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# Development of YouTube Learning Media Based on Practicum of Electrolyte and Non-Electrolyte Materials

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**Abstract**

Education in Indonesia is currently ranked among the lowest in terms of quality, as evidenced by PISA 2018. Therefore, it is crucial to introduce technological innovations, such as instructional videos, to improve the state of education in the country. This project aims to create animated films that can serve as instructional resources for electrolyte and non-electrolyte solution materials, specifically designed for classroom use. The research method employed is Research and Development (R&D), utilizing the ADDIE (Analysis, Design, Development, Implementation, Evaluation) model. The results of this study demonstrate the high validity of the learning videos developed, as indicated by the validation tests carried out by media experts (81.4%) and material experts (96.9%). These results are further supported by a questionnaire-based assessment of student responses, with an overall satisfaction rate of 98.67%. Therefore, it can be concluded that the development of practicum-based YouTube animation videos on electrolyte and non-electrolyte materials, using the ADDIE model, is highly suitable for educational purposes.

**Keywords:** Electrolytes and Non-Electrolytes; Learning Media; Practicum Videos; YouTube videos

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## INTRODUCTION

Education in Indonesia is looked down upon by other countries, especially developed countries such as the Netherlands, Canada, America, etc. This can be proven from the PISA 2018 international survey that Indonesia is a country that joined the Organization for Economic Cooperation and Development with an education ranking of 72 out of 79 countries (Wahyudi, 2022). The results of PISA 2022, which was attended by 81 countries, consisting of 37 OECD member countries and 44 partner countries, showed an increase in Indonesia's literacy learning outcome ranking from 5 to 6 positions compared to the results of PISA 2018 (Putra et al., 2024). Efforts are consciously and systematically carried out to create an atmosphere of an active learning process by improving skills, intelligence, noble morals, personality, society, nation, and state is interpreted as education (Dwianti, 2021). Education is the spearhead of the nation's progress because, without education, a country cannot run well (Muspawi & Lukita, 2023). Therefore, education in Indonesia requires innovation in the form of technology in the learning system.

Technology has a considerable role in the education system to support the improvement of students' thinking skills and cognitive processes (Lestari, 2018). Technology is necessary for various educational activities (Salsabila & Agustian, 2021). The implementation of learning

in schools today has utilized technology by using technological tools in learning activities such as those carried out by teachers (Jamun, 2018). Technology can be a learning resource and a tool to improve students' understanding of certain subjects when used in educational activities. Utilizing technology in the form of learning videos is one of the right ways to enhance learning.

Video is a non-print learning media that helps make learning activities effective so students can receive learning materials well (Yulianto, 2022). Today, video-based learning is at the center of attention. This can be proven by CGS 2017 that the most significant change was in 2016, with 74% of video acquisition coming in third place (Agustini & Ngarti, 2020). Consequently, the goal of using video as a teaching tool is to help students grasp what they are learning and facilitate teachers' delivery of the subject in offline and online learning activities (Suantiani & Wiarta, 2022). This learning video is an example illustration of educational media applied in schools.

The function of educational media in the learning process is inseparable from education (Tafonao, 2018). Learning media also has an important role, namely obtaining learning objectives clearly when delivering material with space and time limitations (Hidayati, 2021). With the availability of this learning media, students can be motivated to learn and bring students to imagine, speak, and write (Rahma, 2019). Learning media is one of the supporters of online chemistry practicum learning. This media can be in the form of practicum videos on chemistry subjects.

Learning media can be used to overcome the obstacles to the effectiveness of practicum implementation, namely in the form of videos equipped with experiments along with explanations from electrolyte and non-electrolyte practicum so that it can make it easier for students to grasp teaching material. Practicum video is an innovation in developing remote practicum activities (Muchtar, 2022). Practicum videos have the advantage of being able to increase students' curiosity about what they are learning because the presentation of the material is carried out in a verbal way as well as nonverbally (visual) (Husna & Habibati, 2023). Video-based practicum, in which there is an explanation of the use of practicum tools and materials and a trial of practicum implementation (Rosita, 2023). The advantage of this practicum video is that it can be uploaded on mass media such as YouTube.

