Journal of Natural Science and Integration
P-ISSN: 2620-4967 | E-ISSN: 2620-5092
Vol. 8, No. 2, October 2025, pp 412-422

Available online at:
http://ejournal.uin-suska.ac.id/index.php/JNSI
DOI: 10.24014/jnsi.v8i2.32493

Effectiveness of H5P Interactive Video in Promoting the Development of Science Critical Thinking Skills

Edy Chandra[1*], Kartimi[1], Moh. Sarjana[1]

[1] *Department of Chemistry Education, Universitas Islam Negeri Siber Syekh Nurjati Cirebon, Indonesia*

**Correspondence Author: dydra75@gmail.com*

ABSTRACT

This study was conducted to examine the effectiveness of H5P interactive videos in enhancing students' critical thinking skills within an online biochemistry learning environment. A true experimental design employing a pretest-posttest control group model was utilized, involving two randomly selected third-semester student classes. The experimental group received instruction through H5P interactive videos, while the control group was taught using conventional methods. The findings revealed that the students who engaged with H5P interactive videos demonstrated significantly greater improvement in critical thinking skills compared to those in the control group. The mean critical thinking score of the experimental group was 80.08, exceeding the control group's score of 66.08. The incorporation of interactive features such as embedded quizzes and real-time feedback within the H5P videos encouraged more active participation and deeper cognitive engagement, thereby fostering the development of critical thinking. The results of this study confirm that the integration of interactive digital technology into the learning process can substantially improve the quality of education, particularly in online settings. Furthermore, the implementation of H5P supports higher levels of student engagement and enables more personalized and adaptive learning experiences, both of which are essential for cultivating reflective and critical learners.

Keywords: *interactive video, H5P, critical thinking, science.*

INTRODUCTION

The role of information technology in enhancing learning processes and developing student competencies has been increasingly recognized as a key element in modern education. Among various technological innovations, interactive videos have emerged as a prominent medium for facilitating active learning. As stated by Zhang et al. (2006), interactive videos provide dynamic and immersive learning experiences through the inclusion of features such as quizzes, simulations, and branching scenarios, which are designed to engage learners and support knowledge retention. Despite these advantages, the lack of direct interaction between instructors and students in such digital environments may limit opportunities for developing higher-order cognitive abilities, particularly critical thinking skills. According to Ennis (2011) and Facione (2011), critical thinking requires deliberate reasoning, reflective judgment, and continuous feedback elements that are often reduced in asynchronous or automated learning contexts.

Previous research has primarily examined the effectiveness of traditional instructional videos or isolated interactive components (Dieck-Assad et al., 2020; Febliza, Afdal, & Copriady, 2023), while limited attention has been given to how various forms of interactivity within comprehensive

interactive videos contribute to the enhancement of critical thinking. This gap is significant, as many current interactive video designs focus more on content delivery than on promoting cognitive engagement. The development of technologies such as H5P has created new opportunities to address this issue. Through its embedded questions, feedback mechanisms, and performance tracking features, H5P enables interactive learning experiences that enhance student engagement and self-regulation (Jacob & Centofanti, 2023). Consequently, this study was conducted to investigate the effectiveness of H5P-based interactive videos in improving students' critical thinking skills in biochemistry learning.

In interactive video-based learning, the role traditionally played by the instructor is substituted by the video itself, making learner–content interaction essential. H5P technology has been implemented in various learning contexts to promote learner activity and comprehension (Rama Devi, 2022; Nirmala, 2022; Utari, 2022). Interactive strategies that incorporate multiple-choice questions and visual prompts have been shown to enhance student engagement during online learning (Snowball, 2014). Moreover, the gamification features of H5P have been effectively utilized to support educational objectives (Killam & Luctkar-Flude, 2021). The adoption of H5P-based learning has also been found to encourage self-directed learning and self-assessment among students (Naidu, 2021).

Empirical evidence suggests that the effectiveness of H5P interactive videos largely depends on the level and design of interactivity provided. Optimal interactivity allows learners to receive immediate and relevant feedback, which strengthens their understanding and performance. The integration of H5P into learning management systems, such as Moodle, has been found to provide procedural advantages by facilitating the transformation of existing video materials into interactive learning content (Wehling, 2021). Furthermore, the collaborative capabilities of H5P contribute to increased learner engagement (Jacob & Centofanti, 2023). The development of H5P-based interactivity, therefore, holds considerable potential for cultivating critical thinking skills, particularly in biochemistry education.

