JPPIPA 11(5) (2025)

Jurnal Penelitian Pendidikan IPA

http://jppipa.unram.ac.id/index.php/jppipa/index

Development of Intertextual-Based Learning Videos on the Concept of the Influence of Changes in Concentration on Shifts in Equilibrium

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Received: February 07, 2025
Revised: April 03, 2025
Accepted: May 25, 2025
Published: May 31, 2025

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DOI: 10.29303/jppipa.v11i5.11018

Abstract: This research aims to produce an intertextual-based learning video on the concept of the effect of concentration on shifting equilibrium. This research uses the development research method (R&D) with the ADDIE development model (Analysis, Design, Development, Implementation, and Evaluation). The resulting product is an animated video in the form of mp4 which contains the concept of the effect of concentration on shifting equilibrium. Based on the assessment of product quality by content experts obtained a percentage of 85.71% with a very good category (VG); from the pedagogy expert assessment obtained a percentage of 90.27% with a very good category (VG); from the media expert assessment obtained a percentage of 95.60% with a very good category (VG). The video was implemented by limited testing to high school students in class XI as many as 34 students, and chemistry teachers using questionnaires, and according to the assessment of high school chemistry teachers obtained a percentage of 97.40% in the very good category (VG). This product received a positive response from students with a percentage of 90%. Based on the feedback received from experts, teachers and student responses, this learning video was revised so that it can be used as an alternative media for the chemistry learning process in the classroom.

Keywords: Affect chemical equilibrium; Changes in concentration; Intertextual; Research development

Introduction

Chemistry is one of the branches of science that is important for students to learn in order to understand the various phenomena that occur around them. Chemistry can be viewed as a process and a product. As a process, chemistry can be interpreted as a scientific activity to perfect knowledge or discover new knowledge, while as a product, chemistry is interpreted as the result of a process in the form of facts, concepts, principles, and laws and theories discovered by chemical scientists. Chemistry is often called a difficult subject by students because of its abstract nature which includes macroscopic, symbolic, and microscopic levels (Wu, 2003). The difficulties experienced by students in learning chemical concepts can lead to misconceptions. One of the concepts in the concept of chemical material is the effect of changes in concentration on shifts in equilibrium. Based on research by Ganasen & Shamuganathan (2017), Jusniar et al. (2020), and Permatasari et al. (2022) found that students have misconceptions about one of the chemical concepts, namely the wrong basic concept related to the effect of changes in concentration on equilibrium shifts, increasing reactant concentrations or reducing product concentrations has no effect on equilibrium shifts. This misconception is caused because students have difficulty understanding submicroscopic and symbolic

How to Cite:
Nisrina, P., Wiji, W., & Widhiyanti, T. Development of Intertextual-Based Learning Videos on the Concept of the Influence of Changes in Concentration on Shifts in Equilibrium. *Jurnal Penelitian Pendidikan IPA*, *11*(5), 190-201. https://doi.org/10.29303/jppipa.v11i5.11018

representations, because these representations are abstract and cannot be experienced, this can trigger difficulties in constructing students' understanding and meaning of concepts related to the effect of changes in concentration on equilibrium shifts so that students' understanding is not complete (Irby et al., 2018).

Incomplete understanding indicates difficulties in learning the concept of equilibrium shifts caused by students' inability to link the three levels of chemical representation (Johnstone, 1991; Akaygun & Adadan, 2021). According to Johnstone (2006), a triplet chemistry pioneer, the characteristics of chemistry are shown by the level of chemical representation consisting of three levels, namely macroscopic, sub-microscopic, and symbolic levels. The macroscopic level involves observable and real phenomena such as observing rust on iron nails; the symbolic level includes symbols, graphs, and mathematical formulas, such as writing balanced chemical reactions; the submicroscopic level involves the structure and processes of particles (atoms, ions, molecules, etc.) such as the interaction between zinc atoms and copper ions in a solution (Wang et al., 2022). When studying chemistry, students must be able to connect the three levels so that they can understand the process conceptually. According to Wardani et al. (2018), Nicolaou et al. (2021), Naimah (2022), and Ulu-Aslan & Baş (2023) the idea of intertextuality can be used to connect macroscopic, submicroscopic, and symbolic representations in chemistry learning. One way to connect the three levels of representation is to use multimedia tools (eg, video, animation, and simulation) that have strong potential to enhance understanding in submicroscopic and symbolic representations. Further research by Abdulrahaman et al. (2020), shows that multimedia tools can be very effective in introducing links between the three levels of representation.

