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THE INFLUENCE OF H5P INTERACTIVE VIDEO ON STEREOISOMER UNDERSTANDING IN TERMS OF LEARNING STYLE

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ABSTRACT

The study aims to find differences in understanding of stereoisomers using h5p interactive videos based on student learning styles. The research method used was quasi-experimental, with a one-group posttest-only design. This study's subjects were all second-year biology teacher education students at IAIN Syekh Nurjati Cirebon. The data were analyzed using descriptive and two-way ANOVA tests to determine differences in understanding. Future research is suggested to include more interactive video features in learning scenarios and measure other cognitive topics. The study found differences in stereoisomer understanding based on interactive videos and learning styles. There is no relationship between interactive video interaction and learning style and stereoisomer understanding simultaneously. This study is limited to the use of H5P interactive video. Subsequent work can increase the intensity and optimize the use of all H5P interaction features.

Keywords: E-learning; H5P; interactive video; IPA; learning style

INTRODUCTION

Universities and colleges are adapting to the current technological changes in learning. Universities quickly adapted to unplanned remote learning. There are many obstacles to teaching preparation from traditional to online learning, particularly the hardware users must have (Xie et al., 2020). Users currently own mobile devices for digital-based learning. Moreover, teachers must create learning content based on users' characteristics. According to Clark and Feldon (2014), multimedia, such as video, offers teachers interactive and authentic learning activities. Fujita (2020) suggests that students learn concepts by combining images and spoken text. Videos deliver the context of the content and relevance of the material to increase understanding through learning experiences (Alpert & Hodkinson, 2019; Scagnoli et al., 2019). Students can use interactive videos to obtain information from various user characteristics (Albertson & Ju, 2016).

Every student has varying levels of attention during learning, which affects their concentration. Additionally, students have diverse learning styles. Some students learn more effectively through practical or visual methods, while others grasp lessons through discussions or direct experiences. Interactive video-based learning with H5P is one effective solution to bridge potential gaps in students' understanding that may arise during conventional learning. Interactive videos combine the strengths of visual, audio, and interactivity to create a more engaging learning experience that can be tailored to students' learning styles. This way, visual learners can see graphs and images, auditory learners can listen to verbal explanations, and kinesthetic learners can participate in interactive activities.

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In remote learning, interactive movies can be put to use to keep students intrigued in what they are learning (Chouhan, 2022). Students can visualize and understand concepts better with interactive videos that help them remember new information (Choe et al., 2019; Ahmad et al., 2021). Interactive multimedia, such as interactive video, can aid information retention and conceptual understanding (Hung et al., 2018; Ku et al., 2019). Students' participation in learning through interactive videos is essential for maintaining information retention and conceptual understanding of the material. This study uses an 8-minute video strategy to maintain engagement and focus when learning with interactivity.

Interactive videos allow students to learn through interactions, such as clicking, zooming in, and playing, meeting the needs of diverse learning styles. Interactive videos in learning help students acquire technology skills and become more familiar with digital tools. Interactive videos can be supplemented with evaluation and feedback features, helping teachers and students assess and evaluate the learning process. Interactive videos provide powerful visualizations and help students understand concepts easily. It is imperative because visualization helps students maintain the idea being learned.

According to Yulianci et al. (2021), interactive videos improve students' learning outcomes and engagement rates and can be used effectively in visual learning styles. Fan and Wang (2020) state that learning styles impact interactive media learning experiences. Various interactive media support students' various types of learning styles. It involves activities that enhance students' learning experiences based on their learning styles. Effective interactive videos consider some students' learning styles (Ovalle et al., 2017). Ensuring students can interact with the instruction and content is critical to their success in learning concepts and understanding lessons.

In their study, Liu et al. (2022) determined the impact of interactive videos on learning outcomes. They found that interactive videos improve students' learning outcomes and affect attention and emotion during learning. Interactive videos positively influence students' engagement rates and help process knowledge understanding (Priyakanth et al., 2021). There is a significant difference in students' performance with interactive video-based teaching in online mode (Chouhan, 2022). Multimedia and interaction in videos make learning more fun and engaging for students; it helps them maintain focus and interest during the learning process (Afify, 2020; Ploetzner, 2022).

Stereoisomers are a concept that involves understanding the spatial arrangement of atoms in molecules. Learning stereoisomers greatly benefits from two-dimensional or three-dimensional illustrations accompanied by sound. Learning styles play a role in how students understand stereoisomers. Preparing interactive videos can help students comprehend and develop their understanding visually, auditorily, and kinesthetically.

