Development of Articulate Storyline 3-Based for Chemical Bonding Teaching Materials

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Abstract

The development of Articulate Storyline 3 (AS3)-based chemistry teaching resources on chemical bonding is the aim of this research. the subject of research was 10th-grade senior high school students. This research was conducted to investigate the form of creation and viability of chemical bonding teaching materials using the AS3 application. Minor modifications are made to the Borg and Gall method for instructional design for the production of AS3-based chemical bonding teaching materials. The technique consists of five steps: preliminary studies, product design plan (planning and development), product validation (validation design and revision), field trials, and final product dissemination. The instruments used in this study were interview sheets, questionnaires in the form of instrument validation for material experts, and media experts, tests for students, and documentation. Material expert data, media, and student responses were obtained and analyzed to describe the validity and feasibility of teaching materials. The findings indicated that the optimal percentage was 96.42%, while the very excellent percentage was 96.66%. The results of the evaluation of the feasibility of teaching materials by material specialists and media specialists were 83.07% and 84.61 %, respectively, in the very excellent category. According to the findings of expert evaluations and field testing of chemical teaching materials based on AS3, this chemical bond material is very appropriate for use in educational settings.

INTRODUCTION

Chemistry is the study of the structure and composition of matter, as well as the processes that precede the transformation of matter (Jelita et al., 2021; Jespersen et al., 2012; Safitri et al., 2022). One of the substances contains a chemical link. Material for chemical bonds has abstract, microscopic, and layered properties (Bergqvist et al., 2013; Irwansyah et al., 2020). Due to the features of chemical bonding material, learners have learning challenges (Chandrasegaran et al., 2007; Chittleborough & Treagust, 2007; Oludipe and Awokoy, 2010, Pérez et al, 2017; Kumpha, Suwannoi, & Treagust, 2014). Atomic structure, electron configuration, Lewis structure, and molecular formula are the required materials (Pabuccu & Geban, 2012). The fundamental principles of chemistry are crucial because if they are not fully understood, it is impossible to comprehend the more complex concepts (Sirhan, 2007; Pahriah and Hendrawani., 2019).

The fundamental notion of chemical bonding becomes more difficult for pupils to grasp if the content is presented in a convoluted, repetitive, uninteresting, and less engaging manner (Nahum et al, 2007). The instructor is required to be able to communicate chemical bond

content in an engaging manner so that students grasp the information correctly (Aclufi et al, 2019). The creation of digital learning media is an alternate method for delivering content in order to enhance students' conceptual comprehension. Text, pictures, videos, animations, graphics, and audio may be visualized via text, photos, videos, animations, and graphics in digital learning materials (Rusman, et al. 2011; Imron, 2019; Krisnawati et al., 2023). Media is a component that increases student learning motivation and learning results (Ljubojevic, et al., 2014; De Jong, 2010; Mayer, 2009; De Jong, 2010; Mayer, 2009).

Learning media is a method of information transmission used to attain learning objectives. Teaching resources are among the learning mediums. The term teaching materials refers to any items used to make it simpler for teachers to impart information in the course of teaching and learning (Thiagarajan et al., 1974). Yet, there are a number of schools that rely only on printed textbooks, causing students to be less engaged and bored; hence, interactive teaching materials must be modified (Meltzer, 2002). One of the interactive teaching tools is based on the Articulate Storyline 3 software (AS3).

AS3-based instructional resources may help students comprehend and comprehend the offered subject more thoroughly. AS3 has the ability to build presentations that are more thorough and innovative. AS3's capabilities include user-friendly timelines, videos, images, characters, and assessment tests (Darmawan, 2011). On the basis of the preceding explanation, it is required to produce AS3-based teaching materials on chemical bonding material in order to address the issue of learning challenges and to provide the appropriate media solution for students engaged in independent study at home.

