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Development of Water Purification Video as Teaching Material for Middle School Chemistry Course

Muhammad Iqbal Abdul Hafiz, Hairida Hairida*, Eni Mayasari
Chemistry Education Study Program, Faculty of Teacher Training and Education, Tanjungpura University, Pontianak Indonesia
* Corresponding Author e-mail: hairida@fkip.untan.ac.id

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Abstract
The purpose of this study was to determine the validity of the Development of Water Purification Videos as Teaching Materials for Junior High School Chemistry Courses. The research method used is Research and Development (R & D) using the ADDIE development model . The subjects of this study were Water Purification Videos assessed by material experts, media experts, and language experts. The research tool used was an assessment sheet using a Likert scale . Data collection techniques used were interviews, observations, and validity assessments. The validation of the water purification video was assessed by two material experts, five media experts, and two language experts. The final results of the assessment showed that The water purification video is very valid to be used as teaching material for Middle School Chemistry courses.

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INTRODUCTION

Natural Science (IPA) is one of the learning in schools that equips students with knowledge, ideas, and concepts about nature obtained from scientific processes related to investigation, preparation, and ideas (Panggabean et al., 2021). Science learning can improve a person's abilities, namely regarding the development of thinking skills that can improve abilities in life skills. Skills that can be obtained in science learning are communication, delivery in discussions, and the ability to read learning resources (Junanto & Sartika, 2023). Science learning in junior high school chemistry, which contains one of the topics in science learning in junior high school chemistry, separation of mixtures.

Starting with the Course Learning Outcomes (CPMK) being able to carry out simple experiments to support understanding of chemical content or concepts studied in Integrated Science subjects at the junior high school level. So, it is reduced to sub-CPMK, namely being able to design a water purification device with a filtration technique and carry out water purification experiments with a filtration technique . Water purification is a physical-chemical reaction process that involves various stages of coagulation, flocculation, sedimentation, filtration and disinfection. (Anugrah et al., 2023). These stages have an important role in removing different contaminants, ranging from large particles to pathogenic microorganisms. (Kurniasih & Fadhilah, 2016; Puspita et al., 2024). In addition to theory, application in everyday life is needed so that students can connect chemical concepts with environmental problems (Dristyan et al., 2018; Umar et al., 2023).

Based on the results of interviews with junior high school Chemistry teachers at the Chemistry Education Study Program, FKIP Untan, the difficulty in junior high school Chemistry courses is the use of less varied media in conducting learning, making learning less interactive. As learning media has an important role in the learning process because one of the functions of learning media is to attract attention or interest (Fadilah et al., 2023). In addition, the lecturer uses the lecture method in teaching. The effectiveness of the lecture method is that it can be used for a fairly large number of students (Fardilah et al., 2023). However, the weakness is that students can become bored and passive during learning (Wulandari, 2022).

One of the learning media that can be used is video. Video media was chosen because it has a number of advantages compared to other learning methods. Videos are able to present information visually and auditorily, so that they attract students' attention more and make it easier for them to understand the concepts presented (Serungke et al., 2024). In addition, videos allow students to see practical steps directly and in detail, which are difficult to explain effectively through text or images (Batubara & Ariani, 2016). Video media also has other advantages, namely flexibility that can be accessed anytime and anywhere, so that students have the opportunity to study the material independently according to their learning abilities (Alga et al., 2024), video media can improve students' ability to understand the material as a whole so as not to cause misconceptions (Apriliani et al., 2022).

Another problem of students is the lack of mastery of the concept of separating mixtures so that when practicing only a few are successful. So that a video guide is needed for water purification. A video tutorial is a series of images containing information given by an expert or tutor to a group of audiences so that the audience is able to understand the process or increase their knowledge just by watching the video. (Utomo & Ratnawati, 2018). Therefore, from the previous statement, a water purification video product was created that can be used in junior high school chemistry courses.