The interactive features available within H5P have been recognized as effective tools for maintaining student focus and engagement during learning activities (Kartimi et al., 2022). Structured video-based learning also enables more systematic assessment of students' critical thinking abilities based on specific performance indicators. Prior research has demonstrated that instructional videos can effectively serve as substitutes for instructors by organizing lessons in a coherent and pedagogically sound manner. For example, Sukarini and Manuaba (2021) developed a series of videos aimed at improving science teachers' critical thinking skills. Similarly, the use of video-based learning has been well received by students and has been shown to increase engagement and understanding, particularly in complex scientific topics such as natural selection (Bohlin et al., 2017).

METHODOLOGY

This study was conducted using a true experimental quantitative design with a pretest–posttest control group model (Sugiyono, 2010). This design was selected to evaluate the effect of an intervention on a group receiving specific treatment compared to a control group that did not receive such treatment. The research focused on examining the impact of H5P interactive videos in online learning on students' critical thinking skills. In this design, two groups were involved: an experimental group that received instruction through H5P interactive videos and a control group that participated in conventional learning.

The population of this study comprised third-semester students, from which two classes were selected randomly using a cluster random sampling technique. One class was assigned as the experimental group, while the other served as the control group. Prior to the implementation of

the intervention, prerequisite tests including normality and homogeneity tests were conducted to ensure that both groups possessed equivalent initial characteristics.

Data were collected through a critical thinking skills test consisting of essay-based questions. The test items were developed based on a pre-determined blueprint and underwent content validation and reliability testing to ensure their quality and consistency. The collected data were analyzed quantitatively. Normality and homogeneity tests were first applied to verify that the data satisfied the assumptions required for parametric statistical analysis. Subsequently, an independent samples t-test was employed to compare the pretest and posttest mean scores of the experimental and control groups in order to determine the significance of the treatment effect.

RESULT AND DISCUSSION

In this study, several H5P interactive features were utilized to support biochemistry learning. The inclusion of interactive quizzes embedded within the video was found to enhance students' concentration and engagement with the instructional content. By integrating questions directly into the video, learners were encouraged to interact more actively with the material, thereby fostering a more participatory and reflective learning experience. The interactive videos were implemented within the institutional Learning Management System (LMS), which operated on the Moodle platform. A dedicated online learning space titled Biochemistry was provided by the institution specifically for this research, where the interactive learning videos were made accessible to the experimental class. The development of the interactive videos was carried out through several stages, including content preparation, PowerPoint-based recording, voice narration, and animation editing. The completed videos were subsequently uploaded to YouTube and then embedded into the LMS with H5P interactive elements. These steps ensured that the videos were both pedagogically structured and technologically integrated for effective online delivery as shown in Figure 1.

