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The Utilization of Moodle-H5P with Flipped Classroom in Global Warming Learning to Enhance Students' Creative Attitudes

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Abstract

Fostering creative attitudes is essential in global warming learning, as it helps students think creatively and critically about complex environmental issues. This study aims to examine the impact of Moodle-based interactive media with H5P in flipped classroom settings on improving students' understanding of global warming in physics. The creative attitude indicators measured in this study include curiosity, imagination, collaboration, perseverance, risk-taking, openness to new experiences, independence and self-confidence in one's ideas, persistence, imagination and appreciation of fantasy, discipline and commitment to tasks, and collaboration and group trust. The research uses a pre-experimental design with a one-group pretest-posttest approach. Data were collected through tests, and analysis was conducted using ANOVA and N-Gain analysis. The findings reveal a significant improvement in students' creative attitude test scores after using Moodle H5P-based learning media, as shown by the ANOVA results. Additionally, the N-Gain analysis indicates that the improvement in students' creative attitudes falls into the moderate category. The use of Moodle H5P-based interactive media in a flipped classroom setting has a significant impact on enhancing students' creative attitudes, especially in understanding global warming. The use of Moodle H5P-based interactive media in a flipped classroom setting has a significant impact on enhancing students' creative attitudes towards understanding physics topics, particularly global warming.

Keywords: creative attitude, moodle, learning media, flipped-classroom

INTRODUCTION

Developing creativity is essential to equip students to face the complexities of 21st century learning. In 21st century learning, creativity is often associated with an individual's ability to generate new ideas, create innovative work, or design new solutions (Malik et al., 2023). Creativity as an interaction between talent, process, and environment that produces new, real, and valuable products through individual or group activities (Plucker et al., 2004). Lucas (2019) views creativity as a state of mind in which all aspects of a person's intelligence work together. Fisher & Williams (2004) describe creativity as a materialized imagination, where imaginative activity produces something original. Thus, creativity as 'adventurous thinking', is characterized by an unconventional approach, openness to new experiences, and letting one idea lead to another.

Creativity in individuals can be divided into three components, namely creative thinking, creative attitudes, and creative performance (Hidayah et al., 2015). Furthermore, it can be said that creativity can be seen as a trait (who we are), a process (what we do), or a product (what we produce) (Fisher &

Williams, 2004). Creative thinking leads to creative attitudes, which are then manifested through creative processes or actions (Sambada, 2012). Creativity in students includes creative thinking, attitudes, and behavior, so this study specifically examines the components of creative attitudes.

Attitude is defined as a coherent arrangement of knowledge, beliefs, feelings, motives, behaviors, and emotional expressive reactions to a particular object. A positive attitude toward creativity known as a creative attitude can be expressed through a series of knowledge and beliefs about creativity, positive affect related to creativity, and behavioral responses that support creativity (Grohman & Szmidt, 2013). A strong creative attitude influences how individuals interpret information about creativity and influences their behavior. Rusilowati (2009) defines a creative attitude as the affective aspect of creative students. This creative attitude is described as a dynamic structure consisting of cognitive and character components, which encourages the transformation of personality and surrounding objects. Creative attitudes include dynamic characteristics such as openness, tolerance for ambiguity, flexibility of thinking, persistence, motivation for creativity, and the need to express oneself, which can be formed through experience, learning, and training (Plucker et al., 2004). Lucas (2019) identifies the components of a creative attitude as curiosity, imagination, collaboration, discipline, and persistence. Individuals with creative attitudes show high curiosity, persistence, not easily bored, self-confidence, independence, unwillingness to accept progress, dare to take risks, and divergent thinking (Lassig, 2020). Green et al. (2011) further explain creative attitudes as follows: high drive, intense involvement, curiosity, persistence, dissatisfaction with the status quo, self-confidence, independence, freedom in decision making, self-acceptance, humor, high intuition, interest in complex issues, tolerance for ambiguity, and sensitivity. Piirto (2011) also noted that creative attitudes include self-discipline in creative work, openness to experience, daring to take risks, tolerance for differences, and trust in groups. Based on the theoretical perspective, the indicators of students' creative attitudes can be summarized as follows: 1) Curiosity; 2) Imagination; 3) Collaboration; 4) Discipline; 5) Perseverance; 6) Risk taking; 7) Openness to new experiences; 8) Independence and self-confidence in one's own ideas; 9) Persistence; 10) Imagination and appreciation of fantasy; 11) Discipline and commitment to tasks; and 12) Collaboration and group trust.

