Development of Interactive Powerpoint Learning Media Based on Guided Inquiry on Class XI High School Chemical Equilibrium Material

Tifani Qairani Fitri*, Syamsi Aini

Department of Chemistry, Padang State University, Padang, 25132, Indonesia

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A B S T R A C T

Learning media is one of the supporting factors for achieving learning objectives. One of the learning media used is Powerpoint media. the type of research used is research and development or Research and Development (R&D). This study aims to develop a guided inquiry-based powerpoint interactive learning media on chemical equilibrium material and reveal its validity and practicality as a chemistry learning medium. The development model used in this study is a 4-D model (define, design, develop and disseminate). The stages that are carried out are only up to the develop stage. The study was conducted at SMAN 2 Lubuk Basung. The learning media developed were assessed by 9 validators, and practicality was assessed by 2 chemistry teachers and 27 students of class XII MIPA. Based on the research that has been carried out, it is found that the content validation and construct validation of the learning media developed have a high validity category with the Aiken's V formula of 0.90399 and 0.92857 and the practicality of learning media based on the practicality questionnaire of the teacher's response is 91.05556 and student responses of 94.2469 with very practical category.

1. Introduction

The Minister of Education and Culture emphasized that educators can deliver learning materials innovatively, creatively and can be fun and of course the material delivered will be easily understood by students, so that students can understand the material independently at home. Chemistry is one branch of natural science that studies the structure, composition, properties, and energy of every matter or substance that exists in life. Chemical equilibrium material is one of the chemical materials studied in class XI of high school in odd semesters. Chemical equilibrium material consists of facts, concepts, principles and

procedures that require understanding at the macroscopic, submicroscopic and symbolic levels. This characteristic of the material is abstract. Based on the results of research that has been conducted, it was found that the difficulty of students in understanding dynamic equilibrium is very high, namely 61%, the difficulty of students in understanding the equilibrium constant is classified as medium, which is 39% (Indriani & Dkk, 2017).

The activeness of thinking and working students in understanding chemical equilibrium material can be helped by the existence of appropriate strategies, methods, models and media to support the learning process in accordance with the curriculum. Learning media is a tool that can be used by teachers to help the learning process and serves to clarify the meaning or message of the material to be conveyed to students, so that in the learning process can achieve indicators and learning objectives properly and perfectly (Nomleni & Manu, 2018)

In the 2013 curriculum, one of the appropriate learning models used and in accordance with the process standards to involve active participation of learners in learning is the guided inquiry learning model. According to research conducted by Lovisia (2018) the guided inquiry learning model has a significant influence on improving student learning outcomes in the learning process. In realizing learning that encourages students to be active in the learning process, one of them is using Microsoft PowerPoint devices. Pribady (2017) stated that the advantages of Powerpoint media are that in Powerpoint media in addition to being able to present elements of text, animation and images, Powerpoint media can also present video elements. This video can make it easier for students to understand the material provided such as the presentation of practicum videos. Powerpoint can guide students in the learning process that can lead students to find concepts by presenting demanding questions in each slide according to the guided inquiry learning cycle..

Based on observations and interviews conducted by researchers at SMAN 2 Lubuk Basung school, it is known that: 1) the methods applied are discussion, demonstration and experiment methods, but the application of discussion methods has obstacles because it takes a long time. While demonstration and experimental methods have constraints due to limited time and means. These obstacles can be overcome by displaying practicum and animation videos, 2) students receive lesson information through teaching materials in the form of textbooks that only display one level of representation, namely the symbolic level. While macroscopic and submicroscopic levels are not displayed so that students do not find and understand concepts, 3) chemical equilibrium material is material that is considered difficult by students. This statement is supported by the daily test scores of students whose average is below KKM.