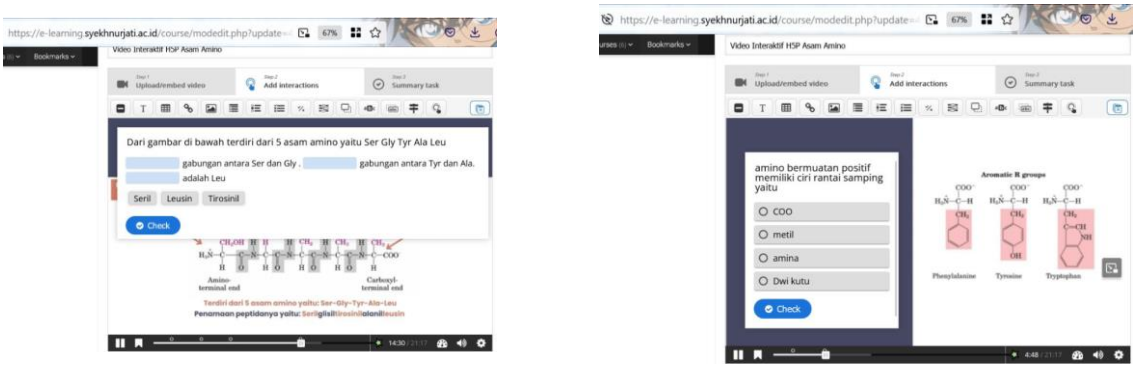

Figure 1. H5P interactive on LMS

The interactive H5P features were successfully implemented in the LMS used by students during biochemistry learning. Students were able to participate in learning activities through quiz-based interactive videos developed with H5P technology. Each video was equipped with an H5P scoring mechanism, requiring students to complete all interactive components in order to receive a final grade. During the learning process, students were actively engaged in answering embedded questions that appeared at specific intervals within the videos. The application of H5P interactive videos was observed to significantly enhance student engagement and participation. Students demonstrated increased focus and motivation while learning complex biochemical concepts through interactive media. The structured integration of quizzes and feedback within the videos allowed learners to immediately assess their understanding and correct misconceptions, aligning with the principles of formative assessment. These findings are consistent with previous studies

which have reported that interactive learning environments contribute to the development of higher-order cognitive skills, including critical thinking (Rama Devi, 2022; Jacob & Centofanti, 2023).

Moreover, the interactive learning environment created through H5P was found to promote self-regulated learning. Students were able to control their learning pace, revisit specific segments, and reflect upon their responses, which facilitated deeper cognitive engagement. This aligns with the assertion of Naidu (2021) that H5P-based learning not only encourages autonomous learning but also supports learners in evaluating their own progress. Overall, the implementation of H5P interactive videos within Moodle proved to be an effective strategy for enhancing student participation, engagement, and critical thinking in biochemistry learning. The results indicate that well-designed interactivity can transform passive video-based instruction into an active, student-centered learning experience. These findings reinforce the importance of integrating interactive digital technologies in higher education to support meaningful learning and the development of critical cognitive skills.

The results of critical thinking skills were obtained based on data collection using essay tests. Several questions were distributed and answered by students in both the experimental and control groups. The results of the descriptive calculation of critical thinking ability are as follows.

Table 1. Descriptive of Critical Thinking Ability

Statistics	Experiment Class	Control Class
Range	9	12
Minimum	75	60
Maximum	84	72
Mean	80,083	66.08
Std. Deviasi	2.778	3.941
Variance	7.720	15.538

The results revealed that the experimental group demonstrated a higher level of critical thinking ability compared to the control group, as evidenced by the higher mean and maximum scores obtained. In contrast, the control group exhibited greater variability in performance, as indicated by a wider score range, higher standard deviation, and increased variance. These findings suggest that the intervention involving the use of H5P interactive videos had a positive influence on the enhancement of students' critical thinking skills. The superior performance of the experimental group may be attributed to the interactive nature of the H5P learning materials, which were designed to sustain students' attention and foster deeper engagement throughout the learning process. The embedded quizzes, immediate feedback, and active learning components within the H5P videos likely contributed to greater cognitive involvement and more effective knowledge construction. Consequently, students in the experimental group were observed to exhibit higher motivation and engagement when interacting with the learning materials, leading to improved critical thinking outcomes.

Further analysis was conducted to identify which specific critical thinking indicators demonstrated the most substantial improvement following the implementation of the intervention. The indicator-based performance results are presented in Figure 2, which illustrates the comparative achievement levels of each critical thinking component between the experimental and control groups. The analysis indicated that indicators related to analysis, inference, and evaluation showed the most significant gains in the experimental group, suggesting that interactive learning environments encourage learners to reason more critically and reflectively.

