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Development of YouTube-Based Electrolysis Learning Media to Increase Student Learning Motivation

Ghaitsa Zahira Shofa Pradana Putri[1], Hayuni Retno Widarti[1*]

[1]Departement of Chemistry, Universitas Negeri Malang, Malang, Indonesia.

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Corresponding Author:
Hayuni Retno Widarti
hayuni.retno.fmipa@um.ac.id

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Abstract: The low motivation of students in learning chemistry, especially electrolysis, encourages educators to continue to develop new innovations in the learning process that are tailored to the characteristics and needs of students. This research aims to develop YouTube-based electrolysis learning media to increase student learning motivation. The method used is Research and Development (R&D) with the ADDIE development model until the development stage. Preliminary tests carried out include validity tests, readability tests, and small-scale trials. The developed media was tested in problem-based learning using a one-group pretest-posttest design to assess the effectiveness of the developed media in increasing student learning motivation. Quantitative data obtained from a Likert scale (5, 4, 3, 2, 1) was analyzed using the average percentage calculation technique for validation tests and student perspective tests, as well as standard gain for small-scale trial data. The data obtained were then interpreted into categories of feasibility and improvement, followed by revision based on suggestions from qualitative data. The research results in the form of a YouTube social media account named "YuroLab" with three educational video content. The validation test resulted in an average score of 83.89%, and the student perspective test resulted in a score of 81.99%, placing it in the very feasible category. The increase in student learning motivation resulted in an average standard gain of 0.58 which is included in the moderate category.

Keywords: Electrolysis cell; Learning motivation; YouTube learning media

Introduction

Chemistry is often perceived as a difficult subject, leading to low student interest and frequent misconceptions (Lutfianasari & Lestari, 2024; Prayunisa, 2022). One topic prone to misconceptions is electrolysis, a subtopic of electrochemistry (Nisa & Fitriza, 2021). These misconceptions are influenced by various factors, including students' lack of motivation and teachers' own conceptual errors (Hartanti et al., 2024). To overcome these challenges, concrete and contextual learning strategies are needed (Sari et al., 2023a).

Although practicum-based learning offers a promising approach, its implementation is still limited due to inadequate laboratory facilities in many Indonesian schools (Marcella et al., 2018). This situation hinders students from gaining hands-on experience, making alternative approaches such as ethnoscience relevant (Ardyansyah, 2024). Ethnoscience, by utilizing local culture, offers a contextualized and meaningful learning experience (Sari et al., 2023b).

In addition, digital media has emerged as an effective educational tool (Tanjung et al., 2022). Social media platforms, such as YouTube and podcasts, have been shown to enhance student motivation and engagement (Nugroho et al., 2019; Widarti et al., 2022; Sari & Tuerah, 2023). Monhartini et al. (2023) and Erlitaviana & Tyas (2025) added that, the use of audio visual learning media in YouTube can increase student

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motivation and enthusiasm. Therefore, there is a need for training and making creative videos to support more interactive learning (S et al., 2024). The small-scale laboratory approach also presents a solution by minimizing chemical usage while supporting exploration (Listyarini et al., 2019). The application of media can be further optimized by the use of an ethnoscience approach that is integrated or applied in the Problem-Based Learning learning model.

Problem-Based Learning (PBL), when integrated with ethnoscience, has proven effective in fostering scientific literacy, creativity, and learning interest (Munandar et al., 2022; Widarti et al., 2025). Handayani & Djukri (2024) and Safitri et al. (2023) added that Problem-Based Learning is feasible and effective in increasing students' interest and motivation to learn. However, there is still a lack of research that combines YouTube's, ethnoscience's, PBL's, and electrolysis's elements into a unified learning media.

Based on this background, this study aims to develop YouTube-based learning media on electrolysis material, integrated with ethnoscience and the PBL model. The media will be evaluated for its feasibility and potential to increase student motivation. This research seeks to fill the existing gap by offering a flexible, culturally relevant, and engaging alternative for chemistry learning.