One of the multimedia tools that can be chosen is a combination of visual media and audio media that can be seen and heard. Media that is auditory and visual makes this media said to be complete and optimal in its presentation. One of the media that displays real audio-visual is video media (Ayuni & Paramita, 2024). Several research results have shown the positive impact of using videos in learning. The positive impact of learning videos, because of the ability to pause, speed up and slow down, and repeat parts of the video, students can learn at a comfortable pace and can review the material on demand if needed. This is very helpful for students who have language difficulties (Gross & Pawlak, 2020). The use of videos as a complement to learning, and more facilitating students in class, because the learning styles of students in the current generation are different. In developing intertextual-based learning video products as a chemistry learning medium, several important aspects need to be considered such as content aspects, pedagogical aspects, and media aspects. The content aspect in the learning video products developed is based on three levels of representation. The pedagogical aspect in the learning video products developed uses constructivism theory and learning principles. Constructivism theory was developed by Piaget under the name individual cognitive constructivist theory and Vygotsky in his theory called socialcultural constructivist theory (Mensah, 2015).

According to the constructivist paradigm, it is also stated that learning prioritizes problem solving, developing concepts, social construction and algorithms rather than memorizing procedures and using them to obtain one correct answer (Gonda et al., 2022). In addition to the constructivist theory, learning principles according to Darling-Hammond et al. (2020), also include the learning process is complex but organized, learning takes place from the simple to the complex, learning from the factual to the conceptual, learning from the concrete to the abstract. Media aspects in learning video products developed based on Mayer's multimedia principles. The principles in multimedia development according to Mayer (2017), include the coherence principle, signaling principle, redundancy principle, spatial contiguity principle, temporal contiguity principle, segmenting principle, pre-training principle, modality principle, multimedia principle, personalization principle, voice principle, embodiment principle. From the results of the analysis of existing media conducted on several learning videos related to the concept of the influence of changes in concentration on shifts in equilibrium, it was found that these learning videos had several shortcomings in terms of presenting the level of representation, delivering material pedagogically, and multimedia aspects as reviewed from Mayer's multimedia principles.

The link between content aspects, pedagogical aspects, and media aspects in this study is called intertextual. Intertextual is seen as the main process in constructing the meaning of an unknown text (Martín-Rodríguez, 2023). The meaning of the text in this case is defined as a functional language that can be spoken or written and even expressed in other media (Khurana et al., 2023). Based on this explanation, a learning video is needed that pays attention to aspects of material content, aspects of learning pedagogy, and aspects of learning multimedia which are then referred to in this study as intertextual so that difficulties in the concept of the influence of changes in concentration on shifts in equilibrium can be avoided. Based on this, the researcher intends to conduct a study entitled "Development of Intertextual-based Learning Videos on the Concept of the Influence of Changes in Concentration on Shifts in Equilibrium".

Method

This study uses the research and development (R&D) method. Research and development (R&D) was chosen because this research method is a scientific way to research, design, produce, and test the validity of the products that have been produced (Adeoye et al., 2024). The development model used is ADDIE development which consists of five stages (Analysis, Design, Development, Implementation, and Evaluation). The analysis stage is used to determine and collect what is needed for development. This stage consists of five steps. First, determine the learning outcomes in the Merdeka curriculum. The material created and developed is the effect of concentration on equilibrium shifts. Second, formulate the Learning Objective Flow (ATP) and concept labels. Third, concept analysis based on the level of chemical representation from various General Chemistry textbooks. Fourth, concept analysis based on misconceptions and student learning difficulties from various research journals. Fifth, analysis of existing videos from various sources based on content aspects, pedagogical aspects, media aspects.

This design stage is carried out to create a learning video design. The design stage consists of three steps. First, determine the level of chemical representation. The level of chemical representation is based on the results of the concept analysis in the General Chemistry textbook. The second stage is making the initial design of the learning video product. The initial design includes making a script and storyboard in the form of a design for integrating the three levels of chemical representation into the learning video product. Third, making the instrument is done by making a product quality instrument and testing the product's implementation.

The development stage functions to produce the final format of the learning video. The development stage consists of four steps. First, making an initial product design. The initial product design is in the form of making components that will compose the learning video product that has been determined at the chemical representation level. These components are demonstration videos, animations, and reaction equation titles. Second, developing learning video products. Developing learning video products by combining components that have been prepared such as demonstration videos, animations, and chemical equation titles into a video format. Third, is expert validation. Validation is carried out by content experts, pedagogy experts and media experts. Validation of products developed by experts is intended to obtain suggestions and input. Fourth is revision. Products that have been validated and asked for suggestions from peer reviewers are then revised according to input and suggestions before being assessed by chemistry teachers and responded to by students.

The implementation stage is carried out by implementing learning videos in the classroom. The application of learning videos through limited field tests conducted on three chemistry teachers and responded to by 34 students.

