A Powtoon Animation Video Development Utilizing a Scientific Approach for Teaching Electrolyte and Non-electrolyte Solutions

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Abstract: Students often experience difficulty learning chemistry because the concepts are abstract and complex and require deep understanding. Therefore, innovation in learning is needed. Educational media is crucial for fostering this innovation. This research aims to develop educational materials on Powtoon animation that utilize a scientific approach to instruct on electrolyte and non-electrolyte solutions and evaluate their efficacy. The method applied was ADDIE model covering five steps, i.e. Analysis, Design, Development, Implementation, and Evaluation. The study involved three peer reviewers, experts in media and materials, five high school chemistry teachers, and thirteen students. Data were collected through questionnaires that were analyzed qualitatively and quantitatively with validated instruments. The result is an interactive learning video in HD mp4 format covering electrolyte and non-electrolyte solutions. The product obtained a score of 82.5% and 95% by material and media experts, respectively, and was categorized as valid. Assessments by teachers and students show scores of 82,5% and 94.4% in a very good category. This Powtoon animation video serves as an alternative and potential medium for teaching chemistry on this topic in the classroom.

Keywords: Chemistry; Learning media; Powtoon; Scientific approach.

Introduction

Chemistry is one of the compulsory subjects for students in class X IPA Senior High School. Chemistry education necessitates growth and application involving diverse activities and skills like memorization, calculations, and lab practice. In chemistry class X Science, electrolyte and non-electrolyte solutions are crucial topics encompassing conceptual, factual, procedural, and theoretical knowledge students need to grasp. This subject often makes chemistry seem challenging and uninteresting to many students. (Muderawan et al., 2019). Chemistry can be challenging for students because it involves abstract and complex concepts, necessitating a thorough understanding (Sariati et al., 2020). Students need regular guidance and practice from teachers to develop a solid understanding (Suarsani, 2019). Ismail (2016) highlighted that learning obstacles arise when specific factors impede learning, underscoring the teacher's critical role in ensuring effective education.

Teachers are essential in helping students with learning difficulties (Adini et al., 2023), so effective learning methods are needed. However, the fact is that at school, many teachers still use the lecture method to deliver learning materials (Mihalova & Reinita, 2023), where students feel bored and saturated with such activities, so this requires innovation in the learning process. Learning innovations can be supported by the role of learning media, making learning more varied (Putri & Reinita, 2022). Innovation can be applied in the learning process by using learning media (Putri &

Reinita, 2022). Learning media is a tool that is needed by teachers in the learning process (Septian, 2022).

Interviews with chemistry teachers at MA Nurul Ilmi Bategede Nalumsari Jepara showed that the most widely used chemistry teaching method is applying PowerPoint media. The dominant media is written text, while the PowerPoint design lacks colors, graphics, and visual elements, thus reducing its overall appeal. It challenges students' understanding, which may lead to disinterest during learning (Fardany & Dewi, 2020). This means that teachers also need to apply various methods of learning process activities so that students do not feel bored or bored when participating in learning activities (Wardana & Adlini, 2022). Learning media improves communication and interaction between educators and learners, thus improving students' understanding of learning content (Prayitno et al., 2022) and is very necessary to support the achievement of learning objectives (Qosyim & Priyonggo, 2018). Muyassaroh & Ardhana (2021) noted that using audio in learning media improves students' understanding of the subjects delivered in class. Therefore, there is a need to develop learning media equipped with video and audio elements to present material more effectively in the classroom.