Methodology

The development research method was carried out by applying the Research and Development (R&D) method with the ADDIE development model. According to Adeoye et al. (2024), the method developed by Robert Maribe Branch in 2009 has the potential to revolutionize education in Indonesia through structured instructional design. The stages of ADDIE include analysis, design, development, implementation, and evaluation (Setiaji & Rinawati, 2022). Due to time constraints, this research was only carried out up to the development stage. The analyze stage is carried out through literature studies, distributing questionnaires or questionnaires, interviews, and observations to find out the condition of chemistry learning in schools, including learning goals and obstacles, student characteristics, and available resources. Based on the data obtained, a needs analysis was conducted to determine learning media innovations to overcome the problems found. The innovations obtained were followed up at the design stage. Learning media is designed with adjustments to student characteristics and learning materials.

Planning at the design stage includes making video story boards and logo designs, preparing material delivery strategies, determining YouTube account layout themes, content types, talents, and sources. The third step is the development stage, which consists of the production and initial testing stages. The production stage includes making scripts, taking video and audio, and editing. In addition, a YouTube account was also created, uploading content, and preparing initial testing instruments. The learning media validation test was conducted on expert lecturers and chemistry teachers using a questionnaire with a Likert scale (5, 4, 3, 2, 1) accompanied by a column of comments and suggestions. The validation test aims to determine the feasibility of the media developed (Sugiyono, 2013).

The readability test was conducted on high school students to see the feasibility of learning media developed based on student accessibility (Novela et al., 2022). The readability test was conducted using a Likert scale questionnaire (5, 4, 3, 2, 1) which was equipped with a column of comments and suggestions. The small-scale trial was conducted on class XII students from one of the public high schools in Tulungagung who had received electrolysis material, to see the feasibility of the media on increasing student learning motivation. The number of students in the class used was 36 students. The small-scale trial was conducted by applying the developed media in learning with the Problem-Based Learning model. The measurement instrument used is an assessment questionnaire with aspects of interest and interest, involvement and effort, and a sense of student achievement. The questionnaire instrument used is a researcher-developed instrument, which has been tested for validation before use. The measurement questionnaire uses a Likert scale (5, 4, 3, 2, 1) with criteria score 5 'strongly agree', score 4 'agree', score 3 'moderately agree', score 2 'disagree', and score 1 'strongly disagree'. The last part of the instrument is equipped with a column of comments and suggestions as qualitative data.

The technique of analyzing data from the validation test results was carried out by calculating the average technique with the formula:

$$\bar{x} = \frac{\sum x}{n} \times 100\% \qquad (1)$$

Description:
$\bar{x}$ = average of value
$\sum x$ = Total of scores given by validators
n = amount of validators

The technique of analyzing data on the results of the readability test is carried out by calculating the average technique with the formula:

$$\bar{x} = \frac{\sum x}{n} \times 100\% \qquad (2)$$

Description:
$\bar{x}$ = average of value
$\sum x$ = Total of scores given by students
n = amount of students

The average value of the validation and readability tests obtained was then interpreted to see the feasibility of the product, according to the average analysis criteria according to Sukarelawan et al. (2024), which is described in Table 1.

Table 1. Average analysis criteria

Average Value (%)	Criteria
81 – 100	Very feasible
61 – 80	Feasible
41 – 60	Feasible enough
21 – 40	Less feasible
0 – 20	Not feasible

The technique of analyzing data from small-scale trial results used to measure the increase in student learning motivation is done by calculating the average standard gain with the formula:

$$N_{-Gain} = \frac{(S_{post} - S_{pre})}{(S_{max} - S_{pre})} \quad (3)$$

The average standardized gain obtained is then interpreted with the improvement criteria according to Sukarelawan et al. (2024), which is shown in Table 2.

Table 2. Criteria of improvement

N-Gain Score	Interpretations
N-Gain > 0.7	High
0.3 ≤ N-Gain ≤ 0.7	Medium
N-Gain < 0.3	Low

The research was conducted for 1 year with the research schedule allocation shown in Table 3.

Table 3. Research schedule

Activities Name	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
Problem analysis and literature study	√	√	√	√								
Preparation of tools and materials for media preparation			√	√	√							
Design of instruments and teaching materials					√	√	√	√				
Implementation of validation and reliability tests of instruments and media							√	√				
Data collection									√			
Data analysis									√	√		
Writing and presentation										√	√	
Preparation of reports											√	√

Results and Discusion

The data from the needs analysis questionnaire for chemistry teachers and high school students with the highest percentage are shown in the graph in Figure 1.