YouTube learning media is an innovation in the interactive learning process between students and teachers to explore subject matter more flexibly (Hamidah & Marsiah, 2020). YouTube is a social media that is easily accessible to all walks of life, including students. The emergence of YouTube as one of the most widely used social media platforms presents an educational opportunity (Mujianto, 2019). Discussions with videos will be more enjoyable for students learning anywhere, and they can be done at home or school. The learning materials that are applied effectively will be easily understood by students (Maunah, 2022). Using learning media such as YouTube will improve students' understanding of chemistry.

Based on the description above, this researcher aims to develop practicum-based YouTube learning media with electrolyte and non-electrolyte materials that are suitable for use to make it easier for students to do chemistry practicum online. This product can also be a reference for students that can be accessed in various places.

## METHOD

Research and Development (R&D) techniques are used in this research. Research with a method applied to publish a particular product can be interpreted as R&D (Hanafi, 2017). R&D is a research method used to develop products in education and the learning process (Qondias et al., 2019). The method to test the effectiveness of research and development products can be interpreted as Research and Development (Karisma et al., 2019). A research method is applied to developing new or existing products, which is then tested for product effectiveness in teaching and learning.

Development research that applies the ADDIE development model is developed orderly based on the foundation of learning theory (Wati et al., 2022). The stages of this model, according to Lynch & Roecker, are Analysis, Design, Development, Implementation, and Evaluation (Wicaksana et al., 2019). The ADDIE model is selected based on the reality of several series of systems based on problem-solving and learning needs (Nurhamidah, 2021). This research aims to determine how learning materials are developed, if feasible, and how students react to products in animated videos that serve as practicum-based YouTube learning materials on electrolyte and non-electrolyte materials. The research steps in the development of ADDIE, when presented in the form of a diagram (Figure 1).

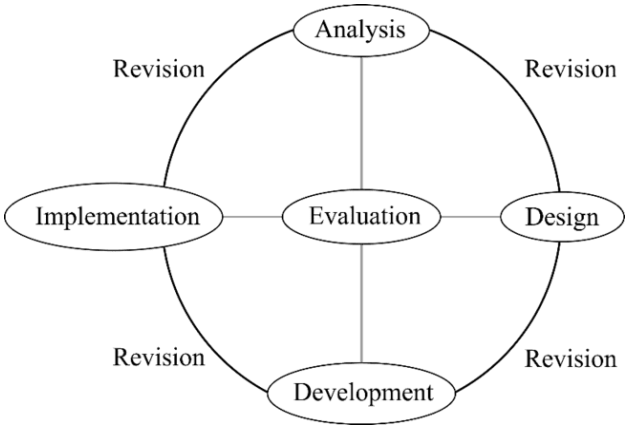



**Figure 1.** ADDIE model steps (Permana et al., 2023)

This study selected subjects from 30 high school class X students in Yogyakarta to respond to the student trial in January 2024. The data collection applied in the study included instrument validation sheets, media expert validation sheets, material expert validation sheets, student questionnaires, and chemistry teacher assessment sheets. Data analysis techniques are used to analyze the information provided by experts in the validation survey, namely media, material, and teaching and learning implementation experts, and obtained from student response surveys. The Percentage is the result of validation, which can be adjusted to the validation criteria presented in Table 1.

**Table 1.** Criteria for the Validity of Learning Tools (Fatmawati, 2016)

| No | Score (%) | Validity criteria |
|---|---|---|
| 1 | 85,01 – 100,00 | Highly valid |
| 2 | 70,01 – 85,00 | Quite valid |
| 3 | 50,01 – 70,00 | Less valid |
| 4 | 01,00 – 50,00 | Invalid |

The formula below is used to generate the total score of the assessment aspect, which the reviewer or chemistry teacher then uses to determine the final product assessment :

$$\bar{X} = \frac{\sum x}{n}$$

Note:
$\bar{X}$ = Average score
$\sum x$ = Total Score
N = Number of appraisers (Sumanjaya & Padmaningrum, 2018)

Calculating the Percentage of ideal quality of YouTube learning media products based on practicum of electrolyte and non-electrolyte materials using the formula:

$$\text{\% Overall ideality} = \frac{\text{Average score}}{\text{Ideal highest score}} \times 100\%$$

Calculating students' responses to YouTube learning media based on practicum of electrolyte and non-electrolyte materials for each aspect using the formula:

$$\text{\% the ideality of each aspect} = \frac{\text{Average score}}{\text{Ideal highest score}} \times 100\%$$

Analysis of student response questionnaire data by changing qualitative data to quantitative using the Guttman scale consists of negative statements interpreted as scores of 1 (no) and 0 (yes), and positive statements mean that scores of 1 (yes) and 0 (no) (Violadini & Mustika, 2021). The results of the data obtained on the Percentage of ideals are interpreted into categories, as shown in Table 2.