The development of learning media based on guided inquiry is arranged based on the stages of guided inquiry learning, namely: orientation, exploration, conceptual formation, application and closure (Moog & Farrell, 2008). In guided inquiry learning, learners must develop basic skills in inquiry. This is because learners will be directly involved in making observations, explorations, concept formation

and closing. In line with Nugraha (2017) argues that through interactive media, students' skills in processing information can be done effectively. Learners can discover concepts on their own by following the steps of the guided inquiry learning model. Based on research conducted by Febriani (2016) which concluded that interactive inquiry-based Powerpoint learning media guided on class X high school / MA chemical bond material is suitable to be used as a learning media in learning with a very high level of validity and a level of practicality by teachers and students with very high practicality categories. And based on research conducted by Dewi (2020) which concluded that interactive inquiry-based Powerpoint learning media guided on buffer solution material is suitable for use as a learning media with a very high level of validity and practicality. And based on research from Waleulu (2019) it can be concluded that there is an influence of the use of the guided inquiry learning model on critical thinking skills and learning outcomes of class X MIA SMA Muhammadiyah Luhu on the subject matter of chemical bonding. Furthermore, based on research from Saida (2019) it can be concluded that interactive Powerpoint media has a positive effect on learning motivation, study habits and on student learning outcomes. So from the above, the author conducted a study that aimed to develop interactive powerpoint learning media based on guided inquiry on chemical equilibrium material and revealed its validity and practicality as a chemistry learning media.

2.   Methodology

This type of research is research and development or Research and Development (R & D). R&D is a process or steps to develop a new product or improve an existing product. Development research is research used to produce a particular product and test the effectiveness of that product. The development model used is a 4-D model (four D models) which consists of 4 stages, namely define, design, develop, and disseminate. However, this research is limited to the development stage, namely testing the validity and practicality of Powerpoint Learning Media. The subjects in this study were 4 FMIPA chemistry lecturers, 3 FT engineering lecturers, 2 chemistry teachers and 27 class XII MIPA students.

At the define stage, the determination and definition of learning conditions are carried out. Determination and determination of learning requirements begins with an analysis of the objectives of the material limitations by analyzing the objectives of the learning material limitations based on the curriculum. This stage includes: a) front-end analysis; b) learner analysis; c) task analysis; d) concept analysis; e) formulation of learning objectives. The design stage is carried out to design Powerpoint Learning Media based on guided inquiry. The develop stage is carried out to produce guided inquiry-based Powerpoint Learning Media that is valid and practical to use in the learning process of high school students. Validity Test aims to evaluate Powerpoint that has been developed (Lestari dkk, 2018: 172). The research data collection instruments used are validity questionnaires, validation sheets are used to determine whether the teaching materials that have been designed are valid or not (Lufri dkk, 2017:65) (addressed to FMIPA UNP chemistry lecturers, FT UNP engineering lecturers and high school chemistry

teachers) and practicality questionnaires (consisting of teacher and student response questionnaires).

For the validity test, it is analyzed using Aiken's V formula

$$V = \frac{\Sigma s}{n(c-1)}$$
$$s = r - Io$$

Information:

Io = The lowest validity assessment number (in this case = 1)

n = Number of expert validators

c = The highest number of validity assessments (in this case = 5)

r = Figures given by an appraiser

The criteria for assessing validity using Aiken's V are presented in table 1:

Table 1. Validity Categories Based on Aiken's V Scale

No. Of Items (*m*) or Raters (*n*)	Number of Rating Categories (*c*)							
	2		3		4		5	
	v	P	v	p	v	p	v	p
2							1.00	.040
3							1.00	.008
3			1.00	.037	1.00	.016	.92	.032
4					1.00	.004	.94	.008
4			1.00	.012	.92	.020	.88	.024
5			1.00	.004	.93	.006	.90	.007
5	1.00	.031	.90	.025	.87	.021	.80	.040
6			.92	.010	.89	.007	.88	.005
6	1.00	.016	.83	.038	.78	.050	.79	.029
7			.93	.004	.86	.007	.82	.010
7	1.00	.008	.86	.016	.76	.045	.75	.041

According to Nieveen (1999) in (Roliza dkk, 2018: 42) states that measuring the level of practicality is seen from whether teachers (and other experts) consider that the material is easy and can be used by teachers and students so that it can be said to be practical

For the practicality test, it is analyzed with practicality techniques

$$P = \frac{SA}{SM} \; x \; 100\%$$

Information:

P   : Product practicality

SA   : Scores obtained

SM   : Maximum score

The criteria for assessing practicality are presented in table 2.