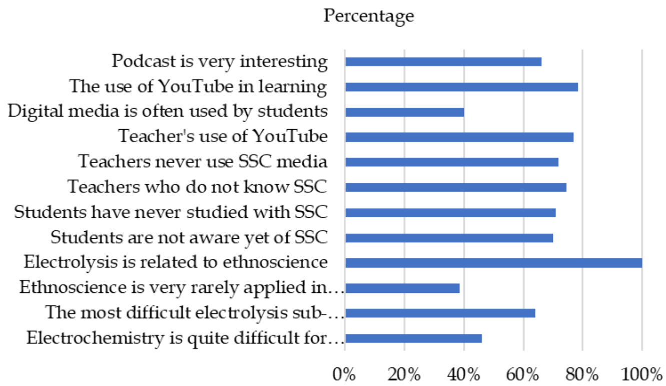

Figure 1. Graph of the highest percentage of questionnaires (Source: Author's research data)

Based on the data obtained, the results of the needs analysis are described as follows: 46% of students have enough difficulty in learning electrochemical materials, according to 64.10% of teacher respondents, students have difficulty in electrolysis sub-materials. The questionnaire data is supported by the results of student interviews which convey that the difficulties of electrolysis material are mostly experienced in the calculation of Faraday's Law and the difference in reactions between electrolysis cells. The difficulties experienced by students are caused by various factors, one of which is the lack of real and contextual learning (Silva & Santos, 2023). Learning with real exploration is needed to provide students with concrete learning experiences, and help students understand the material, one of which is through practicum-based learning (Krushinski et al., 2024).

Based on field observations, there are still several schools in Indonesia that do not have adequate laboratory infrastructure. This condition has an impact on the lack of opportunities for students to explore learning directly. The application of ethnoscience approach is one of the alternatives in realizing real and contextual learning (Sari et al., 2023b). The questionnaire results show that 38.5% of teachers rarely relate electrolysis material to the context of local culture, while 100% of teacher respondents agreed that electrolysis material can be related to local culture. Other alternatives, such as small-scale laboratories, are also still very little used (Toit & Toit, 2024). The results of the student questionnaire show that 69.9% of students do not know the small-scale laboratory learning media, and 71% of students have not received small-scale laboratory learning or small-scale virtual laboratories by teachers. This data is reinforced by the results of the teacher questionnaire which shows that 74.4% of teachers do not know the small scale laboratory learning media, and 71.8% have never used it in learning electrolysis.

The lack of insight and optimization of learning media in the learning process is unfortunate. Seeing 76.9% of teacher respondents have used digital learning media, such as YouTube to find information and as learning support. The use of YouTube social media has the potential to be optimized in supporting the learning process and disseminating information related to small scale laboratories (Hikmah et al., 2024). This is relevant to the characteristics of today's students, where 40% of them often use digital learning media, and 78.5% use YouTube social media. This finding is in line with the research results of Widarti et al. (2022) and Tanjung et al. (2022) who found that chemistry learning based on YouTube social media can increase student motivation, enthusiasm, and learning outcomes.

Based on the needs analysis, researchers provide solutions in the form of making learning media based on YouTube social media "YuroLab" to increase student motivation. Utilizing the characteristics and interests of students in accessing YouTube, YuroLab developed using ethnoscience approach and the use of small scale laboratory in podcast content. Selection of podcast content types and small scale laboratory because the needs analysis data show that 42.4% of students are moderately interested, 27.2% are interested, and 66% are very interested in podcast content. This is also supported by the results of Sari & Tuerah (2023) which states that the factual and interesting delivery of podcasts has succeeded in making podcasts popular in society, one of which is through their application in learning (Krúpová, 2024). Meanwhile, in addition to the small scale laboratory that is still not well known by teachers, the use of small scale laboratories is effective in minimizing the use of chemicals (Listyarini et al., 2019), so it needs to be disseminated, one of which is with tutorial content (Widarti et al., 2024). Tutorial content combined with an ethnoscience approach can provide more real and contextual learning (Jannah et al., 2022).