Video media is one type of media educators can use as a tool in learning (Febriani et al., 2017). Video media can attract students' attention to learning and can increase understanding and make it easier for students to remember the material they are studying (Utami et al., 2024). So that class conditions are calmer and concentration automatically develops in each student (Caella & Yulianto, 2024). Powtoon is an animated video platform that is suitable for use in an educational context. Research (Putri & Reinita, 2022). shows that the Powtoon application can be an opportunity for teachers to create learning media that is more interesting and not boring for students. The advantages of Powtoon lie in its convenience because the result is in the form of a video, as well as the ease of creating animations that attract students' attention and can be accessed anytime and anywhere. In addition, Powtoon also provides music, allowing users to add sound (recording), handwriting animation, and transition effects with various colors that make learning more interesting and dynamic (Dewi & Handayani, 2021). Powtoon is known as software in the form of animation and can be accessed online through a website that can help users easily and quickly create presentations or videos in the form of animation, and can be done by manipulating objects, inserting various images, music, and voice recordings from users (Istiqomah & Adi, 2024). Powtoon has the ability to convey the material through visual and audio messages that contain images and animations (Banggur et al., 2018). Latifah (2020) research found that using Powtoon

media on the material of the periodic system of elements was considered useful and effective based on student responses. However, developing Powtoon animation videos based on a scientific approach to chemistry material is rarely done. The use of Powtoon animation media can be further developed with a scientific approach.

The scientific approach in learning can be interpreted as a learning method based on scientific processes by applying logical and empirical steps. In this approach, the media is designed according to the characteristics of students through the stages of observing, questioning, trying, reasoning, and communicating to improve students' critical, creative, systematic, analytical, and logical thinking skills (Malinda et al., 2021). The use of Powtoon animated videos based on the scientific approach in electrolyte and non-electrolyte solution materials has never been applied. Therefore, this research focuses on making learning videos based on a scientific approach using Powtoon on electrolyte and non-electrolyte solutions for senior high school students class XI. Powtoon animation media with a scientific approach is expected to eliminate student boredom in the classroom, create a pleasant learning atmosphere, and facilitate understanding of material without teacher-centered learning (Sary et al., 2023). Researchers chose Powtoon animation media based on a scientific approach because it can create a pleasant learning atmosphere and helping students understand the material independently and is expected to make it easier for teachers to simplify the material, make the material more concrete, simple, and interesting, and increase students' enthusiasm for learning (Dewi & Kamaludin, 2022). Other research by Fardany & Dewi (2020) also states that Powtoon learning media based on a scientific approach to economic subjects is considered feasible, practical, and effective. Powtoon animated videos can be operated easily and can be repeated so that it can make it easier for students to understand the material. In addition, video media can also show a demonstration that is difficult for teachers to demonstrate (Afrilia et al., 2022).

Method

This research is a type of research and development (R&D). The development model used is the ADDIE model, which consists of five stages: analysis, design, development, implementation, and evaluation (Yulia et al., 2023). However, in this study, the process was only carried out until the implementation stage (Figure 1). The ADDIE model was chosen because it is suitable for producing software products. The selection of this model is based on its ability to develop products

effectively and efficiently so that the products produced can be feasible to use (Lestari et al., 2018). Previous research shows that this animated video helps teachers and students in learning and effectively improves student learning outcomes (Candra Dewi & Negara, 2021). Each stage in this research follows the steps contained in the ADDIE model, where each stage is interrelated with each other (Pribadi, 2016). The following are the ADDIE stages applied by researchers in developing Powtoon animation video products based on a scientific approach.

Analysis

At this stage, researchers interviewed a chemistry teacher at one of the high schools and obtained information about the material suitable for developing learning media, the curriculum used, and the needs of students. Needs are seen based on the characteristics of students who will be adjusted to the developed product, namely learning media in the form of Powtoon videos. In addition, an analysis of the learning materials to be used and the tools needed to make these products is carried out (Dewi & Handayani, 2021).

Design

Design stage to design a product appropriate to the results from analysis (Nuri et al., 2023). At the design stage, it aims to provide an initial design of the learning media to be created. Researchers formulate development concepts at this stage, compile materials and scripts, and collect images, fonts, font sizes, and music (Dewi & Handayani, 2021). The researchers used the Powtoon platform to design the animation (Sary et al., 2023).

