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Expert response to the development of interactive video as teaching media on cell material

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ABSTRACT

This research originated from the lack of utilization of learning media by educators in learning biology in high school which has the potential to affect student interest in learning. This study aims to produce learning media in the form of a valid interactive video. This research refers to the research and development approach by applying the 4D development model, which consists of defining, designing, developing, and disseminating stages. The focus of this research is one of the development stages of interactive learning videos, involving the assessment of expert validators who assess three main aspects, namely the presentation of material, video quality, and language used. Data analysis was conducted using descriptive statistics. Based on the data analysis, the validity level of the developed interactive learning video reached a score of 4.6. The score indicates that the video was declared into the "valid" category. In this study, four discussion videos discussed cell material. The conclusion from the results of the data analysis shows that the interactive learning videos developed on cell concepts meet the valid criteria.

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INTRODUCTION

In this modern era, technology plays an important role in the learning process. Appropriate utilization of technology can increase the effectiveness of learning. In addition, the use of technology can also increase learners' knowledge about the development of technology itself (Channy & Wibawanto, 2015). In line with that, the Ministry of Education has implemented and developed Information and Communication Technology (ICT) in education, as stated by Adnan and his colleagues (Adnan et al., 2014).

ICT-based learning opens new opportunities in presenting various learning materials interestingly and interactively. Technology-based learning media, such as learning videos,

multimedia presentations, educational games, and online learning platforms, have become popular choices in the modern education process. The diversity of these learning media provides flexibility for learners to learn according to their learning styles. In addition, the use of ICT-based learning media also allows collaboration and discussion between learners, both in a classroom environment and virtually. Learners can interact with fellow learners and teachers online, share thoughts, ask questions, and give each other feedback. This creates a more dynamic learning atmosphere, builds social skills, and develops critical thinking.

Based on the results of a questionnaire distributed to twenty biology teachers in South Sulawesi, it was revealed that in teaching and learning activities, both theory and practice, teachers predominantly use printed teaching materials in the form of package books and sometimes interspersed with the provision of material through Powerpoint media. For some special materials, additional teaching materials are used in the form of learning videos sourced from YouTube. This is also supported by the results of questionnaire answers from several students of Senior High School 9 Makassar, who stated that some biology materials are difficult to understand because the media used by teachers are printed books with language that is sometimes less understood. In addition, students also argue that it would be better if learning media could be packaged more interestingly so that students are interested in reading and understanding it. Learning videos are considered good to use in the learning process, but there is a drawback video teaching materials tend to make students more passive.

Interactive learning comes as an effective solution in stimulating students to always want and have an interest in learning. In the process, students are required to respond to the material presented by the educator. The media can be used as a forum for students to respond and interact with each other. Many media can be utilized to provide interactive learning. In learning Biology, it is necessary to use learning media that can simultaneously integrate text, images, sound, and video so that learning biology becomes more interesting, effective, and efficient (Rizki, 2017)

According to Yudianto (2017), video is an electronic media that can combine audio and visual technology to produce a dynamic and interesting show. Through video media, learning can be easily accessed and used and can reach a wide and interesting audience. According to R. Rahardjo et al (2012), the use of video as a learning media will increase the concentration and memory of students in learning. Video can collect information entry in humans by 94% through vision and hearing, which can strengthen learners' memories by more than 50% of what is seen and heard in the video.

Based on the existing problems, interactive learning videos can be a good solution for students to understand the material and increase their interest in learning independently. For educators, interactive learning videos can also be used as an efficient way to deliver learning materials thoroughly. Interactive learning videos integrated with the Edpuzzle learning application can also be a solution for educators to monitor the extent to which students understand the material presented. This is supported by research conducted by Sirri & Lestari (2020) which states that the use of Edpuzzle and WhatsApp groups can improve learning outcomes and student interest in mathematics.