METHOD

Research and Development (R&D) is a kind of AS3-based teaching material development research, whereas the model is the Borg and Gall model with numerous modifications (Sugiyono, 2010). There are both quantitative and qualitative data acquired. The method of data analysis used in this study is descriptive analysis.

Preliminary Studies

This phase aims to determine and establish learning requirements by examining challenges and resource constraints. The preparatory phase comprises a literature review and field research to determine the requirements of students, the breadth of the content, the degree of difficulty of the material, and references to support the creation of learning media.

Product Design Plan (Planning and development)

This stage aims to prepare materials and product designs from the mapping of preliminary study results. The planning stage obtained the initial design of the developed media, in the form of material format and initial design. This phase is aimed at creating Articulate Storyline 3-based chemical bonding teaching resources. This stage of development includes designing, developing, and creating teaching materials.

Product Validation (validation design and Revision)

The validation phase comprises of material expert validation and media expert validation of the created AS 3 instructional materials. In this expert validation, material experts and media experts are decided based on their education and competence. The material experts in this study were 2 lecturers from the chemistry education study program and 1 chemistry teacher at SMA Negeri 4 Kupang. 2 media experts, namely 1 STIKOM Uyelindo Kupang lecturer and a Chemistry Media Lecturer. This validation's results will be used to improve instructional

materials so that they are acceptable for usage. The examination of material and media expert validation employs a Likert scale.

Calculation of the average validation score of each aspect of the criteria assessed by the formula:

$$\text{Validity percentage } (\%) = \frac{\text{average score}}{\text{highest score}} \times 100\%$$

Table 1. Expert Team Validation Criteria (Arikunto, 2006)

No	Validity criteria	Number	Validity level
1	91% - 100%	5	Very valid, or usable without revision
2	61% - 90%	4	Valid, or able to be used but needs minor revision
3	41% - 60%	3	Valid enough, or slightly revised
4	11% - 40%	2	Invalid, recommended not to use it because it needs major revisions
5	0% - 10%	1	Invalid or not able to be used

The validity test was carried out to measure the eligibility of the teaching material products developed based on the eligibility criteria table.

Table 2. Expert Team Validation Eligibility Criteria (Arikunto, 2006)

Score	Category	Score Range	Information
5	Very good	$X > 80\%$	Worth using without revision
4	Good	$66{,}67\% < X \leq 80\%$	Worth using without revision
3	Medium	$53{,}5\% < X \leq 66{,}67\%$	Worth using with minor revisions
2	Less	$40\% < X \leq 53{,}5\%$	Worth using with multiple revisions
1	Very less	$X \leq 40\%$	Not worth using

Field Trials

It conducts field trials to evaluate the quality of AS-based instructional materials 3. This step is performed in small groups of 10 individuals and big groups of 20 individuals. The Guttman scale is used for student replies. Calculate the proportion of student replies based on the table below.

Table 3. Student Response Percentage Criteria (Arikunto, 2006)

No	Score range	Category
1	91% - 100%	Very good
2	61% - 90%	Good
3	41% - 60%	Enough
4	11% - 40%	Less
5	0% - 10%	Very less

Final Product Dissemination

The final stage is to disseminate this teaching material by distributing this teaching material to those who need it, both teachers and students in the learning process and can make this teaching material an efficient means of learning media at school or at home. This development only reaches the field trials stage. Evaluation of the effectiveness of product dissemination can be carried out in the advanced research agenda. Its requires a considerable amount of subject and time within the framework of qualitative and quantitative research to give confidence that the products developed are indeed reliable and effective in improving the quality of learning.

RESULTS AND DISCUSSION

The development of chemical bonding teaching materials based on AS3 seeks to identify the shape and degree of the practicality of teaching materials.

Preliminary Studies

In an attempt to address the challenges encountered by students, researchers selected chemical bonding as the subject for the development of AS3-based teaching materials. This developed instructional content is simple to manufacture inexpensive and required little time. It is anticipated that the generated teaching materials would stimulate students' interest in learning since they contain material, interesting animations, and videos.