Development

At the development stage, a team of experts carried out a validation test to assess the feasibility of the products that had been developed. The product is then improved based on input from peer reviewers, media experts, material experts, and five Senior High School chemistry teachers reviewers before implementation (Dewi & Handayani, 2021). Powtoon animation learning media development based on the scientific approach was tested by distributing questionnaires to thirteen MA Darul Quran Wahid Hasyim students. The research was limited to the development stage because the implementation stage was not carried out due to time constraints. The implementation stage requires time following learning in schools involving more students.
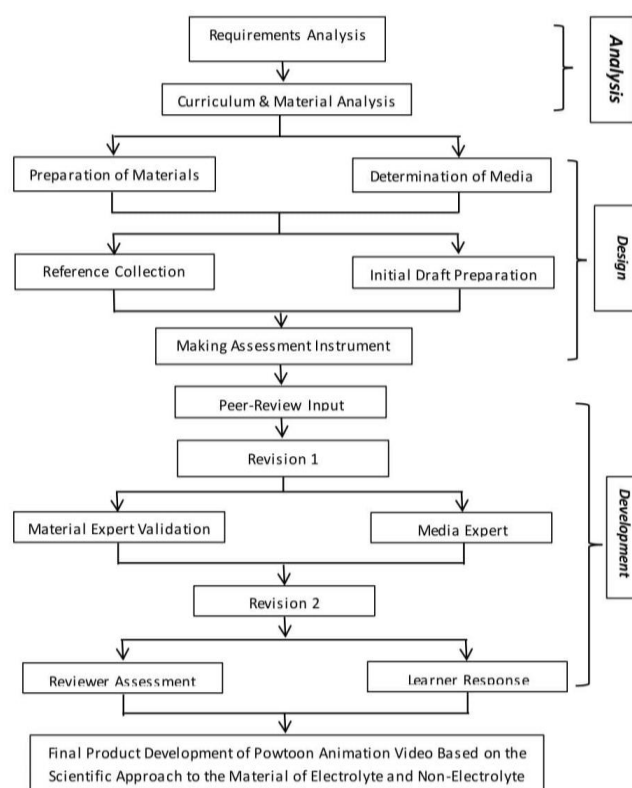

Figure 1. Development of a Powtoon Animation Video Based on a Scientific Approach to Electrolyte and Non-electrolyte Solution Materials

This study involved three peer reviewers, media experts, material experts, five Senior High School chemistry teachers as reviewers, and thirteen Senior High School students as respondents. The data collection technique used a product assessment questionnaire sheet to collect validation data from media experts, material experts, teachers, and student responses to determine the validity or feasibility of the developed media. Product assessment from the validation test of material experts and media experts uses a Likert scale, with the score of each criterion being 4 (Very Good), 3 (Good), 2 (Less), and 1 (Very Less). Data from respondents' questionnaires were quantified using a Guttman scale, with a score of 1 (Yes) and 0 (No) for each criterion. The data analysis technique used was descriptive qualitative and quantitative analysis. Qualitative data is input and corrections from peer reviewers, material experts, media experts, teachers/reviewers, and student responses. In contrast, quantitative data comes from product assessments by media experts, material experts, and teachers/reviewers.

The data from the chemistry teacher reviewer questionnaire were quantified with the following scoring provisions:

Table 1. Provisions for Scoring Media Experts, Material Experts, Reviewers

Criteria	Score
Very good (VG)	4
Good (G)	3
Poor (P)	2
Very poor (VP)	1

The data from the respondents' questionnaires (high school students) were quantified using a Guttman scale as follows:

Table 2. Guttman Scale Determination

Criteria	Score
Yes	1
No	0

Next, calculate the average score of each indicator using the following formula:

$$\overline{X} = \frac{\sum x}{n} \tag{1}$$

Description :

$\overline{X}$ = average score
$\sum X$ = sum of scores
N = number of assessors

Table 3. Ideal Assessment Criteria

Quantitative score range (i)	Score	Qualitative categories
$X \geq \bar{X}i + 1.SBx$	A	VG (Very good)
$\bar{X} + 1.SBx > X \geq \bar{X}i$	B	G (Good)
$\bar{X}i > X \geq \bar{X}i - 1.SBx$	C	P (Poor)
$X < \bar{X}i - 1.SBx$	D	VP (Very poor)

Information:

$\bar{X}$ = average ideal score
= $\frac{1}{2}$ (maximum score + maximum score)
X = score achieved
SBx = standard deviation of ideal score
= $\frac{1}{6}$ (maximum score – minimum score)

Ideal highest score = Σ criteria item × highest score
Ideal lowest score = Σ criteria item × lowest score

$$\text{Idealization (\%)} = \frac{Score\ achieved}{ideal\ highest\ score} \times 100\% \tag{2}$$

Result and Discussion

This research develops Powtoon animation video-based learning media with a scientific approach for electrolyte and non-electrolyte solution materials. The research was carried out using the ADDIE development model (Wanti & Erita, 2024). Powtoon provides various features such as music, the ability to add sound (recording), handwriting animation, and transition effects with various colors, which makes learning more interesting and dynamic (Dewi & Handayani, 2021). Animated videos are said to be interesting because they have video benefits, namely: attracting attention, beautifying the appearance and making learning unique, simplifying systematic learning, understanding student learning, being able to cmaterial (Ayuningsih, 2017; Candra Dewi & Negara, 2021; Kasih, 2017). Previous rlarify difficult esearch findings state that this animated video helps teachers and helps students in learning and is effective in improving student learning outcomes (Candra Dewi & Negara, 2021; Siddiq, 2020). The development procedure used in this research is the ADDIE model, which consists of five stages: analysis, design, development, implementation, and evaluation. However, this research was only conducted up to the implementation stage due to time constraints and adjustments to the learning schedule at school involving many students. The research subjects were grade X students at MA Darul Quran Wahid Hasyim, with a sample of 13 students selected through non-probability techniques. The instruments used included interviews with teachers, validation sheets from material experts and media experts, and questionnaires to collect responses from teachers and students.

Analysis Stage

At the analysis stage, the researcher analyzes the needs of students by identifying the problems faced, and analyzing the curriculum, and the material to be taught through interviews with chemistry teachers. At this stage, it is important to pay attention to the characteristics of students, because this will be adjusted to the learning media to be developed, namely Powtoon animation videos based on the scientific approach. Analysis of the material in the development media is in accordance with the basic competencies, indicators, and student characteristics. It aligns with the opinion of Nurfadillah et al. (2021), which states that good media are specifically designed to convey relevant material. The material's feasibility also includes applying the steps of the scientific approach. Lestari et al. (2018) supports this, stating that applying the steps of the scientific approach can encourage active student participation in the learning process. Curriculum and material analysis are conducted to facilitate the integration of materials into the learning video in accordance with the applicable curriculum. The materials that have been selected are then used as learning objectives and concept maps to

make them more focused. The materials used in this study include electrolyte and non-electrolyte solutions, which cover classification of solutions based on electrical conductivity, strong electrolytes and weak electrolytes, ionization reactions, and polar ionic and covalent compounds. Interviews with chemistry teachers revealed that students were less active during learning without media variations, although they are enthusiastic and have high curiosity. Students tent to take notes more often, do assignments, and listen to teacher explanations. Therefore, researchers are interested in developing Powtoon learning media based on a scientific approach to overcome these problems.

Design Stage

In the design stage, researchers develop product concepts by designing materials, scripts, and animations in the form of images and designs. The resulting product is a Powtoon animated video that uses a scientific approach, adapted to the material about electrolyte and non-electrolyte solutions. This learning media is designed with attractive images, easy-to-read text, and clear audio in accordance with the visual display. The video-based learning media are able to present clear audio, interesting and easy-to-read text, and images in one frame to increase the attractiveness of the display. The advantage of this learning media is that it is designed to stimulate students' critical thinking skills and foster their curiosity. At this stage, researchers designed a learning video using the powtoon application containing material related to daily life, which was divided into two parts: material explanation and practice questions. Supporting websites used were www.remove.bg to remove the image background, www.pinterest.com to search and download GIFs or images. YouTube is used to upload videos, watch various videos, and can also share videos where they can be seen by all (Setiyana & Badu Kusuma, 2021). The following are the stages of making learning videos using Powtoon.