Based on the conditions and potential that exist in schools, both students who need interesting teaching materials and teachers who still have difficulty motivating students to learn, researchers are interested in conducting product development and research with the title "Development of Interactive Learning Videos on Cell Material for Class XI Senior High School." The cell material was chosen because it has a breadth and depth that can be classified as microscopic material. The discussion of cells cannot be seen directly with the human eye. Several factors can cause a low understanding of the cell concept, such as the complexity and abstraction of the cell concept, the lack of interactivity in the learning process, and students' difficulties in

understanding foreign languages or related Latin. This finding is in line with research conducted by Dinarni et al (2021) which shows that the concept of cells tends to be conceptual and often causes misconceptions, especially in the sub-concept of cell structure and function. This is due to the abstract nature of the concept which confuses students' understanding. Similarly, according to Rahman et al (2018), sub-concepts related to animal and plant cell organelles are considered abstract because they cannot be observed directly, which results in difficulties for students in imagining their structure and body shape.

By using interactive learning videos, it is expected that students can more easily understand cell material. This video will integrate text, images, sound, and video to make learning more interesting, effective, and efficient. In addition, through the use of the Edpuzzle application, students can actively interact with learning materials, and educators can monitor the extent to which students understand the material.

With the development of this interactive learning video, it is expected that learning biology at the Senior High School level can be more interesting, effective, and efficient. Students will be more motivated to learn and have a better understanding of cell material. Interactive learning can also help students in developing social skills and critical thinking. By utilizing technology in learning, we can create a better learning environment and support the development of learners in this modern era.

RESEARCH METHODS

Research Design

The type of research used in this study is research and development (R&D). The product development model used refers to the 4D model by Thiagarajan. This is relevant to the goals of researchers who want to produce valid products, in this case in the form of interactive learning video media on cell material for class XI Senior High School.

Population and Samples

This study involved two experienced validators who evaluated the validity of interactive learning videos. The data collected included both quantitative and qualitative information. Quantitative data was gathered through the assessment of module feasibility, covering aspects such as material presentation, video quality, and language proficiency. Additionally, practical feedback was collected from both lecturers and students. Qualitative data, on the other hand, stemmed from interviews and observations with lecturers, as well as notes on suggestions for product enhancement provided by the validators.

Instruments

The research instrument developed was a product validation questionnaire. The validation questionnaire aims to obtain assessments and suggestions from expert validators on interactive learning videos that have been made by researchers. The video validation questionnaire was developed by researchers by looking at several aspects, namely aspects of material presentation, video quality, and language use. The validation questionnaire is equipped with 5 answer choices, namely very good (5), good (4), sufficient (3), less good (2), and not good (1). Before use, the research instruments that have been developed are first validated by expert validators.

Procedures

The development of interactive learning videos on cell material begins with the defining stage, which consists of front-end analysis, learner analysis, concept analysis, task analysis, and formulation of learning objectives. The next stage is the design of interactive learning video media

on cell material. This stage includes the preparation of material, preparation of video scripts and storyboards, selection of video materials, and editing and mixing processes tailored to cell material. The interactive learning video developed then goes through the development stage by going through the validity test process. Media assessment was carried out by two expert validators using an interactive learning video assessment instrument that had been validated and declared suitable for use. The validity test of research instruments and products is carried out to ensure that the research instruments used and the products developed are truly feasible/valid based on the assessment of expert validators. After the research instruments and products are shown to the validator and declared valid, the data obtained is then analyzed.

Data Analysis

The data analysis technique used to process the research data is descriptive statistics. This analysis is used to process data obtained in the form of analysis of research questionnaire criteria scores using a Likert scale (1 to 5). According to Sudjana (2007), to determine the validity assessment by the validator, the formula is used:

$$\text{VSA} = \frac{\sum Validator\ Score}{\sum items}$$

Keterangan:

VSA	: Validation Score for each Aspect
∑ validator score	: The sum of the scores given by both validators
∑ items	: Number of items assessed for each aspect

RESULTS

This research produces products in the form of interactive learning videos on cell material that are valid. The development of this video refers to the 4D design which consists of four stages, namely the defining (define), designing (design), developing (develop), and disseminating (disseminate) stages. In the four stages of the 4D development design, three stages were carried out to produce a valid product. The results obtained at the stage of developing interactive learning videos on cell material are described as follows.