In the context of learning about global warming, a complex and uncertain issue, creative attitudes are essential. Favier et al. (2021) argue that addressing global warming requires innovative thinking and problem-solving skills. Fostering creative attitudes allows students to see uncertainty as an opportunity for exploration and innovation rather than an obstacle, helping students develop resilience and adaptability (Beghetto et al., 2015). Despite the increasing importance of nurturing creative attitudes, many studies have shown that creativity in the classroom environment is still underdeveloped and underutilized. Hidayah et al. (2024) found that secondary school students generally showed low levels of creative thinking skills and attitudes, indicating a gap that requires more effective strategies to foster these important traits. Similarly, research by Nuswowati & Taufiq (2015) showed that students showed poor creative thinking and attitudes in environmental chemistry before the implementation of the problem-based learning (PBL) model, indicating the need for innovative approaches to stimulate creativity. Problem-Based Learning (PBL) and Creative Problem Solving (CPS) models have been shown to enhance creative thinking skills, but these models still have limitations in fully developing students' creative attitudes (Julianto et al., 2022). While Panjaitan & Bukit (2017) found that collaborative Project-Based Learning models enhanced creativity in static fluid lessons, students with below-average scientific attitudes struggled to reach their full creative potential. These findings clearly indicate gaps in current approaches to nurturing creativity across educational contexts. This highlights the urgent need to develop new educational media and models that can effectively enhance students' creative attitudes, providing them with the skills needed to thrive in a rapidly evolving world. Therefore, this study seeks to develop innovative teaching media specifically designed to address these shortcomings and foster creative attitudes more comprehensively.

Observations at SMAN 4 Yogyakarta revealed that students' creative attitudes are also underdeveloped, primarily due to teaching methods that emphasize material explanation and limit opportunities for creative expression. However, students' creative attitude can be nurtured through appropriate instructional design and media (Shen & Lai, 2018). One of the instructional designs that can foster this is the flipped classroom design. This is because the flipped classroom model shifts the traditional learning approach by encouraging students to engage with learning materials before class

(Bergmann & Sams, 2012). By exploring content independently, students have the opportunity to develop their curiosity, critical thinking skills, and problem-solving abilities (Gilliland, 2017). Additionally, the flipped classroom model allows for more interactive and collaborative activities during class time, providing students with opportunities to express themselves creatively, collaborate with peers, and explore complex topics in depth (Rombot et al., 2018). Overall, the flipped classroom design promotes active engagement and empowers students to take ownership of their learning, thus fostering their creative attitude.

One of the learning media that provides teachers with the flexibility to create customized learning materials, including improving creative attitudes, is Moodle-based learning assisted by H5P. The integration of Moodle LMS in physics education has shown significant positive effects on collaborative learning and students' creative thinking skills. A study by Abtokhi et al. (2024) explains how Moodle improves group discussions and problem-solving skills as evidenced by improved performance. Research by Sharma and Patwardhan (2024) also highlights that Moodle strengthens the learning process, motivates students and has a positive impact on their physics learning achievements. In addition, Moodle's support for blended learning environments has been effective in optimizing student skill development, with its features allowing instructors to monitor and evaluate student activities more comprehensively (Suyatna et al., 2024). The features provided by Moodle are able to support learning activities as well as manage assignments including feedback, discussion forums, questionnaires, quizzes, and surveys. Moodle provides a flexible platform and supports various interactive media, its application in physics learning still faces challenges, such as lack of technical understanding and infrastructure readiness in schools (Mutoharoh 2021). The platform facilitates the Creative Problem Solving (CPS) process in a blended learning setting, significantly enhancing students' critical and creative thinking (Nurrijal et al., 2023).

