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Digital storytelling to enhance English language students' understanding of climate change mitigation: A linguistic evidence

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Abstract

Digital Storytelling (DS) is an innovative learning approach that integrates technology and digital narratives to enhance students' engagement, critical thinking, and environmental awareness. The study explores the role of Digital Storytelling (DS) in fostering students' ability to connect real-world issues with academic learning, particularly in language education. This study employs an exploratory approach using qualitative research. Data is collected through classroom observation, semi-structured interviews, and analysis of students' narratives. The findings reveal that DS effectively enhances students' engagement and cognitive processing by incorporating collaborative storytelling, multimedia elements, and interactive learning experiences. DS encourages students to participate in discussions actively, express their perspectives through digital media, and build deeper connections with complex global issues beyond traditional learning approaches. This study concludes that DS is a powerful educational tool that supports independent learning, fosters meaningful engagement, and aligns with the Merdeka Curriculum's vision of equipping students with competencies relevant to 21st-century education.

INTRODUCTION

In the era of globalization, 21st-century skills are crucial in education, especially for language learners who master critical thinking, communication, collaboration, and digital literacy to address global challenges (Trilling & Fadel, 2009). Modern education demands innovative teaching methods for students to understand theories and apply their knowledge in real-world contexts (Paragae, 2023). To support this, integrating technology-based learning methodologies has

become crucial for enhancement and comprehension (Zhang, 2022). Among these approaches, digital storytelling (DS) is an effective tool that enhances the student learning experience (Gadizoraya, 2017; Wahyuni, 2022).

As a global challenge, education must prepare students' competencies to raise awareness of global issues, such as climate change. Climate Change not only affects the environment but also influences education systems worldwide (Putri et al., 2024). To ensure that future generations are prepared, climate change education is crucial in raising young learners' awareness of environmental sustainability within their communities (Silvhiany et al., 2023). Students must be prepared to mitigate and adapt to the consequences of climate change mitigation. As future leaders, they require critical knowledge and skills to navigate and respond effectively to these challenges (Cranston, 2000; Schleicher, 2012).

The Merdeka Curriculum was implemented widely in Indonesia in 2024. The Merdeka Curriculum allows teachers and students to choose appropriate methods and subjects to create competency and character to adapt to fostering 21st-century skills (Hartoyo & Rahmadayanti, 2022; Kurniawan et al., 2024). One of the main focuses of the Merdeka Curriculum is the global awareness topic, which aims to equip students with skills in dealing with global issues (Corkett et al., 2025; Eilam, 2022; Gürsoy, 2021; Kemendikbud et al., 2024; Ratnaningsih, 2024). In this focus, the Merdeka Curriculum integrates diverse topics related to climate change, sustainability, and protecting the environment, providing Digital Storytelling (DS) an optimal method for enhancing students' comprehension of these critical issues. Through DS, students can participate in meaningful debates, explore real-world environmental concerns, and create solutions that extend academic learning.

Before implementing Digital Storytelling (DS) in English learning, a pre-observation was carried out at MA the Daarul Falah Islamic Boarding School to understand students' initial condition and how they access and understand environmental issues in their learning. This observation aims to explore students' initial understanding of the term of climate change and their awareness of its connection to their daily lives. The pre-observation results showed that most students were less familiar with environmental terms, and their understanding of the global issue could be carried out was still limited. In addition, the use of technology in teaching at the pesantren is also quite limited, with little access to digital resources. These observations provide an important overview of the challenges and opportunities in

applying DS as the linguistic evidence to improve students' understanding of the environment and critical thinking skills in the context of English language learning.

A significant obstacle to this integration is the limited implementation of technology and interactive approaches to teaching in Islamic educational settings (Smeda et al., 2014a). The problem in the teaching approach ultimately contributed to students' weak comprehension of key environmental issues. One of the promising approaches is Digital Storytelling, which provides students with interactive and complex problems (Rajendran & Yunus, 2021). Digital Storytelling, or DS, offers engaging and interactive education about complicated topics such as climate change while improving their understanding of the English language (Neas, 2019).

