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Development of Video *Motion Graphics* for Electrolyte and Non-Electrolyte Solutions to Increase Senior High School Students' Interest in Learning

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Abstract: This study aims to develop video motion graphics on electrolyte solutions and non-electrolyte solutions and to determine the quality of the products produced. This is development research (R&D) with a 4D model (Define, Design, Development, and Disseminate). Data collection techniques used include observation, interviews, and questionnaires. Data was obtained through a purposive sampling technique. The data analysis technique modifies the Likert and Guttman scales by changing qualitative data into quantitative data. One material expert, one media expert, and four reviewers (chemistry teachers) assessed the products. The results of product quality assessment by material experts get a percentage of 95% in the Very Good category, media experts get a percentage of 90% in the Very Good category, and reviewers get a percentage of 91.25% in the Very Good category. In addition, the results of student responses were 98%. Based on the results of this assessment, it can be concluded that video motion graphics are valid and appropriate to be used as learning media for electrolyte and non-electrolyte solutions to increase student learning interest.

Keywords: Learning media; Video *motion graphics;* Electrolyte; Non-electrolyte solutions.

Introduction

The Coronavirus outbreak in Indonesia has forced teachers to change class teaching and learning activities (Anugrahana, 2020; Handarini & Wulandari et al., 2020). In order to implement *social distancing* and *physical distancing* rules in order to reduce the spread of the coronavirus, access to learning is needed in the classroom that is not bound by space and time (Herliandry et al., 2020; Herwanto & Hatmo, 2020; Kurniasari et al., 2020). Online learning is adequate during the COVID-19 outbreak (Abidin et al., 2020; Baety & Munandar, 2021; Ismiyarti et al., 2021). Online learning combines electronic technology with the internet. The ease of accessing learning resources anytime, anywhere, and anyone can facilitate the learning process (Assidiqi & Sumarni, 2020; Maudiarti, 2018; Tuti et al., 2020). However, teachers' and students' varying level of technological literacy causes difficulties in implementing online learning (Abroto et al., 2021; Mar'ah et al., 2020; Sholichin et al., 2021). Implementation of online learning in schools has many obstacles, such as limited learning media, less intense internet network access, inadequate learning facilities, less optimal learning quality, and lack of support from parents (Rasidi et al., 2021; Rosnaeni & Prastowo, 2021; Yanti & Sumianto, 2021). Based on the research done by Astuti (2021), the level of effectiveness of online learning is only 39.6% in the low category. The low effectiveness of online learning is because students tend to feel bored when participating in online learning (Pawicara & Conilie, 2020; Wangge et al., 2021).

The crucial problem of boredom in learning can be overcome by creating innovative learning media (Audie, 2019; Risabethe & Astuti, 2017). Learning media adapted to student learning styles effectively improves student learning performance (Hildayah, 2019; Yektyastuti et al., 2015). One learning media that provides a new learning experience is learning videos (Nurwahidah et al., 2021; Rasman, 2021). Learning videos are *audio-visual* media

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that contains learning messages (Parlindungan et al., 2020; Permatasari & Octaviarni al., 2021; Wisada et al., 2019). The use of learning videos as learning media provides benefits in the form of more efficient learning, more active students, assisting teachers in explaining the material, fulfilling all aspects of student learning styles, and reducing the burden on teachers who still use the lecture method (Agustini & Ngarti, 2020; Dayutiani & Fitrianna, 2021; Hafizah, 2020). However, in reality, the learning videos made by teachers are not optimal because their appearance is still monotonous and boring (Khairani et al., 2019).

