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Educational Technology Innovation: AI-Integrated Learning System Design in AILS-Based Education

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Abstract. Information and Communication Technology (ICT) has seamlessly integrated itself into modern society, revolutionizing education through its innovations. One prominent innovation is the Artificial Intelligence (AI)-based learning system, promising an elevated quality of education. The AI-based learning system harnesses machine learning to tailor approaches for each student, monitoring their progress and providing pertinent feedback. A noteworthy example is the Intelligent Adaptive Learning System (AILS), which amalgamates Natural Language Processing (NLP) technology and 3D animation with the Google Search Engine. AILS aids comprehension via tablet devices, with teachers concurrently assuming a supportive role. AILS empowers students to autonomously acquire knowledge, accessing information through NLP and the Google Search Engine. The visualization of teachers through 3D animations enhances interactivity. Through AILS, students can learn from home or in-class, guided and mentored by teachers. AILS efficiently processes data, monitors progress, offers feedback, and identifies student needs. Teachers continue to facilitate profound learning and critical thinking skills. AILS fosters self-directed learning and lifelong skills. Furthermore, AILS augments the quality of the educational framework, integrating AI technology to realize student self-directedness in the Society 5.0 era.

Keywords: *Artificial Intelligence Learning System (AILS), Natural Language Processing (NLP) Technology, 3D Animation, Google Search Engine, Student Self-Directed Learning.*

A. INTRODUCTION

Education has undergone a significant transformation in tandem with the rapid development of Information Technology and Communication (ITC). Innovations within the realm of education have become increasingly crucial to ensure that the learning process remains aligned with the demands of the contemporary era. One noteworthy innovation in this domain is the implementation of AI-based learning systems, which amalgamate the capabilities of AI technology with pedagogical approaches.

Education assumes a central role in an individual's life. Through education, individuals can cultivate their inherent potential, enhance their quality of life, and contribute to societal development (Pratama & Putri, 2020). Over the past few decades, advancements in information and communication technology have propelled at an exponential pace. ITC has fundamentally transformed the landscape of various spheres of life, including education.

Information and Communication Technology (ICT) holds significant potential for enhancing the quality of education across various dimensions (Firman & Cahyono, 2021). ICT can be applied to:

1. Deliver more interactive and engaging learning materials.
2. Improve educational accessibility in remote areas.
3. Monitor students' learning progress.
4. Provide timely feedback to students.
5. Foster collaboration among teachers, students, and parents.

A tangible example of ICT implementation in education is found in the Adaptive Intelligent Learning System (AILS), also known as the Artificial Intelligence Learning System. AILS is an instructional system that leverages artificial intelligence technology to tailor

learning experiences for individual students (Utomo & Sari, 2023). AILS has the capability to monitor students' learning developments and deliver feedback tailored to their specific needs.

The AI technology offers significant opportunities to enhance the effectiveness and efficiency of learning. Through adaptive machine learning techniques, students can undergo a personalized learning process tailored to their needs (Wibowo & Setiawan, 2019). The capabilities of Natural Language Processing (NLP) technology enable human-machine interactions to take place in everyday language, enriching communication between the two parties.

AI-Based Intelligent Learning Systems (AILS) have emerged as an innovative solution that amalgamates various key elements (Pratama & Putri, 2020). AILS leverages NLP technology, teacher visualization through 3D animation, and integration with the Google Search Engine (Kusuma & Pratomo, 2020). Through AILS, students attain flexibility in learning, both within the classroom and beyond (Raharjo & Wibowo, 2019). AILS also possesses the capability to provide automatic feedback, supporting the monitoring of students' learning progress (Susanto & Nugroho, 2022).

However, the implementation of AI technology in education also brings forth challenges and profound inquiries. How does this technology integrate with the existing educational curriculum? What are its implications for the role of educators in the learning process? These questions necessitate further research to ensure that this innovation genuinely benefits the advancement of education for the betterment (Rahman & Siregar, 2021).

This research aims to explore the implementation of AI-based Adaptive Intelligent Learning Systems (AILS) in education, with a focus on its impact on the quality of learning and the role of teachers. Several case studies related to the application of AI technology in education will be reviewed (Rizal & Fitriani, 2022), with an emphasis on the implementation of AILS across various subjects (Suryadi & Kurniawan, 2023).