The results of this study are expected to improve students' ability to understand junior high school chemistry courses. For this reason, it is necessary to conduct research on the development of water purification videos. In addition, through this study, it is expected to produce water purification videos that are suitable for use in learning junior high school chemistry courses in the chemistry education study program of the Faculty of Teacher Training and Education (FKIP) Tanjungpura University (UNTAN)

METHOD

Research and Development (R & D) is the method used in this study with the ADDIE development model (analysis, design, development, implementation, and evaluation) (Lyanda et al., 2023). This study aims to determine the level of validity of the Water Purification Video . The subject in this study is the Water Purification Video.

The stages of the ADDIE model used for this study are analysis, design, and development where each stage is evaluated (Yulis & Fauziah, 2024). This study only reaches the development stage. The ADDIE development model is commonly used in developing various products such as teaching materials, models, and learning strategies (Maydiantoro, 2020). At the analysis stage, the techniques used are interview and observation techniques. Interviews were conducted with the Junior High School Chemistry Course Lecturer and observations were conducted after Junior High School Chemistry learning was carried out. At the analysis stage, data or information on performance gaps that occur with current education are analyzed, the curriculum applied is analyzed, and the needs of students are analyzed .

The design stage is carried out by creating a media design in the form of a storyboard, determining the video to be made, both in *script format* and content/material format, then compiling a validation assessment sheet . The development stage is carried out by realizing the media that has been designed and assessing its validity . The product that will be produced from this research is the Water Purification Video Media. The product that has been produced is then validated by testing its validity based on aspects of material, media, and language. The validity of the media is assessed by experts in their fields consisting of two material experts, five media experts, and two language experts.

The data collection technique used is an indirect communication technique carried out by distributing validation questionnaires and data analysis using a Likert scale . Data obtained from the validation questionnaire were analyzed based on the instruments that had been designed. The instrument was used to collect data from the developed product. After obtaining expert assessment data, the data was then interpreted with certain criteria .

Table 1. validity assessment scores

Value Interval	Validity criteria
0% - 20%	Very Invalid
21% - 40%	Less Valid
41% - 60%	Quite Valid
61% - 80%	Valid
81% - 100%	Invalid

(Ersando et al., 2022)

The criteria for interpreting validity assessment scores can be obtained by calculation using the formula:

$P = \frac{F}{N} \times 100\%$

While P : Percentage; F: Total scores obtained from experts; and N : Maximum validator score (Number of experts × highest scoring item)

RESULTS AND DISCUSSION

Analysis Stage

The analysis stage is carried out by identifying the causes of performance gaps in the field, determining instructional objectives, confirming the target audience, determining the resources needed, determining potential systems, and preparing a project plan. (Waruwu , 2024) . Analysis conducted through interviews and observations. Based on interviews with junior high school Chemistry course instructors, learning is carried out using LMS, *Google Meet* , *Google Form* , *WhatsApp* , and *Quiz media* , which use lecture methods in their delivery so that students become bored. At the analysis stage, the Course Learning Outcomes (CPMK) are also analyzed, namely being able to conduct simple experiments to support understanding of chemical content or concepts studied in Integrated Science subjects at the junior high school level. Then analyze the sub-CPMK section, namely being able to design a water purification device with a filtration technique and being able to carry out water purification experiments with a filtration technique which are the objectives of this learning.

This learning is in the form of practicing making and carrying out simple water purification. When practicing, students still do not understand the concept of separating mixtures. This has an impact on the success of water purification practices, which is only a little. So from the analysis stage, it is concluded that students' needs require interactive classroom learning media to support classroom learning. Based on this problem, a product was created in the form of a water purification video.

Design Phase

At the design stage, media design is carried out in the form of video storyboards, compiling materials, and designing experiments. This stage produces product design specifications. This stage clarifies content of learning media , so that each part is developed relevant to CPMK. At the stage of compiling materials according to student needs, it is done by taking from several sources such as junior high school science books in the form of mixed separation materials, journals, news, and government policies.

