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Development of Powtoon-Based Learning Videos for Elemental Chemistry in 12th-Grade Senior High School

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ABSTRACT

Teachers often struggle to implement new teaching methods to motivate students. One of the solutions is to utilize technology, which can improve the quality of education, effectiveness, and efficiency of learning, as well as provide knowledge support and information resources. The use of technology has the potential to improve the quality of education in schools, efficiency, and effectiveness in the teaching and learning process, and act as a tool to enrich knowledge and sources of information for learning. This research aims to create learning video material using the Powtoon platform for the topic of elemental chemistry, as well as evaluate the quality of the learning video as a learning tool on this topic. Evaluations were conducted by material experts, media specialists, chemistry teachers, and student responses. This study adopts a research and development (R&D) approach using the 4-D (Define, Design, Develop, and Disseminate) model, this paper focuses limited to the Develop stage only. The result is a learning video that is available in .mp4 format and can be viewed on YouTube. This video covers material about chemical elements. According to the assessment of material experts, the product received a score of 95% in the very good category; assessment from media experts shows a score of 94.29% also in the very good category; while the assessment from high school chemistry teachers resulted in a score of 83.64% in the very good category. The product was responded positively by high school students in 12th-grade with a percentage of 100%. According to the evaluation that has been carried out, learning videos can be an effective teaching option for teaching elemental chemistry material in the classroom.

Keyword: *Development research, Powtoon-based learning videos, Elemental chemistry.*

INTRODUCTION

The field of education cannot overlook the rapid development of information and communication technology (ICT) in this era of globalization (Agustian & Salsabila, 2021). Technology must be used in education to help students learn (Lestari, 2018). Educational technology has a crucial role in the field of education because it can overcome the problem of developing human resources in Indonesia so they become more competent and competitive (Achyanadia, 2016). Technological innovation facilitates fast and unlimited access to information, making it easier for students to easily get the learning materials they need

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(Salsabila et al., 2021). Therefore, it is hoped that educators will be able to use technology to improve learning (Widiyono & Millati, 2021).

Teachers often struggle to implement innovative teaching techniques to increase students' enthusiasm for learning (Arikarani & Amirudin, 2021). One technology that is attractive to students is video media (Marliani, 2021). The advantage of using video as a learning media is it can help students increase their sense of desire, interest, and motivation throughout the learning process (Riskiya et al., 2023). Video can also help students learn more effectively and independently (Isnaini et al., 2023). The function of learning media in the form of videos is to assist the teacher in delivering complex material that is challenging to explain through text only by providing a direct visual explanation for students (Aditiya & Prastowo, 2021). Previous research shows that using videos as learning media can improve student learning outcomes, including for chemistry subjects. (Benarti, 2022). The utilization of media in chemistry learning is a crucial component because it can affect student learning outcomes. (Ciptarini & Utomo, 2023).

Chemistry contributes to various scientific domains, so it is important to study and understand the concepts, facts, and procedures (Putri et al., 2021). Chemistry studies require extensive critical thinking skills (Setianingsih & Roshayanti, 2022). The reality in the field reveals that quite a few students are unable to understand and apply multiple representations to explain a phenomenon, so students were struggling to understand chemistry material (NLI et al., 2018). Students still struggle to connect different concepts, even though chemistry requires both mathematical logic and language skills. However, not all students have these abilities simultaneously. Additionally, chemistry needs a strong determination to understand the material and answer the questions (Susanty, 2022). Therefore, the concept must be demonstrated more concretely, such as through experiments or certain media, because chemistry has many abstract and complex concepts (Sianturi & Panggabeana, 2019). More over, it is also necessary to learn chemistry that can enhance student motivation and stimulate their critical thinking skills by using a media (Salutri et al., 2022; Endriani et al., 2018). Learning media, especially videos, are considered to be able to help in visualizing and comprehending the chemistry material being taught (Wijaya, 2020).