The learning media innovations produced at the needs analysis stage were followed up at the design stage (Zendrato & Telaumbanua, 2022). YouTube account planning is carried out, including account name, logo design, and channel banner design. The next planning is material selection and content script creation. The selected material was then consulted with expert lecturers, so that the electrolysis cell material was determined in the form of electrolysis concepts, electrolysis cell circuits, reactions in electrolysis cells, Faraday's Law calculations, electrolysis applications in everyday life, and electrolysis cell practicum tutorials. Based on the type of content and material to be delivered, the number of video content and the division of material was determined, so it was decided to make 3 video content. The first video contains the approach and explanation of the material, the second video contains the application of electrolysis cells to culture and daily life, while the third video is about practical tutorials. The next planning was to determine the tools and materials used in the practical tutorial, talents, and speakers. The selected talents are researchers and several researcher friends, while the resource persons for the podcast are 2 lecturers from the chemistry department at State University of Malang.

The third stage in this research is the development stage. Development is carried out through the production and initial testing stages (Sumual et al., 2024). The production stage of learning media is done by taking videos, and editing videos. The podcast video was taken at GKB, State University of Malang, while the unboxing video and practicum tutorial were taken in the research laboratory room of the Chemistry Department, State University of Malang. Video shooting was carried out for 2 weeks by taking into account the licensing of the place and the schedule of the speakers. The next stage of production is video editing. Animation creation is done using the Canva application, which is then edited in the video editing process using the CapCut application. Videos that have been developed are then published through a YouTube social media account called YuroLab. At this stage also made caption, as well as video hastags. The display results of the developement of YuroLab account channel is shown in Figure 2.

Figure 2. YuroLab YouTube account display

The product produced in this study is a social media-based learning media YouTube named "YuroLab" with ethnoscience approach on electrolysis material to increase student learning motivation. YuroLab applied in small-scale trials as a learning support tool for 12th grade students in problem-based learning. YuroLab has an account logo and channel banner, and contains 3 video content that discusses: approach and discussion of electrolysis cell material, examples of the application of electrolysis in culture and daily life, and ethnoscience practicum tutorial with small scale laboratory with standard solutions and ethnoscience materials that exist in the surrounding life. The three video contents have the aim to facilitate students in learning and consist of opening, discussion and closing segments.

The first video content product consists of an opening segment that contains an approach to the material. The approach begins with a discussion of interesting Balinese culture, one of which is in traditional ceremonies with beautiful and shiny equipment. Examples of traditional equipment are bokor and dulang. Bokor and dulang, which look expensive and luxurious, are not made of real silver and gold, but of brass coated with silver or gold. The plating process is called electroplating. Electroplating is one of the applications of electrolysis material (Selly et al., 2020). The explanation of electrolysis material is continued in the discussion segment. The electrolysis material explained includes the concept, circuit, and reaction of electrolysis cells, as well as the calculation of Faraday's Law. The discussion segment is also equipped with examples of reactions and calculations of Faraday's Law. The first video content ends with a closing statement, by the resource person, and closing by the host in the closing segment.

The second video content product consists of an opening segment that contains an affirmation of the concept of electrolysis material close to cultural life and the close relationship between culture and science, especially chemistry. The in-depth explanation is continued in the discussion segment which discusses examples of Indonesian culture related to electrolysis. Discussion about the environment and the application of small scale laboratory as one of the steps to disseminate SSC information was also discussed at the end of this segment. The discussion segment ended with an affirmation of the concept and a closing statement in the closing segment.

The third video content product consists of an opening segment containing a review of electrolysis cell material in Indonesian culture, followed by an introduction to the box and materials in the small scale laboratory. Tutorials and practicum examples are explained in the discussion segment. Practical tutorials are given by minimizing the amount of solution given. The solutions used are standard solutions and solutions that exist in the surrounding life. The third video content ends with gratitude, motivational words, and an invitation to do an electrolysis cell practicum using materials in the surrounding life in the closing segment.

The approach taken at the beginning of the first video and the invitation at the end of the third video aims to make students curious and interested in learning electrolysis material. Students' awareness related to the proximity of electrolysis material in life, and the provision of practicum tutorials with materials in the surrounding life, are expected to be able to make students motivated to learn electrolysis material because it is fun and real. The developed product was then tested in the early stages, including validation tests, readability tests, and small-scale trials. The validation test was conducted on 1 expert lecturer from the Department of Chemistry, State University of Malang and 2 chemistry teachers. The validation test aims to see the validity of the media developed from the aspects of material, presentation, and interaction. The assessment aspects and the average results of the validation test are shown in Table 4.