The Merdeka Curriculum's failure to effectively incorporate climate change education, especially in Islamic boarding schools, prevents students from fully comprehending and interacting with these vital global issues. While Pesantren emphasizes moral and character education, environmental literacy is not yet integral to its structured curriculum. Integrating Digital Storytelling (DS) into the learning process could bridge modern educational approaches and the values upheld in Islamic boarding schools, encouraging students to engage critically with global issues while maintaining their traditional learning framework. This gap requires innovative education to teach students environmental literacy and critical issues. Critical thinking is one of the cognitive activities that individuals use according to specific objects, problems, or conditions (Wahyuni & Sarosa, 2017). In recent years, the rise of technology in education has increased worldwide as digital cameras, personal computers, scanners, and easy-to-use software have become available for educators to harness the digital world (Razmi et al., 2014).

Digital storytelling (DS) is a learning method incorporating digital narratives, allowing students to create stories using multimedia elements such as images, text, audio, and video (Al Khateeb, 2019; Benmayor, 2008; Moradi & Chen, 2019; Ohler, 2013). Integrating personal reflection and real-world circumstances, Digital storytelling (DS) enhances students' critical thinking, communication, and creativity (Alexander, 2017). This approach fosters deeper students' understanding and encourages active engagement in their education (Smeda et al., 2014b). Digital Storytelling (DS) allows students to create story-based solutions that involve discussing environmental problems in depth and contextually, rather than memorizing theories (Neas, 2019; Rajendran & Yunus, 2021)

A previous study by (Fu et al., 2022) highlighted the pedagogical benefits of digital storytelling in enhancing student engagement and speaking competence. This study explored its effects on DS in verbal competence, especially speaking. Similarly, (Ahmad Aljaraideh, 2019) explores the impact of digital storytelling on the academic achievement and motivation of students learning English as a foreign language. The study showed that digital storytelling significantly improved students' performance in both areas. However, Aljaraideh's research did not focus on global issues such as climate change; instead, it focused on student engagement in a controlled environment. Additionally, a study by (Putri et al., 2024) explored integrating climate change education with bilingual picture books in English Language Teaching (ELT). While this study effectively raised awareness about environmental issues among young learners, it did not examine the use of digital storytelling as a method for older students in high school.

By focusing on the intersection of digital storytelling and climate change education for high school students, the current study integrates a real-world global issue into the framework of English language learning. The study explores how digital storytelling can foster language skills and environmental awareness. It promotes critical thinking among the students related to global difficulties and encourages active engagement in promoting students' understanding of crucial global issues like climate change within language education.

The study aims: 1. How does DS impact the students' understanding of the climate change concept issue? 2. How can digital storytelling foster engagement and creative thinking in an authentic classroom setting?

METHOD

Research Design

This research investigates how digital Storytelling (DS) fosters students' understanding of climate change concepts and enhances their language skills. To achieve these aims, the study used a qualitative explorative approach. According to Mirhosseini and Sugiyono (2020), Qualitative studies provide valuable insight into human behavior and experiences, making them appropriate for this study.

Exploratory research is used to gain deeper insights into phenomena that not been extensively studied, making this suitable for examining the implementation of DS in English learning within an Islamic boarding school setting

Participants

The participants in this research are 15 female students in class X and one English teacher at Daarul Falah Islamic Boarding School. Like other Islamic boarding schools in general, this school separated the students into two categories; female classroom and male classroom. Due to classroom interaction, the researchers do this research in female classroom only. Participants were selected through purposive sampling (Etikan, 2016). Etikan stated that purposive sampling to collect information has been designed to enhance comprehension of the theoretical framework. The selection criteria included students with good speaking and writing skills, ensuring they aligned with the research objectives. Before the study, the students had limited exposure to DS as a learning method, and their understanding of climate change was also minimal, as shown by the pre-observation results. Including English teachers is intended to facilitate the implementation of DS while observing the involvement and development of students' understanding during the research.

Method of Data Collection

Instrument

Data were collected through classroom observations, semi-structured interviews, and students' Digital storytelling (DS) project analysis. In line with (Creswell, 2018; Farida N, 2014), the exploratory method effectively captures phenomena as they demonstrate in their natural state, making it appropriate for investigating student engagement with educational content in an authentic classroom environment (Stebbins, 2001). For qualitative research, observation is crucial for collecting rich and genuine data, as it allows researchers to understand participants' actions or activities without relying solely on their verbal language (Patton, 2002).

1. Observation

The observations aimed to capture the interaction between students and the Digital Storytelling approach. The pre-observation focused on collecting data to gain information regarding students' comprehension of the Climate Change Concept in the English language. The main observation collected in-depth data on student engagement in digital storytelling and their use of technology to create narrative text into stories by application and video.