Packaging learning videos with a combination of animation can make learning videos more exciting and fun (Khoiriyah et al., 2021; Syahfitri, 2011). Video with the help of animation can help explain abstract material to be more concrete (Anjarani et al., 2020; Manurung, 2020; Triwahyudi et al., 2021). One of the animations in the video is a *motion graphic* (Efendi et al., 2020; Rizal et al., 2021). *Motion graphics* are visual media in the form of 2D or 3D that can combine graphic design with film language (Dwiflora et al., 2021; Putri, 2018). Technique *motion graphics* focus on moving text and images (Fujianto & Antoni, 2020; Rusdiansyah & Leonard, 2020). The advantage of video *motion graphics* is their simple presentation, making the information easier to understand (Aprianto, 2019) and cost-effective (Anggraini et al., 2019). The use of video *motion graphics* can have a positive impact on student learning outcomes (Saputra & Wibawa, 2020). However, based on Wijaya's research (2020) stated that few animation-based learning videos have been developed, and there are also several videos whose contents are misconstrued, so they cannot be used optimally. Therefore, the development of video *motion graphics* needs to be developed as a learning media solution during the COVID-19 pandemic to change students' perceptions of chemistry lessons (Adawiyah et al., 2021).

Perceptions still regard chemistry as complex and complicated (Julianti, 2017; Nurmeina et al., 2020). This perception arises because a lot of chemical material is abstract and theoretical (Anggraini & Sugoto, 2016; Munandar & Jofrishal, 2017). One of the chemical materials students considers theoretical and abstract material is electrolyte and non-electrolyte solutions (Iqbal et al., 2020; Jannah et al., 2018). The difficulty in learning the material is because it is microscopic, making it difficult for students to imagine (Fitriyani et al., 2019). The inability to translate concepts can cause misconceptions among students (Suyono, 2020; Virtayanti et al., 2018). The presentation of electrolyte and non-electrolyte solution materials with the help of animation media can visualize the material to make it more concrete (Asmawati & Dalming, 2019). Sakinah and Dwiningsih research (2018) stated that as many as 46.67% of students had difficulty classifying solution samples that included electrolyte and non-electrolyte solutions. The common understanding of the concept can also be influenced by the role of the teacher (Nurhuda, 2015).

A teacher's creativity in learning influences student success (Novauli, 2012; Ristiyani & Bahriah, 2016). The teacher does not only act as an educator but also plays a role in influencing the quality and personality of students so that they can foster interest in learning (Sari et al., 2017; Utami et al., 2021). The existence of saturation in the teaching and learning activities in the classroom can cause students to lack interest in paying attention to the material explained by the teacher, causing a decrease in learning outcomes (Yanti & Sumianto, 2021). The characteristics of low interest in learning are caused by, among other things, boredom in learning 90%, likes to sit in the back 86%, playing cellphones 84%, laziness to study 81%, frequent permission to go to the toilet 80%, talking to friends 78%, passive in accepting teacher explanations 77 %, not focusing on studying 74%, not doing assignments 70%, and sleepy and sleeping 69% (Marti'in et al., 2019). Therefore, students' interest in learning is essential to have and grow (Cahyani et al., 2020). The existence of an interest in learning in students can create a desire to learn without coercion so that an interest in learning arises (Ningrum, 2018). Students' interest in learning can be grown by creating an enjoyable learning atmosphere (Rulita et al., 2021; Sari et al., 2018; Sirait, 2016). Interest in learning greatly influences a student's achievement (Adiputra & Mujiyati, 2017; Sriponi et al., 2021).

Based on this background, this research was conducted to develop a learning media in video *motion graphics* on electrolyte and non-electrolyte solutions using the *KineMaster* and *ibis Paint applications*. The hope is that learning media can help the process of learning chemistry to increase interest in learning and students' understanding of abstract electrolyte and non-electrolyte solutions. In addition, teachers can assist students in explaining electrolyte and non-electrolyte material to make it more concrete.

Method

This research was conducted at MAN 1 Yogyakarta, MAN 2 Kulon Progo, MAN 2 Sleman, and MAN 1 Gunungkidul from January - April 2022. Data collection techniques were carried out in this study through observation, interviews, and questionnaires. The sampling technique used was purposive sampling from MANs in the Yogyakarta area, advanced in IT-based learning media.