One of the topics of chemistry is elemental chemistry materials. Elemental chemistry is taught using printed books through reading assignments and doing exercises in the printed books (Wahyuni & Yerimadesi, 2021). The only learning resources for students are textbooks and student worksheets with limited learning duration in class, and sometimes parts of the alkaline and alkaline earth categories are not given because students can read the material independently (Dwiningsih et al., 2018). This also applies to the chemistry of third period elements (Dzikro & Dwiningsih, 2021). The process of learning elemental chemistry in the classroom is still passive, even though the learning methods applied are demonstrations, lectures, and discussions equipped with student worksheets (Rostika, 2020). According to an interview with a chemistry teacher at a high school in the Special Region of Yogyakarta, learning material is delivered through student worksheets. An assessment of student worksheets shows that their use tends to reduce students' enthusiasm for learning (Rahayu et al., 2021). Therefore, the subject of elemental chemistry requires alternative interactive learning media that are independent and capable of stimulating students' understanding (Al-mira & Hidayah, 2020).

Elemental chemistry material is considered difficult according to students at SMAN 1 Driyorejo (Mangengke & Dwiningsih, 2020). Learning elemental chemistry has a main obstacle

namely the material tends to be memorized and has a wide scope based on the results of student questionnaires at SMAN 27 and 59 Jakarta (Salsabila & Nurjayad, 2019). Students at SMA Negeri 1 Ubud do not fully understand the chemical elements material well because the material is so broad. Therefore, they still require significant guidance from teachers and practice consistently to achieve satisfactory results and achieve a high percentage of learning completion (Suarsani, 2019). The students in MAN 1 Tanjung Jabung Timur are less interested in studying elemental chemistry because lots of materials need to be memorized (Jami, 2022).

In dealing with the issues in the learning process of elemental chemistry, both from the aspect of the media used, the model/method applied by educators, as well as the motivation and ability of students, can use alternative learning media that are more interesting. Learning videos are one of the alternative media that can assist teachers in delivering material more effectively while making the teaching and learning process more engaging, so it can increase student learning motivation. Several studies have shown some of the advantages of video learning media. Learning videos about the periodic system of elements created using Powtoon are considered a very practical choice for teachers and students (Latifah & Lazulva, 2020). In learning petroleum material, Powtoon-based learning videos influence learning outcomes (Sakhia et al., 2021). Students responded positively to Powtoon-based learning videos on chemical bonds so that they were suitable as alternative learning media (Dewi & Kamaludin, 2022). Video media helps teachers to explain material on the development of atomic models because the abstract concepts in this material can be described using a multi-sub-microscopic representation approach (Nurfitriana et al., 2022). Based on interviews with 12th-grade students in DIY, they are usually more interested in learning through videos because the videos are interesting and use simple language, making them easier to understand.

Powtoon-based learning videos have the advantage of many varied animation features and effects to create interesting learning videos or presentations (Anggita, 2021). The principles of Powtoon-based learning videos are the same as PowerPoint, but Powtoon-based presentations can create interesting video creations because they combine audio and visuals so students don't get bored easily (Rahmawati, 2022). The development of Powtoon-based learning videos is still not widely developed, especially on the subject of elemental chemistry. Therefore, there needs to be development efforts to stimulate students' thinking processes and support teachers in understanding elemental chemistry material.

This study aims to develop learning video material about elemental chemistry using the Powtoon platform, which is targeted at 12th-grade. It is hoped that the development of this product can become an alternative learning media option for elemental chemistry material, to encourage motivation and improve student learning outcomes. Hopefully, this can trigger students' interest and active participation in the learning process, while also helping teachers present learning material creatively and interestingly.

METHOD

Research Design

This research applies the development approach in the research method (R&D). The development model applied is the 4-D approach which consists of four stages, namely Define, Design, Develop, and Disseminate, however the process was conducted only up to the Develop stage (Thiagarajan et al., 1974). The Define stage aims to establish and define the requirements needed in the development of learning videos. The Design stage aims to create a learning video design. The Develop stage aims to produce the final form of the Powtoon-

based learning video after going through revisions based on feedback and assessments from expert lecturers, peer reviewers, chemistry teachers, and student responses. The 4-D model was chosen because it has stages that are arranged programmatically, simple, and easy to understand, and its implementation is more systematic.

