

VALIDITY OF GUIDED INQUIRY-BASED CHEMICAL EQUILIBRIUM E-MODULE INTEGRATED WITH THE AL-QURAN FOR MADRASYAH ALIYAH

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Abstract: This study aims to determine the validity of the guided inquiry-based chemical equilibrium e-module integrated with Al-Quran for class XI Madrasah Aliyah. The type of research is developmental research (Educational Design Research) using the Plomp development model, which consists of a preliminary research stage, a prototype stage, and a field test. The research instrument used was a validation questionnaire comprised of a content validation questionnaire and a media validation questionnaire. The content validation questionnaire assessment was carried out by material expert validators consisting of Padang State University Chemistry Lecturers and MAN 2 Padang Teachers. The media validation questionnaire assessment was carried out by media expert validators consisting of Padang State University Chemistry and Informatics Engineering Lecturers. Based on the results of processing the media and content validation questionnaire data using the Aiken V formula, the average value of content validation is 0.88 in the valid category, and the media validation average value is 0.91 in the valid category.

Keywords: *E-module, Chemical Equilibrium, Guided Inquiry, Al-Quran Integration*

INTRODUCTION

Indonesia is entering the era of the industrial revolution 4.0 [1]. In this era of the industrial revolution 4.0, education must follow and utilize the development of sophisticated information and communication technology following the development of the 21st century to assist the learning process [2]. One form of technology in the learning process is electronic-based teaching materials like e-modules.

E-module is one of the innovations of the print module that can be accessed through a computer that is integrated with the software. E-modules have advantages compared to print modules. Namely, they are interactive, containing images, audio, video, animation, and formative tests in which automatic feedback is provided [3]. E-modules can also be interpreted as the presentation of independent teaching materials arranged systematically according to a particular curriculum in an electronic format [4].

Implementing the 2013 curriculum in the learning process uses a scientific approach. One of the learning models that uses a scientific approach is the inquiry learning model [5]. The guided inquiry learning model is a learning model that helps students in learning activities and helps students gain knowledge independently. The guided inquiry learning model makes students active in learning activities [6]. Using guided inquiry learning models in the learning process can improve understanding of concepts [7] and involve students in learning [8]. In addition, the guided inquiry learning model can improve student learning outcomes and analytical skills [9].

Chemistry subjects are less attractive to students because chemistry generally contains abstract concepts that could be clearer for students to understand [10]. Therefore we need an intermediary media that can visualize the abstract concept with pictures, animations, and videos so that it is easily understood by students it can make students interested in learning the material. One form of presentation of intermediary media in the form of e-modules can help teachers so that students are more active and independent in studying the material [11]. One of the materials with abstract concepts that could be clearer is chemical equilibrium material [12]. Chemical equilibrium material is one of the materials studied in class XI SMA/MA.

Previous research has developed a guided inquiry-based chemical equilibrium e-module that integrates a virtual laboratory for SMA/MA, which is valid and practical to use in the learning process [13]. In addition, it has also developed an android-based e-module on chemical equilibrium material for high school students that is feasible and can be used as a medium in chemistry learning [14]. However, none of the developed e-modules have been integrated with Al-Quran verses per the demands of the West Sumatra Regional Regulation Number 2 of 2019.

Based on the analysis of the results of interviews with two teachers of MAN 1 Padang and MAN 2 Padang, as well as the analysis of the results of the questionnaire to 59 students at Madrasah Aliyah (MA), it is known that as many as 54% of students still have difficulty in studying chemical equilibrium material. This statement is supported by the results of interviews with teachers

who stated that student learning outcomes on chemical equilibrium material were still average and not optimal. Chemical equilibrium teaching materials used by teachers in the learning process remained the same. They were still using printed books and worksheets and not following developments in the digital-based industrial revolution 4.0. The teaching materials teachers use could be more optimal, making students find concepts independently. This statement is supported by the results of distributing questionnaires to students. As many as 83% of students still need teacher guidance in understanding chemical equilibrium teaching materials. Chemical equilibrium teaching materials used by teachers have not been integrated with the verses of the Koran following West Sumatra Regional Regulation Number 2 of 2019.