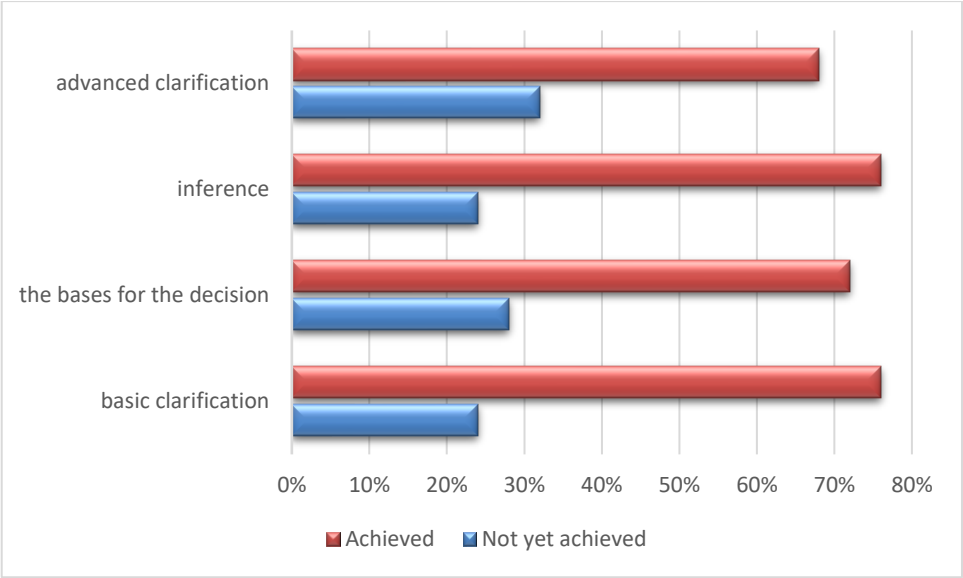

Figure 2. Percentage of Science Critical Thinking Ability Indicators

Figure 2 presents the percentage of achievement across four critical thinking indicators in science learning, namely basic clarification, bases for decisions, inference, and advanced clarification. The analysis revealed that both the basic clarification and inference indicators achieved the highest percentage, each reaching 76%. This result indicates that the majority of students were able to comprehend fundamental concepts and draw logical conclusions based on the information provided. The bases for decisions indicator was achieved by 72% of students, suggesting that most participants were capable of justifying their decisions through appropriate reasoning. In contrast, the advanced clarification indicator showed the lowest achievement at 68%, indicating that students still encountered difficulties in providing detailed and comprehensive explanations. Although most indicators demonstrated satisfactory achievement levels, further improvement is required, particularly in developing advanced clarification skills.

The ability to provide rational and detailed explanations for decisions made is essential for fostering coherent and persuasive argumentation. Such competence enables students to communicate their reasoning effectively and to substantiate the conclusions they draw. The identification of these indicator outcomes was based on students' written responses to the critical thinking assessment administered during the study. The results associated with the inference indicator demonstrate that students were able to make logical judgments and formulate reasonable conclusions based on available information. This process reflects the core of critical thinking, which involves connecting multiple pieces of evidence to form a coherent understanding or conclusion. Meanwhile, performance on the advanced clarification indicator illustrates the students' capacity to analyze and interpret information at a deeper cognitive level. This dimension of critical thinking requires learners to move beyond simple definitions and engage in detailed analysis of underlying concepts or relationships.

Although the students' achievement in advanced clarification was relatively lower than in other indicators, it reflects the complex nature of higher-order thinking that requires extensive practice and metacognitive awareness. The observed outcomes suggest that while H5P interactive videos effectively supported comprehension, inference, and decision-making processes, further instructional emphasis is needed to enhance students' analytical depth and explanatory reasoning. Strengthening these aspects could be achieved by incorporating more open-ended, reflective questions and problem-based tasks within the interactive video framework.

Overall, the findings underscore that the implementation of H5P interactive videos has positively contributed to improving students' critical thinking across multiple dimensions. However, sustained instructional efforts are required to strengthen the higher-level components of critical thinking, particularly advanced clarification, to achieve a more comprehensive development of scientific reasoning skills.

Hypothesis testing in this study used the Independent Samples Test formula. The purpose of this hypothesis test is to determine whether there are differences in critical thinking skills between experiments and controls. The test results using SPSS assistance can be seen in the table below. The data analyzed in the test is the final data from each experimental and control class related to critical thinking skills in biochemistry material.

Table 2. Independent Samples Test

	Levene's Test Equality of Variances		t-test for Equality of Means				
	F	**Sig.**	**T**	**Df**	**Sig. (2-tailed)**	**Mean Difference**	**Std. Error Difference**
Equal Variances assumsed	2.688	0.115	10.056	50	0.000	14.00	1.392
Equal Variances not assumsed			10.056		0.000	14.00	1.392

The results of Levene's Test indicated that the assumption of equal variances was satisfied, confirming that the data were homogeneous. The obtained t-value and significance level demonstrated a statistically significant difference between the experimental and control groups. The mean difference of 14.00 showed that the experimental group achieved a higher mean score than the control group. The t-value was employed in the hypothesis testing process to determine the statistical significance of the difference between the two sample means. Since the obtained p-value was lower than the predetermined significance level of 0.05, the null hypothesis was rejected. This finding indicates that there was a statistically significant difference in critical thinking skills between students who received instruction through H5P interactive videos and those who were taught using conventional methods.