Participants

The participants of this research consist of lecturers who are experts in the field of materials, lecturers who have expertise in the field of media, peer reviewers, three chemistry teachers, and ten students in 12th-grade.

Instrument and Data Analysis

Data collection techniques include interviews, validation, and student responses. Interviews were conducted with chemistry teachers and 12th-grade students regarding elemental chemistry material. The tools used in this research include product quality evaluation forms and student response forms. The instrument was developed by the researcher, then validated and revised based on the suggestions given by the instrument expert lecturer, and then declared suitable for use in this study. Product quality evaluation is carried out using a Likert scale questionnaire filled in by experts in materials, media, and chemistry teachers. Student responses were recorded by filling in a questionnaire sheet with the Guttman scale. Product validation information comes from various sources such as peer reviewers, media experts, material experts, and chemistry teachers, who provide data in qualitative form. Data which was initially in qualitative form, was then converted into quantitative data using a Likert scale. Student response data was converted into quantitative data using the Guttman scale. Information about determining the Guttman scale is available in table 1 (Sugiyono, 2011).

RESULTS AND DISCUSSION

The learning videos used in this development study were created using the Powtoon platform. Powtoon has the advantage of having many varied animation features and effects to create interesting learning videos or presentations (Anggita, 2021). The benefit of learning videos that use animation is that they can attract students; apply simple words so that students can easily understand them; and presenting learning material through animated videos specifically designed to help their understanding. Video media is also interactive, where after students watch, the teacher can invite them to make reviews regarding the video content (Hutauruk et al., 2022). Powtoon learning media has the advantage of covering all sensory aspects; it is easy to use; can be used collaboratively with various options; can be adopted in large groups; provides feedback; and increases motivation (Rahmawati, 2022). The approach used in this research is 4-D, but only reaches the Develop stage.

Define Stage

The Define stage aims to help determine and explain the needs and collect relevant information that will be developed in the product to be made (Johan et al., 2023). The Define stage also aims to obtain the data and information needed for the research. Data and information obtained through literature studies and interviews with chemistry teachers and 12th-grade students were further analyzed to sharpen the basis of the research conducted. Based on literature studies from previous research, elemental chemistry material is taught

using materials from printed books through reading assignments and doing exercises in printed books (Wahyuni & Yerimadesi, 2021). Elemental chemistry material is also taught using presentation and discussion methods, and according to 12th-grade students, 50% answered that elemental chemistry material was the most difficult chapter (Yantika et al., 2023). Students' motivation, interest, and engagement in the elemental chemistry learning process also low, causing a lack of preparedness to receive the subject matter (Rostika, 2020). Interviews conducted with teachers focused on learning models and methods, as well as the media utilized in teaching elemental chemistry. Meanwhile, student interviews are about learning styles, motivation, and level of mastery of elemental chemistry material. Wawancara yang dilakukan terhadap guru yakni seputar model dan metode pembelajaran, serta media yang digunakan dalam pokok bahasan kimia unsur, sedangkan terhadap siswa yakni seputar gaya belajar, motivasi, dan tingkat penguasaan pada materi kimia unsur. According to the results of interviews with chemistry educators at high schools in the Special Region of Yogyakarta, the elemental chemistry learning process uses student worksheet media. This is following the fact that using student worksheets in printed format is still not optimal and it's less comfortable to use (Lathifah et al., 2021). Based on interviews with 12th-grade students in Special Region of Yogyakarta, students tend to like learning using video media because it is interesting and uses words that are easy to understand to make understanding simpler. This is in line with the fact that video media makes learning clearer, more interesting, interactive, more efficient in time and energy, improve the quality of learning outcomes, can be done anywhere and at any time, fosters a positive learning attitude towards learning processes and materials, and increases the role of teachers to a more positive and productive direction (Haryani & Elida, 2021). Therefore, it is important to develop learning media in the form of videos so that they can increase students' understanding and motivation to learn, especially regarding elemental chemistry material.