Results of Defining Stage (Define)

The development of interactive learning videos on cell material begins with the defining stage, which consists of front-end analysis, learner analysis, concept analysis, task analysis, and formulation of learning objectives. Front-end and learner analysis is the stage of collecting information by providing questionnaires to teachers and students to find out the conditions and problems experienced in the learning process, especially in biology subjects. the high needs of teachers and students for teaching media in the form of videos on cell material that are truly by the learning objectives to be achieved. The teacher's need for video teaching media is related to the substance of microscopic cell material so visualization is needed that makes it easier for students to understand the material. The use of video media is considered by teachers to be suitable for providing understanding to students, but there are shortcomings, namely, students tend to be passive when taught with video teaching media. So, teaching media is needed in the form of learning videos that can also increase student activity. In this case, researchers provide a solution by developing interactive learning videos on cell material.

After knowing the problems and outcomes to be developed, the concept analysis stage is carried out to analyze the sub-materials and indicators used in the video. The analysis is based on the core competencies (KI) and basic competencies (KD) listed in the 2013 curriculum (K13). At this stage of the analysis, the development of material that will be used in the video refers to the

syllabus of Senior High School biology subjects in the 2013 curriculum that applies and also looks at the needs of students in the learning process.

At the task analysis stage is done by mapping the materials based on the results of concept analysis. The results of this analysis become some of the main material, thus forming several learning videos according to the material. In each video material, several questions are inserted as a reference for teachers in assessing students' understanding. The materials that will be included in the interactive learning video are Cell Introduction, Cell Size and Shape, Prokaryotic Cell Structure, and Eukaryotic Cell Structure.

Goal analysis becomes a reference in the development of interactive learning videos. The activities carried out in the analysis of objectives are reviewing the Basic Competencies and Competency Achievement Indicators that have been developed. The formulation of learning objectives on cell material was developed by the 2013 Curriculum. The selected learning objectives are then formulated by containing ABCD components (Audience, Behavior, Condition, and Degree).

Results of the Design Stage (Design)

The design stage is the video design stage which includes the preparation of material, preparation of video scripts (scripts) and storyboards (storyboards), collection of video materials, to the editing and mixing stages. Based on the grouping of learning objectives that have been carried out, four sub-points of cell material are collected. The four materials are Cell Introduction, Cell Size and Shape, Prokaryotic Cell Structure, and Eukaryotic Cell Structure. Each material will be used as the subject matter in the interactive learning video developed so that the resulting product totals 4 (four) videos.

The preparation of video scripts and storyboards is adjusted to the learning components in general which consist of apperception, material provision, assignments, and closing. Storyboard snippets of interactive learning videos can be seen in Table 1.