Different types of material are presented in interactive videos (Rama Devi et al., 2022). Through visualization and interaction, interactive videos present various materials and help students strengthen their understanding. Kleftodimos and Evangelidis (2016) state that most media player interfaces facilitate a common interactive feature in online videos. These media player buttons or play heads let viewers take a number of different actions, like pausing and restarting the clip from the same point in the video timeline or performing backward and forward leaps. Videos with a basic level of interactivity that allow for non-linear viewing have better learning outcomes than videos without control buttons to stop, rewind, or change speed and, as a result, can only be watched linearly.

Today, video-based learning environments' levels and types of interactivity constantly evolve. Interactive features can be used for a variety of purposes, such as testing student knowledge at a specific point in time (e.g., video quizzes) and making student navigation more efficient (e.g., content from the open web and content from educators) (Kleftodimos & Evangelidis, 2016). Interactive video design requires a material concept mapping design to inform the stages teachers must prepare (Palaigeorgiou et al., 2019). The design must meet the theory of learning and consider cognitive skills. Interactive videos provide a more engaging and enjoyable learning experience, help students understand the material better, and improve information retention. Interactive videos enable students to learn actively through assignments and interactions and help them understand and remember information better. Positive learning experiences positively impact students' information retention (Dietz-Uhler et al., 2007; Leeds et al., 2013). By extending the learning environment, the integration of H5P content into course material gives students the chance to engage in critical thinking about what they are learning while also supporting the flexibility they are demanding (Singleton & Charlton, 2019).

Using H5P interactive videos in education provides an adaptive learning scheme and feedback. Students will progress through the material if they understand the video's explanations from the previous minutes. Students with visual, auditory, or kinesthetic learning styles can repeat the interactive video process to grasp the material better.

As a platform to foster independent learning, H5P is actively involved in the learning process (Llerena-Izquierdo & Zamora-Galindo, 2021; Sinnayah et al., 2021). H5P interactive video is a form of learning video that combines interactive technology with web-based learning technology. H5P interactive video uses the H5P platform, allowing users to create, share, and use interactive learning content such as videos, images, sounds, and games. H5P interactive videos improve students' understanding and learning outcomes by providing a fun, engaging, and motivating learning method. H5P is an open-source platform for creating interactive content such as videos, presentations, quizzes, and more. H5P has many interesting features, including Interactive Videos, Course Presentations, Branching Scenario, Drag and Drop, Dialog Cards, Virtual Tour (360), Image Hotspots, Flashcards, Drag the Words, Timeline, Question Set, Multiple Choice Questions, Fill the Blanks, True or False, Image Sequencing, Arithmetic Quiz, Mark the Words, Dictation, and Essay (https://h5p.org).

Learning styles are individuals' preferences for processing information and integrating knowledge that influences how they learn and complete tasks (Moser & Zumbach, 2018). Visual learning styles involve visualizations and images to understand and remember information, while auditory learning styles prefer using sound and discussion to process information. Individual processes and absorbs different information (Balakrishnan & Gan, 2016). Applying pedagogical design is beneficial in planning and developing learning and improving students' teaching and learning process in online education (Fang et al., 2023).

METHODS

The type of research used is quasi-experimental with a two-group posttest-only design. This experimental research applied H5P-based interactive video learning. This study's subjects were all second-year biology teacher education students at IAIN Sheikh Nurjati Cirebon. The cluster random sampling method selected the research sample as an experimental and control class. The experimental class used interactive video-based learning, and the control class used traditional lecture methods. Research data were collected in two ways. First, the data was obtained with a learning style questionnaire covering three visual, auditory, and kinesthetic categories. The stereochemistry understanding test received both. The collected data were descriptively analyzed to determine the frequency of learning style categories and the level of stereochemistry understanding. The test instruments used as data collectors have met the standards of validity and reliability scores. The validity and reliability calculations yield good results, making them suitable tools for assessing student understanding. The data were analyzed using the two-way ANOVA formula after descriptive analysis. The two-way ANOVA analysis method was used to determine whether there were significant differences between the two groups (experiment-control) and the learning style category on the average scores of several data groups.