2. Teacher's Interview

The researchers employed an interview to answer the research question in this research. The semi-structured interview was conducted with an English teacher to gain detailed information about integrating the effectiveness of DS in the teaching and learning process. Kurniadi stated that the semi-structured interview provided more flexibility in investigating participant's experiences while remaining focused on the research objectives (Etikan, 2016; Kurniadi, 2011).

3. Narrative text and Video

This study utilized narrative text and video as the primary data sources. Students independently authored their narratives, creatively developing them to align with the specific themes of climate change. According to Ribeiro, creating narrative text engages students to explore their understanding and perspective through their stories (Ribeiro, 2016). The researchers collected and analyzed them to determine which stories effectively aligned with the concept of climate change mitigation. The chosen narrative, demonstrating a clear comprehension of mitigation strategies, was the foundation for the DS process. The selected narratives were converted into digital storytelling videos, enabling students to articulate their ideas through multimedia components such as visual, audio, image, and text (Grant & Bolin, 2016).

Table 1. Steps Composing Digital Storytelling

Step	Detailed
Step 1 Creating Narratives text	The students composed narrative text based on themes related to climate change mitigation.
Step 2 Choosing Canva Templates	The students utilized Canva templates to create their digital narratives.
Step 3 Selecting picture	The students choose the illustrations with the narrative content.
Step 4 Inserting Text	Students add their narrative text to the Canva slides to complement the visuals.
Step 5 Recording and adding Audia	The students demonstrate their narration and integrate the audio files into the Canva project.
Step 6 Presentation DS	The students presented their digital narratives to the class for peer evaluation.

The first step is creating Narrative text.

The process began with creating their narratives, following climate change themes, and students following a narrative structure: orientation, complication, resolution, and evaluation. As a result of this stage, students were given an individual narrative that served as an outline for their digital storytelling.

The second step: Selection of Canva themes

When students had finished writing their narratives, they moved on to Canva to begin designing the digital stories they had created. Before starting this process, students received a brief training session to familiarize themselves with Canva's key features. The training covered essential functions such as selecting appropriate templates, inserting images, adding text, and integrating multimedia elements to enhance their narratives. After this training, they chose templates most appropriate for their storylines, such as slides meant for educational presentations, slides suitable for storytelling, or slides focused on environmental issues. By providing students with a library of pre-built templates, Canva allows them to concentrate on content production rather than technical design.

Next third and fourth steps: Inserting pictures and texts

The narrative material that the students had written was put into the Canva slides. The narrative had been divided into pieces corresponding to the graphics, and they ensured the text was clear and succinct before distributing it.

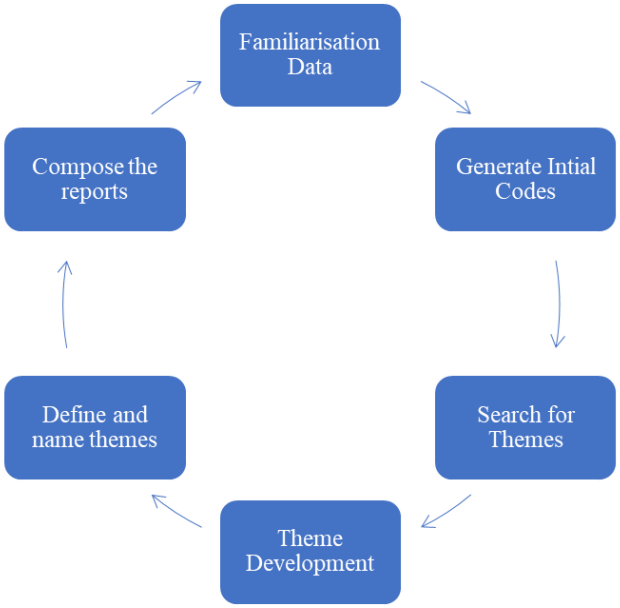
The fifth step is recording and adding Audio.

A recording of the students' voices was made of them narrating the stories that they had written. The tapes were created using basic instruments, such as mobile phones or the recording functions included within Canva.

The sixth step: Presentation DS

The students presented their digital storytelling (DS) projects using a projector in front of the class. They worked in groups and took turns presenting their projects. Each group showcased their DS video while the rest of the class and the teacher watched attentively. After each presentation, a structured discussion session followed, where peers provided feedback on specific aspects such as narrative clarity, creativity, multimedia integration, and alignment with the climate change theme. The teacher facilitated the discussion by asking reflective questions and encouraging students to analyze each other's work critically.

