.

2.3 Project-Based Learning in English Education

Project-Based Learning (PBL) is a student-centered learning approach that emphasizes active participation through project activities. In PBL, students learn by completing projects that require investigation, collaboration, and problem-solving [7]. Project-Based Learning has been widely used in language education because it encourages meaningful communication. Students use language as a tool to complete tasks rather than simply memorizing vocabulary and grammar rules.

PBL supports the development of English writing skills by providing authentic writing experiences. Students produce written work such as reports, essays, and project documentation. These activities improve writing organization, vocabulary usage, and grammar accuracy [8].

Another advantage of Project-Based Learning is increased student motivation. Students become more engaged when they work on projects that reflect real-world situations. This approach helps students develop both academic skills and social skills. Project-Based Learning is particularly effective when combined with technology. Digital tools support collaboration and provide access to learning resources. Technology also allows students to present their work in creative ways.

2.4 Hybrid Learning and Virtual Laboratory

Hybrid learning combines traditional face-to-face instruction with online learning activities. This approach provides flexibility while maintaining direct interaction between teachers and students. Hybrid learning environments allow students to learn at their own pace while still receiving guidance from teachers [9]. Virtual Laboratory technology has become increasingly important in hybrid learning environments. Virtual laboratories provide digital learning spaces where students can perform learning activities online. These platforms allow students to access materials, submit assignments, and collaborate with classmates [10].

Virtual laboratories support interactive learning by integrating multimedia resources such as videos, simulations, and digital exercises. These features enhance student engagement and improve learning outcomes. In language learning, Virtual Laboratories can support writing activities through collaborative tools and digital feedback systems. Students can revise their work based on teacher feedback and peer evaluation. This process helps students improve writing quality. Virtual Laboratory technology also allows teachers to monitor student performance more effectively. Learning data can be collected automatically, making evaluation more efficient and accurate.

2.5 HYLED 5.0 Learning Model

HYLED 5.0 (Hybrid Laboratory Based on Education 5.0) is an innovative learning model designed to integrate Education 5.0 principles with hybrid learning environments. The model combines Project-Based Learning, Virtual Laboratory technology, and environmental-based learning. HYLED 5.0 provides a structured learning environment where students engage in project-based activities using both physical and virtual learning spaces. The Virtual Laboratory serves as a central platform where students access materials, collaborate on projects, and submit assignments.

The integration of environmental topics into HYLED 5.0 provides meaningful learning contexts for English writing activities. Students develop writing skills while exploring environmental problems and proposing solutions.

HYLED 5.0 also supports collaborative learning where students work in groups to complete projects. Collaboration encourages communication and idea sharing, which improves writing quality. The model is expected to improve both English writing skills and environmental awareness. HYLED 5.0 represents an innovative approach that aligns with the principles of Education 5.0.

3 Methodology

3.1 Research Design

This study employed a **Research and Development (R&D)** method to develop and evaluate the HYLED 5.0 learning model. The R&D approach was selected because the purpose of this research was not only to investigate learning outcomes but also to produce an innovative instructional model. The development process included several stages: needs analysis, design, development, implementation, and evaluation. The HYLED 5.0 model was developed by integrating Education 5.0 principles, Project-Based Learning, and Virtual Laboratory technology into a structured learning framework. The model was designed to improve students' English writing skills through environmental-based learning activities. The research focused on developing a practical and effective learning model that could be implemented in vocational high schools.

3.2 Research Location and Duration

The research was conducted at **SMK Nusaputera Semarang**, located on Medoho III Street No. 2, Semarang, Indonesia. The implementation of the research was carried out over a period of three months, from March to June 2025. During this period, the HYLED 5.0 learning model was implemented in English classes focusing on writing skill improvement through environmental-based projects. The research activities included preparation, model implementation, data collection, and evaluation.

3.3 Population and Sample

The population of this research consisted of all eleventh-grade students at **SMK Nusaputera Semarang**, totaling 180 students. The sample consisted of two classes with a total of 175 students. The sample was divided into two groups:

- Experimental group
- Control group

The experimental group received instruction using the HYLED 5.0 learning model, while the control group was taught using conventional teaching methods. Cluster sampling technique was used in selecting the sample. This technique was chosen because the classes were already organized into intact groups, making it more practical for classroom-based research.

3.4 Research Instruments

Several instruments were used to collect data in this study.

a. Writing Test

Writing tests were used to measure students' English writing skills before and after the implementation of HYLED 5.0. The tests consisted of environment-based writing tasks such as essays and short reports.

The writing tests were evaluated using a scoring rubric that included:

1) Grammar accuracy
2) Vocabulary usage
3) Organization of ideas
4) Content relevance
5) Writing mechanics

b. Observation Sheet

Observation sheets were used to monitor student participation during the learning process. The observations focused on:

1) Student engagement
2) Collaboration
3) Participation in Virtual Lab activities
4) Project completion

c. Questionnaire

Questionnaires were distributed to students to measure learning motivation and perceptions toward the HYLED 5.0 learning model.