The evaluation stage is carried out by product research. Product assessment is carried out through limited field tests on three chemistry teachers and responded to by 34 students. The results of the limited test serve to improve the product. The subjects of the study were grade XI MIPA students at one of the SMANs in the city of Bandung. The results of the limited test serve to improve the product.

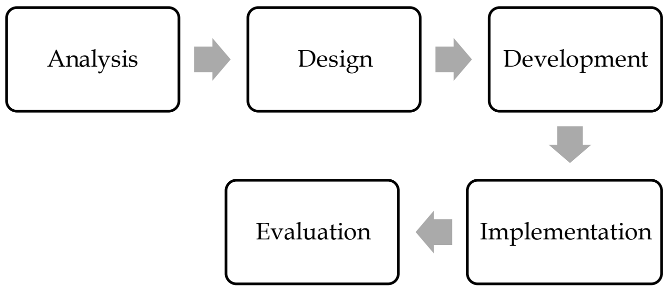

Figure 1. The process of ADDIE

The subjects of the study were grade XI MIPA students at one of the SMANs in the city of Bandung. The product validation data in the form of input from peer reviewers of content experts, pedagogical experts, and media experts, in the form of qualitative data. The qualitative data is then converted into quantitative data based on the Likert scale. The scoring rules on the Likert scale can be seen in Table 1.

Table 1. The rules of scoring

Description	Score
VG (Very Good)	4
G (Good)	3
P (Poor)	2
VP (Very Poor)	1

Next, the validation score is calculated using the following equation:

$$\overline{X} = \frac{\Sigma x}{n} \quad (1)$$

Description:
$\overline{X}$ = Average score
Σx = Total score from each assessor
n = Number of assessors

Table 2. The assessment criteria

Range of Score (i) Quantitative	Value	Qualitative Category
$\mathbf{X \geq \bar{X}i + 1.SBx}$	A	VG (Very Good)
$\mathbf{\bar{X} < +1.SBx > X \geq \bar{X}i}$	B	G (Good)
$\mathbf{\bar{X}i > X \geq \bar{X}i - 1.SBx}$	C	P (Poor)
$\mathbf{X < \bar{X}i - 1.SBx}$	D	VP (Very Poor

Description:
X = Score achieved
X̄i = Average ideal score (1⁄2 (ideal maximum score + Ideal minimum score)
SBx = Ideal standard deviation (1⁄6 (ideal maximum score - ideal minimum score)
Ideal maximum score = criterion item × highest score
Ideal minimum score = criterion item × lowest score

Next, the score aspect is modified by using a four-point scale assessment criterias. The reference for changing the score to a four-point scale is as follows in Table 2.

Teacher and student response data are converted into quantitative data using the Guttman scale. The Guttman scale is a scale used to obtain firm answers from respondents (Box et al., 2017; Pradiko et al., 2021). On the Guttman scale, there are only two intervals used in the teacher and student response questionnaires, namely "Yes-No". The determination of the Guttman scale can be seen in Table 3.

Table 3. Guttman scale determination rules

Description	Score
Yes	1
No	0

After that, the percentage of the ideal product and each aspect as a whole is calculated using the equation:

$$\text{Ideal Percentage} = \frac{\text{Achieved score}}{\text{Ideal maximum score}} \times 100\% \quad (2)$$

Result and Discussion

The media chosen in this development research is intertextual-based learning videos. Intertextuality is chosen because it is seen as the main process in building the meaning of unknown texts. The meaning of the text in this case is defined as a functional language that can be spoken or written and even expressed in other media. From this point of view, the text intended in the learning video is based on three aspects, namely the content aspect, the pedagogical aspect, and the media aspect. The content aspect is based on three levels of representation according to Johnstone (2006), the pedagogical aspect is based on the constructivist paradigm and learning principles according to Darling-Hammond et al. (2020), and the media aspect is based on the multimedia principle according to Mayer (2017). The approach used in this study is ADDIE.

Analysis Stage

The definition stage consists of 4 stages, namely formulating learning objectives, concept analysis, misconception analysis, existing video analysis. The first stage of formulating learning objectives is carried out by determining the learning outcomes in the Merdeka curriculum, then formulating the Flow of Learning Objectives (ATP) and concept labels.

The second stage after knowing the topic to be discussed, the concept analysis of the three levels of chemical representation, namely the macroscopic, sub-microscopic, and symbolic levels on the concept of the effect of concentration changes on equilibrium shifts in five General Chemistry textbooks, namely from Chang (2010), McMurry & Fay (2012), Whitten et al. (2014), Silberberg (2021), and Brown et al. 2022). In some concept analysis found for the macroscopic level in the form of factual such as stalactite and stalagmite rocks, in which there is a symbolic level in the form of chemical equations by showing the process of formation of stalactite and stalagmite rocks (Hamerská et al., 2024). In addition, a macroscopic level was found as a result of changes in the color of the solution in the test tube when concentration was added, there was also a submiscopic level by showing the number of molecules contained in the solution when before and concentration was added, and there was a symbolic level showing the chemical equation that occurred when the solution before and concentration was added.