In the first part of the learning video, the material of electrolyte and non-electrolyte solutions is explained. This video presents various examples of phenomena related to everyday life and in accordance with the syntax of the scientific approach, so that students can more easily understand the concepts conveyed. The suitability of the use of language used is made as simple, concise, clear, and as brief as possible, and the language and intellectual rules are appropriate because they are in accordance with developmental desires, so that students can easily understand the content of the material. The explanations in the video are designed to help students deepen their understanding of electrolyte and non-

electrolyte solutions in a more contextual way and relevant to everyday experiences.
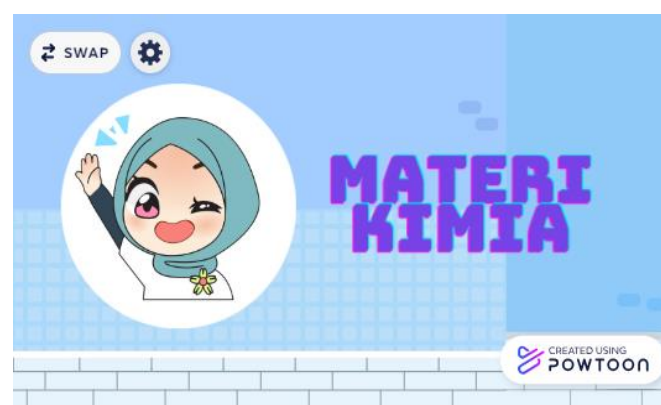

Figure 2. Initial view of the video

Figure 3. Display of material to be discussed

Figure 4. Electrolyte and Non-electrolyte Solution Materials

The second part of the learning video discusses various problems related to electrolyte and non-electrolyte solution material. This video not only presents the issues, but also gives a detailed discussion for each problem. The goal is to help students understand how to solve problems systematically, as well as strengthen their understanding of the concepts they have learned. With clear discussions, students are expected to more quickly master the material and apply their knowledge in various situations.

The last stage in preparing this learning video is the video publication stage. The learning video made is at the High Definition (HD) level so that the animated video can be seen clearly. The final product is a powtoon learning video that discusses electrolyte and non-

electrolyte solution materials. The video is organized in the opening, content, and closing format. The opening part is very important because it serves as an introduction and the beginning of a video (Kountul & Wibowo, 2021). The animated video was then uploaded to the YouTube platform for easy access. After the animation video was made, the research instruments were made. The research instruments include validation, assessment from media experts, and student responses. The media expert assessment instrument includes aspects of readability, display quality, product characteristics. While the student response instrument includes aspects of media and material. The instruments that have been made have been validated by instrument experts. This Powtoon animation video focuses on the Scientific Approach because most of the existing research has not specifically examined the effects of the scientific approach when using Powtoon media in teaching electrolyte and non-electrolyte solutions. The scientific approach involves observing, questioning, exploring and applying, which may not be fully integrated with existing research.

Figure 5. Initial view of the video

Figure 6. Problem and Discussion Display

Figure 7. Sample case problem

Figure 8. Example of multiple choice questions

Development Stage

At the development stage, the learning media made is validated by experts. Validation will be carried out by two validators (Novianti et al., 2023), both from material expert validation and media expert validation to see the feasibility of the media that has been prepared before being implemented to ensure its feasibility. This validation is vital in product development because it determines whether the media is suitable for learning. Material experts and media experts carried out the validation test. The assessment was carried out by sending learning media in the form of Powtoon animated videos based on a scientific approach via WhatsApp and Google Drive, then analyzed using a validation questionnaire.

Based on the criticism, suggestions, and input given to the Powtoon animation videos that have been developed, researchers make adjustments to improve the quality of the learning media. Input from experts covers various aspects, such as the suitability of content, design, and the integration of material with the scientific approach. The validation process results can be seen in detail in the validation assessment section by material experts. This assessment provides a clearer picture of the feasibility of the learning media, including the extent to

which the media can meet the learning objectives and its effectiveness in helping students understand the material developed.