RESULTS AND DISCUSSION

As an innovation, H5P interactive videos with stereoisomer materials were successfully integrated into the learning management system. The steps include creating material designs in PowerPoint, doing voiceover, exporting to video, and providing interactive H5P effects in the LMS. The final result of the H5P interactive video is presented in Figure 1.

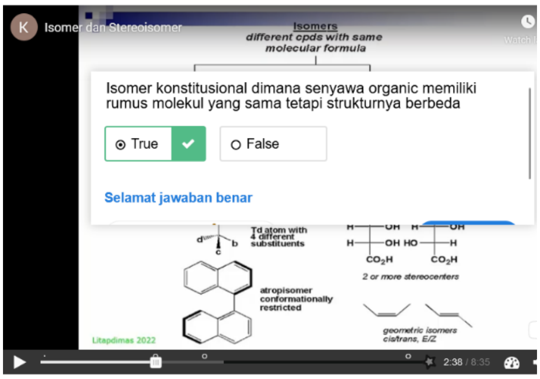

Figure 1. Features Interactive Video from h5p.org

Students engage in e-learning equipped with H5P. In e-learning, four instructional videos are available as teaching materials for students to understand stereoisomers. Students undergo this learning process for two months, equivalent to eight sessions, with comprehension exercises included.

In this stereoisomer video, the H5P features utilized are true-false, multiple choice, single choice, fill-in-the-blank, and crossword. In the video, interactivity is demonstrated by selecting the appropriate moment. Interactive component integration coincides with closing the video's primary idea presentation. The implementation of interactive videos within educational settings has been found to significantly impact student satisfaction, thereby enhancing the overall learning experience (Kamran Mir et al., 2022).

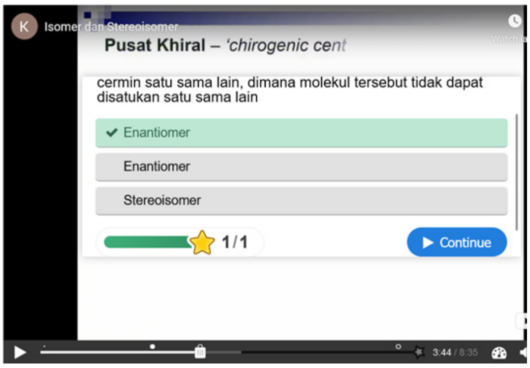

Figure 2. H5P Single Choice Features

Each interactive feature has specific settings such as feedback, repeat answers, clues, answer duration, and auto-correct. This study uses the settings of the auto-correct and feedback features to support stereoisomer concept understanding. Some settings can be adapted to learning characteristics and objectives. The H5P has useful interactive features for maintaining the retention and concentration of information, creating new learning experiences. Mutawa et al. (2023) found that students may benefit from a more pleasurable and successful learning experience thanks to the interactive and engaging character of H5Ps, which can also keep them interested and motivated throughout their studies.

Students' learning styles are grouped based on the questionnaire scores prepared in advance. The questionnaire was designed using Google Forms and distributed to the research population. Students filled out statements that indicated their learning habits. The questionnaire questions are arranged based on the characteristics of the three learning styles: auditory, visual, and kinesthetic. The collected questionnaires were calculated and searched for the average score. The results of stereoisomer understanding in both groups are presented in Table 1.

Table 1. Description of Students' Stereoisomer Understanding by Group and Learning Style

	Visual	Auditory	Kinesthetic
Mean	77,9	74,5	72
Std. Dev	1,911	2,139	2,828

The average result of stereochemistry understanding of each learning style has differences, although they are not too significant (Table 1). The kinesthetic learning style is the last in average knowledge after visual and auditory. Figure 3 shows more information about the frequency of students' learning styles. The process of categorizing students' learning patterns into three learning styles is used to calculate the frequency of learning styles.

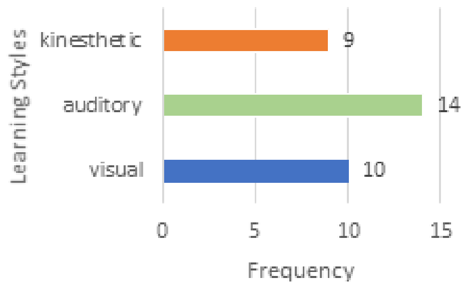

Figure 3. Description of Students' Stereoisomer Understanding by Group and Learning Style

The distribution of learning style questionnaires in the experimental class yielded a variety of learning styles. The analysis of learning styles in this study shows that the scores are not the same, indicating that students in the experimental group have different ways of learning. Further investigation revealed that visual learning styles have the highest frequency. At the same time, audio and kinesthetic learning styles are comparable. In other words, students in experimental classes enjoy learning while observing a study object.