The material for separating the mixture is done using the filtration method. Filtration is a method of separating solid particles from liquids using a filtering technique. After determining the material, an experiment was designed in the form of collecting materials such as bottles, sand, charcoal, tissue, cotton, stones, gravel, and water samples. In the first stage, cut ¾ of a 2-liter bottle. The bottle functions as a place for water purification instruments. The second stage, add cotton and tissue, 4 sheets each. Cotton is used because cotton is made of cellulose which is used to bind oil and dyes (Danial & Purnaini, 2024). Cotton also contains polymers that function to hold large particles. The third step, gravel is inserted as high as 2 cm. Gravel functions as a filter for coarse dirt and stones also have carbon which can help oxygen to enter the water (aeration) (Fajriaty et al., 2023).

The fourth step, add stones as high as 2 cm. Stones function as filters for large dirt and as filter stabilizers. The fifth step, add sand as high as 2 cm. sand. Sand has SiO2 molecules $_{\text{that}}$ can precipitate fine particles that are anions. The sixth step, add 2 cm of charcoal. Charcoal has carbon properties so it can bind chlorine, heavy metals and microorganisms that can cause water to smell. The seventh step, add 4 sheets of tissue which function as initial particle filters. Finally, measure the pH using universal. This stage functions to determine the pH of the water sample and the results of the purification. The water sample using peat water is characterized by its brown water color due to the very high carbon content and has a pH of 4 or is acidic (Fajriaty et al., 2023).

At the design stage, media, language, and material validation assessment sheets were also prepared using the Likert scale. The validators were selected as two language experts, two material experts, and five media experts.

Development Stage

The purpose of the development phase is to produce and validate the developed learning resources . Based on the results of the media development that has been realized in the form of a water purification video made using the Capcut and Canva applications. The video was made for 6 minutes consisting of the opening, content, and closing sections. The opening section of the water purification video contains water problems in peatlands. A screenshot of the opening of the water purification video can be seen in Figure 1.

Figure 1. Opening of the water purification video

The video content section shows the making of simple water purification. Consisting of tools and materials to the steps of making water purification. A screenshot of the video content section of water purification can be seen in figure 2.

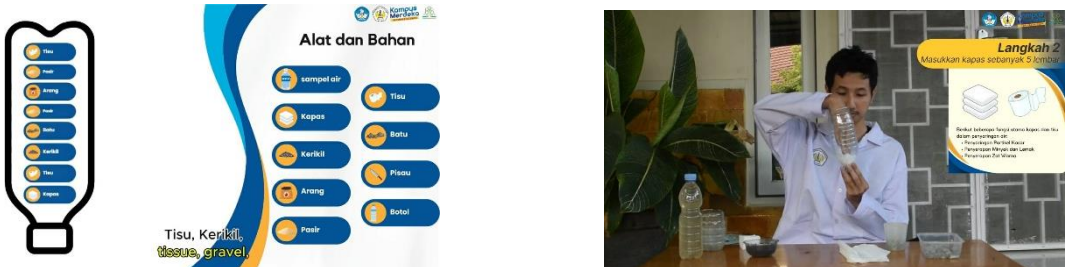


Figure 2. Contents of the water purification video

The closing part of the video features a conclusion, a call to action to monitor water pollution, and a credit scene. A screenshot of the closing part can be seen in figure 3.

Figure 3. Closing of Water Purification Video

The video can be viewed at the following link: https://youtu.be/OGn_SoyYpeU

In the development stage, after the product is realized, the next stage is the validity assessment stage and formative revisions are carried out based on the results obtained. The validity assessment is carried out based on the material, media and language aspects. A validity assessment is carried out to determine the level of validity of the media developed based on percentage criteria so that it can be used in the next stage of field testing. Validation assessments are carried out by experts in their respective fields. The results of the validation assessment of the three aspects obtained very valid results with a percentage of material aspects of 97.5 %, media 100%, and language 97.5 % (Figures 4 and 5).