Table 4. Material Expert Validation

Aspect	Percentage (%)	Category
Language	83.3	Very good
Presentation	100	Very good
Product Characteristics	100	Very good
Scientific Approach	62.5	Good

Based on Table 4, learning media was assessed through several aspects, including language, presentation, product characteristics, and scientific approach. In the language aspect, the learning media received an average score of 83.3%, categorized as very good. This assessment includes the use of language that is clear, polite, and easily understood by students. Language clarity is essential to ensure students understand the material well without confusion or ambiguity. Using appropriate language also helps create a positive learning atmosphere and appreciates the interaction between teachers and students. Regarding presentation, the learning media received a perfect average score of 100%. This assessment is based on a questionnaire filled out by material experts. It includes several essential indicators, such as the suitability of the material presented with the learning objectives, the clarity of information delivery, the completeness of the material displayed, and visual support such as images and animations, which are also important factors in the assessment. The suitability of the presentation of images with the material was rated very positively, indicating that the photos used support the understanding of concepts well.

Furthermore, regarding product characteristics, the learning media again obtained an average score of 100%. Learning media must be designed interestingly so that students are more involved in learning and meet pedagogical standards relevant to the subject being taught. In addition, in terms of the scientific approach, the learning media obtained an average score of 100%. This assessment includes how influential the media is in facilitating the application of the scientific approach, such as observing, asking questions, exploring, and applying the concepts learned. The scientific approach aims to increase students' active participation and make learning more interactive. Learning media that make it easier for teachers to teach and attract students to be actively involved are also a focus. Overall, the material experts gave an average score of 82.5%, categorized as very good. These results align with the research of (Melisa & Fadlan, 2023) which shows the feasibility of media by material experts of 91.66% with the category

very feasible for use in learning. This assessment indicates that the learning media has met the most essential criteria to support an effective learning process. Validation by media experts can be seen in Table 5.

Table 5. Media Expert Validation

Aspect	Percentage (%)	Category
Readability	87.5	Very good
Display Quality	100	Very good
Product Characteristics	100	Very good

Based on Table 5, the readability aspect of the learning media obtained an average score of 87.5%, which is included in the excellent category. This assessment comprises various important elements related to ease of reading, such as the selection of appropriate fonts, font sizes that are large enough and proportional, and the level of readability that makes it easy for students to understand the information presented. This readability is a fundamental aspect that ensures the text is easily read by users from various backgrounds, especially students, without causing confusion or obscurity. The learning media obtained a perfect average score of 100% on the display quality aspect, which also falls into the excellent category. This aspect involves several important indicators that attract attention and facilitate student understanding, including the clarity of the images used, the selection of backgrounds that support readability and aesthetics, and appropriate colors and animations to support the material. In addition, this aspect also includes the suitability of the narrator's voice, which aims to guide students during the learning process, as well as the selection of appropriate music that does not disturb concentration.

Meanwhile, in the aspect of product characteristics, the learning media also managed to obtain an average score of 100%, which is included in the excellent category. This assessment contains indicators of easy online access to the product, allowing students and teachers to easily access learning materials anytime and anywhere. In addition, this aspect also assesses practical use, where the media is designed to be easy to use by users without requiring complex instructions or additional technical support. Media experts gave an average score of 95%, placing this product in the excellent category and worthy of use in learning. These results are in accordance with research (Meianti, 2018), which showed media feasibility of 93.33%. The media meets high-quality standards in readability, visual appearance, and product characteristics, thus supporting optimal learning experiences for students and facilitating teaching tasks for teachers.

Table 6. Teacher Assessment Results

Aspect	Percentage (%)	Category
Language	80.8	Very good
Presentation	85	Very good
Display Quality	82.5	Very good
Product Characteristics	85	Very good
Scientific Approach	75	Very good

Based on Table 6, the assessment of the learning media shows that the language aspect obtained an average score of 80.8%, which is included in the excellent category. This assessment includes the use of language that is clear, polite, and easily understood by students. The language used in the learning media must convey information effectively without causing confusion and maintain politeness and suitability to the learning context. In the presentation aspect, the learning media obtained an average score of 85%, also categorized as very good. The assessment in this aspect includes several important indicators, such as the suitability of the material with the learning objectives, clarity in delivering information, ease of students in understanding the material, and completeness of the material presented. The completeness of the material here means that all information required to support student understanding is presented thoroughly and systematically, so that students can follow the learning flow well.