The results of comparing the extent to which students' stereoisomer understanding differ based on groups and learning styles. Three categories of learning styles are visual, auditory, and kinesthetic. Bidirectional variance analysis (ANOVA) in SPSS is used to process and measure comparisons of comprehension results. Table 2 displays the output results of the SPSS calculation.

Table 2 states the results of the calculation of the two-way ANOVA analysis in determining the interaction between variables in this study. The effects of the estimate show differences in students' understanding based on the use of H5P-based interactive videos (sig. 0.000 < 0.05). In other tests, it was found that there were differences in students' understanding based on learning styles (sig. 0.000 < 0.05). The final analysis showed no interaction of using H5P-based interactive video with learning styles in determining students' stereoisomer understanding (0.430 > 0.05). There is no interconnected interaction between using H5P-based interactive video and learning styles on students' stereoisomer understanding.

Table 2. Tests of Between-Subjects Effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	6666.567[a]	5	1333.313	429.546	.000
Intercept	234282.191	1	234282.191	75477.437	.000
Video interactive	5917.049	1	5917.049	1906.264	.000
Learning_Style	236.158	2	118.079	38.041	.000
Video interactive * Learning_Style	5.319	2	2.659	.857	.430
Error	167.616	54	3.104		
Total	258647.000	60			
Corrected Total	6834.183	59			

This study employs learning through interactive videos created with H5P and integrated into the LMS. Before learning, stereoisomer learning videos were created, and students completed a learning style questionnaire to determine the mapping of learning styles. H5P in LMS was used to combine video learning with interactive features. Students can effectively use the H5P-based interactive video application.

Table 1 shows the mapping of stereochemistry understanding. Visual learners better understand auditory and kinesthetic learning styles. H5P-based interactive video learning offers visual learners much stereoisomer concept stimulation. Visual learning styles usually involve understanding through visual experiences, such as viewing images, maps, diagrams, or slide presentations. Students with visual learning styles tend to remember visually presented information better than verbally (Švarcová & Jelínková, 2016; Hassan et al., 2021). Students can better understand and remember the information presented to facilitate learning by referring to visual learning styles.

Students with auditory learning styles can understand and remember information through listening. They prefer to follow conversations, group discussions, and teaching materials complemented by sound and music. An effective way to help students with auditory learning styles is to use audio teaching materials, group discussions, and presentations in a clear and engaging voice. Students can also benefit from audio-based assignments and exercises, such as listening to voice recordings and answering questions.

Interactive videos visually represent the material to be taught, helping students better visualize and understand new concepts. Anderson et al. (2017) shows that visual representation has a more substantial effect on improving information retention than verbal representation alone. Visuals help remember memories longer and more easily (Riccomini et al., 2022).

Learning with interactive videos can help find important information and constructive learning experiences (Palaigeorgiou et al., 2019; Seo et al., 2021). The physical components featured in the interactive video provide a conceptual direction for gathering information, thus creating a productive learning experience. The text and concrete objects presented in the video give a stimulus to carry out constructions with prior knowledge and confirm understanding of the interactive features of H5P. Applying H5P in courses shows a correlation between student responses and performance to show development success (Chilukuri, 2020).

Students have various types of responses and are enthusiastic about participating in learning using interactive H5P-based videos. Learning with interactive videos can improve information retention and enhance student learning outcomes (Hung et al., 2018; Smithwick et al., 2018; Kuhail & Aqel, 2020). Interactive videos can improve information retention by providing students with a different and fun learning experience. Interactive videos allow students to interact with the subject by following instructions. It helps strengthen the connection between new and existing information, making it easier to remember. Therefore, interactive videos can help students improve their information retention and enhance learning outcomes. H5P can improve knowledge retention and learning focus through interactive video elements (Unsworth & Posner, 2022).

Ahmet et al. (2018) examines the extent to which students can comprehend course material when presented either through interactive videos or through more traditional teaching methods. Compared to students who learn through more conventional means, the outcomes for students who learn through interactive videos are significantly more favorable.