Table 1. Overview of interactive learning video storyboard design

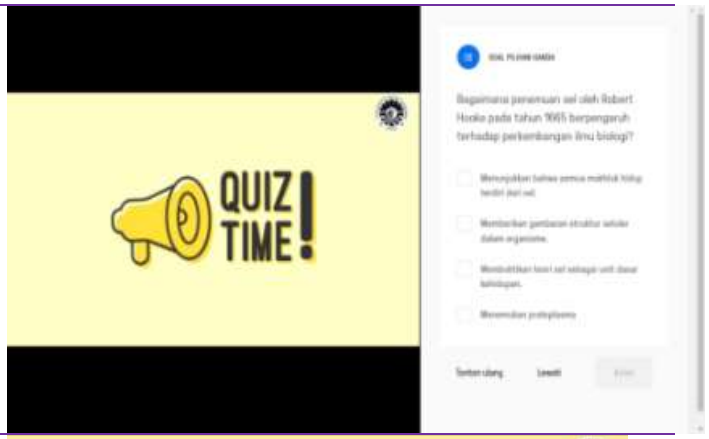
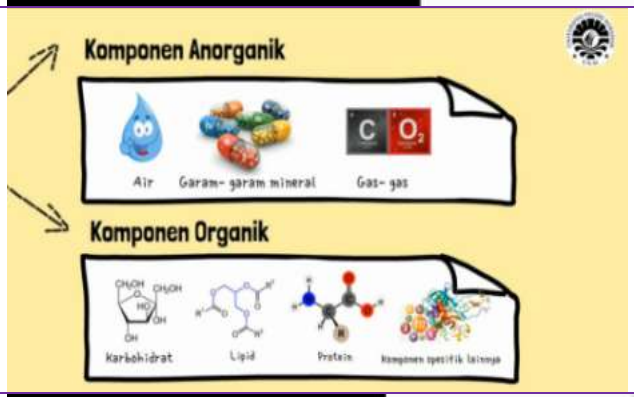
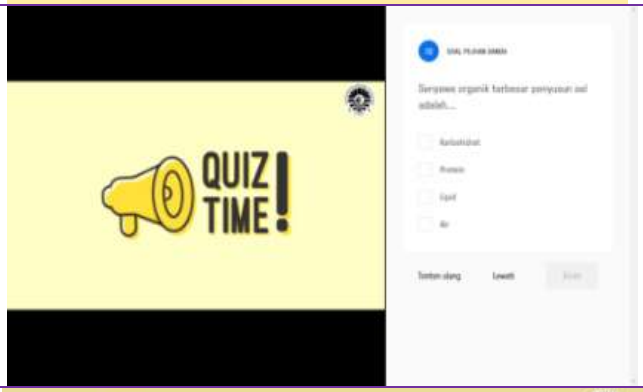
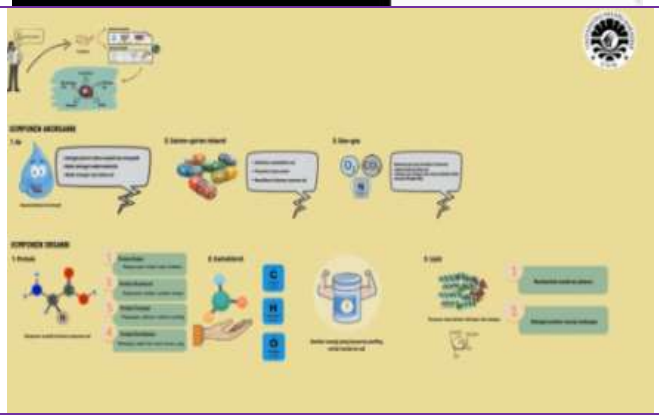
Video Component	Description
Apperception	Activities that lure learners into learning activities
Intro	Description of video title and subject matter
Opening	-
Material Description	Contains the main discussion or learning material. Learning materials are packaged by combining various supporting elements that are interesting and by the material. Some scenes in the explanation of the material are also presented with a typical whiteboard animation, which is a video display that illustrates the narrative with explanations as if using a whiteboard directly.
Interactive Scene	Scenes that display evaluation questions or comment columns that can be directly responded to by students. This interactive scene will appear as an interlude at the transition of the subject matter.
Advanced Material	Is the follow-up material after the interactive scene?
Interactive Scene	Follow-up questions or comments based on the material that has been presented previously.
Closing	contains the conclusion of the main discussion in the interactive video. At the end of the video, there is also an interactive scene that becomes a closing evaluation of the video.

Results of the Development Stage (Develop)

The development of interactive videos is based on the results of defining and designing that have been illustrated through storyboards. The interactive learning video developed contains 4 cell submaterials, namely video 1 cell introduction, video 2 cell size and shape, video 3 prokaryotic cell structure, and video 4 eukaryotic cell structure. The description of some components of the developed interactive learning video can be seen in Table 2.

Table 2. Description of interactive learning video specifications

Component	View
Apperception	
Intro	
Opening	
Description of material	

Component	View
Interactive Scene	
Advanced Material	
Interactive Scene	
Closing	

The results of the interactive video development were then validated by two expert validators. Expert validators assessed the product from various aspects and provided suggestions as

revision material for the improvement of interactive videos. The suggestions from the validators on the development of this interactive video are contained in Table 3.