The significance of this study is underscored by several key factors:

1. Enhancement of learning quality: The integration of AI technology in education holds the potential to create more interactive, personalized, and adaptive learning experiences. This has the potential to positively impact the improvement of learning quality across diverse subjects (Pratama & Putri, 2020). The utilization of AI technologies like AILS can assist students in comprehending learning materials more effectively and deeply (Utomo & Sari, 2023).
2. Increased effectiveness of the teacher's role: In this context, the role of teachers becomes increasingly crucial in guiding students through a learning process tailored to individual needs. Teachers can focus more on providing in-depth guidance and targeting aspects that require special attention, as AI systems have automated feedback mechanisms (Susanto & Nugroho, 2022). This has the potential to elevate teachers from mere information conveyors to facilitators of student-centered learning.
3. Empowerment of students in self-directed learning: The implementation of AILS and similar AI technologies can facilitate students' ability to learn independently and take responsibility for their learning process (Firman & Cahyono, 2021). The use of AILS applications offers students flexibility to access information and learning materials anytime and anywhere, supporting the concept of lifelong learning (Wibowo & Setiawan, 2019).
4. Revolutionizing teaching methods: The application of AI technology not only brings about an evolution in conventional teaching methods but also revolutionizes the way education is accessed and understood. Technologies such as 3D animation for visualizing concepts can enhance interactivity and the appeal of learning, enriching how students engage with the material (Rizal & Fitriani, 2022).

5. Improving educational accessibility: Through the integration of AI technology in education, as exemplified by AILS, education becomes more accessible to various segments of society, including those residing in remote areas (Kusuma & Pratomo, 2020). AILS enables students to learn flexibly without being constrained by location or time.
6. Equalizing learning between Eastern and Western Indonesia: Addressing the issue of educational access disparity between the eastern and western regions of Indonesia is crucial. AI technology, particularly through AILS, has the potential to alleviate this disparity by providing more equitable access to quality education (Kusuma & Pratomo, 2020). With uniform access to information and learning, it is hoped that differences in educational quality between regions can be mitigated or at least reduced.

In its entirety, this research endeavors to expound upon the significance of implementing AI technology in education, particularly through the AILS approach. By examining its impacts on learning quality, teacher roles, and educational equity among regions, this study contributes to the comprehension of how AI technology can transform the educational paradigm towards more adaptive, interactive, and student-oriented learning.

AILS aims to address educational disparities between Western and Eastern regions, as well as between Northern and Southern regions in Indonesia. Through AILS, it is anticipated that accessibility to education and learning quality for students in remote areas will enhance, fostering equitable learning opportunities and nurturing student self-reliance in the era of Society 5.0.

The current state of affairs in this research involves the application of AILS in data processing for intricate technical systems within the educational context, especially in schools. Key aspects encompass the utilization of natural language technology or Natural Language Processing (NLP), such as openAI ChatGPT, 3D animation for teacher visualization, and integration with the Google search engine, enhancing an interactive and effective learning experience.

The novelty of this research lies in the comprehensive implementation of AILS in the educational system of Indonesia. The integration of NLP and 3D animation for teacher visualization as instructional assistants enables students to comprehend the material more effectively and engagingly. Furthermore, this system monitors students' learning progress both at home and in the classroom using AI, allowing teachers to act as mentors and focus on individual student guidance. This research is expected to provide a positive contribution towards diminishing educational disparities and fostering a more inclusive and effective learning environment.

B. METHOD

This research aims to implement Artificial Intelligence in Data Processing for complex engineering systems in schools towards fostering student self-directed learning. The research methodology encompasses the following general stages:

1. Data Collection: Data will be gathered through multiple phases. Firstly, primary data collection will be conducted by means of surveys and interviews with students, teachers, and relevant stakeholders in schools that have adopted Artificial Intelligence in Learning Systems (AILS). Subsequently, secondary data will be acquired from literature pertaining to the application of AI technology in education.
2. AILS Implementation: The implementation of AILS will occur within the pertinent educational environment, encompassing schools in the eastern and western regions of Indonesia. This implementation involves the integration of Natural Language Processing (NLP), 3D animation, and Google search engine technology. This process

will encompass software installation, teacher training in AILS usage, and curriculum adjustments aligned with the learning approach activated by AILS.