Based on this background, the authors have conducted research, namely testing the validity of teaching materials developed as an Al-Quran integrated guided inquiry-based chemical equilibrium e-module for class XI Madrasah Aliyah (MA)".

RESEARCH METHOD

Educational Design Research (EDR) is carried out based on the research objectives. The development model used in this study is the Plomp development model. The advantage of the Plomp development model is that this model is more flexible and flexible, where each step contains a development stage that can be adapted to the characteristics of the study [15]. The Plomp development model consists of three stages, namely:

Preliminary research stage

The preliminary research stage carried out several activities: needs analysis, context analysis, literature studies related to the research carried out, and theoretical and conceptual development.

Prototyping phase

At the stage of forming the prototype, a research microcycle occurs, namely design, evaluation, and revision. The evaluation carried out at this stage is a formative evaluation. Formative evaluation is a research activity that aims to improve and perfect the product being developed. The formative evaluation carried out in this study is the evaluation proposed by Tessmer. The formative evaluation will produce four prototypes: I, II, III, and IV. At this stage, four prototypes are produced, namely:

1. Based on the preliminary research stage that has been done, then the design of a guided inquiry-based chemical equilibrium e-module integrated with the Quran is carried out to produce prototype I,

2. The prototype I that has been produced is then carried out a formative evaluation, namely self-evaluation (self-to-self). In this evaluation, a checklist is used that contains essential components that the e-module must own to produce a complete prototype II,
3. The complete prototype II is then carried out one to one evaluation and expert review, which will produce a valid prototype III,
4. At this stage, a formative evaluation of the valid prototype III was carried out through a small group trial to produce a practical IV prototype.

A. Field test stage

This stage determines whether the prototype has been produced and met the predetermined specifications [16].

The research was limited to prototype stage III (prototype stage), so a valid Al-Quran integrated guided inquiry-based chemical equilibrium e-module was produced. The research instrument used to test the validity of the e-module is a content validation questionnaire and a media validation questionnaire. Validation Questionnaire content is given to material expert validators consisting of 3 UNP Chemistry Lecturers and 2 MAN 2 Padang Teachers consisting of 39 assessment items. In contrast, the media validation questionnaire was given to media expert validators consisting of 2 UNP Chemistry Lecturers and 3 UNP Informatics Engineering Lecturers consisting of 15 assessment items. The data obtained from the content and media validation questionnaire were analyzed using the Aiken V formula. A product is categorized as valid if the V index is 0.8 [17]. The formula can be formulated as follows:

$$V = \frac{\sum s}{[n(c - 1)]}$$

$$s = r - lo$$

Information:

V = validity index

R = Number given by validator

n = Number of validators

lo = The lowest validity score

c = Many categories selected

RESULTS AND DISCUSSION

Preliminary research

1. Needs analysis

The needs analysis stage is a stage that aims to find out the problem basics related to learning chemistry on chemical equilibrium material. For these problems, interviews were conducted with the teachers of MAN 1 Padang and MAN 2 Padang, and questionnaires were given to 59 students at MAN 1 Padang and MAN 2 Padang. Based on the results of interviews with teachers and giving questionnaires to students at MAN 1 Padang and MAN 2 Padang, it can be concluded that 1) as

many as 54% of students still have difficulties in understanding chemical equilibrium material, this statement is supported by the results of interviews with teachers who state that student learning outcomes the chemical equilibrium material is still average or not optimal, 2) chemical equilibrium teaching materials used by teachers in the learning process are still in the form of printed books, worksheets that are not in accordance with the development of the digital-based industrial revolution era, 3) teaching materials used by teachers it is not optimal to make students find concepts independently, this statement is supported by the results of distributing questionnaires to students as many as 83% of students still need teacher guidance in understanding chemical equilibrium teaching materials, and 4) chemical equilibrium teaching materials used by teachers have not been integrated in the Al- Quran according to with the West Sumatra Regional Regulation No. 2 of 2019.