Table 3. Corrections and suggestions from expert validators

No.	Suggestion
1	Provide a pause at each turn of the discussion. Learners need time to internalize knowledge before getting the next knowledge.
2	Pay attention to the suitability of the text that appears with the narration. Some are not yet appropriate.
3	The articulation of some words needs to be clarified, especially in scientific words, some still sound unclear.
4	The mention of the term "Pili" should be read as "Fili".
5	Provide an opening narration before entering the question at each transition of material to the evaluation question.
6	Pay attention to the duration of the video
7	Replace some animations and images that are considered unclear, and eliminate some video scenes that are considered less supportive of the material.

Suggestions from validators are used as a basis for making product improvements. After that, the assessment from the expert validator is analyzed to obtain validation data as a reference that the product developed has met the valid criteria and is suitable for use in the learning process. The results of the analysis of the validity of interactive learning videos based on aspects of content feasibility can be seen in Table 4.

Table 4. Interactive learning video validation data based on content feasibility aspects

No.	Indicator	Value	Posted on
1.	Suitability of material with KD 3.1 (2013 Curriculum)	4,8	Valid
2.	Suitability of material with learning objectives	5	Very Valid
3.	Clarity of material presentation	4,7	Valid
4.	Systematic presentation of material	4,8	Valid
5.	The material presented does not contain misconceptions	4,2	Valid
6.	The suitability of the animation / image used with the material	4,8	Valid
	Average	4,7	Valid

Based on the analysis in Table 4, the average value of the final product validation is 4.7 which means valid. The validation results show that the developed product has met the assessment criteria in the video quality aspect. Furthermore, the results of the analysis of the validity of interactive learning videos on cell material based on video quality aspects can be seen in Table 5.

Table 5. Interactive learning video validation data based on video quality aspects

No.	Indicator	Nilai	Posted on
1.	The visual quality of the video	4,6	Valid
2.	Clarity of animation/image display	4,1	Valid
3.	Clarity of audio in the video	4,6	Valid
4.	Audio compatibility with the text displayed (audio	4,2	Valid

	mixing quality)		
5.	The intonation of the narrator in the video	4,8	Valid
6.	The clarity of the narrator's articulation in delivering the material	4,5	Valid
7.	The suitability of the dominance of the narrator and background music in the video	4,2	Valid
8.	Suitability of video duration to the learning process	4,7	Valid
9.	The suitability of the text displayed with the narration	4,8	Valid
10.	Lighting Quality	4,7	Valid
11.	Readability of text on video	4,1	Valid
	Average	4,5	Valid

Based on the analysis in Table 5, the average value obtained in the validation of the final product validation is 4.5 which means valid. The results of this validation, indicate that the product that has been developed has met the assessment criteria on the video quality aspect. Furthermore, the results of the analysis of the validity of interactive learning videos on cell material based on language aspects can be seen in Table 6.

Table 6. Interactive learning video validation data based on language aspects

No	Indicators	Value	Posted on
1.	Use of Indonesian language by Refined Spelling (EYD)	4,5	Valid
2.	The language used is simple, easy to understand, and communicative	4,5	Valid
	Average	4,5	Valid

Based on the analysis in Table 6, the average value obtained in the validation of the final product validation resulted in a value of 4.5 which means valid. The results of this validation indicate that the product that has been developed has met the assessment criteria in the language aspect. Furthermore, the accumulated results of the validity of interactive learning videos can be seen in Table 7.

Table 7. Final results of product validation

No.	Assessment Aspect	Average	Note
1.	Presentation of Material	4,7	Valid
2.	Video Quality	4,7	Valid
3.	Language	4,5	Valid
	Average	4,6	Valid

Based on the analysis in Table 7, the total average value of the validity of interactive learning videos on cell material is Va = 4.6, which means that it falls into the valid category ($4 \leq Va \leq 5$) and interactive learning video products on cell material are feasible to use.

DISCUSSION

The development of interactive learning videos on cell structure and function material for class XI Senior High School Equivalent refers to the 4D model which consists of four stages, namely the defining (define), designing (design), developing (development), and disseminating (disseminate) stages. As for the dissemination stage, it was not carried out due to time constraints.