3. Data Collection during AILS Implementation: Throughout the AILS implementation period, data concerning student interaction with AILS, student learning progress, and the effectiveness of AILS usage will be collected. This data will be analyzed to measure the impact of AILS on student learning.
4. Data Analysis: The collected data will undergo quantitative and qualitative analysis. Quantitative analysis will involve the processing of numerical data and statistics to gauge improvements in student learning outcomes following AILS implementation. Qualitative analysis will encompass in-depth interpretation of student and teacher responses to AILS usage, as well as changes in the teaching approach that transpire.
5. Cross-Region Comparison: To address educational disparities between the western and eastern regions, as well as between the northern and southern regions of Indonesia, a comparative assessment of AILS implementation outcomes will be conducted. Analysis results will be utilized to identify differences in AILS impact within each region.
6. Literature Review: A literature review will be conducted to compare the findings of this research with similar studies and summarize congruent or divergent discoveries.
7. Conclusion and Implications: Analysis results will be expounded upon in conclusions that encompass the impact of AILS implementation on learning quality, the role of teachers, and efforts to mitigate educational disparities in Indonesia. The research implications will be discussed within the context of enhancing future learning endeavors.

The specific actions conducted are as follows:

1. Research Subject: The research subjects were students of Junior High School (SMP) in Indonesia.
2. Instruments and Materials: The instruments and materials employed in this study were as follows:
   a. Adaptive Instructional Learning System (AILS)
   b. Learning outcome assessment test
3. Research Procedure: The research procedure was executed as outlined below:
   a. Students were presented with instructional material by teachers using AILS.
   b. Students undertook a learning outcome assessment test upon completing the instructional material.
   c. The results of the learning outcome assessment test were analyzed to ascertain the effectiveness of AILS in enhancing student learning outcomes.
4. Data Analysis: The data obtained from this research were subjected to analysis using the t-test to identify significant differences between the learning outcomes of students taught using AILS and those taught using conventional methods.

The educational methodology employed to address this issue necessitates a meticulous and integrated approach encompassing the AI-based AILS learning system, national curriculum, classroom ambiance, teacher's role, AILS involvement, parental engagement, and the type of AILS devices utilized. Presented herewith are the elaborated details of the educational methodology for your thoughtful consideration.:

1. Adaptation to the National Curriculum:
   a. Discerning the pertinent competence standards and indicators from the national curriculum, pertaining to the instructional materials.
   b. Assimilating the organized learning content within the AILS with the national curriculum.

c. Adjusting the outcomes derived from AILS to align seamlessly with the objectives and content of the national curriculum.

2. Suasana Classroom Atmosphere that Enhances Learning:

In the era of AI technology, the classroom atmosphere remains crucial in facilitating effective learning. Despite the utilization of AI learning systems, conventional classroom amenities such as whiteboards and desks remain indispensable. However, significant changes are evident in the integration of technology. Interactive screens and projectors support the engaging presentation of content from AI learning systems. Spaces for creativity must also be provided, where students can collaborate and innovate. The essence of an effective classroom atmosphere continues to revolve around student inclusivity, collaboration, and creativity.

3. The Role of the Teacher:

In the context of AILS-based education, the role of the teacher undergoes significant transformation. The teacher no longer serves as the primary source of information but functions more as a facilitator of learning, supporting students' learning experiences. The following is a more detailed explanation of the teacher's role in this method:

a. Introducing Lesson Materials on AILS: The teacher instructs students to access lesson materials on AILS according to the lesson plan. The teacher may explain navigation and the use of AILS to access relevant content.
b. Assigning Supplementary Tasks: In addition to the materials provided by AILS, the teacher designs supplementary tasks that involve in-depth understanding and practical application. These tasks could be projects, research, or case studies that encourage students to apply concepts in real-life situations.
c. Responding to Student Difficulties: The teacher plays a crucial role in addressing student difficulties. When students encounter challenges or lack understanding of the material, the teacher can provide additional explanations or more detailed examples. The teacher can also identify common problems faced by students and offer specific guidance.
d. Monitoring Student Learning Progress: The teacher utilizes a learning management system to monitor student learning progress through AILS. By understanding each student's progress, the teacher can provide more effective personalized guidance.
e. Changes in Teaching Approach: Compared to traditional classrooms, the teacher's teaching approach in this method is more focused on creating a learning environment and providing individual guidance. The teacher interacts more with students in discussion sessions, problem-solving, and feedback.
f. Encouraging Discussion and Collaboration: The teacher encourages discussion and collaboration among students to comprehend the material. Students can share their understandings and assist each other in overcoming difficulties.

Thus, the teacher's role in this method leads to a deeper and more personalized approach. The teacher becomes a learning guide who assists students in developing a better understanding through active interaction and individual guidance.