H5P is an open-source and free content creation tool that enables teachers to design interactive learning tasks such as presentations, quizzes, games, and interactive e-books (Magro, 2021). The effectiveness of interactive digital tools, particularly H5P and Moodle, is consistently highlighted across several studies, showing a positive impact on student engagement, motivation, and performance. Berbel et al. (2024) found that H5P-based matching games in a structural analysis course significantly increased students' motivation and engagement, leading to moderate improvements in their understanding of internal force graphs (GIFs). Similarly, Rahmi et al. (2024) demonstrated that H5P content in a blended learning environment enhanced students' knowledge, skills, and satisfaction by making the learning process more interactive. Mutawa et al. (2023) further supports this, showing that H5P's interactive features, such as quizzes and videos, effectively engage and motivate students in asynchronous distance learning, creating a more enjoyable and effective learning experience. Lastly, Pfennig (2023) emphasizes the flexibility of using H5P activities in a blended learning context, allowing for personalized learning experiences that improve engagement and allow more interactive teaching methods. Collectively, these studies underscore the crucial role of H5P and Moodle in fostering student-centered, interactive learning environments that enhance academic performance.

Technology-based learning media, such as H5P in flipped classrooms, have the potential to increase student engagement in the learning process and encourage their creative thinking skills (Sari, 2022). By using innovative teaching methods and utilizing technology effectively, interactive learning media developed with the help of H5P in flipped classroom settings can serve as a solution to improve students' creative attitudes (Mayer, 2002). Thus, it can prepare them to face future challenges with confidence, resourcefulness and ingenuity. Although Moodle-based learning offers flexibility and interactivity, the use of such media is still limited.

Based on the literature of creative attitude which highlights the significance of qualities like curiosity, perseverance, and willingness to take risks in nurturing creativity, and also the lack of students' creative attitude based on observation, this research initiative aims to offer students opportunities to cultivate these vital skills. The research addresses a significant gap in the existing literature by exploring the impact of Moodle H5P-based learning media on enhancing students' creative attitudes within a Flipped Classroom model, an area that has previously been underexplored. This study introduces the novel integration of interactive Moodle H5P features with the Flipped Classroom approach, aiming to foster creativity in education, particularly in the context of Global Warming. The hypothesis posits that this innovative combination will lead to a notable improvement in students'

creative attitudes, as evidenced by enhanced indicators such as curiosity, risk-taking, and imaginative thinking.

METHODS

The research was conducted at SMAN 4 Yogyakarta during the academic year of 2023–2024. The sample consisted of 45 10th-grade students, divided into two classes: a modeling class with 20 students and an implementation class with 25 students. The sample was selected using cluster random sampling, ensuring that the chosen classes represented the population effectively.

This study employed a pre-experimental research design, specifically utilizing a one-group pretest-posttest approach. The research involved two classes: one modeling class and one implementation class. The Moodle-based interactive media with H5P assistance for Global Warming learning was used by both classes. In the modeling class, the learning was guided by the researchers, while in the implementation class, a physics teacher led the instruction. Each class was given a pretest before the learning session and a posttest afterward to measure students' creative attitudes.

A test instrument developed to measure students' creative attitudes. This instrument was designed based on the combination of creative attitude indicators from various expert perspectives, including Lucas (2019), Lassig (2020), Green et al. (2011), and Piirto (2011). The resulting test consisted of 20 items covering various aspects of creative attitude: curiosity (2 items), willingness to take risks (3 items), openness to new experiences (3 items), independence and confidence in one's ideas (3 items), perseverance (2 items), imagination and appreciation of fantasy (3 items), discipline and commitment to tasks (2 items), and collaboration and group trust (2 items). Before being employed to measure the students' creative attitudes, the instrument was validated by three raters, including one expert lecturer and two practicing teachers. The validation results, analyzed using Aiken's V, yielded a validity score of 0.865, indicating that the instrument was valid.