**Table 2.** Product Quality Ideals Assessment Percentage Scale (Fajriyanti et al., 2018)

| No. | Score Interval (%) | Category |
|---|---|---|
| 1 | 81 - 100 | Excellent |
| 2 | 61 - 80 | Good |
| 3 | 41 - 60 | Keep |
| 4 | 21 - 40 | Less |
| 5 | 0 - 20 | Very Less |

## RESULTS AND DISCUSSION

This development research produces a product as a video, which is used as a learning medium and uploaded on YouTube social media. It contains chemistry practicums on electrolyte and non-electrolyte material and explanations regarding the material. This development research produces learning media in videos using the ADDIE stages, which can be explained as follows.

### Analyze Stage

Observation and interviews with chemistry teachers carried out the needs analysis stage in several high schools in Yogyakarta. In addition to observations and interviews at the analysis stage, literature studies were also used by analyzing several videos on YouTube regarding the ingredients of electrolyte and non-electrolyte solutions. Observations and interviews focused on students' and teachers' challenges, difficulties, and obstacles during the learning comprehension process. Results from interviews show that few technology-based learning media are used. Hence, schools need engaging learning media to focus students' attention and create a new and not dull learning atmosphere. Media in the learning process is one of the supporting components of the success of good learning practices (Mahardika et al., 2021). YouTube was chosen because its use is familiar to the community, especially students, and its videos are easy to access (Humaidi et al., 2021).

Analysis of several videos on YouTube as social media regarding electrolyte and non-electrolyte solutions shows that there are no practical animated videos of this material on YouTube. Therefore, the material chosen for developing this learning media is KD 3.8, which analyzes the properties of solutions based on solution conductivity, and 4.8, which designs and carries out experiments and can differentiate the electrical conductivity of various solutions (Akili et al., 2022). The material selected using the sub-chapter contains the definition of electrolyte and non-electrolyte solutions, types of chemical bonds, properties of chemical solutions, electrical conductivity experiments, and properties of solutions based on electrical conductivity. Videos based on practice can serve as instructional materials, encouraging students to learn independently and achieve better learning outcomes (Hafizah, 2020). Particularly for class X MIPA electrolyte and non-electrolyte solution material, creating

practice-based YouTube learning media can be an alternative learning media to improve student learning outcomes, interest, and motivation.

**Design Stage**

At the design stage, it is carried out to design learning media. Researchers have prepared KI & KD learning materials and learning objectives to be used in the learning media to develop and make storyboards. A storyboard can be understood as a visual script tool that will be used to outline a project, displayed shot by shot, which is commonly referred to as a scene (Santika et al., 2024). A storyboard is a design tool in the form of a collection of images in simple sketches to illustrate the sequence of events of a video (Arini et al., 2023). Storyboards are made to make it easier for writers to create animated videos. The application used to create storyboards is Canva.

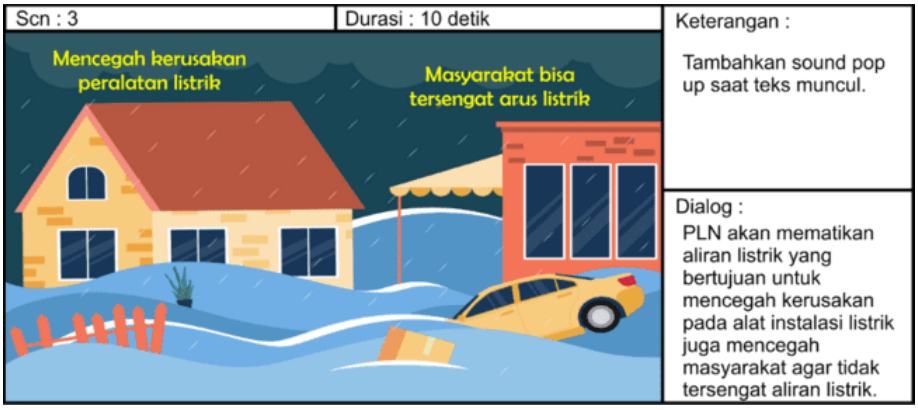



**Figure 2.** Storyboard

In addition to making storyboards, instruments are also manufactured to assess product quality. The instrument consists of a series of questions that collect data from respondents (Ardiansyah et al., 2023). A questionnaire containing several aspects used as a product assessment tool is a form of instrument created by researchers. This instrument is used to assess product quality by material experts, media experts, reviewers, and student response questionnaires as a quality assessment of products. A student response questionnaire will determine how students respond to the product developed in this research. The researcher also designed a validation sheet, a reviewer assessment sheet, and a student response sheet. The instrument's validator then validates the instrument. The video format design includes an introduction, material, practicum, results, discussion, and closing.

