Development of Animated Videos on Basic Chemistry Laws as Digital Learning Media

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Abstract: This research aims to develop animated videos media as a digital learning medium to support students' understanding of the basic laws of chemistry. The study employs the ADDIE development model, which includes the stages of Analysis, Design, Development, Implementation, and Evaluation. The develop media is validated by matter experts, media experts, and linguists as well as small-scale and large-scale trials by students. Validation results indicated that the animated videos were included in the category of "Very Valid", while results of the practicality test by teachers and students placed the media in the category of "Very Practical". Based on these results, the animated videos are considered very valid and very practical for use as a digital learning medium for improving students' understanding of the basic laws of chemistry at Taman Mulia Kubu Raya High School.

Keywords: Animated Video; Basic Laws of Chemistry; Digital Learning Media.

Introduction

Science and technology have experienced rapid development and have a significant influence in various fields, especially education (Prastika et al., 2024; Ully & Nugraheni, 2024). In learning chemistry as a branch of natural science that involves understanding concepts, theories and calculations (Hemayanti et al., 2020; Supriyanti et al., 2023). One of the chemistry subjects in class X high school is basic chemical law material. Basic chemical laws that contain concepts and require calculation skills as an important basic for understanding advanced material such as stoichiometry (Furqon et al., 2024; Sotikno et al., 2022). However, in the field, many students experience difficulties understanding material that involves concepts and calculations. This was observed among students of Taman Mulia Kubu Raya High School.

The results of observations and interview with chemistry teachers show that there are some students who have difficulty in understanding the material. This

is due to the low mastery of basic concepts, weak calculation skills, and limited learning media used in the classroom in the form of whiteboards and student worksheets. Although the media is quite helpful, some students expressed the need for digital media that is more interesting and interactive to support understanding of the material. Therefore, it is necessary to develop digital media as a learning supplement that is tailored to the needs of students so that students can understand the material well.

Digital learning media are flexible tools that allow students to access learning resources without being bound by specific learning hours (Hafizah, 2020; Purwita & Zuhdi, 2023). Animated videos combine text, audio, and images with moving elements, colors, and sounds to visually convey abstract concepts (Geni et al., 2020). These videos can increase motivation, attract students' attention, and make learning more enjoyable and interactive (Muslim et al., 2021). Additionally, animated videos help students understand the material

better, stimulate critical thinking, and enhance information retention (Apriansyah, 2020).

Previous research by the researcher Gustianty (2024) indicated that animated videos on buffer solution materials were rated as very valid by material and media experts, with scores of 95% and 92.85%, respectively. Practicality assessments by teachers and students also yielded very good categories, with percentages of 94.74% and 92.36%. Similarly, Nurfitriana et al. (2022) reported that animated videos on atomic model development received a validity score of 93% from material and media experts, and a practicality score of 90%, both in the very good category. However, no research has been found that specifically develops animated video media on basic chemistry law material at Taman Mulia Kubu Raya High School.

Based on the problems described, this research was conducted to develop animated videos as supplements to digital learning media for basic chemistry laws. This development aims to helps students overcome difficulties in understanding concepts and calculations, so as to increase the clarity of the material and provide more flexible access to learning. Thus, this media is expected to bridge the gap between abstract chemical concepts and students' understanding concretely and contextually. Therefore, this research is entitled Development of Animated Videos on Basic Chemistry Law Materials as Digital Learning Media.

Method

This research is a type of research and development (R&D) using the ADDIE development model which consists of five stages Analysis, Design, Development, Implementation, and Evaluation (Pradilasari et al., 2020). This research aims to make animated videos of basic chemical law material as digital learning media.
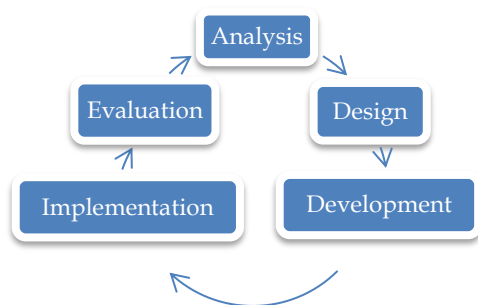
Figure 1. Developing using the ADDIE Model

The instruments used in this research are validation sheets and response questionnaires. The validation sheet was filled in by three material experts, three media experts, and three linguists, each of whom consisted of two lecturers and on teacher. Meanwhile, the response questionnaire was filled in by teachers and students, involving one chemistry teacher, as well as a small-scale trial on nine XB class students and a large-scale trial on twenty XA class students at Taman Mulia Kubu Raya High School.