Design Stage

In the design stage, several activities were conducted to design the learning video. First, identify learning outcomes, as well as select material in chemistry subjects. The material included in this media is chemical elemental material which consists of several sub-materials, namely alkali metals, alkaline earth metals, and halogens. Next, each topic is briefly summarized as a learning indicator and learning objectives are formulated. Next, choose the media that will be developed in this research, namely Powtoon-based learning videos. Next, collect materials and supporting materials for making products from various references, such as books, images, and other supporting sources for the process of making Powtoon-based learning videos (Mashuri & Budiyono, 2020). Next, create a basic framework for Powtoon-based learning videos, namely a Flowchart consisting of the following elements.

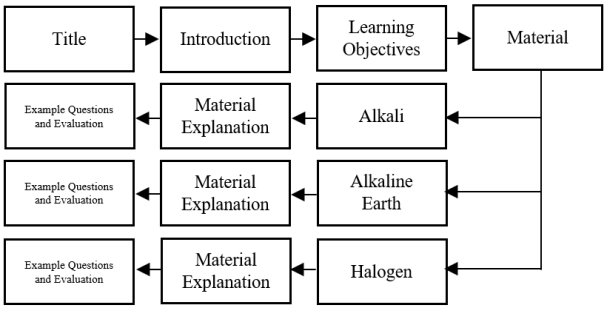

Figure 1. Powtoon Based Learning Video Development Flowchart

Subsequently, an evaluation tool consisting of a product quality assessment form using a Likert scale and a student response form using the Guttman scale was prepared. The product quality evaluation checklist includes elements to be assessed by academic experts and chemistry educators. The student answer sheet contains a series of statements to which students can respond with "Yes" or "No" answers. The instruments that have been prepared are adjusted to the supervisor's views before being validated. Then, instrument experts validate the tool.

Develop Stage

At this develop stage, create Powtoon-based learning videos according to the flowchart that has been created. First, choose a display design created using Canva and stickers from www.flaticon.com, as well as those that are available on Powtoon. Next, create a Powtoon-based learning video supported by another application, namely InShot. These are the steps in creating a learning video using the Powtoon platform.

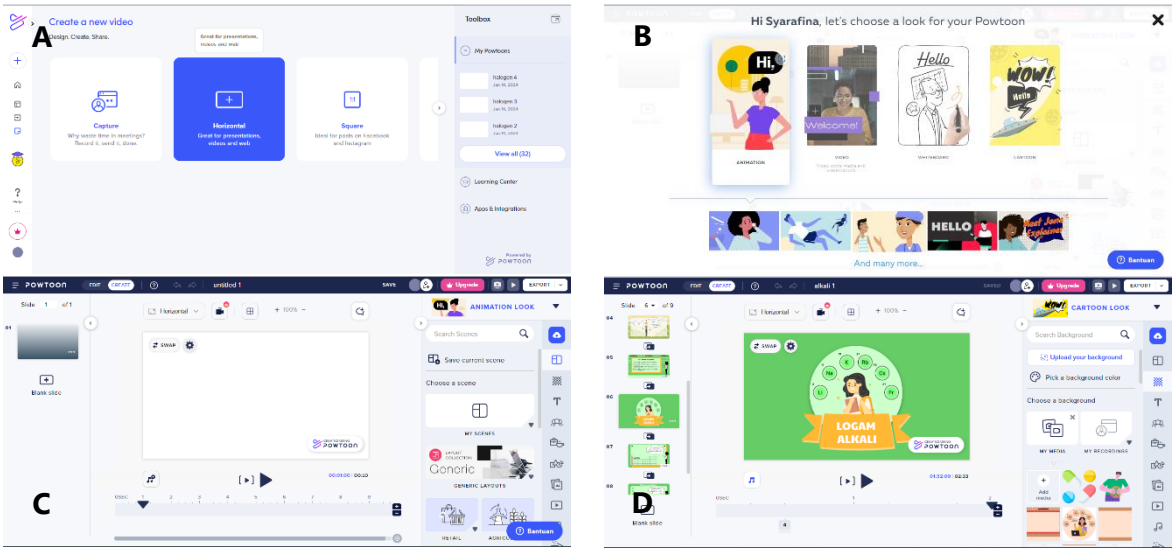

Figure 2. Video Making Process in Powtoon: select a video size (A); select a video theme (B); initial view of the Powtoon work page before a video is created (C); and initial view of the Powtoon work page during video creation (D)