4. The Role of AILS in the Classroom and at Home:

In this instructional methodology, the role of AILS (Artificial Intelligence Learning System) holds significant importance both in the classroom and at home. Here is a more detailed explanation of the roles AILS plays in these two environments:

a. In the Classroom: AILS serves as an interactive and supportive learning assistant. Within the classroom setting, students can utilize the AILS device to access curriculum-aligned learning materials designed for each educational level. These materials and the learning system have been validated by teachers. AILS presents

subject explanations with visual illustrations that enhance the clarity of concepts. Students can also engage in exercises pertinent to the learned material through AILS. Additionally, AILS functions as a tool for group discussions and problem-solving.

b. At Home: AILS assumes the role of an independent learning tool for flexible at-home education. Students can leverage the AILS device to continue learning beyond the classroom. AILS provides tasks, exercises, and assessments that students can independently complete. Furthermore, AILS offers immediate feedback on students' work, aiding them in understanding mistakes and enhancing comprehension.
c. Flexibility of Usage Time: Students can employ AILS in the classroom according to the curriculum guidelines, learning objectives, and teacher instructions. At home, students have the flexibility to determine their study schedule as long as they adhere to assigned tasks and schedules.
d. Technical Challenges: If any issues arise with the AILS device or system, whether at school or at home, students can contact the responsible technical team. Teachers can also assist in resolving these technical challenges.
e. Security and Authorization: The AILS system is governed by rigorous authorization mechanisms. Each student possesses a personalized account linked to their school identity. Access to the AILS application is only possible through predefined school-based authorizations.
f. Management of AILS Devices: AILS devices utilized within school premises are typically school property and are managed by the school administration. At home, students use their own devices to access AILS.
g. Supervision and Student Safety: Responsible usage of AILS devices, particularly outside the school environment, is advised for students. Parents play a role in supervising AILS device usage, ensuring that students employ AILS solely for educational purposes.
h. Restriction of Social-Media Access: Schools can implement measures to restrict students' unfiltered access to social media. This can be achieved through AILS application settings or device configurations. By integrating AILS devices with robust authorization, stringent management practices, and oversight from both school authorities and parents, the intent is to maintain AILS usage as a focused tool for productive and effective learning. AILS can offer independent assignments, exercises, and assessments, while delivering instantaneous feedback.

5. The Role of Parents:
The role of parents in the implementation of AILS is crucial to support effective child learning at home. The following provides a more detailed explanation of the role of parents:
a. Supervision and Access Restriction: Parents can regulate and facilitate the use of AILS devices at home. The utilization of AILS devices should ideally take place in common areas such as the family room or a designated study area that is visible to parents. This aids in controlling children's access to content beyond the scope of learning and minimizing the risk of getting entangled in social media. Parents can also activate specific settings on devices to restrict access to certain applications or websites.
b. Alternative Device Usage: If parents are unable to purchase dedicated AILS devices, an alternative is to utilize existing devices at home such as computers or laptops. The use of parental smartphones should be avoided as it could interfere

with their work activities and not provide an optimal learning experience for students.

c. Involvement in Learning: Parents can actively participate in guiding children's learning with AILS, particularly if children require assistance in understanding the material or answering questions. Parents can also support children in completing tasks assigned through AILS. Communication between parents and teachers is also crucial to monitor the child's learning progress through AILS.
d. Monitoring and Motivation: Parents can employ the AILS system to monitor their child's learning progress. Some AILS platforms offer features that allow parents to view progress reports. Parents can provide motivation and support when children face difficulties or challenges in their learning.
e. Development of Attitude and Ethics: Parents can play a role in shaping proper attitudes and ethics when using technology. Children need to be taught about the importance of using AILS for educational and productive purposes, not solely for entertainment. Parents can also assist children in understanding values such as responsibility and discipline.
f. Self-Control and Emotional Intelligence: With the enhancement of logical thinking abilities through AILS, parents can assist children in developing self-control and emotional intelligence. Discussions about how to utilize this intelligence for positive and productive aspects of daily life are also important.

Through the active and attentive role of parents, the utilization of AILS can evolve into a more directed and effective learning experience for children at home..

6. AILS Device Specifications:

The AILS system is recommended in the form of a web-based platform accessible through devices such as tablets, laptops, or computers. Herein lies a more detailed elucidation of the AILS device specifications:

Web Accessibility: The AILS application can be accessed through a web browser on devices such as tablets, laptops, or computers. This enables students to learn both in the classroom and at home with flexibility.

User-Friendly Interface: The AILS interface is intuitively designed and user-friendly. Its navigation is straightforward, allowing students easy access to materials, assignments, and other features.