The results of this study demonstrated that the application of H5P-based interactive videos in biochemistry learning had a significant positive effect on students' critical thinking skills. The experimental group, which engaged with interactive video-based learning, obtained higher mean scores and exhibited lower score variance compared to the control group. This outcome indicates that interactive video learning fosters more consistent and effective improvement in students' reasoning abilities. The integration of quiz-based interactivity within the video content encouraged learners to engage actively with the material, thereby promoting deeper conceptual understanding and more reflective learning processes.

From a theoretical standpoint, these findings are consistent with the frameworks of critical thinking proposed by Ennis (2011) and Facione (2011), who described critical thinking as a purposeful, self-regulatory process encompassing interpretation, analysis, evaluation, inference, and explanation. The design of H5P interactive videos embedding formative questions, instant feedback, and reflective prompts was found to stimulate these cognitive processes in real time. As learners were required to respond to questions while engaging with the content, they were encouraged to interpret, analyze, and evaluate information continuously, thus reinforcing the cyclical reasoning processes described in Facione's model of critical thinking disposition and skills.

The improvement observed in the basic clarification and inference indicators, both reaching an achievement rate of 76%, suggests that H5P interactivity particularly enhances foundational reasoning and evidence-based conclusion-making. This finding aligns with the results of Snowball (2014), who reported that interactive learning environments increase students' focus and improve their ability to synthesize information through guided questioning. Similarly, the present results correspond with those of Rama Devi (2022), who found that H5P promotes deeper comprehension in asynchronous learning contexts through the use of interactive questioning and feedback mechanisms. Collectively, these findings support the notion that interactive engagement transforms passive content delivery into an active learning experience that strengthens reasoning and problem-solving abilities.

The comparatively lower performance in the advanced clarification indicator (68%) indicates that students still encountered challenges in articulating complex arguments and providing comprehensive justifications for their reasoning. This finding supports Facione's (2011) assertion that advanced clarification represents a higher level of cognitive demand, requiring learners to critically evaluate assumptions and synthesize evidence across diverse contexts. The lower achievement in this indicator suggests that while H5P facilitates conceptual engagement and comprehension, additional instructional scaffolding such as peer discussion forums, instructor-guided reflection, or collaborative problem-solving activities may be required to cultivate advanced analytical reasoning. Wilkie et al. (2018) likewise emphasized that dialogic interaction and feedback are essential components in nurturing evaluative and reflective thinking within online learning environments.

The statistical findings further reinforce the effectiveness of the H5P intervention. The results of the independent samples t-test ($t = 10.056$, $p < 0.05$) confirmed a significant difference in critical thinking performance between the experimental and control groups. This result validates the effectiveness of H5P-based interactive videos in improving critical thinking skills. The outcome is consistent with previous studies demonstrating that interactive video tools enhance cognitive engagement and learning outcomes compared to conventional video-based instruction (Zhang et al., 2006; Dieck-Assad et al., 2020). Moreover, this study extends existing literature by providing empirical evidence that H5P-based interactivity not only supports content mastery but also stimulates higher-order reasoning in complex scientific topics such as biochemistry. The integration of H5P into Learning Management Systems (LMS) such as Moodle has also been shown to make the learning process more engaging and interactive (Kartimi, Chandra, & Riyanto, 2023).

Interactive videos facilitate the visualization of abstract scientific concepts, enabling students to better comprehend fundamental ideas (basic clarification) through clear visual presentation. According to constructivist learning theory, learning that involves active interaction promotes greater understanding and long-term retention of knowledge. Active learning approaches have been widely recognized for enhancing students' engagement and critical thinking skills, particularly in science education. The inclusion of interactive tools such as quizzes and real-time feedback within H5P contributes significantly to improving students' conceptual understanding and confidence in explaining scientific phenomena (Carr & Barry, 2020). The use of digital instructional materials such as H5P represents an adaptive response to technological developments in education, aligning with recent findings that digital interactivity fosters meaningful learning and cognitive growth (Irfandi et al., 2023; Yudha & Sandy, 2023).