The learning videos cover 3 sub-materials from elemental chemistry, namely alkali metals, alkaline earth metals, and halogens. Each sub-material consists of an introduction, definition, abundance of elements, properties of elements, elemental reactions, as well as example questions and evaluations. The introduction contains apperception, namely chemical elemental material associated with phenomena or events that occur in everyday life. Apperception aims to make students feel comfortable before studying because comfort and readiness to learn are positively correlated with learning outcomes (Saidah et al., 2021). Apperception also aims to arouse students' curiosity by showing an enthusiastic attitude when starting learning so that it is effective in motivating and stimulating students' passion to be involved in lesson feedback and response to teacher instructions (Puteri, 2018). Alkali metal elements include lithium, sodium, potassium, rubidium, cesium, and francium. Alkaline earth metals consist of several elements such as beryllium, magnesium, calcium, strontium, barium, and radium. Halogen elements include fluorine (F), chlorine (Cl), bromine (Br), iodine (I), and astatine (At).

After making a learning video using Powtoon, screen recording is carried out. The results of the screen recording were edited using InShot. InShot is an application used to create or edit videos easily (Mulyani, 2023). In this editing stage, users have the ability to insert various elements such as sound, music, video clips, and so on.

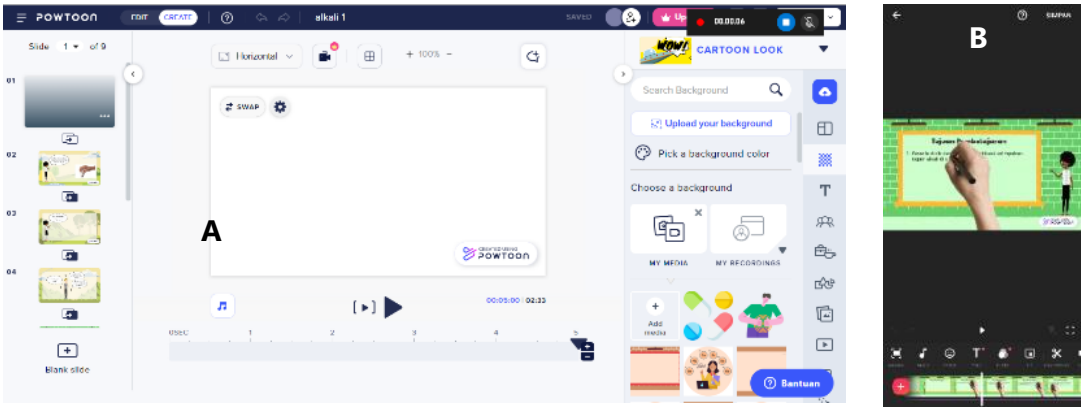

Figure 3. Screen Recording Process (A) and Video Editing Process in InShot (B)

The end result is three learning videos using the Powtoon platform, each between 7 and 10 minutes long. The initial part consists of an introduction, learning objectives, and material title. The content section includes learning material, namely understanding, abundance of elements, properties of elements, and elemental reactions. The closing section contains example questions and evaluations.

Figure 4. Opening Part: introduction (A) and learning objectives (B); Contents Section: properties (C) and reactions of alkali metals (D); Closing Part: example question (E) and

Figure 5. Opening Part: introduction (A) and learning objectives (B); Contents Section: properties (C) and reactions of alkali metals (D); Closing Part: example question (E) and evaluation (F) ***(continued)***

After the product has been created, the next step is to validate it by experts in the field, including material experts and media experts. Material experts play an important role in confirming the product from the material aspect and the way it is presented. The product suitability assessment is carried out by teachers who are experts in the field of material from the Chemistry Education study program at State Islamic University Sunan Kalijaga Yogyakarta. There are two aspects of eligibility, namely material and presentation aspects. The criteria in the material aspect are the suitability of the material with the specified achievements, the presentation of the material has been sorted from easy to difficult and presented as a whole, and the questions and discussions are presented correctly according to the theory. The criteria for the presentation aspect focus on its ability to stimulate students' curiosity. Information regarding the evaluation of the quality of learning videos using the Powtoon platform by material experts can be found in Table 2.