The third stage to minimize the misconceptions that occur on this topic, an analysis of misconceptions and student difficulties from three research journals on the concept of the effect of concentration changes on equilibrium shifts, namely Ganasen & Shamuganathan (2017), Jusniar et al. (2020), and Permatasari et al. (2022) was carried out. The misconceptions found are when students think when adding reactant concentration or reducing product concentration will stop the equilibrium reaction, it is also found when the product concentration will continue to increase when equilibrium is reached and the addition of product concentration will only change the concentration of reactants, and it is also found when adding reactant concentration will increase the concentration of reactants and product concentration will decrease.

The fourth stage also analyzed existing videos on the concept of the effect of concentration changes on equilibrium shifts based on content aspects, pedagogical aspects, media aspects. From the results of the analysis of existing media conducted on several learning videos related to the concept of the effect of changes in concentration on shifting equilibrium, it was found that these learning videos had several shortcomings in terms of presenting the three levels of representation in the content aspect, it was found that some videos only presented one of the three levels of representation, Some videos only present one of the three levels of representation, such as only presenting the macroscopic level, which is factual, while the submicroscopic level which includes the movement of the molecules contained therein, and the symbolic level which includes chemical equations are not included in the video, while there are videos that only include the symbolic level, without the macroscopic level and submicroscopic level. Some videos found that the delivery of material in pedagogical aspects is not considered, where the concepts presented are not in accordance with the principles of learning, such as learning does not start from factual concepts to conceptual concepts, there are videos that directly explain concepts without any factual such as images or practicums presented, this will affect students' lack of understanding of the information constructed after watching the video. Then some videos do not pay attention to multimedia aspects that are reviewed from Mayer's multimedia principles. One of them does not pay attention to the principle of temporal contiguity, namely students can learn better if words and related images or animations are presented simultaneously (stimulant) rather than alternately (successive), there are videos that are still out of sync between words and images, this causes confusion for the audience. Of the three aspects above, all videos still do not pay attention to the link between aspects of content, aspects of pedagogy, and aspects of media in this study called intertextual.

Design Stage

The design stage was conducted to design an intertextual-based learning video. The design stage consisted of three steps. The first step was to select the level of chemical representation. This selection was made based on the results of the analysis of three levels of representation in five General Chemistry textbooks. The result of the selection of the three levels of representation is to create a script that is easy to understand when developed into a learning video.

The second stage is making the initial design of the learning video product. The initial design includes making a script and storyboard in the form of a design for integrating the three levels of chemical representation into the learning video product.

The third stage, making the instrument. The instrument is made by making a questionnaire in the form of a Likert scale and a student response sheet in the form of a Guttman scale. The questionnaire contains several aspects that will be assessed by expert lecturers and teachers. While the student's response is only in the form of a statement that will be answered by the student with a yes or no answer. The instrument that has been made is first consulted with the supervisor.

Development Stage

The development stage functions to produce the final format of the learning video. The development stage consists of four steps, namely, making an initial product design, developing a learning video product, validation, revision. The initial product design is in the form of making components that will compose the learning video product that has been determined at the chemical representation level. These components are demonstration videos, animations, and reaction equation titles. These components are made based on the script and storyboard that have been made. The making of the demonstration video is done through the filming process. The animation and reaction equation title were created using Canva software.

After creating components for the video, the next step is to combine the components that have been arranged such as demonstration videos, animations, and chemical equation titles into a video format. To combine the demonstration videos, animations, and titles, editing is done using Capcut software. To add text to the learning video product, Canva software is used. In this editing process, users can add sound, music, cut videos, and so on. Sound editing is done using the BandLab application so that the resulting sound has good quality. The resulting learning video can be accessed using a laptop and mobile phone.