The product resulting from this development is an interactive learning video of valid cell structure and function material.

The video developed is an interactive learning video on cell structure and function material that is tailored to the characteristics of students, learning objectives, and learning environments that allow videos to be used in the learning process. The interactivity of the learning video is expected to increase students' activities in learning. This interactive learning video is also packaged with an attractive appearance to increase students' interest in learning.

The development of interactive learning videos on cell structure and function material begins with the defining stage, which consists of front-end analysis, learner analysis, concept analysis, task analysis, and formulation of learning objectives. Front-end and learner analysis is the stage of collecting information by providing questionnaires to teachers and students to find out the conditions and problems experienced in the learning process, especially in biology subjects. Questionnaires were given to 20 biology teachers in South Sulawesi and 52 students of class XI Senior High School 9 Makassar.

The results of the analysis of teacher and learner questionnaires show the high need of teachers and learners for teaching media in the form of videos on the material of the structure and function of cells that are truly in accordance with the learning objectives to be achieved. The teacher's need for video teaching media is related to the substance of microscopic cell material so that visualization is needed that makes it easier for students to understand the material. This is in line with Alexander et al (2018) statement that audio-visual media can make students understand better, be independent, active, and increase students' interest in learning in the learning process. The use of video media is considered by teachers to be suitable for providing understanding to students, but there are shortcomings, namely students tend to be passive when taught with video teaching media. So that teaching media is needed in the form of learning videos that can also increase student activity. In this case, researchers provide a solution by developing interactive learning videos on cell structure and function material.

After knowing the problems and outcomes to be developed, the stages of concept analysis, tasks, and formulation of learning objectives are carried out to analyze the sub-materials and indicators used in the video. The analysis is based on the core competencies (KI) and basic competencies (KD) listed in the 2013 curriculum (K13). At this stage of the analysis, the development of material to be used in the video refers to the syllabus of Senior high school biology subjects in the 2013 curriculum that applies and also looks at the needs of students in the learning process.

The next stage is the design of interactive learning video media on cell structure and function. This stage includes the preparation of material, preparation of video scripts and storyboards, selection of video materials, and editing and mixing processes tailored to the material of cell structure and function. After all the processes are completed, the initial product (prototype) of an interactive learning video of cell structure and function material is produced. Video design is made relevant to the learning process, where the content of the video begins with apperception activities, providing material, providing evaluation questions, and closing. As stated by Riyana (2007), video media development goes through several plans such as preparing the devices that will be used, and making a video framework that includes determining the introduction, opening show, introduction, video content, and closing.

The interactive learning video that was developed then went through the development stage by going through the validity test process. The validity test is carried out to determine the feasibility of the product that has been developed. Media assessment was carried out by two expert validators using an interactive learning video assessment instrument that had been validated and declared suitable for use before. The validation assessment consisted of nineteen questions that

were representative of three aspects of the assessment, namely aspects of material presentation, video quality, and language.

The validity test was assessed by two expert validators who assessed various aspects and the examination was carried out in stages. The interactive video developed has been revised several times based on suggestions from the validators. The first validation by the validator stated that the product could be used with minor revisions so improvements needed to be made to the product that had been developed. The validator then provided some improvement suggestions to improve the material in the video script. There are still some concepts that are not correct. Researchers are also advised to refer to more relevant and reliable sources to avoid misconceptions. In addition, the validator also suggested paying attention to the compatibility between the text that appears and the audio that is heard.

Another suggestion given by the validator was to provide a longer pause at each turn of the discussion. It was explained that learners need time to internalize the information received before moving on to the next information. Poor pause settings will have an impact on the level of understanding of learners. In addition, there are still some words whose articulation sounds less clear so it is necessary to improve the mention, especially in the mention of scientific terms. The validator also suggested giving preliminary instructions before giving interlude questions on the material so that students are not surprised when the interlude questions appear when the video is shown. Furthermore, the validator suggested replacing some animations and images that were considered unclear, as well as eliminating some video scenes that were considered less supportive of the material.