Table 2. Categories Practicality

Interval	Category
80% < x ≤ 100%	Very practical
60% < x ≤ 80%	Practical
40% < x ≤ 60%	Quite practical
20% < x ≤ 40%	Less practical
0% < x ≤ 20%	Impractical

3.   Results and Discussion

1. Defining Stage

a. Front End Analysis

The front end analysis (beginning-end) obtained data in the form of interview results which stated that the teaching materials used by teachers were still printed books that did not use computer-based media such as powerpoint optimally. Teachers must play more roles to be able to embed concepts, especially in this chemical equilibrium material. From the results of interviews and the distribution of questionnaires in high school, they still use printed books and LKPD. The obstacle faced by teachers in teaching chemical equilibrium material is the characteristics of the material that are difficult to understand if only explained without involving its sub-macroscopic. Three levels of representation (macroscopic level, sub-microscopic and symbolic level), in chemistry are very important, the teacher displays only one level of representation which is symbolic while the macroscopic and sub-macroscopic levels have never been displayed. Therefore, to overcome a discussion that still runs, one teaching material or media such as powerpoint is needed which is equipped with images, animations and videos.

b. Student Analysis

Based on the results of interviews with teachers, data were obtained that students easily forget the concepts learned in chemical equilibrium material because they are accustomed to memorizing concepts. So an interesting teaching material or media is needed so that students can do a learning that is easy to understand and can see videos. By knowing and understanding the characteristics of students, it will make it easier for researchers to design learning media on Chemical Equilibrium material that is suitable for use by students. Learning media designed in the form of guided inquiry-based powerpoints that can maximize students' active participation in finding their own concepts and increase students' understanding of Chemical Equilibrium material.

c. Task Analysis

Task analysis is carried out by analyzing basic competencies (KD) based on the 2013 revised 2018 curriculum syllabus. In the analysis to be carried out is basic

competence 3.8, namely explaining the equilibrium reaction in the relationship between the reagent and the reaction result. Competency achievement indicators are made according to the circumstances in the school, so the competency achievement indicators amount to 9.

d. Concept Analysis

Concept analysis can identify the main concepts in the chemical equilibrium material to be taught and detail relevant concepts by referring to source books, namely textbooks and high school chemistry books. The main concepts in chemical equilibrium material are: the concept of dynamic equilibrium, the concept of homogeneous equilibrium and heterogeneous equilibrium, the equilibrium constant, calculating the price of the equilibrium constant (Kc and Kp), determining the relationship between Kc and Kp, calculating the degree of dissociation. Based on the 2013 KD 3.8 curriculum using discussion methods and scientific approaches with a guided inquiry learning model.

e. Learning Objective Analysis

This learning objective is analyzed and used as a basis for the preparation of interactive powerpoint learning media based on guided inquiry on chemical equilibrium material class XI high school. So it is expected that students actively observe, analyze and answer questions in order to process the information contained in powerpoint and be able to explain reversible chemical reactions and irreversible chemical reactions, explain the notion of dynamic equilibrium, explain the meaning of homogeneous equilibrium and heterogeneous equilibrium, write the equilibrium constant (Kc) for homogeneous equilibrium and heterogeneous equilibrium, calculate the price of Kc based on the concentration of substances in equilibrium, calculating the price of Kp based on the partial pressure of the reagent gas and the reaction result at the equilibrium state, determining the relationship between Kc and Kp, calculating the price of Kc based on Kp or vice versa and calculating the degree of dissociation.

2. Design Stage

At this design stage, the design of learning media in the form of inquiry-based powerpoint was guided on chemical equilibrium material for class XI high school chemistry learning. This design stage consists of several steps, namely: 1) determining basic competencies, IPK and learning objectives, concept analysis in chemical equilibrium learning in accordance with the 2013 curriculum; 2) selection of media by choosing the learning model used is guided inquiry and choosing the learning method used, namely discussion; 3) Compile formats and instructions for using interactive PowerPoint media in accordance with the design of the learning content to be made. Arrange the Powerpoint format in accordance with the design of the learning content that will be made as follows:

a. Cover

The cover contains titles as well as images related to chemical equilibrium materials. Figure 1 below shows what the cover page looks like.