This research is a *research and development* (R&D) study. *Motion graphic* video development adapts the model developed by Thiagarajan, namely 4-D (*Define, Design, Develop, and Disseminate*), but is limited to the development stage. The dissemination stage can be carried out for further research by testing the experimental and control classes to determine the effect of the product being developed. The *define* phase aims to collect needs analysis data and high senior school chemistry curriculum analysis. The *design* stage aims to design a product by selecting media, formats, references, making instruments, and initial designs. The *development* stage aims to obtain data from the assessment and validation results from material experts, media experts, and reviewers. The resulting product is then tested on students to get suggestions and responses about the product being developed.

The subjects of this study included one material expert, one media expert, four *reviewers* (senior high school chemistry teacher), and ten tenth-grade senior high school students who would respond to the product. The instruments used were product validation sheets, product quality assessment sheets, and student response sheets. Product validation data in the form of suggestions and input as a guideline for improving the product. Product quality assessment data uses a *Likert scale* filled in by material experts, media experts, and *reviewers* covering material, learning interest, and video aspects. Student response data were made using the *Guttman scale* to measure product usability on student learning interest.

Data from the results of product quality assessments by media experts, material experts, and *reviewers* were processed by changing the results of qualitative assessments to quantitatively using a *Likert scale* with the provisions in Table 1 (Sugiyono, 2013).

Table 1. Scoring rules

Information	Score
Very Less	1
Less	2
Enough	3
Good	4
Very Good	5

Next, the average score is calculated using the equation:

$$\bar{X} = \frac{\sum x}{n} \quad (1)$$

Information:

$\bar{X}$ = average score

$\sum x$ = total score

n = number of appraisers

The average score of each assessment aspect is converted into a qualitative value according to the ideal category with the conditions in Table 2 (Sukardjo, 2012).

Table 2. Criteria for the ideal rating category

Score Range (i) quantitative	Qualitative categories
$X > Xi + 1.80\ SB\ i$	Very good
$Xi + 0.60\ Sbi < X \leq Xi + 1.80\ Sbi$	Good
$Xi - 0.60\ Sbi < X \leq Xi + 0.60\ Sbi$	Enough
$Xi - 1.80\ Sbi < X \leq Xi - 0.60\ Sbi$	Not enough
$X \leq Xi - 1.80\ Sbi$	Very less

Student response data is processed by changing descriptive data into quantitative data (scores) using the *Guttman scale* with the provisions in Tables 3 and 4.

Table 3. Positive Statement Scoring Rules

Information	Score
Yes	1
No	0

Table 4. Negative Statement Scoring Rules

Information	Score
Yes	0
No	1

The data that has been processed is in the form of a score which is calculated by the ideal proportion of the product using the formula:

$$\text{Ideal percentage} = \frac{\text{score reached}}{\text{ideal max score}} \times 100\% \quad (2)$$

Results and Discussion

This research aims to develop *motion graphic* video media on electrolyte and non-electrolyte solutions. Learning videos can help facilitate teachers in the process of transferring knowledge and understanding to students (Wuladari et al., 2020). According to research by Ilsa et al. (2021), using video as a learning medium is considered to help increase student interest in learning during online learning. Packaging innovations for this media are carried out by utilizing *motion graphics techniques* commonly used in advertising and film.

Define stage

The define stage is carried out by needs analysis and curriculum analysis. Needs analysis begins with identifying problems in schools with literature studies and interviews. At the same time, curriculum analysis is done by analyzing KI and KD. The results of interviews with chemistry teachers at MAN 1 Yogyakarta, MAN 2 Kulon Progo, MAN 2 Sleman, and MAN 1 Gunungkidul show that the media used is the module, *PowerPoint*, and LKS, so in the distance learning process it cannot explain abstract chemical material in detail. These conditions make students bored, so their interest and learning outcomes are low. Therefore, learning media are needed to concretize abstract material to encourage student learning interest and interest students in learning chemistry material. One abstract and theoretical chemical material is an electrolyte and non-electrolyte solution.