The interactive learning video that had been revised based on the suggestions and corrections from the validators was then assessed by the validators using an assessment sheet consisting of several aspects of assessment divided by several aspects, namely presentation of material, video quality, and language. The average value for the material presentation aspect is 4.7, the video quality aspect is 4.5, and the language aspect gets an average value of 4.5. Based on the validity level category, the value is categorized as valid and suitable for use in supporting more interesting and interactive learning. The interactive learning video developed by the researcher is declared valid with a validity value of 4.6 which is in the interval $4 \leq Va \leq 5$ which is assessed from various aspects and has met the requirements based on the assessment by validator one and validator two. So that the interactive learning video of cell structure and function material is declared feasible to be used as teaching media for class XI Senior High School students.

CONCLUSION

The resulting product from this development research is a valid interactive learning video, tailored to students' characteristics, learning objectives, and environments, aiming to enhance engagement through interactivity and appealing presentation. Beginning with front-end and learner analysis, followed by concept and task analysis, and formulation of learning objectives aligned with the 2013 curriculum, the content addresses syllabus requirements and student needs. In the design stage, material preparation, scripting, storyboarding, selection of video elements, and editing ensure relevance to the learning process. After validation by expert validators and subsequent revisions addressing script accuracy, articulation clarity, pacing, and visual clarity, the video achieves high scores in material presentation, video quality, and language, indicating its suitability for classroom use with a validity value of 4.6. Thus, the interactive learning video offers an engaging and effective teaching medium for Class XI Senior High School students.

REFERENCES

Adnan, A., Abhimanyu, S., Patta, B., & Arsyad, N. (2014). The Improving of junior high school

student in learning motivation through implementation constructivistic biology learning model based on information and communication technology. *Journal of Education and Practice,* *5*(2), 63–71. Retrieved from https://www.iiste.org/Journals/index.php/JEP/article/view/10639/10866

Adnan, A., Saenab, S., & Saleh, A. R. (2016). Unleash students' motivation with blended knowledge transfer instructional model. *In Proceeding International Conference on Mathematic, Science, Technology, Education and their Applications,* 1(1). Retrieved from https://ojs.unm.ac.id/icmstea/article/view/2659

Adnin, A. R. (2016). Pengembangan video stop-motion sebagai media pembelajaran peserta didik SMA/MA kelas X pada materi pokok ikatan kimia (Doctoral dissertation, Universitas Islam Negeri Sunan Kalijaga). Retrieved from https://digilib.uin-suka.ac.id/id/eprint/24671/

Affandi, U. C., & Wibawanto, H. (2015). Pengembangan media animasi interaktif 3 (tiga) dimensi sebagai alat bantu ajar mata pelajaran IPA kelas VII menggunakan blender game engine. *Jurnal Teknik Elektro,* *7*(2), 62-70. Retrieved from https://doi.org/10.15294/jte.v7i2.8586

Afsari. (2017). Pengembangan lembar kerja peserta didik (LKPD) Berpikir tingkat tinggi pada pokok bahasan sel kelas XI IPA SMA negeri 16 makassar. *Skripsi*. Fakultas Tarbiyah dan Keguruan UIN Alauddin Makassar. Retrieved from https://repositori.uin-alauddin.ac.id/8410/

Alexander, A., Rahayu, H. M., & Kurniawan, A. D. (2018). Pengembangan Penuntun praktikum fotosintesis berbasis audio visual menggunakan program camtacia studio di SMAN I hulu gurung. *Jurnal Pendidikan Sains Indonesia,* *6*(2), 75–82. Retrieved from https://doi.org/10.24815/jpsi.v6i2.12075

Arsyad, A. (2017). *Media pembelajaran*. Jakarta: PT. Raja Grafindo Persada.

Daryanto. (2018). *Media pembelajaran (perannya sangat penting dalam mencapai tujuan pembelajaran)*. Yogyakarta: Gava Media.