4. Data Analysis Method



Cycle of Thematic Analysis (modified from (Braun & Clarke, 2021))

4.1 Thematic Analysis Proses

The analysis of Data includes six steps:

1. Familiarization Data

The researchers analyze the observation classroom and teacher interviews.

2. Generate Initial Codes

The researchers conducted Saldaña (2021) qualitative coding techniques, coded student narratives, interview responses, and observation notes to identify the pattern. The key terms related to climate change experiences ("extreme heat", "unbearable weather", "plastic waste", "dehydration", "exhaustion")

3. Search for themes

The process of generating code identified and classified codes into general categories, including "climate effect", "adaptation strategies", "sustainability initiatives", "health concern", and "collective action".

4. Theme development:

Braun & Clarke (2021) stated that an established theme represents something significant about the data connected to the research question. It demonstrates a certain level of pattern or significance among the data set. Determining themes accurately reflects the learning outcomes.

5. Define and name themes

After the themes were evaluated and finalized, the next stage involved explicitly defining and naming each topic, providing these effectively reflected the students' learning experiences and engagement with climate change concepts through DS.

6. Compose the reports

The final step was composing a detailed report that conveyed the study's findings with integrity. The writing process ensured the findings were systematically provided and substantiated by beneficial qualitative evidence after the study's research objectives. This structured approach improved the report's readability and highlighted DS' importance as a climate change educational tool in English language instruction.

RESULT & DISCUSSION

1. The Impacts of DS on the Student's Understanding of the Climate Change Concept

1.1 Enhance Student Understanding through Narrative Storytelling

The first research question aims to investigate the effectiveness of DS in enhancing students' comprehension of climate change education in English language acquisition. From the teacher's perspective, DS significantly improves students' understanding after participating in digital storytelling activities. One of their students demonstrated their narrative creativity with the title living through extreme heat. By writing narratives, students actively engage with climate change topics, organize their thoughts, and express their understanding coherently and structure (Lestari et al., 2022; Vogindroukas et al., 2020). The students explore the effect of the greenhouses on daily lives.

The teacher's interview findings revealed several linguistic evidences, that DS considers the ability to improve students' understanding of the essential concept of climate change. The teacher observed:

> "The student can explain climate change-related terminology such as "greenhouse effect," "mitigation," "global warming," and "carbon emission in speaking and narrative writing. Before the lesson, many of them were unfamiliar with these concepts, but at the end of activities, they could confidently describe their meaning and provide instances".

This observation indicates that Digital Storytelling (DS) effectively enhanced students' understanding of climate change-related terms. Initially, students had

limited knowledge of these concepts. However, by engaging in DS, they learned the definitions and developed the ability to use these terms in spoken and written narratives.

1.2 Contextual Knowledge in Real Life

The results in Table 2 show how students actively used the climate change topic in their stories. The teacher found that digital Storytelling drives students to think critically and imaginatively, improving comprehension beyond passive learning. These findings support earlier research demonstrating that active and creative learning strategies like storytelling help students understand topics (David, 2020; Yazar Soyadı, 2015).

Table 2. A thematic analysis of key concepts in climate change mitigation

Theme	**Key term identified (linguistic evidences)**
Understanding Climate Change Impact	Climate Change, extreme heat, plastic waste, pollution
Sustainability Efforts	Planting trees, using reusable items, reducing energy use
Adaptation Strategies	Seeking Shade, drinking water, adjusting habits
Collective Actions and Awareness	Organizing clean-up events, community participation
Health and Well-Being Challenges	Dehydration, exhaustion, difficulty sleeping.

The teacher observed:

> "Composing the text narratives gave better impact because it forced students to think critically and creatively about the content and explain it in their own words. This process helped them internalize the concepts more effectively than passive learning methods."

This aligns with the study demonstrating that involving students in active and creative projects (Yazar Soyadı, 2015), such as writing or storytelling, improves their comprehension and understanding of complicated concepts (David, 2020).

Table 2 highlights that the students could apply several key terms related to climate change to their narratives. For example, the sentence "The extreme heat we have been experiencing is making it hard to focus, sleep, and even go about our activities." This statement is classified as **Understanding of impact** as it highlights extreme heat's direct effect on daily living and well-being.