The data analysis technique used for validity and practicality tests is to use a Likert scale with an assessment score from 1 to 4, as shown in Table 1.

Table 1. Response Questionnaire Choice Score

Answer Options	Criteria
Strongly Agree	4
Agree	3
Disagree	2
Strongly Disagree	1
	(Pradilasari et al., 2020)

Conclude the assessment score of each validator for all indicators and find the validity value using the percentage Formula 1.

$$P = \frac{f}{N} \times 100 \tag{1}$$

Information:
P = Percentage number
f = Total score obtained from all validators/respondents
N = Maximum possible score

The results obtained are matched to the validity criteria, which can be seen in Table 2.

Table 2. Percentage of Validation Criteria

Percentage %	Criteria
0 -20.99	Invalid
21.00 -40.99	Less Valid
41.00 -60.99	Fairly Valid
61.00 -80.99	Valid
81.00 -100	Very Valid
	(Dheadema et al., 2023)

Match the percentage value of the response questionnaire of teachers and students of class X with the percentage of the questionnaire criteria, which can be seen in Table 3.

Table 3. Percentage of Practicality Criteria

Percentage %	Criteria
86.00-100	Very Practical
76.00-85.99	Practical
60.00-75.99	Fairly Practical
55.00-59.99	Less Practical
0 -54.99	Not Practical
	(Ardiansyah & Yerimadesi, 2024)

The results obtained from the calculation of the formula above can be used to assess the validity and

practicality of animated videos as a digital learning medium. The animated video is valid if the percentage is $\geq$ 61.00%, while it is declared practical if the percentage of practicality obtained is $\geq$ 76.00%.

Result and Discussion

Analysis

The analysis stage aims to analysis in the learning process, namely needs analysis, analysis of student characteristics, and curriculum analysis. Based on interviews with a chemistry teacher and four students of Taman Mulia Kubu Raya High School, information was obtained that the learning media used were in the form of whiteboards and student worksheets. The media is still conventional, so students' understanding of abstact concepts and calculations is still low.

Based on the analysis of student characteristics that assess cognitive abilities, it shows that student test results on basic laws of chemistry are still incomplete, even after remedial lessons provided by the teacher. Problems and learning conditions, based on classroom observations show that during the lesson there are some students who actively listen to the teacher's explanation and after learning in counting students will forget to remember the calculation steps. Therefore, digital learning media is needed as a supplement to help students understand the material and learn independently.

Digital learning media in education can support the learning process, especially for the basic laws of chemistry (Safitri et al., 2025). Animated videos, as a form of digital media, are effective because they combine audio and visual elements to attract students' attention, facilitate understanding, and enhance memory retention (Marliani, 2021). Research Melati et al. (2023) states that animated videos are practical, efficient, and can increase students' motivation and interest in learning.

Based on the analysis of the curriculum applied at the noble Taman Mulia Kubu Raya High School, namely the independent curriculum.

Design

Material collection, which involves gathering information from sources such as books or modules on basic laws of chemistry. Preparation of video scripts, including original voice-over sound recordings conveying information without appearing visually in the video and details of the material to be conveyed. The duration of the video is about 12 minutes 10 seconds in MP4 format Full HD resolution (1920 x 1080). Audio creation, which involves recording original voice-overs for use outside the animated layer. Additionally, intro and outro sounds are sourced from social media platforms, selected based on criteria that ensure they are not copyrighted. Animation video design, utilizing the Canva application, which is adapted to the script to illustrate the basic laws of chemistry. Once the design is complete, the audio and sound recordings are integrated, and the final videos are uploaded to Google Drive. Research instruments, which are intended to streamline data collection. These include validation sheets for instruments, media validation forms, and questionnaires for teacher and student responses, all of which must be validated by experts prior to use.

Development

The goal is to produce animated videos that are valid as a digital learning media. This stage involves validation by three material experts and is summarized in Table 4.