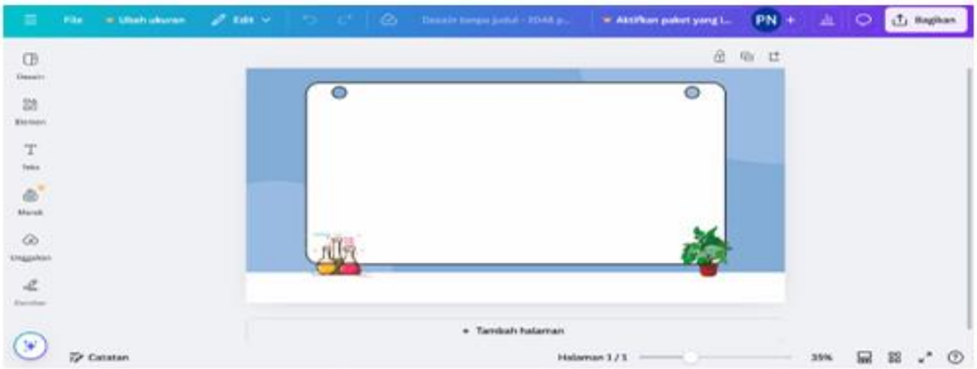

Figure 2. The process of creating video components in Canva

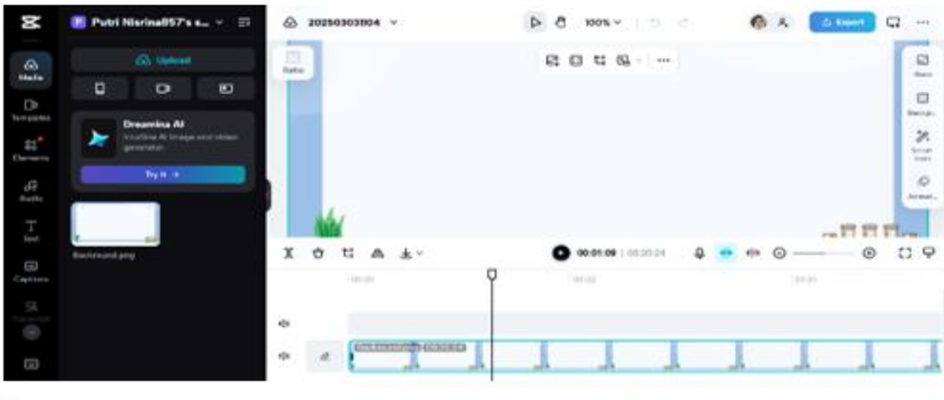

Figure 3. Video editing process using Capcut

Figure 4. Sound editing by BandLab

The final product includes six videos with a duration of 15 minutes each. The opening section consists of the title, author's name, appreciation, and the phenomenon in the context for motivation. The content section includes practical work, practical observations, practical discussion and conclusions. The closing section provides a discussion of the phenomena in the context presented in the introduction.

Figure 5. Opening section of the video

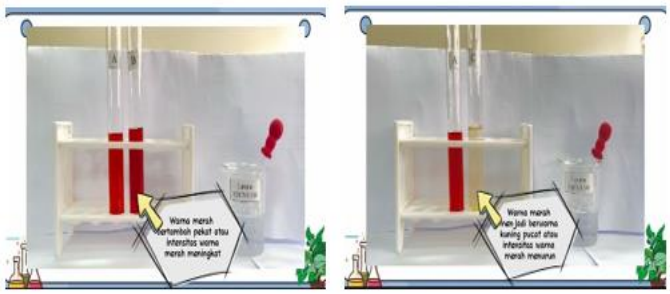

Figure 6. Video content section

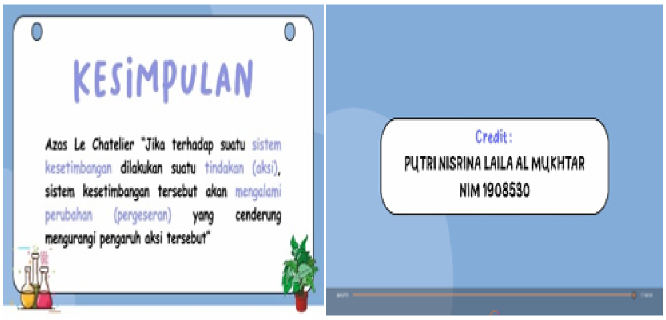

Figure 7. The closing part of the video

After the product is finished, the product is then validated by experts. The experts are content experts, pedagogical experts, and media experts. Content experts play a role in validating the media in terms of conceptual truth, suitability of the representation level, and linkage of the representation level. The media feasibility test was carried out by content experts from the Indonesian Education University. based on the results of the analysis of the quality assessment of intertextual-based learning videos. This can be seen in Table 4.

Table 4. Results of the analysis of the quality of intertextual-based learning videos according to content experts

Assessment Aspect	Ideal Percentage (%)	Category
Conceptual correctness	89.30	VG
Representation level suitability	83.46	VG
Representation level linkage	82.28	VG

Overall, the results of the intertextual-based learning video assessment have a total score of 24 with an ideal percentage of 85.71%. Based on the assessment criteria by media expert lecturers, the total score/score achieved shows that (X) = 24 is in the range of X ≥ 21 and is included in the very good category (VG).