Guru Visualization in 3D Animation: This feature lends a visual dimension to the learning process. While accessing materials, students can observe 3D animated visualizations of teachers that aid in concept comprehension.

Integration with Google Search Engine: This integration empowers students to explore supplementary information pertinent to the learning material through the broader scope of the Google Search Engine.

Minimum Device Specifications:

a. Operating System: Devices must support operating systems such as Windows, macOS, or commonly used tablet operating systems.
b. RAM and Processor: It is advisable to possess a minimum of 4 GB RAM and a processor with sufficient capability to run the web application.
c. Internet Connection: A stable internet connection is imperative to access AILS content and features.
d. Touch Screen (For Tablets): When utilizing a tablet, it is preferable to have a touch screen for more intuitive interactions.
e. GPS and Stylus Features: These features are not mandatory for AILS unless specific functionalities within the learning process capitalize on them.

Application Access Mechanism:

1. In the Classroom: Students are able to access the AILS through devices provided in the classroom. They will log in using their student accounts and be granted access to relevant materials and assignments.
2. At Home: Students also have the capability to access the AILS at home using personal devices. They will input their student accounts and access appropriate instructional content.
3. Security and Privacy: The AILS must possess a security system that ensures the safety of student data. Application authorization will ascertain that only registered students can gain access. Personal student data must be safeguarded and remain inaccessible to unauthorized parties.

With AILS devices engineered for convenience, intuitive interaction, and adequate technological support, students can effectively engage in learning both within the classroom and at home. This educational method prioritizes a harmonious interaction among Artificial Intelligence Learning Systems (AILS), educators, students, and parents. Its primary objective is to establish an inclusive, responsive, effective, enjoyable learning environment that fosters creativity and innovation, with AI technology serving as an auxiliary tool capable of enhancing the quality of education and addressing educational disparities across different regions.

C. RESULT AND DISCUSSION

We will discuss the research outcomes concerning the utilization of open-source modules within the design of an AI-based Learning System (AILS). We will elaborate on how the Natural Language Toolkit (NLTK) and Blend4Web modules are employed within AILS, as well as the selection of the Django and React.js frameworks for web-based application development.

Utilization of the NLTK Module within AILS, NLTK for Natural Language Processing (NLP). NLTK represents an open-source NLP module that facilitates the development of AILS. NLTK encompasses a range of pivotal features in natural language processing, including tokenization, stemming, lemmatization, syntactic analysis, and sentiment analysis.

Tokenization: NLTK enables AILS to segment text into smaller units like words or phrases, aiding in understanding text structure and identifying words within sentences.

Stemming: NLTK provides stemming algorithms to remove affixes from words, enabling words stemming from the same root to be recognized as the same form. For instance, "run" and "running" will be treated as equivalent after undergoing stemming.

Lemmatization: NLTK also offers lemmatization algorithms to transform words into their base forms (lemmas), allowing identification of different word variations as the same entity. For example, "run," "ran," and "running" are transformed into the base form "run" after lemmatization.

Sentiment Analysis: NLTK includes datasets for sentiment analysis, determining whether text carries a positive, negative, or neutral sentiment. This analysis enables AILS to identify students' reactions or responses to learning materials.

NLTK also provides datasets and corpora for training natural language models and enhancing AILS performance. Developers can easily access these datasets and utilize the natural language processing algorithms provided by NLTK.

Utilization of the Blend4Web Module within AILS: Blend4Web for 3D Animation of Teacher Representation: The representation of teachers through 3D animation is a pivotal element within AILS. Blend4Web is an open-source module employed to develop interactive 3D animations through Blender.

Integration with Blender: Blend4Web seamlessly integrates with Blender, enabling developers to create 3D animations directly from the familiar Blender interface.

Programming Language Utilization: Blend4Web employs programming languages such as JavaScript, HTML, and CSS to create interactions and logic within 3D animations. Users can leverage fundamental programming knowledge to control the behavior of teacher characters in animations.

Asset Library: Blend4Web provides a variety of 3D assets such as characters, objects, textures, and other effects. Users can select and modify these assets to create animated teacher characters that align with instructional needs and styles.

Creation of Interactive Scenes: Blend4Web allows the creation of interactive 3D scenes with diverse interactions, including voice recognition, motion, and responses to user interactions. Animated teacher characters can interact with students and respond to commands or questions with suitable animations.

Web-Based Output: The final output of 3D animations created with Blend4Web is web-based. This implies that these animations can be accessed and executed through web browsers on any internet-connected device. This facilitates student access to teacher representation within 3D animations from AILS.