**Develop Stage**

At the development stage, components are collected from the analysis and design stages and converted into ready-to-use media into a product (Mutia et al., 2018). The development phase is executed by designing the resulting product, which can be accessed on smartphones, especially on the YouTube application. This learning media is presented with sounds, colors, and pictures that create attraction for students in doing practicum. The applications used in making learning videos are Adobe After Effects, Kine Master, and Capcut, and applications for creating animated images, namely Zepeto.

The creation of this learning video begins with making an intro using the Adobe After Effects application, assisted by the CapCut application, to add a background sound effect. The first view is seen when the video is played as an opening, also called a video opener (Tejawati et al., 2019). The opening of this video contains the identity of the author and consists of several slides. The first slide contains the university's logo, the author's course of study, and the author's university origin. Then, the second and third slides contain the identity of the author and the supervisor of the video making. The fourth to sixth slides contain the titles of teaching materials, instructional resources, fundamental skills, and learning goals that students will accomplish during the learning process.

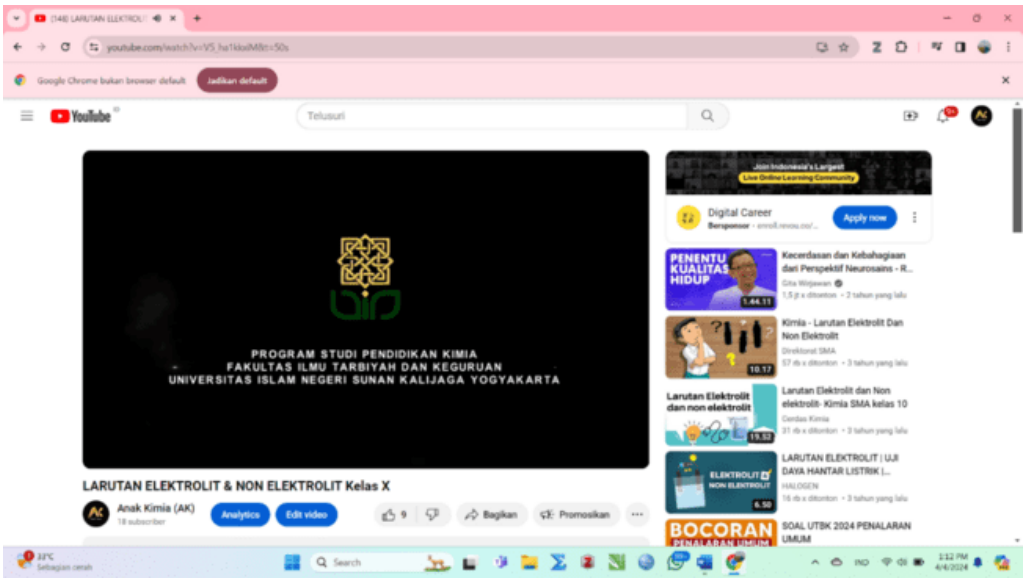



**Figure 3.** Intro

Figure 4 is the content part, which is the most essential part of a learning video because there is material that a teacher will deliver. This video discusses electrolyte and non-electrolyte solution materials consisting of several sub-materials, namely the definition of electrolyte, types of chemical bonds, properties of chemical solutions, electrical conductivity experiments, and electrical conductivity-based features of solutions. This learning video is presented by associating with natural phenomena in the surrounding environment. Providing basic understanding through examples of daily activities and natural phenomena can make it easier for students to understand the material (Yusmanila et al., 2017). The content of this learning video is created using the Canva and KineMaster applications.