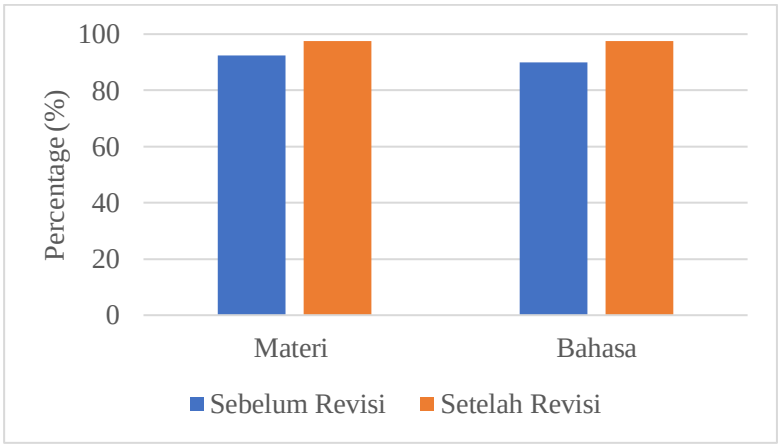


Figure 4. Validation graph of Water Purification Video media based on Material and Language aspects

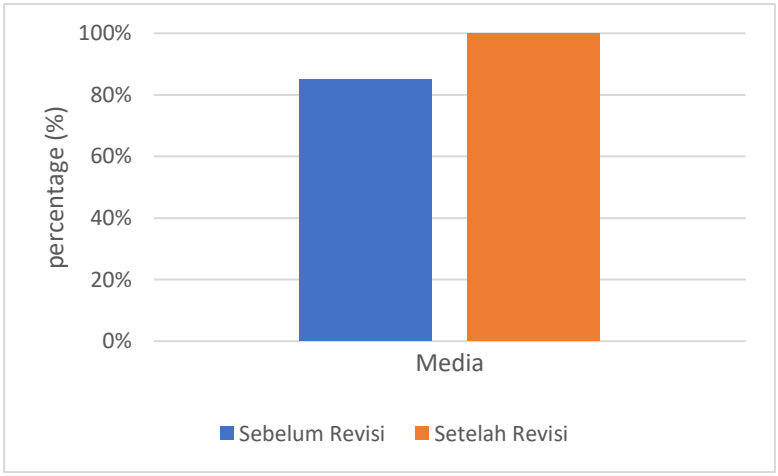


Figure 5. Validation graph of Water Purification Video media based on Media aspects

Validity of Material Aspects

The assessment of the validity of the material was carried out by two experts in their fields. The results of the assessment of the feasibility of the material aspects carried out by the experts can be seen in Table 2

Table 2. Data from the results of the validation assessment of material aspects

Indicator	Percentage (%)
Suitability of the content of the material in the video	87.5
Material sequence	100
Accuracy of material	92
Average percentage	92.5

Based on table 2, the assessment is reviewed from various indicators including the suitability of the content of the material and the video related to learning outcomes. The validator suggested changing the concept from the water pollution video to peat water purification. This is in accordance with the CPMK, namely being able to conduct simple experiments to support understanding of the content or chemical concepts studied in the Integrated Science subject at the junior high school level as well as in accordance with the sub-CPMK section, namely being able to design a water purification tool with a filtering technique and being able to carry out water purification experiments with a filtering technique because the video contains stages in carrying out water purification.

The concept of water pollution has a more complex way to purify water while the video uses a simple separation using the filtration method. The indicator of material accuracy is related to facts and data, case examples that support understanding, and concepts that are made easy to understand. Based on the appropriate facts and data obtained, the results based on the evaluation of the material expert, the presentation of data should be added to the alignment of data on the government with the results of the work of the regulations made. The presentation of facts and data needs to be done so that there is alignment with the video. Therefore, data on the results of government work in the form of providing clean water as a provider of drinking water is added.