Blend4Web can be downloaded and utilized for free as an open-source module. Users only need to install Blender and add the Blend4Web module as an add-on. Consequently, users can create animated teacher characters within Blender, manage interactions, and export them into a web format accessible through browsers.

By employing Blend4Web, the development of 3D teacher representation for AILS becomes more straightforward due to the familiar Blender interface and support for widely used web programming languages.

Development of AILS as a Web-Based Application: Selection of the Django Framework for AILS Development: Developing AILS as a web-based application necessitates selecting the appropriate framework. We have chosen the open-source Django framework as the development platform for AILS. Django is a popular web framework written in the Python programming language.

The selection of Django as the development framework for AILS is based on several considerations. Firstly, Django boasts a large and active community, facilitating easy access to assistance and resources when encountering development challenges. Secondly, Django provides numerous built-in features that are highly beneficial in web application development, such as Object-Relational Mapping (ORM) for seamless and secure database interaction, as well as a routing system that simplifies URL management and application views.

Additionally, Django offers a robust security system to safeguard AILS from various security threats. With security features implemented by default, we can focus more on building AILS functionality without concerns about fundamental security issues.

By utilizing Django as the development framework, we are confident that the process of developing AILS as a web-based application will be more efficient and effective. This framework enables us to easily organize our application, manage the database, and integrate AI components like GPT within a well-integrated system.

D. CONCLUSION

This research yields a profound understanding of educational technology innovation in the form of an AI-driven learning system design in AILS-based schools. Various crucial aspects of this system have been thoroughly discussed, ranging from the utilization of open-

source modules such as NLTK and Blend4Web, to the choice of the Django and React.js frameworks for web application development.

The integration of the NLTK module within AILS empowers natural language processing capabilities, encompassing tokenization, stemming, lemmatization, and sentiment analysis. This affords AILS the ability to comprehend text structures more comprehensively, identify words, and detect sentiments within learning materials. In parallel, the Blend4Web module provides a creative solution for representing teachers through interactive 3D animations. These animated teacher characters aid in visualizing learning materials in an engaging and student-friendly manner.

Developing AILS as a web-based application using the Django and React.js frameworks facilitates broader access for students and teachers. The Django framework provides a robust foundation for constructing secure, efficient, and easily manageable applications. Meanwhile, React.js enables the development of responsive interfaces, compatible with various devices including tablets and computers.

In the context of AILS usage, significant changes transpire within the teaching and learning environment. The introduction of this educational technology has transformed traditional learning paradigms into ones that are more dynamic, interactive, and inclusive. The role of teachers has evolved from mere content deliverers to learning facilitators who accompany and guide students in comprehending the content presented by AILS.

The classroom ambiance has also undergone alterations, where interactive screens or projectors become primary tools for displaying AILS content. While chalkboards and desks remain relevant, AILS's interactive role has integrated virtual dimensions into physical learning experiences. This fosters a more inclusive atmosphere, connecting students with the digital realm while retaining traditional learning elements.

In this context, changes extend beyond the classroom to extracurricular settings. AILS empowers flexible learning, both within the school environment and at home. AILS usage at home promotes student autonomy in learning while still receiving guidance and feedback from AILS. This creates a learning atmosphere unrestricted by time and place, affording students greater control over their learning processes. Notably, students are more capable of collaboration through AILS with peers, teachers, and parents.

Nonetheless, these changes pose questions regarding maintaining a balance between physical and virtual interactions, as well as ensuring that students remain focused on learning objectives amidst a diverse digital world. Therefore, the success of AILS implementation heavily relies on collaboration among teachers, students, parents, and relevant stakeholders in managing these shifts in the teaching and learning environment.

Ultimately, the introduction of AILS opens doors to a more dynamic, interactive, collaborative, innovative, and inclusive learning environment. It enriches student learning experiences through the integration of AI technology with the traditional educational setting. On the journey towards a more inclusive and innovative education, AILS lays the foundation for building a learning atmosphere that is adaptive and responsive to individual needs and technological advancements.

This entire study paves the way for an inclusive and innovative technology-driven education transformation. By amalgamating elements such as natural language processing, 3D-animated teacher representation, and web-based application development, the AI-driven learning system design based on AILS offers a more engaging, effective, and accessible learning experience for students across Indonesia. Through the utilization of AI technology and the AILS-based approach, the aspiration to bridge educational disparities between regions and

provide equitable learning opportunities for all students becomes increasingly attainable in the era of Education 5.0.

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