In comparison with prior studies, the present research reinforces the findings of Wehling (2021) and Jacob and Centofanti (2023) concerning the pedagogical affordances of H5P within Moodle-based learning environments. The platform's capability to log learner activity and deliver adaptive feedback mechanisms creates a responsive and data-informed learning ecosystem that supports metacognitive regulation. This observation aligns with the framework proposed by Naidu (2021), who identified self-assessment and reflective learning as critical components in developing critical thinking within digital contexts. Furthermore, the consistent improvement observed across

multiple indicators in this study parallels the findings of Sukarini and Manuaba (2021), who demonstrated that structured and reflective instructional design in video-based learning significantly enhances teachers' critical thinking skills.

Nevertheless, the results of this study indicate that several indicators of biochemical critical thinking were not fully achieved by students. The incomplete attainment of these indicators may be attributed to suboptimal design features within the interactive video content or the lack of adherence to established principles of effective learning design. Inadequately structured interactivity may result in shallow understanding and insufficient stimulation of analytical reasoning. Furthermore, when interactive videos prioritize visual appeal over the development of analytical and synthetic reasoning, students may be less inclined to engage in critical questioning or problem-solving. To address these shortcomings, content design should deliberately incorporate pedagogical strategies that stimulate higher-order thinking. This includes integrating instructional techniques that encourage critical analysis, formulating tasks or guiding questions that demand in-depth reflection, and presenting information through clear, structured, and conceptually coherent narratives. Instructors may also embed reflective prompts or open-ended questions to provoke evaluative reasoning and foster metacognitive awareness.

Another limitation lies in the reduced level of direct instructor–student interaction within an interactive video-based learning context. As emphasized by Sinnayah and Salcedo (2021), dialogic engagement and formative feedback play an essential role in developing students' critical thinking abilities. Overemphasis on visual components without parallel opportunities for analysis and synthesis can lead to superficial comprehension. This finding underscores the necessity of integrating opportunities for dialogue and reflection within interactive video design. Online learning platforms that incorporate discussion forums and feedback tools can mitigate this issue. Instructors may utilize these tools to facilitate peer discussion, provide timely responses to students' queries, and promote critical dialogue. Similarly, collaborative learning strategies can be implemented to enhance peer interaction, encourage the exchange of perspectives, and deepen collective understanding.

Barriers related to students' technological proficiency and learning preferences may also impede the effective use of interactive video content. Complex or poorly aligned designs can hinder accessibility and reduce learners' ability to engage with the material effectively. When students struggle to navigate the interface or interact meaningfully with embedded activities, the intended cognitive benefits of H5P may not be fully realized. Therefore, an inclusive and learner-centered approach to design is crucial. Supplementary materials, alternative formats, and technical support should be provided to accommodate diverse learning needs and ensure equitable participation. Despite these challenges, the findings of this research confirm that interactive learning through H5P possesses considerable potential for improving students' critical thinking skills. As an HTML5-based educational tool, H5P enables instructors to create rich interactive content such as videos, quizzes, and drag-and-drop exercises that provide immediate feedback. This interactivity not only strengthens conceptual understanding through multimodal visualization but also promotes active learner engagement a fundamental element in the cultivation of critical thinking (Sinnayah et al., 2021).

Consistent with the findings of Mutawa et al. (2023), the present study further demonstrates that H5P maintains learner motivation and engagement in asynchronous learning environments, both of which are vital for the development of reflective and analytical reasoning. By allowing students to interact autonomously with the learning material, H5P supports self-directed and reflective learning that leads to deeper comprehension. Thus, H5P serves not merely as a medium for enhancing engagement but also as a pedagogical platform that fosters critical thinking through adaptive, interactive, and reflective learning processes.

Moreover, the wide range of interactive features offered by H5P such as embedded quizzes, drag-and-drop tasks, and branching video elements encourages students to assume an active role in constructing their understanding (Kartimi, Chandra, & Riyanto, 2024). These activities require learners to interpret data, evaluate alternative perspectives, and make evidence-based decisions, all of which are integral to critical thinking development. The adaptability of H5P further enables personalized learning experiences, allowing students to control the pace of their learning, revisit challenging sections, or progress to more complex topics upon mastery. Such flexibility nurtures learner autonomy, thereby promoting reflective and critical engagement with scientific content.