The data analysis in this reasearch involved several steps. First, pretest and posttest data on students' creative attitudes were collected from both the modeling and implementation classes before and after the Global Warming learning session. Prerequisite analyses included tests for normality and homogeneity to ensure the data met the assumptions required for further analysis. ANOVA was then conducted to determine if there were significant differences between the pretest and posttest scores of the two classes, assessing the impact of the Moodle-based interactive media. Following ANOVA, N-gain score analysis was performed to measure the improvement in students' scores from pretest to posttest, indicating the extent of change in creative attitudes due to Moodle-based interactive media with H5P.

RESULTS AND DISCUSSION

Media Development

In this study, innovative learning media were developed for teaching Global Warming within the context of physics, utilizing a flipped classroom approach. The media were created using the Moodle LMS in conjunction with H5P plugins and are specifically designed to enhance students' creative attitudes. By integrating interactive elements and engaging content, this media aims to deepen students' understanding of Global Warming while fostering their creative attitude through active participation. This media includes several interactive components that engage students both before (Preclass) and during class (In-class). These components include the following:

1. **Interactive Video**: The preclass component consists of an interactive video that covers essential content on Global Warming. This video not only provides educational material but also includes questions designed to provoke deeper thought on the issue. These questions are presented in various formats such as drag and drop, drag the words, fill in the blank, and summary, encouraging active participation and comprehension.
2. **Crosswords Feature**: To reinforce learning and assess understanding, the crossword feature is employed in the preclass phase. This interactive quiz format helps consolidate knowledge in a fun and engaging manner, testing students' grasp of key concepts related to Global Warming.

3. **H5P Documentation Tool**: During inclass activities, the H5P documentation tool is used to capture and evaluate project work. Students participate in role-playing scenarios where they assume various roles, such as mayor or café owner, and create posters aimed at preventing Global Warming. The documentation tool allows students to submit photos of their posters, providing a platform for showcasing their creativity and understanding of the topic.
4. **Moodle Assignment**: For final submissions, the Moodle Assignment feature is utilized. Students upload their posters and detailed reports, enabling instructors to assess their work comprehensively.