2. Context analysis

The results of the context analysis are in the form of a syllabus analysis of the 2013 curriculum. The context analysis stage is carried out to be the basis for developing learning tools from the material-chemical equilibrium. Based on the 2013 curriculum analysis, the basic competence of chemical equilibrium material consists of 2 basic competence, namely KD 3.8 explain the equilibrium reaction in the relationship between reactants and products. These basic competencies are reduced to 8 indicators of competency achievement. The factors that influence the shift in the direction of the equilibrium and its application in industry. From these basic competencies, there are six indicators of competency achievement.

Learning objectives can be formulated from the basic competencies and indicators of achievement of these competencies. The learning objectives in the equilibrium material are through a guided inquiry learning model by connecting the material with everyday life, digging information from various sources of information, and processing information. It is hoped that students will increase their faith and devotion to Allah SWT and be actively involved during the learning process. Polite attitude, discipline, honesty, cooperation, confidence, critical thinking in making observations and being responsible for expressing opinions, answering questions, giving suggestions and criticisms, and being able to explain equilibrium reactions in the relationship between reactants and reaction products and analyze factors which affect the equilibrium shift and its application in the industry (ammonia and sulfuric acid).

3. Study of literature

At the literature study stage, activities are carried out, namely finding and understanding sources and references that support research. The results obtained from the literature study are 1) Tjered Plomp's book on Educational Design Research, 2) Journals Aiken L.R on data analysis with Aiken V, 3) Sugiyono's book on research methods, 4) Ministry of Education and Culture 2017 Guidelines, Ministry of National Education 2008 on the preparation, writing and development of e-modules, 5) Hanson's book on guided inquiry learning models, 6) Karen Timberlake and William Timberlake's book, Nivaldo J Tro's book, Michael Purba's book, Raymond Chang's book, Rosemarie Gallagher's book and Paul Ingram, Steven Zumdahl and Donald J De Coste's book on the subject of chemical equilibrium, and 7) Quranic verses.

4. Formation of a conceptual or theoretical framework

At the stage of developing the conceptual framework, important concepts were obtained from the research conducted based on needs analysis, context analysis, and literature study. The results of this stage are presented as a research procedure framework that aims to guide the development of research procedures.

Prototype stage

At the stage of forming the prototype, a research microcycle occurs, namely design, evaluation, and revision. The evaluation carried out at this stage is a formative evaluation. The formative evaluation carried out will produce four prototypes. The results of this stage are as follows:

1. Prototype I

It was designed based on the analysis results at the preliminary research stage to produce a product in the form of an e-module chemical equilibrium based on guided inquiry integrated with the Koran for class XI MA. The design of the e-module was carried out with several applications, namely Microsoft Office Word 2013, Microsoft PowerPoint 2013, Kinemaster Video Editor, Nitro Pro 9 Pdf, Canva, and Flip Pdf Professional. The e-module design consists of several components: cover, introduction, table of contents, list of pictures, tables, introduction, learning, self-assessment, evaluation, answer key, scoring guidelines, and bibliography adapted to the 2017 Ministry of Education and Culture guidelines. The resulting modules are arranged based on the stages of guided inquiry learning: orientation, exploration and concept formation, application, and closing stages [18].

a. Stage of orientation

The orientation stage is a stage that aims to prepare students for learning. The orientation stage contains learning objectives, motivation,

prerequisite materials, and an overview of the material to be studied by students. In the motivation section, there is integration from the

Koran in videos related to the material to be studied. An example of the orientation stage display can be seen in Figure 1.