In the **sustainability efforts** category, the sentence is "planting more trees around the *pesantren* to create more shade and learning ways to conserve water

and energy." This demonstrates how students connect climate change mitigation with practical actions. Also, the sentence "We tried to adjust by spending more time outside under the trees, hoping for some shade" determined an **adaptation strategy**. The words time in shaded areas to avoid intense heat and arrange cleaning programs to reduce plastic trash in their school environments.

Furthermore, the linguistic evidence of **collection action and awareness** themes captured in the sentence, "Reducing plastic waste might seem like a small step, but it's a step in the right direction. If we all try to use less plastic and care for our environment, we can create a cleaner, greener school." This category suggests that the students think about solutions that involve their community.

Finally, the theme of **health and well-being challenges** captured in the sentence ". Some of my friends got dehydrated, and a few even fell sick from the constant exhaustion" represents their concern about the physical effect of climate change.

During the observation, it became noticeable that students regarded climate change as directly impacting their lives, mainly caused by continuously warmer temperatures. The continuous extreme heat adversely impacted these well-being, focus, and daily routines. These insights demonstrate the potential of DS as a pedagogical model for incorporating climate change awareness into English language education, thus providing relevant and transformative information.

These findings align with (Robin, 2016; Wu & Chen, 2020)). This indicates that learning is enhanced when students construct knowledge through storytelling and personal narratives. DS facilitated the internalization of environmental issues among students by connecting scientific concepts to individual experiences, thereby enhancing the interactivity and reflectiveness of the learning process, in contrast to traditional memorization-based methods.

Furthermore, previous research (David, 2020) indicates that narrative-based learning enhances understanding of complex issues. This study proves that students progressed from simply acknowledging environmental issues to actively suggesting adaptation and sustainability strategies. Their capacity to express climate-related challenges and propose community-driven solutions underscores the efficacy of DS as an educational instrument.

Incorporating personal reflections and real-life scenarios demonstrates that DS effectively connects abstract environmental theories with their practical implications.

The insights highlight the potential of DS as a pedagogical model for incorporating climate change awareness into English Language Education, thereby enhancing the relevance and transformative nature of learning.

1.3 DS encourage Critical Thinking

The results indicate that digital storytelling (DS) enhances students' critical thinking, especially in climate change education. In contrast to conventional rote learning approaches that emphasize memorization, DS necessitated that students engage in the analysis of environmental issues, develop narratives grounded in real-life experiences, and indicate practical solutions. This process involved students in advanced cognitive skills, requiring them to critically assess climate change issues and express their comprehension through narrative techniques.

One significant observation during the DS project was students' transition from merely describing the effects of climate change to actively contemplating adaptation and mitigation strategies. Students provided detailed accounts of their coping mechanisms in response to the challenges posed by extreme heat on their daily routines: "We tried to adjust by spending more time outside under the trees, hoping for some shade". This linguistic evidence illustrates students' capacity to evaluate a problem (extreme heat) and identify a viable adaptation strategy (seeking natural shade), exemplifying critical thinking skills.

Through DS, students were encouraged to extend their thinking beyond personal experiences and propose more comprehensive environmental solutions. One student stated, "I've started thinking about what we can do to make our environment more livable, like planting more trees around the *pesantren* to create more shade and learning ways to conserve water and energy."

DS demonstrates student engagement in problem-solving through recognition of the broader implications of plastic waste and advocacy for collective environmental action. The capacity to link real-world problems with practical solutions illustrates that DS promotes analytical thinking by necessitating students to evaluate causes, effects, and potential responses to environmental challenges.

Moreover, classroom discussions and group collaborations during DS projects facilitated the refining of students' ideas. Observations indicated that students engaged in active debate and explanation of their narrative choices, enhancing their capacity to evaluate diverse perspectives and contemplate alternative viewpoints—essential critical thinking and scientific reasoning components. The

findings align with the research conducted by (Fu et al., 2022), which examined the effects of digital storytelling on English as a Foreign Language (EFL) learners. Their study demonstrated that digital storytelling significantly improves students' speaking competence by promoting better organization, analysis, and connection of their thoughts. The construction of digital narratives implied that students engage in deeper cognitive processing, enhancing their capacity to synthesize information and articulate complex ideas coherently.