CONCLUSION

The implementation of H5P-based interactive videos in biochemistry learning demonstrated a significant positive effect on students' critical thinking skills. Learners who engaged with H5P-integrated materials within the Learning Management System (LMS) achieved higher performance compared to those in the control group who experienced conventional instruction. Improvements were observed across several indicators of critical thinking, with the highest achievement recorded in basic clarification and inference (76% each), followed by reasoning (72%) and advanced clarification (68%). These findings suggest that embedding interactive elements such as quizzes, formative feedback, and reflection prompts within instructional videos effectively fosters analytical reasoning and reflective understanding in complex scientific topics. While the results affirm the pedagogical value of H5P interactivity in promoting cognitive engagement and higher-order thinking, the scope of this study was limited to a single topic and participant group within the domain of biochemistry learning. Consequently, the generalizability of these findings requires further examination across different subject areas, educational levels, and learning environments. Future studies are encouraged to investigate the long-term effects of H5P integration on diverse learner populations, compare various modes of interactivity, and explore how collaborative or instructor-mediated components can complement H5P-based learning to further enhance critical thinking. Expanding research in these areas will contribute to a more comprehensive understanding of how interactive learning technologies can sustainably strengthen cognitive engagement and critical thinking skills within digital education ecosystems.

ACKNOWLEDGMENTS

This study was financially supported by the Ministry of Religious Affairs of the Republic of Indonesia through the *Litapdimas* Research Grant Program in the 2023 fiscal year. The authors extend their deepest appreciation to the Ministry of Religious Affairs and all collaborating institutions for their continuous support, facilitation, and contribution to the successful implementation of this research..

REFERENCES

Bohlin, G., Göransson, A., Höst, G. E., & Tibell, L. A. (2017). A conceptual characterization of online videos explaining natural selection. *Science & Education*, *26*, 975-999. https://doi.org/10.1007/s11191-017-9938-7

Carr, W. H., & Barry, A. (2020). H5P as an active learning tool builds content-based critical thinking skills in Biological Sciences and student confidence in problem-based learning. *The Journal of Immunology*, *204*(1_Supplement), 222-9. https://doi.org/10.4049/jimmunol.204.Supp.222.9

Dieck-Assad, G., Hinojosa-Olivares, J. M., & Colomer-Farrarnos, J. (2020). Study of the effectiveness of interactive videos in applied electronics courses. *International Journal on*

Interactive Design and Manufacturing (IJIDeM), *14*, 983-1001. https://doi.org/10.1007/s12008-020-00689-2

Dieck-Assad, G., Hinojosa-Olivares, J.M. & Colomer-Farrarnos, J. Study of the effectiveness of interactive videos in applied electronics courses. *Int J Interact Des Manuf* **14**, 983–1001 (2020). https://doi.org/10.1007/s12008-020-00689-2

Ennis, R. (2011). Critical thinking: Reflection and perspective Part II. *Inquiry: Critical thinking across the Disciplines, 26(2),* 5-19. https://doi.org/10.5840/inquiryctnews201126215

Febliza, A., Afdal, Z., & Copriady, J. (2023). Improving Students' Critical Thinking Skills: Is Interactive Video and Interactive Web Module Beneficial?. *International Journal of Interactive Mobile Technologies (iJIM)*, *17*(03), pp. 70–86. https://doi.org/10.3991/ijim.v17i03.34699

Irfandi, I., Musdansi, D. P., Murwindra, R., Chandra, M. F., & Rini, R. (2023). Analisis Kebutuhan Pengembangan E-LKM Berbasis STEM pada Materi Makromolekul. *Educational Insights*, *1*(2), 69-74. https://doi.org/10.58557/eduinsights.v1i2.18

Jacob, T., & Centofanti, S. (2023). Effectiveness of H5P in improving student learning outcomes in an online tertiary education setting. *Journal of Computing in Higher Education*, 1-17. https://doi.org/10.1007/s12528-023-09361-6

Jacob, T., & Centofanti, S. (2023). Effectiveness of H5P in improving student learning outcomes in an online tertiary education setting. *Journal of Computing in Higher Education*, 1-17. https://doi.org/10.1186/s12909-021-02784-8

Kartimi, K., Chandra, E., & Riyanto, O. R. (2023). The Influence of H5P Interactive Video on Stereoisomer Understanding in Terms of Learning Style. *Jurnal Pendidikan IPA Indonesia*, *12*(3), 451-459. https://doi.org/10.15294/jpii.v12i3.42757