Pedagogical experts play a role in validating the media in terms of cognitive, constructive, and misconceptions. On cognitive criteria, the content in the developed learning video is in accordance with the principles of learning. On constructive criteria, overall the learning videos developed can provide freedom to the audience to build their own knowledge on each concept, this is in accordance with constructivism learning theory. On the misconception criteria, the content contained in the developed learning video does not contain misconceptions that have been found in the misconception analysis. The media feasibility test was conducted by pedagogy experts from the University of Education Indonesia. based on the results of the analysis of the quality assessment of intertextual-based learning videos. This can be seen in Table 5.

Table 5. Results of the analysis of the quality of intertextual-based learning videos according to pedagogical experts

Assessment Aspect	Ideal Percentage (%)	Category
Cognitive	91.70	VG
Constructive	83.30	VG
Misconception	88.34	VG

Overall, the results of the intertextual-based learning video assessment have a total score of 46 with an ideal percentage of 90.27%. Based on the assessment criteria by expert lecturers in pedagogy, the total score/score achieved shows that (X) = 46 is in the range of X ≥ 36 and is included in the very good category (VG).

Media experts play a role in validating media in terms of multimedia principles according to Çeken & Taşkın (2022), audio-visual displays, readability. The media feasibility test was carried out by content experts from the Indonesian Education University. based on the results of the analysis of the quality assessment of intertextual-based learning videos. This can be seen in Table 6.

Table 6. Results of the analysis of the quality of intertextual-based learning videos according to media experts

Assessment Aspect	Ideal Percentage (%)	Category
Multimedia Principles	93.75	VG
Audio-visual display	100	VG
Readability	100	VG

Overall, the assessment results of intertextual-based learning videos have a total score of 65 with an ideal percentage of 95.60%. Based on the assessment criteria by media expert lecturers, the total score/score achieved shows that (X) = 65 is in the range of X ≥ 51 and is included in the very good category (VG). Based on the validation results by content experts, pedagogy experts and media experts above, the average validator assessment shows very good results. This shows that the quality of intertextual-based learning videos as a good learning medium and is suitable for use by target users, namely students. However, there are several comments and suggestions from the validator to be revised so that the product developed in the form of intertextual-based learning videos becomes a better product.

The product revision carried out on the content aspect, namely in the section on the phenomenon of explaining stalactite and stalagmite rocks, there should be pictures of stalactite and stalagmite rocks so that the level of representation is interlinked between the pictures and explanations on stalactite and stalagmite rocks. And in the discussion section, especially the submicroscopic section that displays the number of Fe^{3+} ions, SCN^- ions and $FeSCN^{2+}$ ions after the SCN^- ion concentration is added or reduced, it is better to display the microscopic section, namely the image of the test tube from the practicum so that the representation levels are interconnected.

The product revision carried out in the pedagogical aspect is from a constructive perspective, in the practicum section before explaining the species contained in the $Fe(SCN)_3$ solution. First, explain the ionization of the 0.1M $FeCl_3$ solution and the dissociation of the 0.1M KSCN solution. So that students know the origin of the Fe^{3+} ions and SCN^- ions contained in the $Fe(SCN)_3$ solution.

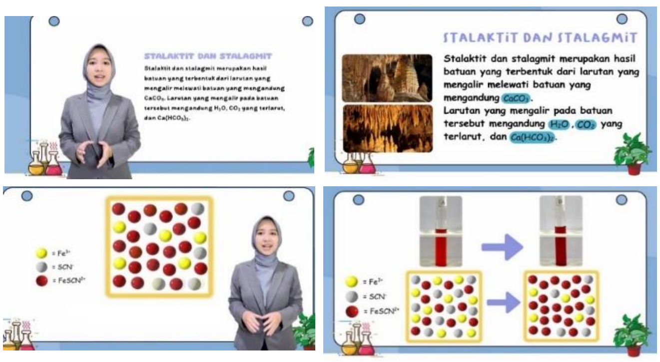

Figure 8. Video section before repair (right) and after repair (left)

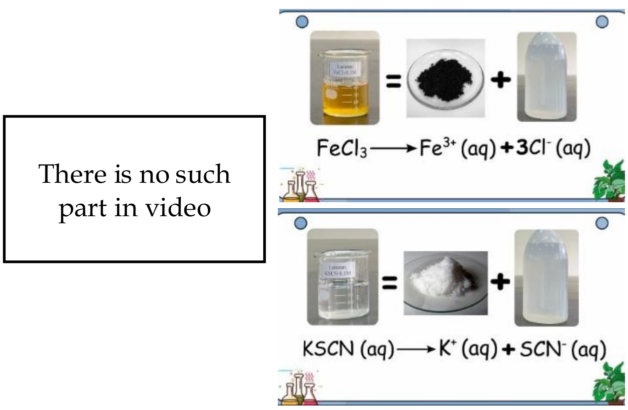

Figure 9. Video section before repair (right) and after repair (left)