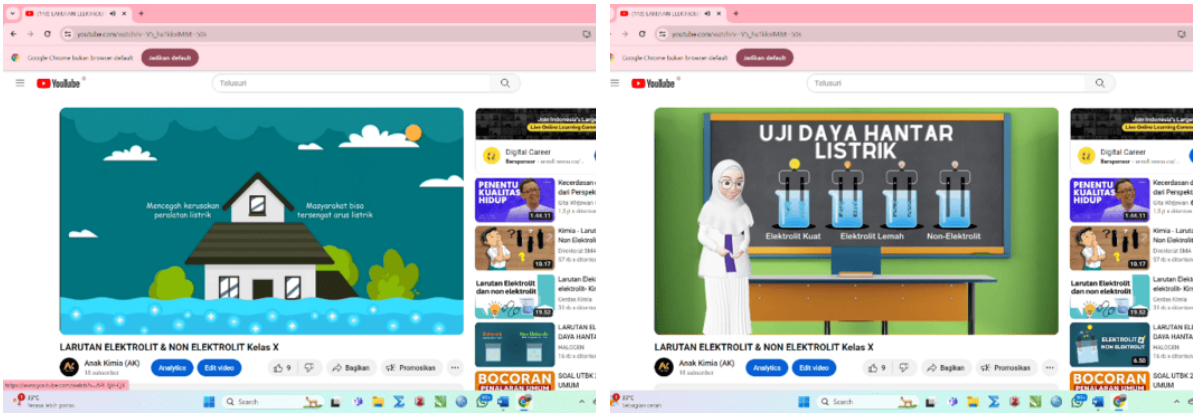



**Figure 4.** Content of the material

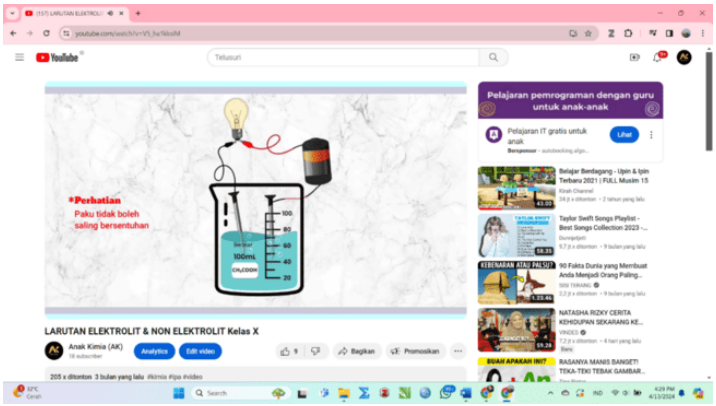



**Figure 5.** Practicum

In addition to explaining the material, in this video, there is practicum content in the form of a practicum on electrical conductivity testing using a solution of sugar, vinegar, isotonic drinks, and salt solutions, which can be seen in Figure 5. The practicum content was created to facilitate students' comprehension of the subject matter and to know the concepts firmly because students see the beginning of the material being taught.

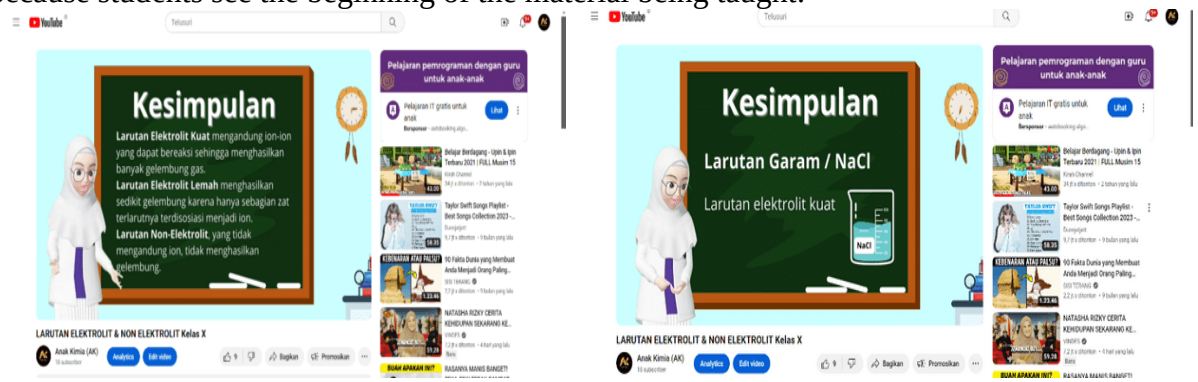



**Figure 6.** Conclusion

Figure 6 is part of the conclusion. Students' comprehension of electrolyte and non-electrolyte materials is strengthened by this result. Validity testing is done by validating learning videos by experts and practitioners; then revisions are carried out. After that, the designed product is verified by evaluators of media and material specialists. The assessment process is carried out by providing the product that has been prepared and a validation sheet accompanied by suggestions for improving the product being developed. Table 3 lists the outcomes of the media and material experts' validation.