Furthermore, in the aspect of display quality, the learning media received an average score of 82.5%, which indicates excellent quality in terms of clarity and visual appeal. This aspect assesses elements such as the clarity and attractiveness of the images, the use of appropriate and not excessive colors, animations that support the understanding of concepts, and the suitability of the narrator's voice and the music used. These elements are important to create a fun and effective student learning experience. The product characteristics aspect also obtained an average score of 85%, which is included in the excellent category. Regarding the scientific approach aspect, the learning media scored 75%, which assesses how much the media helps teachers implement the scientific approach and how interesting the media is for students. The scientific approach involves steps such as observing, questioning, exploring and applying, which aims to increase students' active participation in the learning process. The learning media as a whole received an average score of 82.5%, which is categorized as very good. This score indicates that the media has superior quality in various aspects, such as the use of appropriate language, clear and complete presentation of material, attractive appearance, and ease of access, making it suitable for use in the learning process.

Implementation Stage

The next stage is implementation. At this stage, a limited trial was conducted on 18 students. Student responses assess the media in terms of readability, display quality, and product characteristics. Student responses were carried out by 18 MA Darul Quran Wahid Hasyim students. Data on student responses to learning videos using Powtoon web apps can be seen in Table 7.

Table 7. Student Response Results

Aspect	Percentage (%)	Category
Media	94.25	Very good
Material	94.66	Very good

Table 7 shows that the media presentation component received a score of 94.25%, which is categorized as excellent. It was obtained from a comprehensive questionnaire filled out by students in response to the animation video training materials. The questionnaire contained questions regarding communicative phrases, image quality, aesthetic appeal, color palette, animation, image accuracy, audio clarity, musical accompaniment, animation speed, and text readability. The material scored 94.66% with a very good category. This is related to the ability of the material to improve chemistry learning, from basic subjects to more advanced subjects. The average score obtained from students' answers is 94.4%, including in the excellent category. The findings of this study indicate a positive favorable outcome on students' understanding of electrolyte and non-electrolyte solutions.

Researchers developed Powtoon-based animated learning videos with a scientific approach, given the importance of using learning media in the teaching and learning process. Previous research findings state that learning videos help increase student motivation in the learning process and can facilitate teachers in the learning process (Badra, 2013; Nyoman et al., 2013). Other research findings state that the use of learning videos is very influential and greatly helps students in learning and student skills (Mulyana et al., 2023). Other research findings also state that learning videos help facilitate the student learning process (Octavyanti & Wulandari, 2021; Syafitri, 2019; Yusuf & Amin, 2017). Powtoon can function as a tool in learning with an interesting approach, so that it can increase student interest in learning. Powtoon media on electrolyte and non-electrolyte solution material has several advantages, such as the use of language that is easy to understand, attractive design, and accessibility that allows students to use it at any time. The purpose of developing this media is so that Powtoon can be one of the innovative solutions in developing learning media.

In addition, Powtoon media is also considered capable of increasing student representation in learning (Arif & Muthoharoh, 2021).

Conclusions

Based on the results of the research and discussion, it can be concluded that Powtoon animation video-based learning media with a scientific approach to the material of electrolyte and non-electrolyte solutions was declared valid by material experts and learning media experts. Material experts provide an average percentage of 82.5%, while media experts provide an average percentage of 95%, which is included in the very valid category. The developed learning media was also rated very well by chemistry teachers and students at school, with an assessment percentage of 82.5% from teachers and 94.4% from students, both included in the very good category.

Author Contributions
Sehati Mutiara Eljinsa: Carried out research, prepared the initial manuscript, verified data, devised the methodology, conducted formal analysis, and conceptualized the study. Muhammad Zamhari: Revised and reviewed the manuscript, prepared the initial draft, validated data, oversaw the research, created the methodology, obtained funding, performed formal analysis, and conceptualized the study.

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