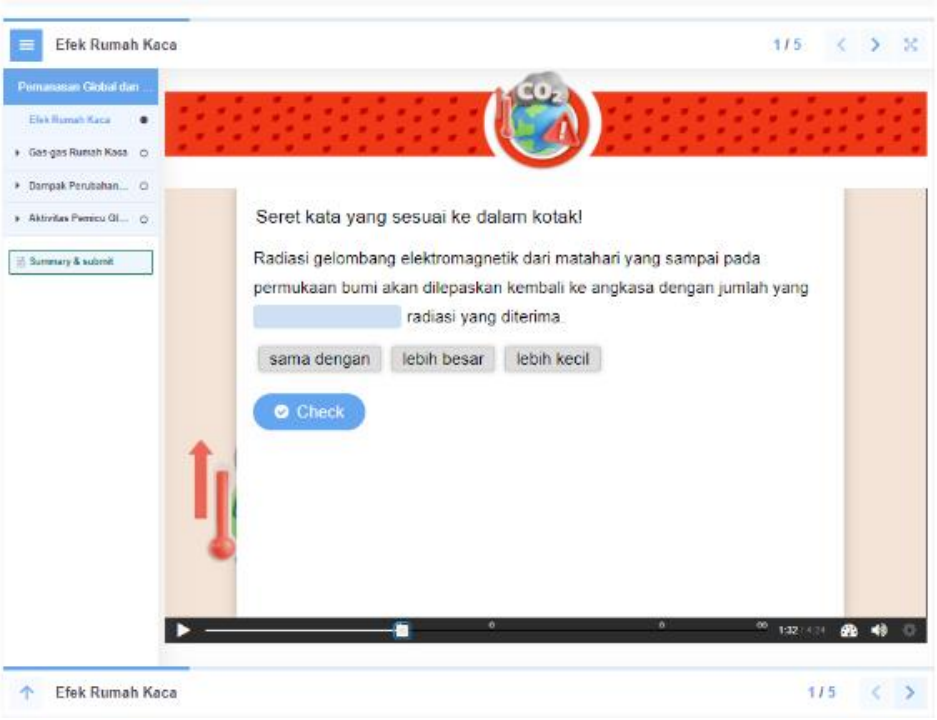

FIGURE 1. Interactive video displays for pre-class learning on Moodle with H5P assistance

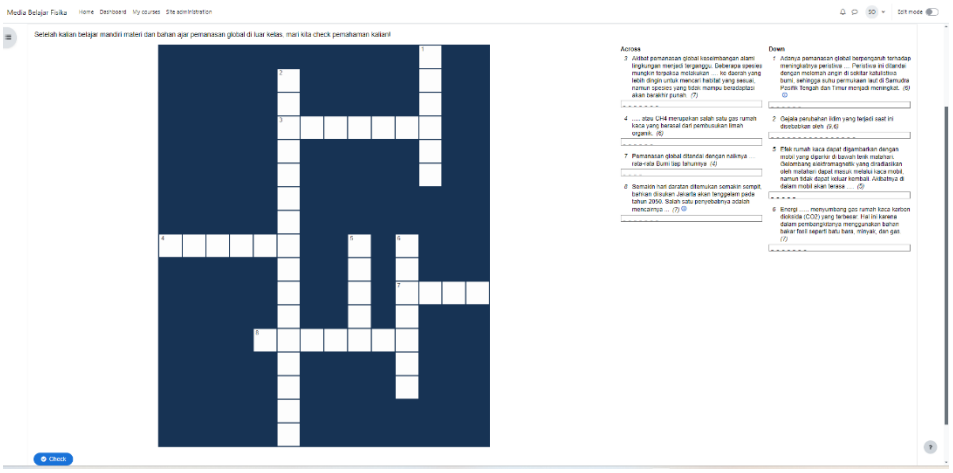

FIGURE 2. Crossword puzzle as learning assessment quizzes

The integration of these interactive features provides several opportunities to enhance students' creative attitudes by offering diverse and engaging ways to interact with the content. The preclass video prompts critical thinking and problem-solving skills, while the crosswords feature provides an enjoyable method to reinforce learning. The inclass role-playing activity, combined with the documentation tool, encourages students to apply their knowledge creatively and practically. By

actively participating in the creation of posters and reports, students exercise their imagination and innovative thinking, which are crucial components of creativity. The combination of these elements fosters an environment where students are not only informed about Global Warming but are also motivated to think creatively and propose solutions. This holistic approach significantly contributes to enhance students' creative attitudes