2. Digital Storytelling as an Innovative Approach to Enhance Students' Understanding of Climate Change Mitigation in English Language Teaching

2.1 Increased Student Engagement Through Interactive Learning

DS has evolved as an innovative approach to instruction that combines digital media, creative expression, and academic learning. This study discovered that DS offered a dynamic and engaging platform for teaching complicated themes such as climate change mitigation. Researchers (Robin, 2016; Tarnopolsky, 2012; Wu & Chen, 2020) also note that DS fosters engaging and collaborative learning, such as teamwork, to compose multimedia narratives.

From the teacher's perspective observed:

> "The students were thrilled to put their ideas through the movie. Even students who were generally uninterested in regular activities participated passionately and creatively."

This aligns with the researchers' perspective; this insight emphasizes DS' transformation potential. DS renewed interest in disengaged students while nurturing essential skills like communication and self-expression. The previous study (Dong et al., 2024) mentioned that using digital storytelling to create historical documentaries and instructional videos efficiently gives students a comprehensive understanding of practice and concepts. Furthermore, DS connects abstract ideas to real-world applications, allowing students to interpret their knowledge within actual circumstances.

2.2 Encouraging Creativity Through Multimedia Integration

The teacher suggested video-based DS as the most effective tool for teaching climate change. They emphasize that videos are especially effective because they blend visual, audio, and textual features in one package. This multimodal method makes complex subjects more understandable and enjoyable for students.

The teacher explained:

> "*Video is an effective tool because it integrates visual, audio, and text elements, helping students understand complex topics like climate change mitigation more interactively and attractively.*"

The teacher explained that DS encourages students' critical thinking and creativity, allowing them to successfully explain notions of climate change mitigation using story and multimedia methods. (Ivala et al., 2014) examined how multimedia tools in DS project their community of practice, improving their collaboration and comprehension through shared learning. Her study found that multimedia technology helps students manage complicated and multicultural environments, fitting with DS' collaborative and reflective.

This is equivalent to the effectiveness shown by student-generated video projects. These activities enable students to present their understanding of the greenhouse effect and mitigation strategies through visuals, narration, and storytelling.

The teacher's opinion is in line with (Yu & Wang, 2025), which highlighted that video storytelling enhances learning by creating a multimodal environment where students engage actively with content.

2.3 Collaboration and Teamwork in the DS Process

Furthermore, DS' collaborative personality also helps this learning process. According to the teacher, students did group discussions to choose story subjects. Even shy students gained confidence by working on a group project.

The teacher observed:

> "Even students who are usually quiet in class became more confident during group work and actively contributed to creating their digital stories."

Graphics, audio, and narratives enhance their comprehension and foster a sense of accomplishment and teamwork. Previous studies have shown that teamwork improves learning. Sumarni found that collaboration in project learning encourages knowledge sharing and peer support (Sumarni et al., 2016). According to Robin, group-based DS encourages students to share learning responsibilities and use their strengths in creativity, technical skills, and topic understanding (Robin, 2015). In the current study, collaborative activities led even reluctant kids to participate and gain confidence.

CONCLUSION

This study demonstrates that Digital Storytelling (DS) supports students' understanding of climate change concepts by facilitating connections between abstract environmental issues and real-life experiences. Students exhibited an enhanced understanding of significant climate change issues, including extreme heat, pollution, and plastic waste, while also recognizing adaptation and mitigation strategies in their narratives. Incorporating DS in English language education facilitated a more effective internalization of scientific concepts among students, illustrating that narrative-based learning enhances environmental literacy and conceptual understanding beyond conventional teaching approaches.

Moreover, DS has been demonstrated to enhance student engagement and critical thinking. Through collaborative storytelling, multimedia creation, and reflective learning, students enhanced higher-order cognitive skills such as problem-solving, analysis, and structured reasoning. DS' interactive and multimodal characteristics facilitated student engagement in discussions, teamwork, and creative expression, thereby enhancing the dynamism and significance of the learning experience. The findings indicate that incorporating DS into English language education enhances environmental awareness and provides students with crucial 21st-century skills, affirming its significance as an innovative pedagogical method.

The findings indicate that DS is a practical approach for improving students' comprehension of climate change mitigation in the context of English language education. Considering its potential, educators should integrate DS as an interactive instrument for teaching complex global issues. Practical applications include using DS for Problem-Based Learning (PBL), Facilitating collaborative learning, and enhancing engagement through technology. Future research should expand the study to encompass a more extensive and diverse sample to assess the scalability of DS across various educational contexts. Furthermore, comparative analyses of DS and alternative innovative teaching methods could provide a deeper understanding of their effectiveness across diverse pedagogical settings.

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