The questionnaire included statements related to:

1) Learning motivation
2) Technology usage
3) Environmental awareness
4) Writing confidence

3.5 Procedure of HYLED 5.0 Implementation

The implementation of HYLED 5.0 followed structured learning stages.

a. Determining Project Topics

Students selected environmental topics such as:

1) Waste management
2) Plastic pollution
3) School cleanliness
4) Environmental conservation

These topics were used as the basis for writing projects.

b. Project Planning

Students worked in groups to plan their writing projects. They collected information from various sources including books, internet resources, and field observations.

The Virtual Laboratory was used as a platform for sharing information and coordinating project activities.

c. Project Development

Students developed their writing projects through collaborative activities. They wrote drafts, revised their work, and improved their writing based on teacher feedback.

Virtual Laboratory technology allowed students to submit assignments and receive feedback online.

d. Presentation Using Virtual Laboratory

Students presented their projects using the Virtual Laboratory platform. The presentations included explanations of environmental problems and proposed solutions.

This stage helped students improve communication and writing skills.

e. Evaluation and Revision

Students revised their writing based on teacher feedback. The final writing products were evaluated to measure improvement in writing skills.

3.6 Data Analysis

The data collected in this research were analyzed using both quantitative and qualitative methods. Quantitative data were obtained from writing test scores. The scores from pre-tests and post-tests were compared to measure improvement in students' writing skills. Qualitative data were obtained from observations and questionnaires. These data were analyzed descriptively to evaluate student participation and learning motivation. The results of the analysis were used to determine the effectiveness of the HYLED 5.0 learning model in improving English writing skills through environmental-based learning.

4 Results And Discussion

4.1 Development of HYLED 5.0 Learning Model

The main objective of this research was to develop an innovative learning model called HYLED 5.0 (Hybrid Laboratory Based on Education 5.0) to improve English writing skills through environmental-based learning. The development process resulted in a structured learning model that integrates Education 5.0 principles, Project-Based Learning, and Virtual Laboratory technology.

HYLED 5.0 consists of four main components:

1. Digital learning platform (Virtual Laboratory)
2. Project-based learning activities
3. Environmental-based learning materials
4. Evaluation and feedback system

The model provides a hybrid learning environment where students participate in both classroom learning and online activities. The integration of these components creates a flexible and interactive learning environment.

The Virtual Laboratory became the central platform for learning activities. Students used the platform to access learning materials, submit assignments, and communicate with teachers and classmates.

The HYLED 5.0 model also emphasizes student-centered learning. Students actively participated in project activities and collaborated with their peers. This approach encouraged independent learning and creativity.

4.2 Implementation of Environmental-Based Learning

Environmental topics were successfully integrated into English writing activities. Students completed writing projects based on environmental issues found in their surroundings.

The environmental topics included:

1. Plastic waste problems
2. School environmental cleanliness
3. Recycling activities
4. Environmental conservation

These topics provided meaningful learning contexts that helped students generate ideas for writing. Students showed greater interest in writing activities because the topics were related to real-life situations. Environmental-based learning also improved students' awareness of environmental problems. Students became more conscious about environmental responsibility after completing the projects. The integration of environmental issues made the learning process more meaningful compared to traditional writing instruction.

4.3 Improvement of English Writing Skills

The results of the writing tests showed that students in the experimental group demonstrated better improvement compared to students in the control group. For the experimental group using the HYLED 5.0 Model, the statistical data regarding their pre-test and post-test scores are summarized in Table 1. Meanwhile, the performance results for the control group, which underwent conventional learning, are presented in Table 2.

Experimental Group (HYLED 5.0 Model)
Total Students: 37

Table 1. Experimental Group (HYLED 5.0 Model)

Pre-Test Mean	Post-Test Mean	Improvement
58.7	77.1	+18.4

Control Group (Conventional Learning)
Total Students: 37

Table 2. Control Group (Conventional Learning)

Pre-Test Mean	Post-Test Mean	Improvement
58.9	65.9	+7.0

A visual comparison of the pre-test and post-test scores for both groups is illustrated in **Figure 2**.

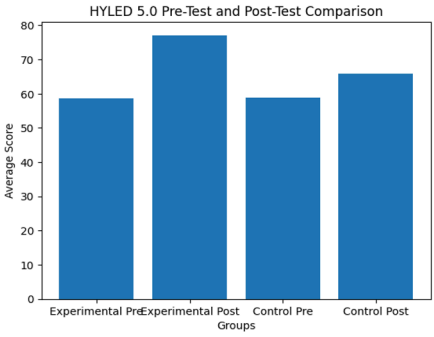

Figure 2. Test Comparison

Figure 2 shows the comparison of students pre-test and post-test scores. The experimental group using the HYLED 5.0 model shows a significant improvement compared to the control group using conventional learning methods. The average score of the experimental group increased from 58.7 to 77.1, while the control group increased from 58.9 to 65.9.