Product Design Plan (Planning and development)

The appearance of the developed teaching material products can be seen in the figure below:
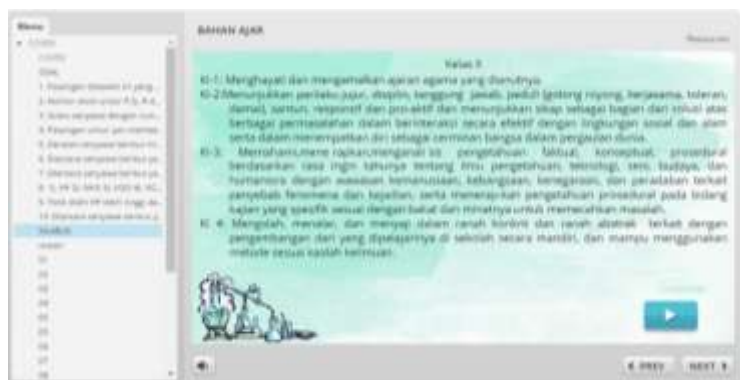

Figure 1. Cover

Figure 2. Syllabus

Figure 3. Cover Material

Figure 4. Cover Evaluation Questions
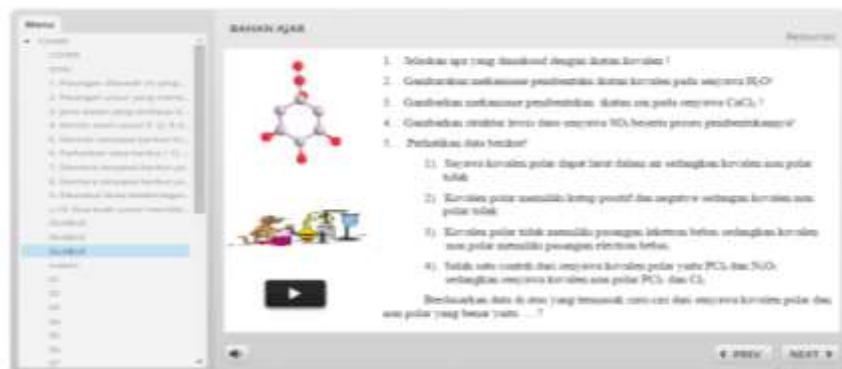

Figure 5. Multiple Choice Questions

Figure 6. Essay Questions

Product Validation (Validation Design and Revision)

Material Expert Validation

The results of the complete material validation assessment from the validator can be seen in the table 4. Based on the average results of material validation as a whole, the revised results of the 3 validators is 145. The overall ideal percentage is 88.29% with details namely for the content feasibility aspect at 84.66%, the presentation aspect at 85.77%, and linguistic aspects at 94.44%. The categories obtained are very good and feasible to use.

Table 4. The average and ideal percentage for each indicator of the three aspects of assessment in material validation (revised results)

Assessment aspect	Indicator	Average	% Idealism
Content eligibility	Conformity of material with Core competencies (KI) and Basic Competence (KD)	57	84.66%

	Conformity of teaching materials with learning objectives		
	Learning objectives are easy to understand		
	Material accuracy		
	The significance of learning materials		
Presentation aspect	Material presentation techniques	55	85.77%
	Presentation support		
	Feasibility and suitability of test questions evaluate dan umpan balik		
Aspek kebahasaan	Straightforward	33	94.44%
	Communicative (dialogical and interactive)		
	Suitability with the development of students		
	Total number	145	88.29%

Media Expert Validation

After revising the suggestions and input from the validators, the researcher re-validated the teaching materials to the validators (media experts). The average results and ideal percentages (revised results) for each material assessment indicator can be seen in Table 5 below.