Design Stage

The design stage includes (1) selecting the media, (2) selecting the format, (3) selecting the references, (4) making the assessment instrument, and (5) making the initial design. The media chosen in this study is learning videos with *motion graphic animation formats.* Selection of reference materials for electrolyte and non-electrolyte solutions using senior high school chemistry books, university chemistry books, *e*-modules, and senior high school chemistry worksheets. The assessment instrument is a quality assessment questionnaire with a *Likert scale* used by material experts, media experts, and *reviewers* to assess product quality. While the student response sheets used the *Guttman scale* in the form of yes or no statements to respond to the product. This instrument is consulted with the supervisor before being validated by an instrument expert. Making the initial design is done by making a product *storyboard* to facilitate the process of making the developed media. The following is the process of making a *motion graphic* video.

The first stage, namely designing all material components using *the ibis Paint application*, can be seen in Figure 1.

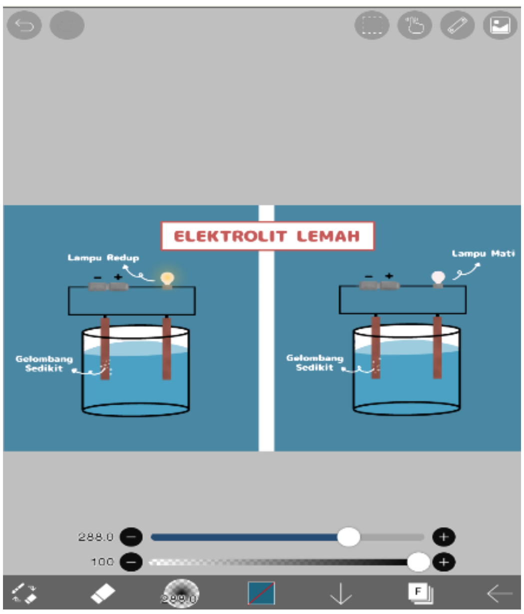

Figure 1. The process of designing drawings

The process of drawing (sketching), coloring, and providing text (typography) is carried out at this stage. The second stage is the *dubbing process* with the help of a *recorder* which can be seen in Figure 2.

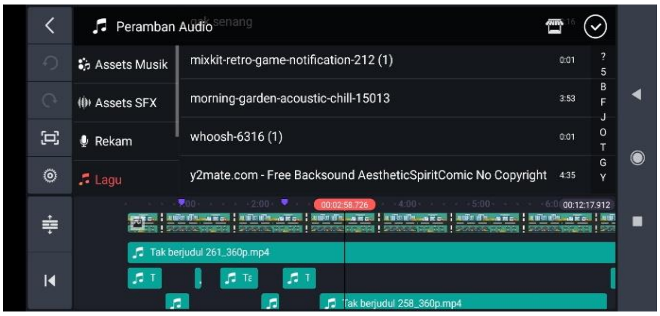

Figure 2. *Dubbing* recording process

At this stage, it is done by recording *dubbing* accompanied by *a script* to minimize errors. The last stage, namely *finishing*. All components, such as holding graphic design, *dubbing*, *sound effect*, and *the back sound*, is entered into the *KineMaster application.* The process at this stage combines visual, text, audio, and animation effects to become a unit in the form of a video containing information. Pictures of the editing process can be seen in Figure 3.

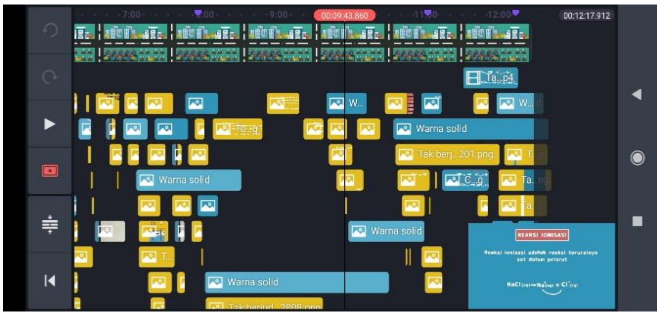

Figure 3. Editing process

This research produced a product in the form of a *motion graphic video* of electrolyte and non-electrolyte solutions with a duration of ±12 minutes. The product components being developed consist of *opening*, core, and *closing*. The *opening* section contains an intro, video title, Core Competencies (KI), Basic Competencies (KD), indicators, learning objectives, concept maps, video menus, and apperceptions. The *opening* image of *the motion graphic* video can be seen in Figure 4.