Students who learned using HYLED 5.0 showed improvements in several aspects of writing:

1. Better organization of ideas
2. Improved vocabulary usage
3. More accurate grammar
4. Clearer sentence structure

The improvement occurred because students practiced writing continuously during project activities. Writing was not limited to classroom exercises but became part of a meaningful project process. Students also received continuous feedback from teachers through the Virtual Laboratory platform. This feedback helped students revise and improve their writing.

The writing improvement indicates that HYLED 5.0 provides an effective learning environment for developing English writing skills.

4.4 Student Engagement and Motivation

Observation results indicated that students showed higher engagement during HYLED 5.0 implementation. Students actively participated in discussions, project activities, and Virtual Laboratory sessions.

Several factors contributed to increased student motivation:

1. Use of technology
2. Collaborative learning
3. Real-world topics
4. Flexible learning environment

Students expressed positive responses toward the use of Virtual Laboratory technology. They reported that online learning activities made learning more interesting and flexible.

The hybrid learning approach allowed students to continue learning outside the classroom. Students could access materials and complete assignments at their own pace.

Increased motivation contributed to better learning outcomes.

4.5 Role of Virtual Laboratory in Learning

Virtual Laboratory technology played a significant role in supporting HYLED 5.0 implementation. The platform provided an organized digital environment that supported collaborative learning.

Virtual Laboratory supported learning in several ways:

1. Access to Learning Materials

Students could access learning materials anytime. This flexibility allowed students to review lessons and improve their understanding.

2. Collaborative Learning

Students worked together through online discussions and group projects. Collaboration helped students exchange ideas and improve their writing.

3. Feedback System

Teachers provided feedback through the Virtual Laboratory system. Students could revise their writing based on suggestions from teachers.

4. Learning Monitoring

Teachers could monitor student activities through the platform. This made it easier to evaluate student progress.

The Virtual Laboratory created a modern learning environment consistent with Education 5.0 principles.

5 Discussion

The findings of this research indicate that HYLED 5.0 is an effective learning model for improving English writing skills through environmental-based learning. The integration of Education 5.0 principles allowed students to learn in a more flexible and interactive environment. Technology supported collaborative learning and improved student engagement.

Environmental-based learning provided meaningful contexts that helped students develop writing ideas. Students were able to connect language learning with real-life problems. Project-Based Learning allowed students to practice writing in authentic situations. This approach improved both writing skills and critical thinking.

The results of this research are consistent with previous studies showing that hybrid learning and project-based learning improve student achievement.

HYLED 5.0 offers several advantages compared to conventional learning:

a. More interactive learning
b. Higher student motivation
c. Flexible learning environment

d. Better writing improvement

However, several challenges were identified during implementation:

a. Limited internet access for some students
b. Need for teacher training
c. Technical problems during online sessions

Despite these challenges, HYLED 5.0 demonstrated strong potential as an innovative learning model.

The model can be applied not only in English learning but also in other subjects that require project-based learning.

6 Conclusion and Future Work

6.1 Conclusion

This study developed and implemented the HYLED 5.0 (Hybrid Laboratory Based on Education 5.0) learning model as an innovative approach to improving English writing skills through environmental-based learning. The model integrates Education 5.0 principles, Project-Based Learning, and Virtual Laboratory technology into a structured hybrid learning environment. The results indicate that HYLED 5.0 provides an effective learning model that enhances students' English writing skills. Students who participated in HYLED 5.0 learning activities showed improvements in writing organization, vocabulary usage, grammar accuracy, and idea development. The use of environmental topics provided meaningful contexts that helped students generate ideas and express their thoughts more effectively.

HYLED 5.0 also increased student motivation and engagement. The integration of technology and collaborative learning activities created a more interactive learning environment compared to conventional teaching methods. Students showed positive responses toward the use of Virtual Laboratory technology, which allowed flexible and independent learning. The findings demonstrate that HYLED 5.0 is a suitable learning model for Education 5.0 environments because it integrates technology, human-centered learning, and real-world problem solving. Environmental-based learning also contributed to increasing students' environmental awareness while improving their language skills.

Therefore, HYLED 5.0 can be considered an innovative and effective model for English writing learning in vocational education.

Implications

This research provides several important implications for educational practice.

First, the study demonstrates that Education 5.0 principles can be effectively implemented in English learning through hybrid learning environments. Technology integration allows students to experience more flexible and interactive learning.

Second, environmental-based learning can serve as an effective context for developing English writing skills. Real-world topics help students generate ideas and develop meaningful writing.

Third, Virtual Laboratory technology can support collaborative learning and improve communication between teachers and students. The use of digital platforms makes learning more efficient and accessible.

Fourth, the HYLED 5.0 model can be adapted for other subjects that require project-based learning. The model provides a flexible framework that can be implemented in various educational contexts.

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