Based on the sequence of materials, for example from general to specific, which can make the viewer understand so that it can increase learning motivation. (Ummah, 2021).Based on the case examples presented in accordance with reality and support student understanding which can make students understand the purpose of the material. The concepts presented in the video can help students understand the material . The concepts taught are in accordance with the

material in Junior High School Chemistry about water purification where the validator suggests that each step be given an explanation of its function.

Before revision After Revision

Figure 4. Revision of the results of the material aspect assessment

After the revision is done, it is submitted back to the validator to re-evaluate. Thus, the data results are obtained in the Data Results of the validation assessment of the material aspect in table 3.

Table 3. Data from the results of the validation assessment of material aspects after revision

Indicator	Percentage (%)
Suitability of the content of the material in the video	100
Material sequence	100
Accuracy of material	96
Average percentage	97.5

Validity of Media Aspects

Validity assessment a media aspect is conducted by five experts with expertise in the field of media. Media aspects are measured based on several indicators, namely Message quality , Video performance , Image presentation , Text / typography readability , and Sound elements The results of the media validation assessment can be seen in Table 4.

Table 4. Data from the results of the media aspect validation assessment

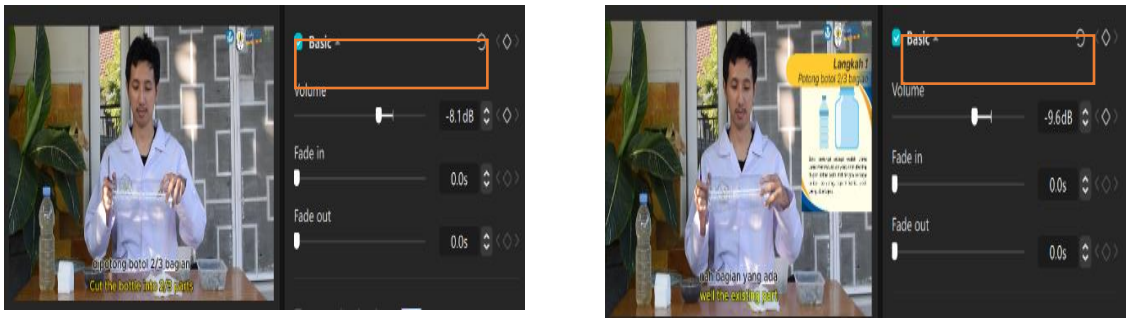
Indicator	Percentage (%)
Message Quality	90
Video Performance	92.5
Image presentation	80
Text readability/typography	78
Sound Elements	87
Average percentage	85

The assessment of the feasibility of the media aspect in the Water Purification Video is based on several indicators presented in Table 4. The message quality includes the content of the material and the quality of the video editing. The content of the material is in accordance with the indicators CPMK, namely " Students are able to conduct simple experiments to support understanding of chemical content or concepts studied in Integrated Science subjects at the junior high school level" . This video contains a simple way to purify water, where the illustrations show the suitability between the video and the material (Dewi & Suniasih, 2022).

On the quality of editing that suits the needs and interests of students, there are suggestions from the validator, namely the addition of video descriptions to make it easier to reach the content. The next indicator of video performance is related to the duration and ease of operation, the duration of the learning video is 6 minutes. Learning videos are made to adjust

to the effectiveness of understanding the contents of the video, which is 5-10 minutes (Susanti et al., 2018). Playing or using learning videos is easy and does not make it difficult for students to open them by uploading them to YouTube because of the ease of access (Yunita & Suprapto, 2021). The readability/typography indicator is related to the font, text color, and layout.