Figure 1. Cover page view

b. Menu page

The menu page has several menu options. Figure 2 below shows what the menu page looks like.

Figure 2. Menu page view

c. Material pages

The material page is the most important page in Powerpoint media. Figure 3 below shows the cover page of the learning activity.

Figure 3. Learning Activities Cover Page

Learning materials will be grouped based on existing IPKs, and IPKs will be delivered based on guided inquiry stages. The orientation stage of learners is given motivation to learn chemical equilibrium material. Figure 4 below shows what the orientation page looks like.

Figure 4. Orientation page view

The next stage is the exploration stage and concept formation. At this stage, the model is presented as an object of exploration in the form of animation, video and data. Figure 5 below shows what the exploration and concept formation page looks like.

Figure 5. Exploration and concept formation page view

The application stage is the stage of understanding obtained by students at the exploration stage and concept formation then tested by answering questions that have been provided at the application stage. Figure 6 below shows what the app page looks like.
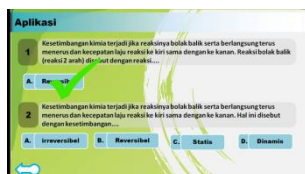

Figure 6. App page view

In the closing stage, students conclude by answering the questions contained in the closing stage and then choose one of the correct answers. Figure 7 below shows what the closing page looks like.

Figure 7. Closing page view

3. Development Stage

   a. Validity Test

Validity test is an assessment of the design of a product. The aspects assessed in content validation consist of several components consisting of content components, language components, presentation components, and graphic components (Sugiyono, 2015). As well as the aspects assessed in construct validation consist of several functions consisting of attentional functions, affective functions, cognitive functions and compensatory functions. The validator is an expert with a minimum of three people to test the validity of the instrument (Sugiyono, 2015). Validation was carried out by validators consisting

of 4 FMIPA chemistry lecturers, 3 FT engineering lecturers and 2 chemistry teachers of SMAN 2 Lubuk Basung. Criticism, input, and suggestions from validators are taken into consideration for revising learning media.

The content validation sheet contains 26 assessment aspects, the construct validation sheet contains 14 assessment aspects. The assessment data of the guided inquiry-based learning media validation sheet was analyzed using the Aiken's V formula. Based on the results of the content validation assessment from 6 validators of the developed Powerpoint learning media, the results were obtained that the developed Powerpoint learning media was valid with the value of the Aiken's V formula obtained 0.90399. Based on the results of the construct validation assessment of 7 validators of the developed Powerpoint learning media, it was found that the developed Powerpoint learning media was valid with the value of Aiken's V formula obtained 0.92857.

The results of the analysis of content validation data from each component by validators obtained Aiken's V formula, namely the content feasibility component 0.91111 with valid categories, the presentation component 0.92708 with valid categories, the language component 0.88889 with valid categories and the graphic component 0.88889 with valid categories.

For content validation there are 4 components that are assessed by validators. In terms of the feasibility component of the content of Powerpoint learning media, chemical equilibrium based on guided inquiry has a valid category with Aiken's formula value V 0.91111. This can be concluded in terms of the feasibility of the content of the Powerpoint learning media developed is valid and has been in accordance with KD. The basic competency developed is KD 3.8. The basic competencies are lowered to 9 IPKs. This means that the IPK developed is valid. In addition, the model contained in Powerpoint learning media means that it is in accordance with the material taught, easy to understand and can be explored to answer questions contained in Powerpoint learning media and can direct and guide to find concepts.

The second component that is assessed by validators is the feasibility of construction (presentation component). In terms of the presentation component of Powerpoint learning media, chemical equilibrium based on guided inquiry has a valid category with the value of Aiken's V formula obtained 0.92708. This shows that the Powerpoint learning media developed has been valid in terms of its presentation components which include the systematic preparation of Powerpoint learning media starting from the title, KI, KD, IPK and the guided inquiry model used has been compiled based on the stages of guided inquiry learning. The stages of the guided inquiry model are orientation, exploration and formation of concepts, applications and closures (Moog & Farrell, 2008). At that stage there are pictures and questions related to the material discussed. This aims to make students more motivated in learning and to increase students' understanding of the material. This Powerpoint learning media is also equipped with evaluation questions. Evaluation questions are tools used to measure the success of achieving learning objectives that have been formulated.