Table 1. Results of Quality Assessment of Powtoon-Based Learning Videos According to Material Experts

Feasibility Aspect	Ideal Percentage	Category
Material	100%	VG
Presentation	80%	VG

Overall, the assessment of the material from Powtoon-based learning videos was conducted by material expert lecturers, the product obtained a total score of 19 with an ideal percentage of 95%. According to the material expert's assessment, the total score reached 19, which is in the range X ≥ 14.67, indicating that his performance is in the very good category (VG). This is following a study conducted by Wulandari et al. (2020) where the material was rated as very suitable overall. So, the videos produced can function as a tool in the teaching and learning process.

Media experts are responsible for evaluating the products in terms of their linguistics, appearance, and characteristics. The product validity test was carried out by lecturers who are experts in the field of media from the Chemistry Education study program at State Islamic University Sunan Kalijaga Yogyakarta. The criteria for the language aspect include the use of easily understandable sentences, standard language, and the clear presentation of information. The criteria in appearance aspect involve the suitability of text and background colors, the alignment of music/accompaniment with the content, and the relevance of images to the material. Meanwhile, the criteria for the characteristics aspect focus on the ability to attract student's attention. Assessments of the quality of learning videos using the Powtoon

platform according to media experts can be found in Table 3.

Table 2. Results of Quality Assessment of Powtoon-Based Learning Videos according to Media Experts

Feasibility Aspect	Ideal Percentage	Category
Language	100%	VG
Appearance	93,33%	VG
Characteristics	80%	VG

Overall, in the assessment of Powtoon-based learning videos carried out by media expert lecturers, the product received a total score of 33, which is equivalent to an ideal percentage of 94.29%. According to the media evaluation criteria used by experts, the overall score obtained is 33, within the range X ≥ 25.67, which places it in the very good (VG) category. This is in accordance with the findings from research conducted by Awalia et al. (2019) where this media was considered very suitable for use. Thus, the videos created can be used as tools in the teaching and learning process.

According to evaluations carried out by material experts and media experts, the product received an assessment above standard, indicating very satisfactory quality. This indicates that the quality of the Powtoon-based learning video, as the developed media has fulfilled pedagogical, psychological, and technical elements. Therefore, it can be claimed as a good and appropriate media for use by students, due to its capable to present the material comprehensively, attracting students' attention, and it is user-friendly. However, there are several inputs and suggestions from material expert lecturers and media expert lecturers to make improvements so that the product developed, namely Powtoon-based learning videos, becomes a better product. Input and suggestions from material expert lecturers, namely videos on alkaline and alkaline earth sub-materials, are better put together because students sometimes cannot differentiate between groups I and II based on the characteristics or characteristics of compounds that are almost the same. According to feedback and suggestions from media expert lecturers, delivery that is relatively flat and with relatively uniform images will make students less interested. Additionally, the color composition and type of images used or the pop-ups are relatively monotonous.

Learning videos use the Powtoon platform which has been approved and improved according to input from experts. Then, the videos are tested by chemistry teachers to evaluate their practical usefulness. Chemistry teachers have an important role in evaluating media from the perspective of material, language, appearance, and characteristics. Three chemistry teachers from various high schools in Special Region of Yogyakarta evaluated the product. There are four aspects of feasibility: material, language, appearance, and characteristics. The criteria for the material aspect include the alignment of the content with the specified learning outcomes, the presentation of the material that has been sorted from easy to difficult and presented as a whole, and the accurate presentation of questions and discussions based on the theory. In the language aspect, the criteria focus on using easily understandable sentences, standardized language, and clear presentation of information. The criteria for the appearance aspect are the suitability of the writing color and background color, the suitability of the music/accompaniment to the content, and the suitability of the image to the material. The criteria in the characteristics aspect can stimulate the curiosity of students and have the ability to attract the attention of students. Table 4 displays the evaluation of the quality of learning

videos using the Powtoon platform by high school chemistry teachers.