Kartimi, K., Chandra, E., & Riyanto, O. R. (2024, May). The impact of interactive H5P video learning on the understanding of stereoisomers based on learning management system. In *AIP Conference Proceedings* (Vol. 3116, No. 1). AIP Publishing. https://doi.org/10.1063/5.0211135

Killam, L. A., & Luctkar-Flude, M. (2021). Virtual simulations to replace clinical hours in a family assessment course: development using H5P, gamification, and student co-creation. *Clinical Simulation in Nursing*, *57*, 59-65. https://doi.org/10.1016/j.ecns.2021.02.008

Naidu, V. R., Singh, B., Agarwal, A., Al Farei, K., AL ISMAİLY, K., AL HARRASİ, R., & Vaidhyanathan, N. (2021). HTML5 Based E-Learning Authoring To Facilitate Interactive Learning During Covid-19 Pandemic: A Review. *IJAEDU-International E-Journal of Advances in Education*, *7*(20), 122-130. https://doi.org/10.18768/ijaedu.964863

Nirmala, E., Mulyati, S., Noris, S., & Irwanto, D. (2022). Pembuatan media pembelajaran interaktif menggunakan H5P. KOMMAS: Jurnal Pengabdian Kepada Masyarakat, 3(1), 75-82. Retrieved from http://digilib.unila.ac.id/75871/

Rama Devi, S., Subetha, T., Aruna Rao, S. L., & Morampudi, M. K. (2022). Enhanced Learning Outcomes by Interactive Video Content H5P in Moodle LMS. In *Inventive Systems and Control: Proceedings of ICISC 2022* (pp. 189-203). Singapore: Springer Nature Singapore. https://doi.org/10.1007/978-981-19-1012-8_13

Sinnayah, P., Salcedo, A., & Rekhari, S. (2021). Reimagining physiology education with interactive content developed in H5P. *Advances in Physiology Education*, *45*(1), 71-76. https://doi.org/10.1152/advan.00021.2020

Snowball, J. D. (2014). Using interactive content and online activities to accommodate diversity in a large first year class. *Higher education*, *67*(6), 823-838. https://doi.org/10.1007/s10734-013-9708-7

Sugiyono. (2010). *Metode Penelitian Pendidikan Pendekatan Kuantitatif, Kualitatif, dan R&D*. Bandung: Alfabeta

Sukarini, K., & Manuaba, I. B. S. (2021). Video animasi pembelajaran daring pada mata pelajaran IPA kelas VI Sekolah Dasar. *Jurnal Edutech Undiksha*, *9*(1), 48-56. https://doi.org/10.23887/jeu.v9i1.32347

Utari, D. A., Miftachudin, M., Puspandari, L. E., Erawati, I., & Cahyaningati, D. (2022). Pemanfaatan H5P Dalam Pengembangan Media Pembelajaran Bahasa Online Interaktif. *Jurnal Pendidikan Bahasa dan Sastra Indonesia Metalingua*, *7*(1), 63-69. https://doi.org/10.21107/metalingua.v7i1.14896

Wehling, J., Volkenstein, S., Dazert, S., Wrobel, C., van Ackeren, K., Johannsen, K., & Dombrowski, T. (2021). Fast-track flipping: flipped classroom framework development with open-source H5P interactive tools. *BMC Medical Education, 21(1),* 351. https://doi.org/10.1186/s12909-021-02784-8

Wilkie, S., Zakaria, G., McDonald, T., & Borland, R. (2018). Considerations for designing H5P online interactive activities. *Open Oceans: Learning without borders. Proceedings ASCILITE*, 543-549.

Yudha, S., & Sandy, M. P. (2023). Development Of Learning Devices In Agricultural Chemistry Courses In Agroecotechnology Study Program Based On Kkni Curriculum. *Educational Insights, 1(2),* 75-80. https://doi.org/10.58557/eduinsights.v1i2.16

Zhang, D., Zhou, L., Briggs, R. O., & Nunamaker Jr, J. F. (2006). Instructional video in e-learning: Assessing the impact of interactive video on learning effectiveness. *Information & management*, *43*(1), 15-27. https://doi.org/10.1016/j.im.2005.01.004