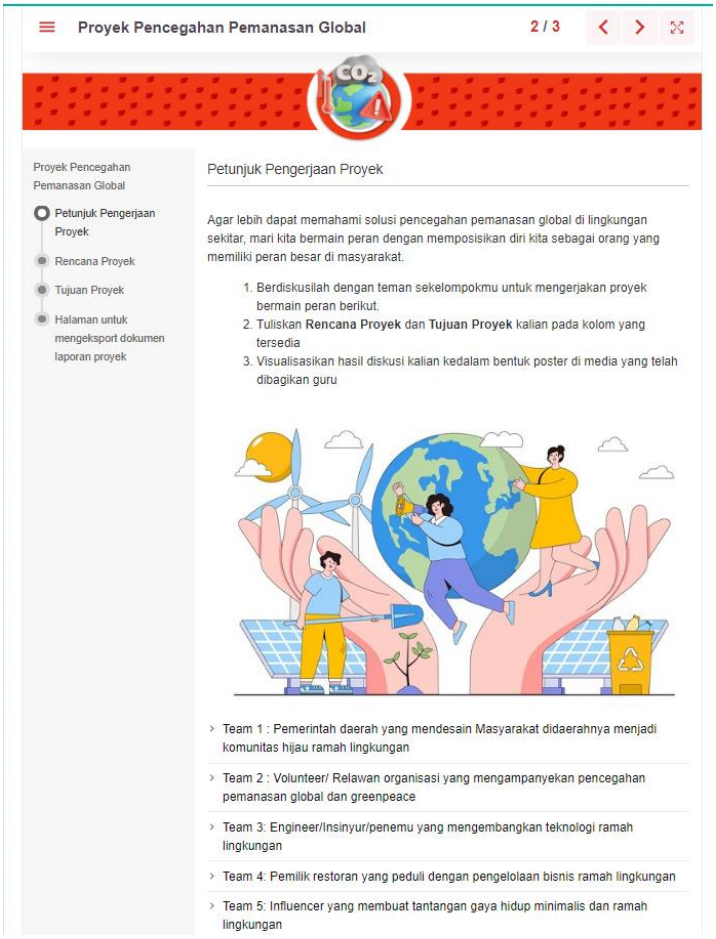

FIGURE 3. Student worksheets on Moodle with H5P assistance for project work

.This study was conducted through physics learning activities on the topic of Global Warming, utilizing Moodle-based interactive media with H5P assistance. The learning took place in two classes: the modeling class and the implementation class. In both classrooms, identical learning materials, approaches, and methodologies were employed. However, there was a key difference in the instructor: the researcher led the modeling class, while the implementation class was instructed by a teacher.

Classroom sessions began with pretests on students' creative attitudes. We briefed students on the flipped classroom method and how to engage with Moodle for learning prior to class meetings. Students then accessed learning materials on Moodle (temanfisika.org), which included videos, reading materials, and interactive quizzes for pre-class preparation. During in-class learning sessions, the teacher adopted a Project-Based Learning (PjBL) model, tasking students with planning and reporting their projects using the Moodle-supported learning media. Throughout the learning process, the teacher acted as a facilitator and learning guide, aiming to deepen students' understanding, provide feedback, and encourage reflection.

Based on observations and informal interviews during class, we noted great enthusiasm among students when introduced to the interactive learning media supported by Moodle for flipped classroom-based physics instruction on Global Warming. The preclass materials, whether instructional videos, text, or images, incorporated various interactive features that allowed students to learn and respond to questions.

Student learning activities on Moodle were monitored by the teacher. Based on observations, many students engaged in independent learning before class, although some did not. The teacher addressed this by reminding students to complete preclass learning activities within their class groups. The implementation of in-class learning, utilizing the project-based learning model, ran smoothly as all instructions, examples, and explanations were readily available on Moodle.

The Effectiveness of the Media

To assess the effectiveness of the learning media, ANOVA was used to analyze the pretest and posttest results. Based on the data analysis, normality tests, specifically the Shapiro-Wilk test, showed significance levels of 0.230 and 0.256 for the modeling class, and 0.427 and 0.197 for the implementation class. These significance values, all above 0.05, indicate that both pretest and posttest data for students' creative attitudes were normally distributed in both classes. Additionally, the homogeneity test using Levene's Statistic showed significance values of 0.689 for the modeling class and 0.076 for the implementation class, suggesting that the data were homogeneous. These results confirmed that the data met the prerequisites for conducting one-way ANOVA to compare the average pretest and posttest scores between the classes.

TABLE 1. ANOVA Test Result of The Effectiveness of Moodle-Based Interactive Learning Media on Students' Creative Attitudes

Class	Sig.	Partial Eta Square
Modelling	.000	.646
Implementation	.000	.549

The analysis of data using ANOVA, as presented in TABLE 1, indicates that the significance values in the respective column are below the threshold of 0.05. This suggests a noteworthy disparity between the pretest and posttest scores, affirming the positive impact of the intervention on students' creative attitudes. Consequently, it can be inferred that there exists a significant divergence in the results between the pretest and posttest assessments across both the modeling and implementation classes.