Figure 4. *Scene opening*

Apperception is presented in the form of an event in everyday life. This apperception activity fosters motivation and understanding that students will relate learning materials to everyday life (Octaviani et al., 2020). The apperception presented in the video is the incident of turning on the lights of an automatic motorbike at night using a battery. Batteries on two-wheeled and four-wheeled vehicles are wet batteries filled with an electrolyte solution of H_2SO_4. H_2SO_4 is a strong electrolyte solution that can conduct electric current to turn on the lights on the automatic motorcycle (Putri, 2018). Apperception illustrations can be seen in Figure 5.

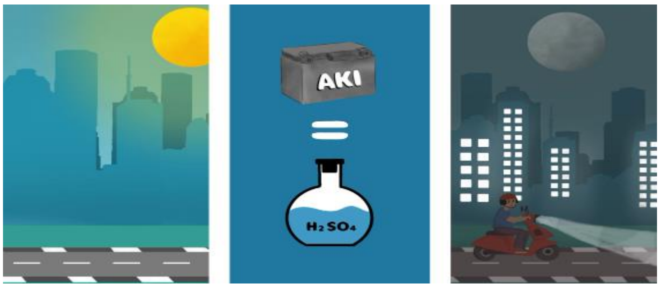

Figure 5. *Scene apperception*

The core contains material for strong electrolyte solutions, weak electrolytes, non-electrolytes, degree of ionization, compounds forming electrolyte and non-electrolyte solutions, and ionization reactions. Each component is presented using a *motion graphic technique* to concretize material initially abstract into a simple and easy-to-understand *visual illustration* (Nugrohadi & Susilana, 2018) and encourage students' interest in learning (Damitri, 2020). In the electrolyte solution material, there is an animation of ions in the electrolyte solution moving freely toward the electrodes. This illustration aims to visualize ions moving freely in the electrolyte solution (Suari, 2018). For example, NaCl dissolved in water will break down into Na^+ ions and Cl^- ions (Suminten et al., 2021) then these ions will conduct an electric current (Dadang, 2018). An electric current occurs when the electrolyte tester is put into a solution, and the ions undergo an oxidation-reduction reaction (Miranda & Afrida, 2018). Therefore it can be concluded that electrolyte solutions can conduct electric current (Okmarisa & Hasmina, 2021). A visual illustration of the electrolyte solution test can be seen in Figure 6.

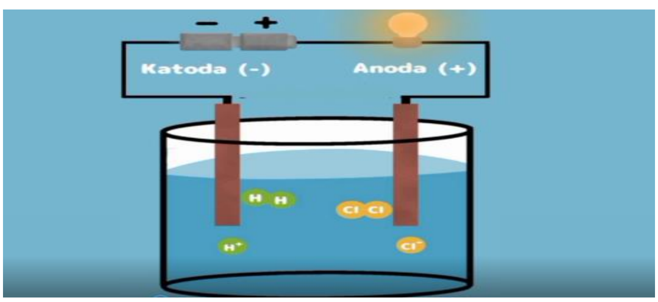

Figure 6. *Scenes of* electrolyte solution material

Not all solutions can conduct electricity even though the substance dissolves in water (Rezki et al., 2019). The sugar solution ($C_{12}H_{22}O_{11}$) belongs to the type of non-electrolyte solution (Pandia & Sumarni, 2021). Non-electrolyte solutions cannot conduct electricity (Sugito & Mujasam, 2009). Sugar solutions cannot conduct electric current because the substances do not undergo ionization reactions and remain in molecular form (Sanjaya et al., 2017; Wilandari et al., 2018). A visual illustration of the non-electrolyte solution test can be seen in Figure 7.