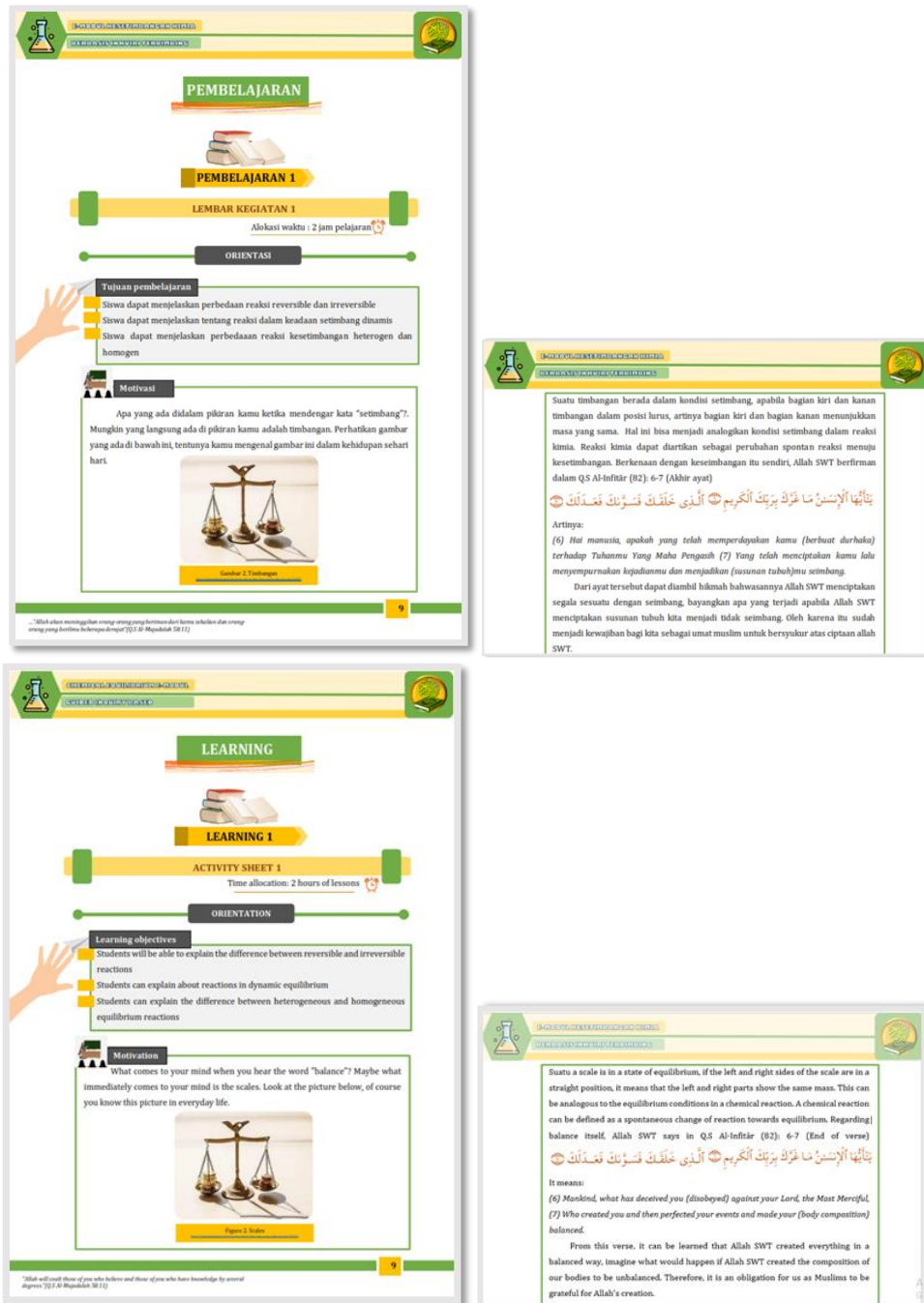


Figure 1. Display of the orientation stage

b. Stages of exploration of concept formation

The exploration and concept formation stages are the stages where students observe and analyze the given model so that students can find concepts by answering the key questions given. The model presented can be in pictures, tables, one or more equations, and animations. An example of the display of the exploration stage of concept formation can be seen in the following figure 2.

c. Application stages

The application stage is applying the concepts students have obtained through the exploration and concept formation stages. The application questions given in the e-module are in the form of essay questions. An example of the application stage display can be seen in Figure 3.

d. Closing stage

In the closing stage, students make conclusions based on the concepts found that are

by the learning objectives. An example of the final stage display can be seen in Figure 4.