Table 4. Results of the Animation Video Validity Recapitulation

Aspects	Expert Validators			Validity score	Criteria
	1	2	3		
Material	100%	77.5%	90%	89.16%	Highly Valid
Media	78.85%	82.70%	100%	87.18%	Highly Valid
Language	93.2%	100%	97.72%	96.96%	Highly Valid

The results of this validation are consistent with several previous studies on the development of animated videos for chemistry learning. First, the animation video on hydrocarbon material received 96.67% validation from material experts and 100% from media experts, with very feasible criteria (Dheadema et al., 2023). Meanwhile, the animation video on atomic model development showed validation scores of 93% from both material and media experts, categorized as very valid (Nurfitriana et al., 2022). The difference in this study lies in the separation of assessments between subject matter experts and linguists, whereas previous studies combined these evaluations.

(a)

(b)

(c)

(d)

Figure 1. Learning media developed: (a) Animation Video Cover; (b) Animated Video Title; (c) Basic Law of Chemistry Material; and (d) Scan Kahoot Questions and Cover

Implementation

Follows after the animated video on basic laws of chemistry, as a digital learning medium, is declared valid based on the assessment by material experts, media experts, and linguists. The next step is the implementation stage, where the animated video was piloted on small and large trial subjects. During this stage, questionnaires were filled out by students and teachers to gather their responses to the animated video products, aiming to determine how practical the developed products are. The statements in the teacher's response questionnaire included aspects of appearance, construction, and language of the animated video media. The teachers' response scores are summarized in Table 5.

Table 5. Recapitulation of Teacher Response Questionnaire

Aspects	Percentage %	Criteria
Display	97.22	Very Practical
Construction	84.37	Very Practical
Language	93.75	Very Practical
Average	91.78	Very Practical

The results of the assessment of the questionnaire responses from students of Taman Mulia Kubu Raya High School regarding animated videos on the basic laws of chemistry as a digital learning medium were reviewed from the aspects of student usefulness and motivation, convenience, construction, display design, and language, all of which met very valid criteria. The recapitulation of student response scores can be seen in Table 6.

Table 6. Recapitulation of Student Response Scores

Aspects	Small-Scale Test %	Large-Scale Test %
Usefulness and Motivation	88.19	91.00
Ease	81.94	94.00
Construction	85.00	90.00
Design Appearance and Satisfaction	90.00	94.00
Language	88.88	94.00
Average	86.80	92.60

The results of the practicality test were based on the responses of teachers and students to the animated video on the basic laws of chemistry as a digital learning medium with categorized as very practical. The suggestions and comments from teachers and students regarding the animated video on the basic laws of chemistry as a digital learning medium at Taman Mulia Kubu Raya High School were collected. Each suggestion and comment provided by the students was selected based on the aspects most frequently mentioned, as shown in Table 7.

Table 7. Teacher and Student Comments

Respond	Comments/Suggestions
Teacher	It's good, hopefully the animated video media can help students understand the basic laws of chemistry and motivate them.
Student	Animated video-based learning with explanations will make it easier for students to understand.
	Interesting and simple animated videos.

Evaluation

The evaluation is conducted by providing a solution to the need for digital learning media in the

form of animated videos on the basic laws of chemistry. Evaluation at the development stage is carried out by revising the animation video based on comments/suggestions from subject matter, media, and language expert validators. After being declared valid, the next stage is implementation involving small-scale and large-scale trials using response questionnaires from teachers and students to determine the practicality of the animated videos.

Conclusion

The development of animated videos on basic chemical law materials as a digital learning medium at Taman Mulia Kubu Raya High School using the ADDIE model has been successfully implemented. The validation results showed that the media has a very high level of validity in terms of material (89.16%), media (87.18%), and language (96.96%). The practicality test conducted by teachers (91.78%) and students by small scale (86.80%) while large scale (92.6%) also indicated a very practical category. Thus, the animated videos are declared valid and practically suitable for use as a digital learning media to improve student understanding of the basic laws of chemistry at Taman Mulia Kubu Raya High School.

Author Contributions
L.Y. conducted the research, data collection, and manuscript writing; F. and H.M. provided feedback and reviewed the manuscript. All authors contributed equally to the writing and preparation of this article.

Conflicts of Interest
No conflicts of interest.

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