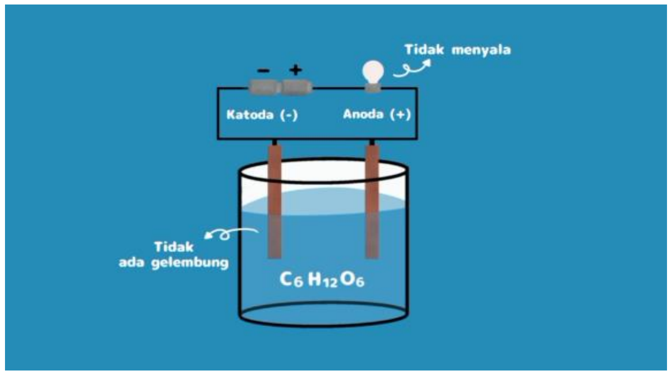

Figure 7. *The scene* of the non-electrolyte solution material

The closing section contains conclusions, closing, quotes, and credits (creative team). The *closing* video *motion graphic* image can be seen in Figure 8.

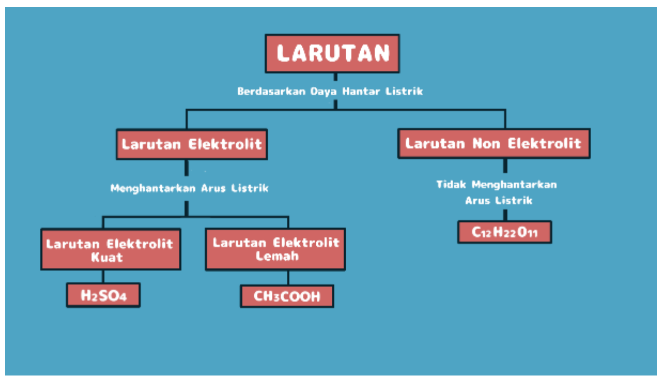

Figure 8. *Closing scene*

The conclusion section summarizes the material based on its electrical conductivity. The solution is divided into electrolyte and non-electrolyte solutions (Nuraini, 2019). Solutions that can conduct electricity are called electrolyte solutions. Electrolyte solutions are divided into two, namely strong electrolyte solutions and weak electrolyte solutions. The difference between the two solutions lies in the ionization reaction, in which the strong electrolyte solution completely decomposes into positive and negative ions, while the weak electrolyte solution only partially decomposes when dissolved in water (Pandia & Sumarni., 2021). Non-electrolyte solutions cannot conduct electric current (Bengi et al., 2018). Furthermore, the compounds that form electrolyte solutions are ionic and polar covalent compounds, while the non-electrolyte solutions are non-polar covalent compounds (Anggraeni et al., 2020).

Development Stage

Video motion graphics of electrolyte and non-electrolyte solutions were created using *the KineMaster* and *ibis Paint applications*. *The ibis Paint* application is a particular application for designing cartoons (Hasanudin et al., 2020). Meanwhile, to combine graphic design pieces, provide transition effects and *back sounds* using the *KineMaster editing application* (Amelia & Arwin, 2020). The choice of *the KineMaster* and *ibis Paint* applications is due to the interface design's simple appearance, which can be operated on Android or iOS and is free, making it easier for editors (Handoko, 2021). Apart from that, the features provided are also complete (Chusniah & Setianingsih, 2019).

The results of developing video motion graphics for electrolyte and non-electrolyte solutions for class X SMA were validated and assessed for quality by media and material experts. The aspect assessed by media experts is the video aspect. Indicators on the video aspect include opening, content (visual and audio), and closing. The media expert's assessment results can be seen in Table 5.