Table 4. Validation results

Assesment Aspect	Average Value (%)	Criteria
Material Aspects	81.90	Very feasible
Presentation Aspects	84.76	Very feasible
Interaction Aspects	85.00	Very feasible
Average	83.89	Very feasible

The readability test was conducted on 36 students of SMA Negeri Tulungagung class XII to see the ease of use of the developed media from the aspects of social media account display, material, and usefulness. Statements assessed on a Likert scale (5, 4, 3, 2, 1) along with the average value results are shown in Table 5.

Table 5. Readibility results

Assesment Aspect	Average Value (%)	Criteria
Display Aspects	81.24	Very feasible
Aspects of Material Content	82.00	Very feasible
Usability Aspects	82.74	Very feasible
Average	81.99	Very feasible

Based on the data from the validation and readability tests with an average value of 83.89 and 81.99% respectively, the learning media developed by researchers fall into the category of very feasible, valid or usable. The product received good feedback from the validators. Students also said that the product is interesting with real explanations so that it is easy to understand. The suggestions obtained from validators and students are on the lack of animation in the video, especially in the podcast dialog session, so revisions are needed to add animation to make it more interesting and clear. Additional explanation is also needed on several scientific mentions, to make it easier for students to understand the material. In addition, the account products developed, in the future, are recommended to be expanded and deepen explanations that are still complicated.

Small-scale trials were conducted to determine the feasibility of the media developed in increasing student learning motivation. The small-scale trial was conducted on class XII students from one of the state high schools in Tulungagung who had received electrolysis material in 2 face-to-face lessons, or 5 hours of learning. The calculation of the average standardized gain along with the standard deviation and standard deviation is shown in Table 6.

Table 6. Results of N-Gain increased motivation

Descriptive Statistics					
	N	Min.	Max.	Mean	Std. Deviation
Skor N-Gain	16	.33	1.00	.5803	.18589
N-Gain Persen	16	33.33	100.00	58.0303	18.58889
Valid N	16				

Based on Table 5, the average result of the standardized gain value is 0.58 which is interpreted in the moderate category. In addition to quantitative data, students also provided feedback through suggestions and comments. Students commented that the delivery in the media developed with a real context and light but detailed, made the learning process more interesting. The results of the improvement and student statements are in line with the results of research by Septianing et al. (2024) and Kurniasari et al. (2024), which states that accessibility and interesting podcast delivery have an important role in the effectiveness of podcasts as learning media. The increase in student learning motivation through the developed learning media products is in accordance with the results of research by Widarti et al. (2022) and Pratiwi et al. (2024) which conveyed that social media-based chemistry learning can increase student learning motivation. The use of podcasts followed by real examples such as ethnoscience and practical approaches, is effective in increasing student involvement and effort in the learning process (Ayukinah, 2022; Fatihatussa'adah et al., 2024). There is an increase in student motivation because the delivery of podcasts in the learning media developed is light and starts from culture and surrounding life, so it is easy to understand and makes students interested in the learning process.

Conclusion

The development of YouTube social media-based learning media on electrolysis material integrated Problem-Based Learning is done through the stages of field needs analysis, design, and development. Learning media development products produced in the form of a YouTube social media account with the name "YuroLab" which contains 3 learning video conte. Learning video content contains the theme of culture or ethnoscience with podcast content and practicum tutorials with small scale laboratory. The average results of the validation test and readability test successively obtained a value of 83.89 and 81.99% which is included in the category very feasible. The product was also tested on a small scale to see its feasibility in increasing student learning motivation in Problem-Based Learning. The results of the small-scale trial obtained an average standardized gain value of 0.58 which is included in the moderate category. Based on the stages carried out, the learning media products developed are considered feasible and have the potential to increase student learning motivation. The developed product still needs to be improved, including through the utilization of the video shorts feature on YouTube and testing it on other variables, such as student learning outcomes. Measuring the effectiveness of the developed product needs to be continued in the implementation stage to measure its effectiveness on various other learning variables. In addition, the media product developed at this time is only limited to electrolysis material, so that its application can be developed for other chemical materials.

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Conflicts of Interest
The authors declare no conflict of interest.

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