Expanding the examination to include the assessment of effect size yields insights into the magnitude of differences between groups, independent of sample size. This step enhances the comprehension of the practical implications of the findings. Effect size metrics, such as partial eta squared, delve beyond mere identification of differences, offering insights into their substantive significance. With a partial eta squared value of 0.646 for the modeling class and 0.549 for the implementation class, a substantial effect size is evident. This underscores the considerable portion of variance in students' creative attitudes attributable to the utilization of Moodle-based interactive learning media. Specifically, around 64.6% of the variance in creative attitudes within the modeling class and 54.9% within the implementation class can be attributed to the intervention. These outcomes underscore the substantial and meaningful enhancement in students' creative attitudes fostered by the Moodle-based interactive learning media across both groups.

In addition to ANOVA, the study employs N-gain score analysis to further assess the effectiveness of the use of Moodle-based interactive media with H5P assistance. This analysis measures the improvement or change in scores from the pretest to the posttest for each individual student, allowing for the evaluation of the extent to which the intervention influenced students' creative attitude. By integrating N-gain score analysis alongside ANOVA, a comprehensive understanding of the intervention's effectiveness is achieved, encompassing both group-level differences and individual learning gains. This multifaceted approach strengthens the validity of the findings and provides valuable insights for educational practice.

The analysis of N-gain for pretest and posttest data reveals that the average N-gain for the Modeling class is 0.605, while for the Implementation class it is 0.619. These results indicate that the use of Moodle H5P-based learning media has effectively enhanced students' creative attitudes, achieving a medium gain category. This suggests that the learning methods employed are quite effective, yet there remains room for further improvement. Detailed data on N-gain for each indicator of students' creative attitudes can be found in FIGURE 4.