Table 3. Results of Quality Assessment of Powtoon-Based Learning Videos according to High School Chemistry Teachers

Feasibility Aspect	Ideal Percentage	Category
Material	82,22%	VG
Language	84,44%	VG
Appearance	84,44%	VG
Characteristics	83,33%	VG

Overall, in the assessment of Powtoon-based learning videos carried out by chemistry teachers, the product received a total score of 138, which is equivalent to an ideal percentage of 83.64%. According to the assessment standards by chemistry teachers, with a total score reaching 138, it is in the very good category (VG) in the range $X \geq 121$. This is in accordance with a study conducted by Donna et al. (2021) where the product was considered very practical based on the results of their research. In this way, the videos created can be used as teaching aids.

The next stage is to conduct a limited trial on 10 12th-grade students. Student involvement in evaluating media focuses on appearance and media. Student responses were obtained from 12th-grade students in DIY. In table 5, students' responses to the learning material presented via video using the Powtoon platform are listed.

Table 4. Student Response Results

Feasibility Aspect	Ideal Percentage	Category
Appearance	100%	VG
Media	100%	VG

The response generated from 10 students was 100% with a total score reaching 80 out of the maximum score that could be obtained of 80. This is in accordance with the results of a study conducted by Astika et al. (2019) where the results of product attractiveness were stated in the very attractive category. Therefore, the Powtoon-based learning videos developed can attract students' interest in studying 12th-grade elemental chemistry material.

Material and media expert validation, chemistry teacher assessments, and student responses prove the achievement or feasibility of Powtoon-based learning videos. This assessment covers various aspects such as appearance, language, characteristics, presentation, material, and media. According to evaluations from experts, assessments from chemistry teachers, and feedback from students, the learning videos that have been made are considered suitable and effective tools for both teachers and students in the learning process. The learning videos developed can present the material in order and intact, using simple and easily understandable language, it has attractive visuals so that are expected to stimulate curiosity and motivation and are easy to use for both teachers and students. This is supported by research conducted by Dewi & Handayani (2021) which shows that students responded to the use of learning videos using Powtoon as a science learning medium with an agreement level of 86.94%, indicating that this use was considered very effective and suitable for implementation.

According to research conducted by Puspitarini et al. (2018), it was found that learning videos created using the Powtoon platform could be used as an effective tool in the learning

process. This support is strengthened by the learning results tested on 9 students in small groups, who achieved an average score of 4.32 with an excellent assessment. Likewise, the 20 students in the large group, who achieved an average score of 4.19 with an excellent rating. Support for this opinion can also be found in research conducted by Suprianti (2020) which shows that using Powtoon in learning is not boring, so students become more interested and focused in the learning process, and even allows them to study outside the school environment via the internet. This is also supported by research by Rahmawati & Ramadan (2021) which shows that the use of animation in videos can help teachers convey material to students, as well as improve students' thinking abilities.

CONCLUSION

Based on the evaluation and discussion regarding the development of Powtoon-based learning videos on elemental chemistry materials for 12th-grade, it can be stated that the video development process follows the 4-D model, but has only reached the Develop stage. In the manufacturing process, supporting applications, including Canva, Flaticon, and InShot, were used. According to material expert evaluation, the ideal level is 95%, which indicates excellent quality. According to the assessment of media experts, the optimal figure is 82.85%, which indicates excellent quality. According to the assessment of three chemistry teachers, it was found that the ideal percentage reached 83.64%, indicating excellent achievement in this category. Based on student responses, a percentage figure of 100% was obtained. Therefore, learning videos using the Powtoon platform can be an alternative choice as a teaching media in the classroom.

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