In interactive videos, students can interact with the material using multiple-choice, drag-and-drop, and question-answer options. These interactions help to strengthen conceptual connections and facilitate information storage in long-term memory (Pang et al., 2019). Students can also control the speed and replay of the material in interactive videos, which helps to reduce confusion and strengthen comprehension (Biard et al., 2018; Botelho et al., 2019). Students' autonomy is enhanced by interactive video, which allows them to control the flow and speed of learning. It makes them feel more competent by increasing understanding and decreasing confusion. Interactive videos can also help students connect by allowing them to interact and collaborate with the material and their classmates.

The study found that the stereoisomer understanding of kinesthetic styles was lacking. Kinesthetic learning styles can be used in online learning by incorporating a high level of interactivity. Trilaksono and Santoso (2017) created a learning design for kinesthetic learning styles, including digital content for experimentation. Furthermore, for kinesthetic learning styles, collaborative project designs, such as forums and learning materials, will have less text and more images or videos with embedded links to external sources.

The kinesthetic learning style emphasizes physical activity and movement. This learning style requires active participation and interaction with the surrounding environment. Meanwhile, video-based learning only provides static visuals and audio, so it does not provide space for students to interact and move. Kinesthetic learning styles require practical activities and trials. Learning styles affect the assessment of learning and understanding of information, and visual learning styles positively impact the performance of visual information. In contrast, kinesthetic learning styles positively impact understanding verbal information (Knoll et al., 2017; Mou et al., 2022).

Because auditory learning styles emphasize understanding through hearing, video-based learning is sometimes appropriate for them. This learning style requires clear and structured verbal information and instruction. Video can provide verbal information and instruction visually and in audio, thus helping students understand the material well. Interactive videos offer visualizations and demonstrations of the concepts learned, making the material easier to understand and facilitating conceptual understanding.

Besides that, the video also gives visual examples that help students understand the concept and principle described. Videos also present material with many corner views and help students understand the material better. However, video-based learning must also be combined with other activities, like discussion, asking for answers, and assignments, to help students understand the material better. Video-based learning cannot become the only source of information for students with auditory learning styles. The time duration and number of H5P questions show significant differences (Dinc & Millet, 2022). Teachers can see this frequency and time via the H5P technical report menu.

Alternatively, interactive video-based learning can be combined with practical activities to meet the needs of kinesthetic learning styles. For example, after watching videos, students can be given assignments to do experimental or simulation activities to understand the material better. Nevertheless, video-based learning can still benefit students with kinesthetic learning styles, primarily if the video features activities and demonstrations requiring movements and physical interaction, such as demonstration videos of how to do things or learning activities requiring training and physical interaction. Thus, video-based learning is not entirely unsuitable for kinesthetic learning styles but must be combined with practical exercises and material interactions to meet the needs of those learning styles.

The design of H5P-based interactive video requires considerations for use, such as internet availability and respondents' proficiency in using handphones or laptops. Creating interactive activities with H5P should be based on carefully analyzing learning goals and objectives, interactivity concepts, and appropriate media use (Sonia et al., 2018). Students become more motivated to learn online using H5P features and activities compared to traditional online activities (Wicaksono et al., 2021; Gil-García et al., 2023).

Interactive videos can facilitate the learning process by providing interactive learning experiences and helping students to understand concepts contextually. In conclusion, interactive videos have great potential to offer a new learning experience for students by collaborating on the idea of giving material into interactive videos. Interactive videos are a valuable and effective tool for improving students' learning. Therefore, the development and use of interactive videos in learning are expected to continue to be improved.

Students who participate in interactive video-based learning understand stereoisomers better and are more enthusiastic than students who participate in traditional learning. Although the stereoisomer understanding learning outcomes are no higher than 80, a more appealing video design is required.

We want to utilize additional features in learning situations for future professionals and include them into learning analytics research. Learner behavior and interactions regarding this feature are also not well understood. By examining video activity data, it is also possible to look into how these features affect the learning process. Observation sheets are indispensable to supporting research analysis.

CONCLUSION

Video-based learning eliminates students' interaction during learning, so developing one of the H5P-based interactive videos is necessary. The results reveal differences in stereoisomer understanding based on applying H5P-based interactive videos and learning style categories. Simultaneously, no interactive video interaction was based on H5P and learning style categories on understanding stereoisomers. Applying H5P-based interactive video helps the learning experience so that the information conveyed can be remembered longer due to visualization and audio through the video. The average results of stereoisomer understanding of each learning style still need to be improved by increasing retention by designing various interactive H5P features to be more on-target.

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