**Table 3.** Results of Validation of Media and Material Experts

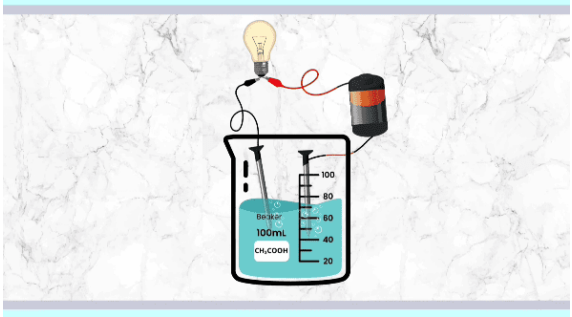
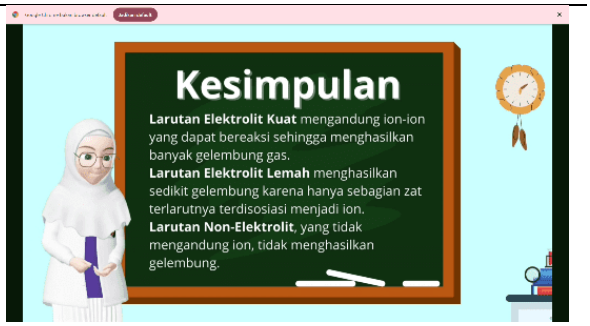
| Validation | Aspects | ∑ Indicators | Criterion | | | Total | Category |
|---|---|---|---|---|---|---|---|
| | | | VTR | VDR | TV | | |
| Material Expert | Eligibility | 4 | 75% | 25% | 0% | 100% | Highly Valid |
| | Interest | 3 | 100% | 0% | 0% | 100% | Highly Valid |
| | Language | 4 | 100% | 0% | 0% | 100% | Highly Valid |
| Media Members | Video | 4 | 50% | 50% | 0% | 100% | Highly Valid |
| | Design | 5 | 40% | 60% | 0% | 100% | Highly Valid |

Based on the findings of a study conducted by media and material specialists, the quality of the content in this product is very valid. These criteria include content feasibility, learning interests, language aspects, videos, and design. However, some revisions have been made by material experts and media experts. Things that need to be revised by material experts include understanding the concept of weak electrolytes and explaining the experimental concept. Meanwhile, things that need to be revised by media experts include the typography of writing, readability, and sound in the video. Improvements before and after the validation of media experts and material experts can also be seen in Table 4.

**Implementation Stage**

Learning media products that material and media experts have validated are then implemented to assess the quality of the developed products. At this stage, the product was evaluated by three high school chemistry teachers in Yogyakarta and 30 high school mathematics and mathematics students in Yogyakarta. The assessment of product quality by teacher reviewers can be seen in Table 5.

**Table 4.** Products Before and After Revision

| No | Before the Revision | After the Revision |
|---|---|---|
| 1 |  |  |
| | Remarks: At the beginning of the opening, you should convey the learning outcomes | |
| 2 |  |  |
| | Remarks: The title needs to be bigger, and the explanation needs to be more varied. | |
| 3 |  |  |
| | Remarks: α = 1 yellow background color with white writing, not visible. | |
| 4 |  |  |
| | Remarks: There should be fewer bubbles in the weak electrolyte part regardless of whether the flame is dim or not lit. | |
| 5 | - |  |
| | Remarks: The explanation in the learning video should be given in addition to why bubbles are produced in solid electrolytes, few in weak electrolytes, and no in non-electrolytes. | |

The assessment of chemistry teachers based on the results in high school/MA schools obtained an average score of 86.97 with an ideality percentage of 86.97% with the category of very good. The assessment in the aspect of presenting the material received a score of 40 out of 48 with an ideality percentage of 83.3%; based on the data, there are suggestions and inputs from chemistry teachers regarding the details of explanations in delivering the material and should be added to make it more interactive to simplify the concepts of electrolyte and non-electrolyte solution materials for the students. The assessment on the aspect of learning interest obtained a score of 32 out of 36 with an ideality percentage of 88.89%; based on this data, there are suggestions and input from chemistry teachers; every question that arises at the beginning of the material should not be answered immediately, but questions are made to provoke students' curiosity. However, if it is used as a learning media that supports electrolyte and non-electrolyte material, then creating a YouTube-based learning media practicum is appropriate and feasible to implement. This is consistent with studies by Adlim, Halim, A., and Mutia, R., who mentioned that video-based practicum learning media is possible. Table 6 presents the evaluation of the student response questionnaire results.