The third component that is assessed by validators is the language component. In terms of language, Powerpoint learning media, chemical equilibrium based on guided inquiry has a valid category with a formula value of Aiken's V of 0.88889. Based on this, it can be concluded that the Powerpoint learning media developed has been valid in terms of language because the language used is communicative, and in accordance with spelling rules Indonesian.

The fourth component that is assessed by validators is the graphical component. In terms of graphics, Powerpoint learning media, chemical equilibrium based on guided inquiry has a valid category with Aiken's formula value V 0.88889. Based on this, it can be concluded that the Powerpoint learning media developed has been valid in terms of graphics because the images and typefaces contained in the Powerpoint learning media can be observed and can be read clearly and the Powerpoint learning media developed has been organized in terms of layout and color selection can attract the attention of students.

The results of the content validation analysis are presented in figure 8.
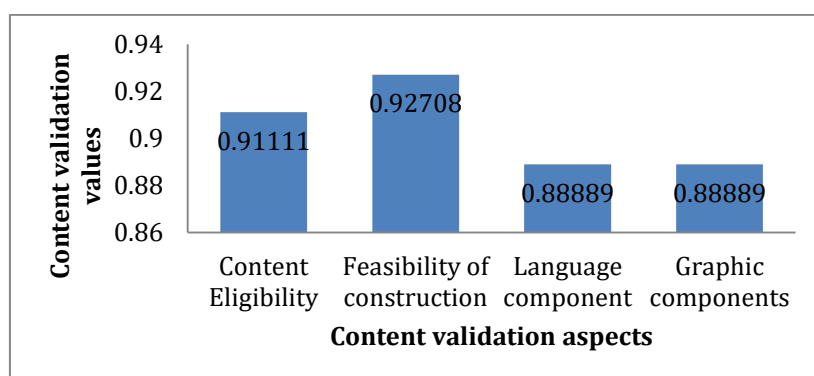

Figure 8. Content validation analysis results

For the results of construct validation data analysis of each function by validators, Aiken's V formula was obtained, namely attentional function 0.875 with valid category, affective function 0.90476 with valid category, cognitive function 0.9881 with valid category and compensatory function 0.94643 with valid category.

The first function is the attentional function. The attentional function is a core function that aims to attract the attention of students to be able to focus their attention on learning content. The overall average attentional function of the interactive Powerpoint media developed obtained Aiken's V scale of 0.875 with valid categories. This shows that the display of media has attracted the selection of images, color selection, the use of letters and the language used is easy to understand and arranged in an attractive format consisting of cover pages, main pages and other menus making students more interested.

The second function is the affective function. The affective function component in interactive Powerpoint learning media from validators obtained a result of 0.90476 with a valid category. This shows that learning media can increase

students' curiosity, foster enthusiasm in learning, and make learning activities fun.

The third function is cognitive function. Cognitive validation testing is testing the content of the subject matter presented in this interactive Powerpoint learning media. The validity value on cognitive function is 0.9881 with a valid category. This shows that the content of the interactive Powerpoint media developed has the compatibility of the content of learning media with indicators and learning objectives that have been developed based on basic competencies.

The fourth function is the compensatory function. The average value obtained by interactive Powerpoint learning media on chemical equilibrium material is 0.94643 with valid categories. From these results, it can be concluded that the media can be used by students to learn independently and repeatedly so that students who are slow to receive learning can use this learning media to help solidify the concept.