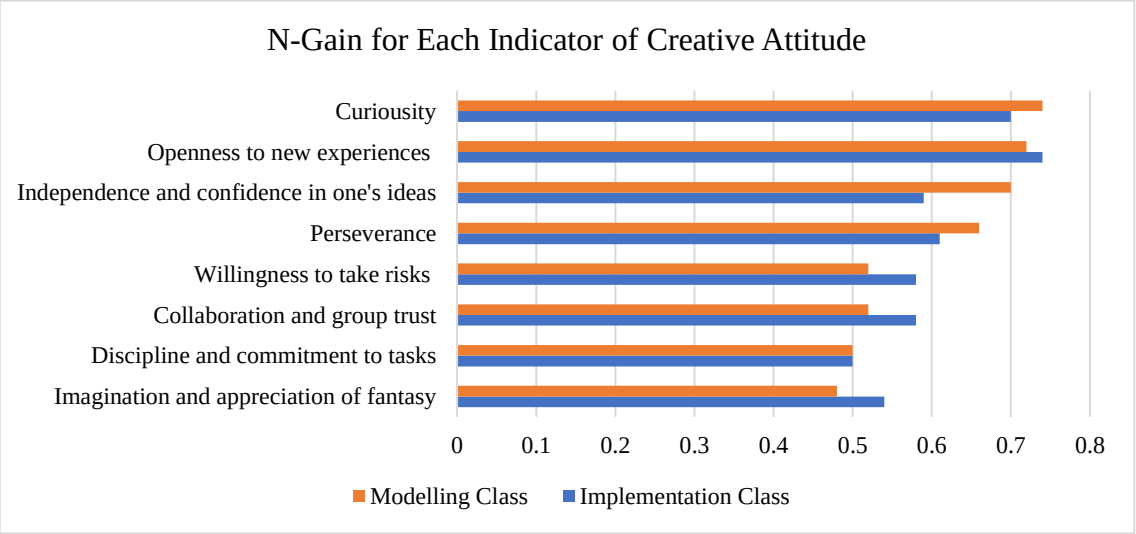

FIGURE 4. Bar Chart of N-Gain for Each Indicator of Creative Attitude

Based on the displayed N-Gain Chart on a FIGURE 4, it is evident that the Moodle H5P-based learning media that has been designed has a varying impact on the improvement of each indicator of creative attitude. Additionally, the effectiveness between the Modelling and Implementation classes also varies. In general, the indicators of *Curiosity* and *Openness to New Experiences* show a significant increase in both classes. This indicates that the use of Moodle H5P-based learning media is highly effective in stimulating students' curiosity and providing opportunities for them to experiment and be open to new experiences. This is in accordance with the results of research conducted by Chan & Yuen (2014) which stated that an interactive and collaborative learning environment, such as that provided by H5P, can significantly increase students' curiosity. Moreover, the chart shows that in the Modelling class, taught by a Master's student (researcher), students excelled in the aspect *of Independence and Confidence in One's Ideas*, while the Implementation class, taught by a regular physics teacher, showed strengths in *Preseverance*.

According to the sequence of data analyses performed it is evident that physics learning based on the flipped classroom approach with the assistance of Moodle H5P can positively influence students' creative attitudes. The effectiveness analysis of the media shows that every indicator of creative attitude has improved. Several factors contribute to this positive impact. The media, designed with a flipped classroom approach, supports students in learning at their own pace and deepening their understanding through activities specifically crafted to foster creativity (O'Flaherty & Phillips, 2015). Preclass learning, or independent learning conducted by students before formal class sessions, encourages students to independently explore the material and discover effective learning methods, thereby boosting creativity in comprehending concepts (Agustini et al., 2022). Additionally, the presence of multimedia content used in preclass learning, such as videos, animations, and interactive quizzes, enables students to grasp physics concepts in a more visual and engaging manner (Rahayu et al., 2022). The interactive features within the H5P videos allow students to ask questions directly, explore topics independently, and access additional information as needed, all of which contribute to increased curiosity (Davies et al., 2013). Moreover, during in-class activities, collaborative tasks facilitated through Moodle promote teamwork, knowledge sharing, and creative problem-solving among students, whether through interactive crosswords or the H5P documentation tool. This collaborative environment nurtures creative attitudes and enhances students' ability to approach problems from diverse perspectives (Kotzer & Elran, 2012). Furthermore, the use of the Moodle assignment feature for submitting posters and reports also encourages students to demonstrate their commitment to assigned tasks, which is one of the indicators of a creative attitude. These findings are supported by research by Susilowati, which suggests that technology-based learning media can foster the development of students' creative attitudes (Susilowati et al., 2021). Overall, these insights underscore the significant

role of interactive technology in enriching learning environments and promoting creative attitudes among students.

CONCLUSION

This study demonstrates that utilizing Moodle H5P-based learning media within a flipped classroom approach on the topic of Global Warming can significantly enhance students' creative attitudes. ANOVA results show significance values below 0.05, indicating a noteworthy disparity between pretest and posttest scores. Additionally, the N-Gain analysis reveals an average N-Gain of 0.605 for the Modeling class and 0.619 for the Implementation class reflecting medium gains in students' creative attitudes. And the highest N-Gain found in the indicators of creative attitude namely Curiosity (0.73) and Openness to new experiences (0.72). These statistically significant results provide strong evidence supporting the effectiveness of the intervention.

However, the study has several limitations, including its focus on a single topic, Global Warming, and the limited duration of the research. The small sample size, involving only 45 students from two classes, may also limit the generalizability of the findings. Despite these limitations, the study's implications are valuable for educational practice, particularly in cultivating essential 21st-century skills such as creativity.

As education continues to evolve, the integration of innovative approaches like Moodle-supported flipped classrooms shows promise for both enhancing creative attitude and fostering deeper understanding in physics education. Future research should investigate the long-term effects of this approach and its impact on other learning outcomes, such as critical thinking and scientific literacy, across a broader range of topics. Additionally, exploring its application in other physics topics, such as motion dynamics or work and energy, could provide insights into the versatility of this approach. Expanding the scope of studies to include larger and more diverse samples over an extended period will yield a more comprehensive understanding of the intervention's broader impact on education.

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