The product revision carried out in the media aspect is in the learning video developed using human gestures and movements on the screen, this is in accordance with Mayer's multimedia principles. According to Mayer's principle of form, it states that students can learn better when the screen uses human gestures and movements. Seeing someone explaining is the main thing of social connection in learning where students participate in learning with the instructor, leading to deeper learning (Huang & Lajoie, 2023; Ribosa & Duran, 2023). However, there is a suggestion from Mayer's multimedia principle, if the screen is too full of text, there should be no human movement, so that students' focus is not divided.

Implementation Stage

At the implementation stage, the validated and revised intertextual-based learning video based on comments and suggestions from experts was then implemented to chemistry teachers to determine its practicality and students to determine their responses. The role of the teacher is to assess the media from the content, application of learning principles, the role of learning videos to explain material concepts, clarity of narration, and clarity of writing, images, animations in the learning video (Sari et al., 2024). Teacher responses were obtained through three high school chemistry teachers at one of the state high schools in Bandung City. Meanwhile, the role of students is to assess the media in terms of motivation, understanding of concepts, activeness, and appearance in the learning video. Student responses were obtained through class XI students of one of the state high schools in Bandung City.

Evaluation Stage

The evaluation stage is carried out by product assessment. Product assessment was carried out by three high school chemistry teachers at one of the state high schools in Bandung City. The following are the results of the analysis of the quality assessment of intertextual-based learning videos according to high school chemistry teachers.

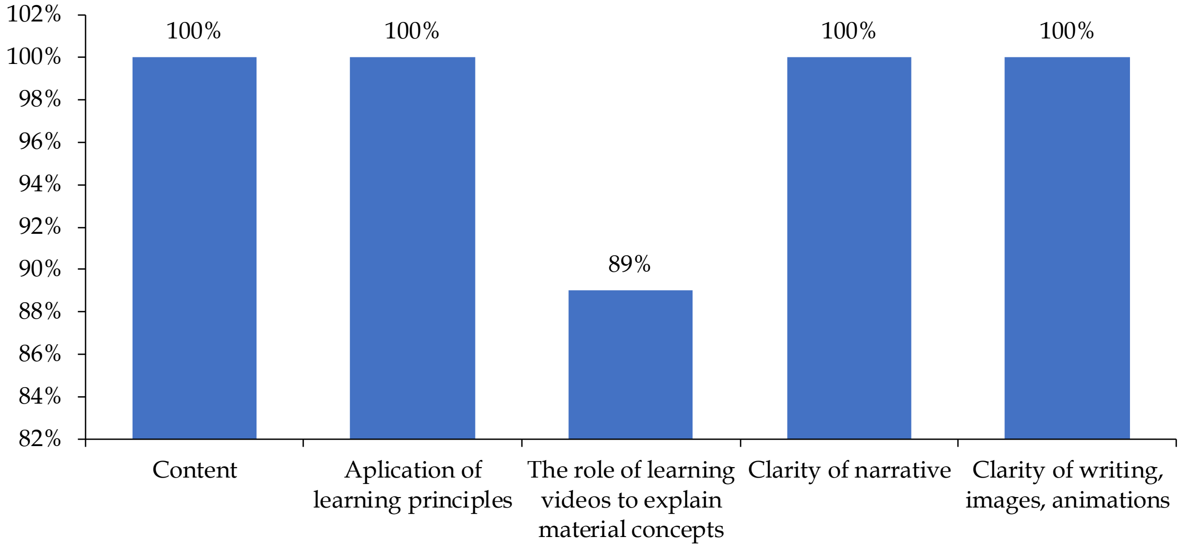

Figure 10. High school chemistry teacher assessment data

Overall, based on the assessment conducted by the chemistry teacher, this product obtained an average score of 25.33 with an ideal percentage of 97.40%. Based on the assessment criteria by the chemistry teacher, the average score = 25.33 is in the range X ≥ 17.33 and is included in the very good (VG) category. Furthermore, the product assessment was carried out by 34 students of class XI at one of the State Senior High Schools in Bandung City. The following is data on student responses to intertextual-based learning videos.