Table 5. The average and ideal percentage for each indicator from the graphical aspect of media validation (revised results)

Indicator	Indicator Items	Average	% Idealism
Changeable	The cover and appearance of the contents of the material attract the attention of students	8	80%
	The design of each page is attractive		
Illustration	Balanced title placement	8	80%
	Display animation is not complicated and continuous with each other		
Color composition	Contrast background color	8	80%
	Use of font color		
Selection of font type and size	The typeface used is easy to read and attractive	8	80%
	The font size used is easy to read		
Image eligibility	Interesting use of images	9	90%
	Clear image captions		
Use of teaching materials	Programs or teaching materials are easy to understand	5	100%
Text readability	Text readability is clear and attractive	8	80%
	The entire text is presented in a systematic and concise manner		
	Total number	54	83.01%

From the table above the average media validation as a whole on the graphic aspect of the revised results of the three validators is 54. The overall ideal percentage is 83.01% with a very good category and is feasible to use.

Product Trials

At this trial stage, a digital teaching material product based on Articulate Storyline 3 was tested on students. The aspects that were assessed by students at the trial stage were the learning aspects and the content aspects of the material which were described in the 7 assessment indicator points. Product trials were carried out in two stages, namely small group trials and large group trials.

Small Group Trial

After validation was carried out by the material validator and media validator, then a small group trial was carried out using 10 assessors. The calculation results obtained can be seen in Table 6.

Table 6. Average and Percentage of Idealism of Small Group Trial on Articulate Storyline 3-Based Chemistry Teaching Materials

Assessment Aspects	Average	% Idealism
Learning	40	100%
Content Material	29	96.66%
Total Score	69	98.33%

Based on Table 6, the average obtained is 69 and the ideal percentage is 98.33%, so it gets a very good category and is suitable for use.

Large Group Trial

Data on the results of student assessment responses in the large group trial are presented in Table 7. the average obtained is 6.75 and the ideal percentage is 96.42%, so it gets a very good category and is suitable for use.

Table 7. Average and Percentage of Ideality of Large Group Trials on Articulate Storyline 3-Based Chemistry Teaching Materials

Assessment Aspects	Average	% Idealism
Learning	3.95	98.75%
Content Material	2.8	93.33%
Total score	6.75	96.42%

There were several responses given by students after small and large group trials were carried out as shown in Table 8.

Table 8. Data on student responses to AS3-based chemical bond teaching materials

Number	Response
1	The quality is very good, it is very useful to be able to display videos of teaching materials that are easy to understand, the appearance is very aesthetic and of course effective for students
2	This digital teaching material is very easy to understand for the chemical bonding material
3	The designed learning media is very easy to understand, and not boring because it is equipped with videos and games
4	Digital teaching materials based on Articulate Storyline 3 are very interesting, provide learning motivation, and help me answer chemistry questions.

Final Product Dissemination

The final stage is to disseminate this teaching material by distributing this teaching material to those who need it, both teachers and students in the learning process and can make this teaching material an efficient means of learning media at school or at home. This development only reaches the field trials stage. Evaluation of the effectiveness of product dissemination can be

carried out in the advanced research agenda. Its requires a considerable amount of subject and time within the framework of qualitative and quantitative research to give confidence that the products developed are indeed reliable and effective in improving the quality of learning.

CONCLUSION

Based on the results of the research and discussion, it can be concluded as follows: 1) The results of the development carried out were in the form of teaching materials based on AS3 on chemical bonding material consisting of cover sections, syllabus, materials, practice questions, and evaluation; 2) The results obtained from material experts and media experts on the feasibility of this teaching material are categorized as very good and suitable for use with an overall ideal percentage of 88.29% for material experts and 83.07% for media experts, while the overall percentage results are obtained for the small group test, namely 98.57% in the very good category and suitable for use. The teaching materials that have been made can be applied by carrying out further research on testing the effectiveness of the use of teaching materials in SMA/MA and also as a reference for chemistry education researchers in making teaching materials for other chemical materials using the AS3 application.

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