The image layout does not interfere with other elements such as text, titles, and highlighted objects, the validator suggests that there should be animated images so that the images are not monotonous in delivery. The subtitle layout overlaps between Indonesian and English, subtitles should be separated in order to improve the readability of the writing in the delivery. The sound element indicator is related to articulation, voice, and music. There is a music volume that exceeds the narrator's voice volume so that the narrator's delivery is less audible. The narrator's voice also experiences sound leakage so that the delivery echoes. This can reduce the concentration of the listener (Utami et al., 2024). The solution is to control the sound recording by resetting the sound so that the sound quality is better. As can be seen in Figure 5



Before revision After Revision

Figure 5. Results of the Media aspect assessment

In the improvement by the suggestions given by the validator, improvements were made so that the water purification video was more accurate. The results of the improvements can be seen from table 5 of the data from the assessment of the feasibility of the media aspect.

Table 5. Data from the results of the media aspect validation assessment after revision

Indicator	Percentage (%)
Message Quality	100
Video Performance	100
Image presentation	100
Text readability/typography	100
Sound Elements	100
Average percentage	100

Validity of Language Aspects

Table 6. Data from the results of the language aspect validation assessment

Indicator	Percentage (%)
Standards/grammar used	87.5
The effectiveness of the sentences used	75
Clarity and completeness of the information provided	100
Ease of understanding language /sentences	87.5
Average percentage	90

Validity assessment was carried out by two experts. The validity of the language aspect is measured based on indicators of standardity/grammar, sentence effectiveness, clarity of information, complete information, the language used in the video is easy to understand.

Measurements based on these indicators so that the media developed can make it easier for students to understand the material presented. Because good language is language that is easy to understand (Devianty et al., 2021).

Based on table 6, there is non-standard language in the video, some use of non-standard sentences that should use standard language so that there is no misunderstanding (Alfian & Fatonah, 2020). Judging from the indicator of using effective sentences , the validator suggests replacing passive sentences with imperative sentences at the steps . In the work procedure, it contains how to make or do something using imperative sentences (Fitriyani & Mukhlish, 2021)as can be seen in Figure 6. Judging from the clarity and completeness of the information, the validator suggests completing information other than from writing but also from delivery.

Before revision After Revision

Figure 6. Results of the language aspect assessment

After the revision is done, it is submitted back to the validator to re-evaluate. Thus, the data results are obtained in the Data Results of the language aspect validation assessment in table 7.

Table 7. Data on the results of the language aspect validation assessment after revision.

Indicator	Percentage (%)
Standards/grammar used	100
The effectiveness of the sentences used	89
Clarity and completeness of the information provided	100
Ease of understanding language /sentences	100
Average percentage	97.5

The validation results from experts on the aspects of material, media, and language in the water purification video are said to be valid and worthy to be tested in learning. A learning resource that is declared valid is worthy of being used in learning activities by lecturers and students. (Fatmadiwi et al., 2021).

After watching the video about the water purification process, students are expected to be able to reflect on the importance of maintaining the availability of clean water as part of environmental conservation efforts. This video not only provides a conceptual understanding of the water purification process, but also encourages students to think critically and apply it to environmental problems around them. As a follow-up to the learning, students are given the task of compiling a written report containing an analysis of the stages of water purification that have been observed and developing simple ideas or solutions that are relevant according to the context of their living environment.

The advantage of the water purification video is that the video is complete with introductory material, benefits, and prevention in water problems on peatlands. The video is also equipped

with alternative materials so that if the material is not available, there is an alternative material. Another advantage is the complete material that can be a source of learning in learning activities.

CONCLUSION

Based on the results of the research and discussion that have been presented, it can be concluded that the Water Purification Video is very valid to be used as a learning resource for junior high school Chemistry courses and can be used for the general public . The video developed is an alternative to make learning more interesting and enjoyable and can generate motivation in learning.

RECOMMENDATIONS

In this study, further research is needed on response tests and effectiveness tests. It is also necessary to pay attention to the suitability between the media and the material to make the material delivered more efficient.

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