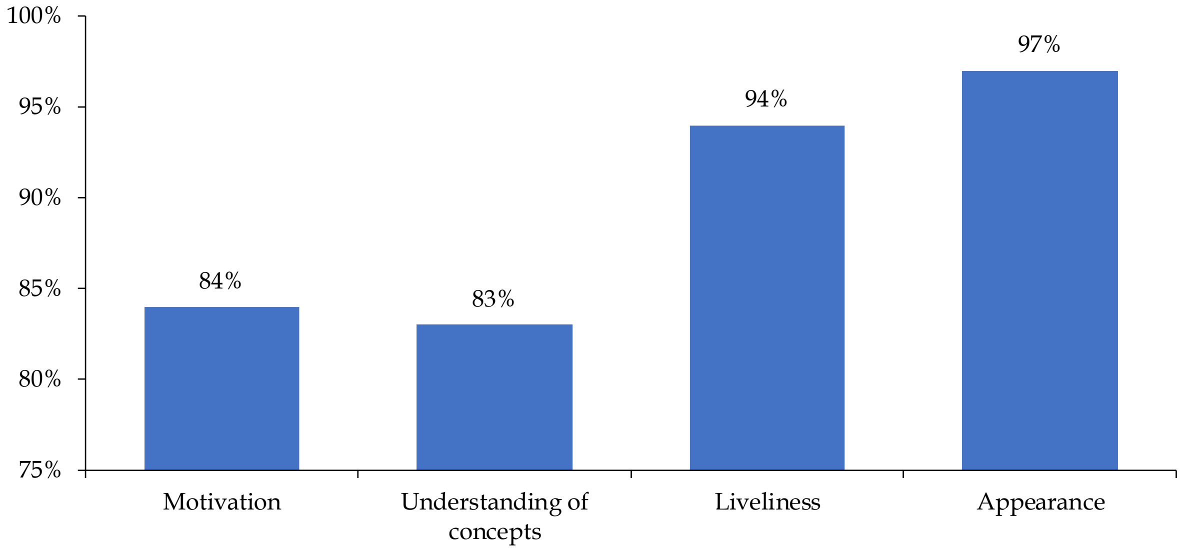

Figure 11. Student response data

The responses generated through 34 students were 90% with a score of 14.41 out of a maximum score of 16. Therefore, intertextual-based learning videos can attract students' interest in studying chemistry subjects in grade XI. The achievement or feasibility of intertextual-based learning videos is proven by validation by content experts, pedagogy experts, and media experts, chemistry teacher assessments, and student responses by considering several aspects such as content, pedagogy, and media. Based on expert validation, chemistry teacher assessments, and student responses, the product is considered feasible and suitable for use (Fauzi et al., 2019; Hasibuan et al., 2023; Yuendita & Dina, 2024; Megahati et al., 2022). As a learning medium, it can help teachers and students in the learning process (Fitri et al., 2024).

This is reinforced by research conducted by Cirkony et al. (2022), Davenport et al. (2018), and Hu et al. (2022), which states that the use of multimedia tools (eg, video, animation and simulation) has strong potential in introducing links between the three levels of representation, and can improve understanding in submicroscopic and symbolic representations compared to using modules or with traditional learning. Based on research conducted by Petillion & McNeil (2020), Eichler (2022), and Nkomo & Bly (2024), it was shown that interview data and initial surveys of the video framework compiled based on the Johnstone triangle, and using live recordings of instructors, were effective in helping students understand and apply the concepts presented.

Conclusion

Based on the results and discussion of the development of intertextual-based learning videos as learning media on the concept of the effect of concentration on shifting equilibrium, it can be concluded that this learning video was developed using the ADDIE model. In the process of making it used supporting software namely Canva, Capcut, and BandLab. Based on the assessment of product quality by content experts, it obtained a percentage of 85.71% with a very good category (VG); from the assessment of pedagogy experts obtained a percentage of 90.27% with a very good category (VG); from the assessment of media experts obtained a percentage of 95.60% with a very good category (VG). The intertextual-based learning video developed was implemented by limited testing to high school class XI students as many as 34 students, and chemistry teachers using questionnaires, and according to the assessment of high school chemistry teachers obtained a percentage of 97.40% in the very good category (VG). This product received a positive response from students with a percentage of 90%. Based on the feedback received from experts, teachers and student responses, this learning video was revised so that it can be used as an alternative media for the chemistry learning process in the classroom.

Acknowledgments
The researcher would like to thank all parties who have supported the implementation of this research, especially Prof. Dr. Wiji, M.Si. Tuszie Widhiyanti, M.Pd., Ph.D who have provided support, input, facilities and opportunities in completing this research.

Author Contributions
Conceptualization, methodology, resources, and writing—review and editing, P.N., W.W., and T.W.; validation, W.W. and T.W.; formal analysis, investigation, data curation, writing—original, draft preparation, and visualization, P.N. All authors have read and agreed to the published version of the manuscript.

Funding
Researchers independently funded this research.

Conflicts of Interest
The authors declare no conflict of interest.

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