**Table 5.** Product Quality Assessment By Teacher Reviewer

| Aspects | ∑ Criteria | ∑ score | Average score | Ideal Percentage | Category |
|---|---|---|---|---|---|
| Visual Aspects | 5 | 55 | 18,3 | 91,67% | Excellent |
| Aspect of Material Presentation | 4 | 40 | 13,3 | 83,3% | Excellent |
| Aspects of Learning Interest | 3 | 32 | 10,67 | 88,89% | Excellent |
| Language Aspects | 4 | 44 | 14,67 | 91,67% | Excellent |
| Total | 16 | 167 | 55,67 | 86,97% | Excellent |

Based on the responses from 30 high school students in class X, an average score of 9,867 was obtained with a total score of 296 out of 300 and an ideality percentage of 98.67% with the category of very good. Overall, the student's responses received quite good assessments, as seen from the students' comments stating that this learning media presents complete and easy-to-understand material, the learning videos are presented with exciting and not dull illustrations and can help in the chemistry learning process at school. However, there are suggestions and input from students; it is better to use their voices. Thus, developing YouTube learning media based on a practicum of electrolyte and non-electrolyte materials can be an effective learning medium for chemistry learning at school. This is consistent with studies by Rosita, R., Syahriani, S., and Jamilah, J., where she mentioned that implementing video-based practicum positively influences student learning outcomes.

**Table 6.** Results of Student Response Assessment

| Aspects | ∑ Criteria | ∑ score | Ideal Percentage (%) | Category |
|---|---|---|---|---|
| Usability Aspect | 1 | 30 | 100% | Excellent |
| Material Aspects | 3 | 89 | 98,6% | Excellent |
| Language Aspects | 1 | 30 | 100% | Excellent |
| Design Aspects | 3 | 88 | 97,7% | Excellent |
| Aspects of Learning Interest | 2 | 59 | 98,3% | Excellent |
| Total | 10 | 296 | 98,67% | Excellent |

**Evaluation Stage**

The evaluation stage is carried out on all stages that have been implemented. Data collection activities, known as evaluations, are carried out to measure how practical learning activities are and the achievement of learning objectives (Dewi, 2022). This stage aims to determine the improvements that need to be made in the previous stages. Evaluation is a process or tool to measure students' achievement in knowing the subject matter (Fatzuarni, 2022). The evaluation stage involves collecting data or suggestions from media and material experts, which are applied in the final stage to determine the effect of students' suggestions in using the developed learning media (Wisada et al., 2019). The evaluation stage in the study is carried out after validating to media and material experts. There were suggestions and inputs from several experts, followed up by researchers, including a practicum in learning videos that needed to be more detailed. The researcher followed up on this by improving the learning video in the practicum section by adding detailed material. Here are the results of the developed products: https://bit.ly/4d4XTUG.

## CONCLUSION

Drawing on the findings of the conducted research, the following conclusions can be made: The result of the product developed is a learning video as a learning medium on the subject matter of electrolyte and non-electrolyte solutions produced a video consisting of an intro, content (material, electrical conductivity practicum), closing. The content display includes the presentation of electrolyte and non-electrolyte solution materials and the electrical conductivity practicum. The closing view of the video contains a discussion of the practicum and conclusions. The learning videos also contain pictures, animations, and music that help students learn electrolyte and non-electrolyte materials with pleasure. Learning media in the form of videos uploaded on YouTube social media that can be played in various levels of resolution according to needs and the format of the resulting learning video, namely MP4, allows videos to be disseminated offline and online and can be played through all electronic devices that support the MP4 format such as mobile phones, laptops, etc. The learning video developed is suitable because it shows excellent category results based on evaluating students' answers. Practicum content on YouTube-based electrolyte and non-electrolyte materials can improve practicum learning. Practicum does not have to be carried out at school but can be done independently at home. The content that has been developed needs further testing in the wide-scale learning process to find out the shortcomings and advantages of the video.

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