Table 5. Results of product evaluation by media experts

No.	Assessment Aspects	∑Score	∑Max. Score Ideal	Ideal Percentage	Category
1	Videos	18	20	90%	Very Good
Total		18	20	90%	Very Good

Table 5 shows that the quality of the video *motion graphics* of electrolyte and non-electrolyte solutions for class X SMA is very good, with an ideal percentage of 90%, and has been declared feasible according to media experts.

Aspects assessed and validated by material experts are material aspects and aspects of interest in learning. Material aspect indicators include the depth of material and language. Indicators of interest in learning aspects include motivation and activity. The results of the material expert's assessment can be seen in Table 6.

Table 6. Results of product assessment by material experts

No.	Assessment Aspects	∑ Score	∑ Max. Score Ideal	Ideal Percentage	Category
1	Material	9	10	90%	Very Good
2	Interest to learn	10	10	100%	Very Good
Total		19	20	95%	Very Good

Table 6 shows that the quality of the video *motion graphics* of electrolyte and non-electrolyte solutions for class X SMA is very good, with an ideal percentage of 95%, and has been declared feasible according to material experts. Products validated and assessed are then revised according to suggestions and input from media and material experts. Furthermore, the quality was assessed by *a reviewer* (senior high school chemistry teacher). The aspects assessed include material, learning interest, and video aspects. The results of the *reviewer*'s assessment can be seen in Table 7.

Table 7. Product evaluation results by *reviewers*

No.	Assessment Aspects	∑ Score	∑ Max. Score Ideal	Ideal Percentage	Category
1	Material	9.25	10	92.50%	Very Good
2	Interest to learn	9	10	90%	Very Good
3	Videos	9.125	10	91.25 %	Very Good
Total		27.375	30	91.25 %	Very Good

Table 7 shows that the quality of the video *motion graphics* of electrolyte and non-electrolyte solutions for class X SMA is very good, with an ideal percentage of 91.25%, and has been declared feasible according to *reviewers*. The results of this assessment are in line with research conducted by Rahmi & Octarya (2020), which stated that the development of *stop motion* animation media obtained a percentage of 94.67% in the Very Practical category from teacher practitioners, so it was suitable for use as an alternative learning media in the learning process of electrolyte and non-electrolyte solutions in class.

Then, 10 class X MAN 1 Yogyakarta students responded to the motion graphic video. Aspects that were responded to by students included aspects of interest in learning, aspects of attention in learning, aspects of learning motivation, aspects of knowledge, and aspects of *motion graphic animation*. The results of student responses can be seen in Table 8.

Table 8. Student response results

No.	Assessment Aspects	∑Indicator	∑Score	∑Max. Score Ideal	Ideal Percentage
1	Interest to learn	2	20	20	100%
2	Attention in study	2	19	20	95%
3	Motivation to learn	2	19	20	95%
4	Knowledge	2	20	20	100%
5	*Motion graphics* animation	2	20	20	100%
Total		10	98	100	98%

Based on Table 8, a percentage of 98% of the student response results were obtained. Four indicators can be used as a benchmark for learning interest according to interest in learning, attention to learning, learning motivation, and knowledge (Nurhasanah & Sobandi, 2016; Slamet, 2010). Therefore, it can be concluded that this *motion graphic* video on electrolyte and non-electrolyte solutions can increase the learning interest of class X senior high school students based on the results of student response sheets. This research follows previous research conducted by Maulida et al. (2021), which states that video can increase students' interest in learning. In this study, student learning outcomes reached 98,3% after using learning videos.

Conclusion

Based on the research, the results obtained from the evaluation of video *motion graphics* on electrolyte and non-electrolyte solution materials by material experts were 95% in the Very Good category, media experts were 90% in the Very Good category, and *reviewers* obtained an ideal percentage of 91.25% in the Very Good category. Then the results of students' responses to obtain a percentage of 98.00% so that video motion graphics on electrolyte and non-electrolyte solutions material are valid and suitable for use as learning media in increasing student interest in learning.

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