Dinarni, D., Safilu, S., & Wirdhana, S. (2021). Analisis penguasaan konsep dan miskonsepsi siswa pada materi sel kelas XI MIPA melalui metode cri (certainty respons index) di SMAN I wawotobi kabupaten konawe. *Jurnal Biofiskim: Pendidikan dan Pembelajaran IPA,* *3*(1), 75. Retrieved from https://doi.org/10.33772/biofiskim.v3i1.16457

Johari, A., Hasan, S., & Rakhman, M. (2016). Penerapan media video dan animasi pada materi memvakum dan mengisi refrigeran terhadap hasil belajar siswa. *Journal of Mechanical Engineering Education,* *1*(1), 8. Retrieved from https://doi.org/10.17509/jmee.v1i1.3731

Lestari, D. S. A., & Khusumadewi, A. (2020). Pengembangan video cinematherapy bullying bagi peserta didik kelas VIII SMP negeri 2 gedangan. *Jurnal BK UNESA,* *11*(3). Retrieved from https://ejournal.unesa.ac.id/index.php/jurnal-bk-unesa/article/view/33446

Marjan, J., Arnyana, I. B. P., & Setiawan, I. G. A. N. (2014). Pengaruh pembelajaran pendekatan saintifik terhadap hasil belajar biologi dan keterampilan proses sains peserta didik MA. Mu allimat NW pancor selong kabupaten lombok timur nusa tenggara barat. *Jurnal Pendidikan dan Pembelajaran IPA Indonesia,* *4*(1). Retrieved from https://ejournal-pasca.undiksha.ac.id/index.php/jurnal_ipa/article/view/1316

Musfiqon, H. M. (2012). *Pengembangan media dan sumber pembelajaran*. Jakarta: PT. Prestasi Pustakaraya.

Niswa, A. (2012). Pengembangan bahan ajar mendengarkan berbasis video interaktif bermedia flash kelas VIIID SMP negeri I kedamean. *Jurnal Bahasa dan Sastra Indonesia,* *1*(1), 1-17. Retrieved from https://ejournal.unesa.ac.id/index.php/bapala/article/view/2019

Putra, H. K. (2021). *Monograf model multimedia interaktif untuk meningkatkan pemahaman dan daya tarik pembelajaran.* Klaten: Penerbit Lakeisha.

Rachmawati, I. K. (2008). Manajemen sumber daya manusia. Yogyakarta: ANDI.

Rahma, F. I. (2019). Media pembelajaran (kajian terhadap langkah-langkah pemilihan media dan implementasinya dalam pembelajaran bagi anak sekolah dasar). *Jurnal Studi Islam, 14*(2), 87–99. Retrieved from http://ejournal.kopertais4.or.id/tapalkuda/index.php/pwahana/article/view/3608

Rahman, A., Ernawati, E., & Ekanara, B. (2018). Profil kreativitas dan pemahaman konsep siswa pada subkonsep organel sel hewan dan tumbuhan. *Biodidaktika, Jurnal Biologi dan Pembelajarannya*, *13*(2), 24–30. Retrieved from https://doi.org/10.30870/biodidaktika.v13i2.3673

Riyana, C. (2007). *Pedoman pengembangan media video*. P3AI UPI.

Sadiman, A. S., R. Rahardjo, Haryono, A., & Rahardjito. (2012). *Pengertian, pengembangan, dan pemanfaatannya*. Rajawali Pres.

Sirri, E. L. & Lestari, P. (2020). Implementasi edpuzzle berbantuan whatsapp group sebagai alternatif pembelajaran daring pada era pndemi. *Jurnal Pendidikan Matematika Indonesia, 5*(2), 67–72. Retrieved from http://dx.doi.org/10.26737/jpmi.v5i2.1830

Sudjana, N., Ahmad, R. (2007). *Teknologi pengajaran*. Bandung: Sinar Baru Algensindo.2007.

Thiagarajan, & Sivasailam,. (1974). *Instructional development for training teachers of exceptional children*. Washinton DC: National Center for Improvement Educational System.

Yudianto, A. (2017). Penerapan video sebagai media pembelajaran. *Seminar Nasional Pendidikan 2017*, 234–237.