The results of the construct validation analysis are presented in figure 9.
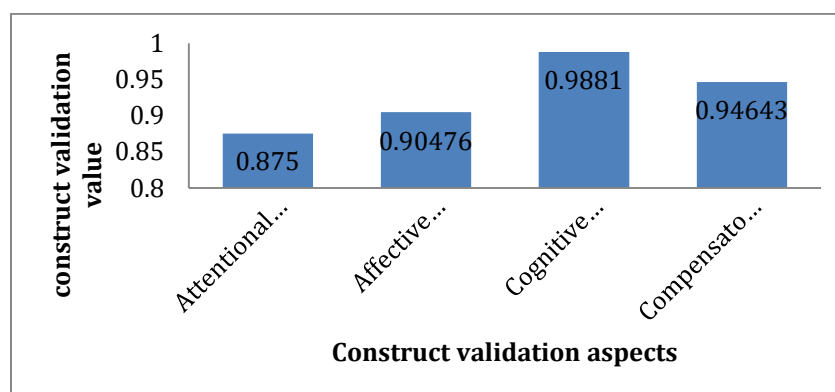

Figure 9. Construction Validation Test Results

Thus the results of the Powerpoint learning media developed are valid. This shows that interactive Powerpoint learning media based on guided inquiry on chemical equilibrium material is in accordance with its components.

Guided inquiry-based chemical equilibrium Powerpoint learning media even though it is declared valid, but there are still several components that must be improved in accordance with the suggestions given by validators, so revisions are made to the Powerpoint learning media developed for further trials.

b. Revision

Based on the suggestions given by validators (in the validity test), revisions were made to the design of chemical equilibrium learning media based on guided inquiry. The purpose of this stage is to improve the part of the learning media that is considered inappropriate by validators before testing. Some parts of the revised media are: 1) Changing the image on the cover according to the chemical

equilibrium material, 2) Changing the IPK writing format, 3) Improving the orientation section, 4) Improving the exploration and concept formation part, 5) Improving the submicroscopic video and changing the writing to be neat. The improved learning media is then given to validators for further education before the trial.

c. Trial

At the practicality test stage, practicality test data were obtained through practicality questionnaires given to chemistry teachers and class XII students. Practicality data were obtained from teacher and student response questionnaires. The results of data analysis of practical assessment of chemical equilibrium learning media based on guided inquiry from teachers and students can be seen in figure 10.
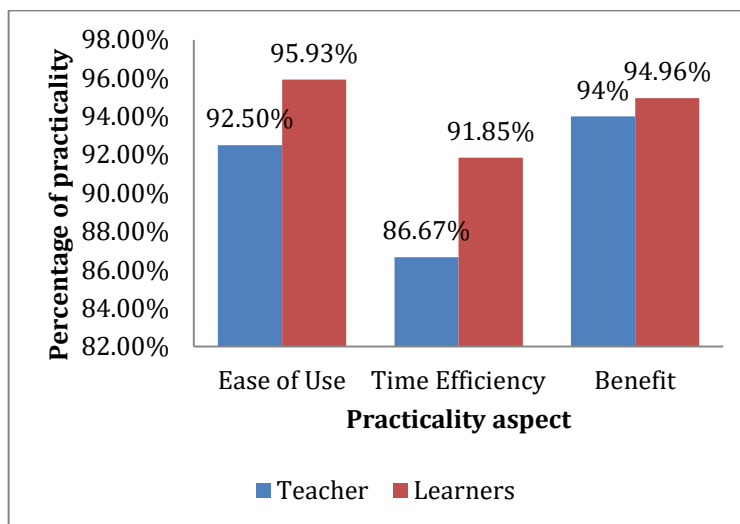

Figure 10. Results of Practicality Analysis

Based on the results of the practicality analysis that has been carried out, it was obtained that the interactive Powerpoint learning media on class XI high school chemical equilibrium material with an average teacher practicality result of 91.05556% with a very practical category and students of 94.2469% with a very practical category. This shows that interactive Powerpoint learning media on class XI high school chemical equilibrium material is very practical to be used in the learning process.

4.   Conclusion

Based on the research that has been done, guided inquiry-based learning media has been produced for grade XI high school using a 4-D development model. The resulting learning media has been tested for validity and practicality. Based on data analysis, content validation and construct validation of this chemical

equilibrium learning media is said to be valid. Practicality tests from teachers and students obtained very practical results.

Acknowledgement

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