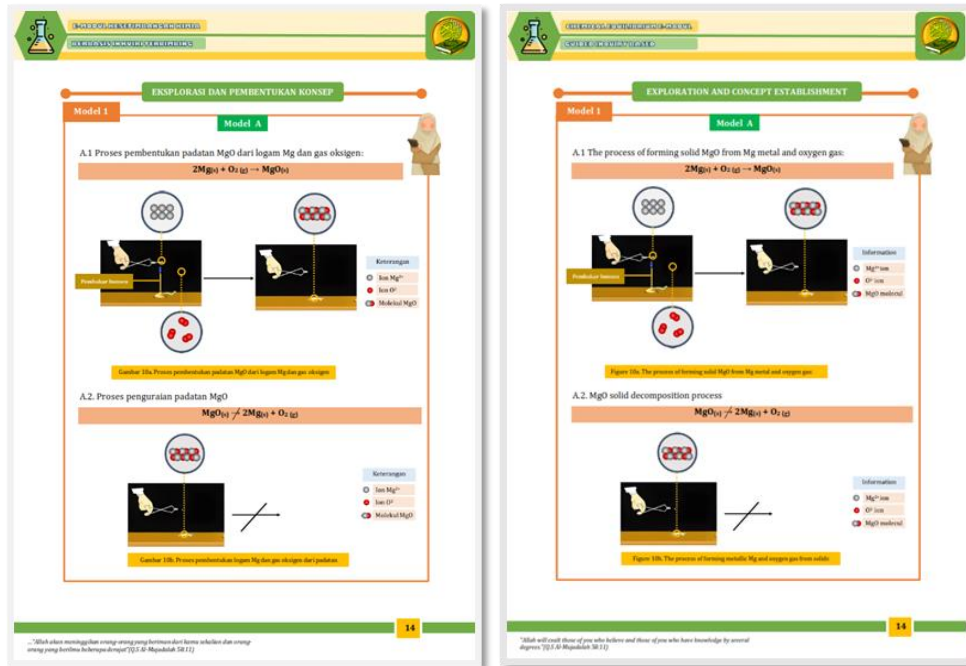


Figure 2. Display of the exploration and concept formation stages



Figure 3. Application stage display



Figure 4. Display of the closing

2. Prototype II

The activity at this stage is to conduct a formative evaluation of the resulting prototype I in the form of self-evaluation. This activity is carried out to see and correct the parts and components of the developed e-module. Based on the self-

evaluation questionnaire, all the components of the e-module were formulated in the e-module. However, there are still improvements, such as font size, errors in writing, and so on.

3. Prototype III

At this stage, a formative evaluation of prototype II that has been produced is carried out. This activity was carried out to produce a valid prototype III. At this stage, prototype II, which has been completed, is subject to expert review and one-to-one evaluation. The activities carried out at this stage are as follows:

a. Expert review

Expert assessment is an activity carried out intending to know the level of validity of the resulting e-module. The expert assessment was carried out by 3 UNP Chemistry Lecturers, 3 UNP FT Lecturers, and 2 MAN 2 Padang Teachers. In this stage, expert appraisers or validators provide input, suggestions, and assessments of the products developed so that the resulting products are valid. The instrument used in this stage is a content and media validation questionnaire. The data obtained based on the validation questionnaire were analyzed using the Aiken V formula. Content validation carried out by material experts was assessed based on the content component, presentation component, linguistic component, and graphic component and the integration of the verses of the Qur'an. The results of the content validation questionnaire analysis from material experts can be seen in the following table:

Table 1. The results of the content validation analysis of 5 material expert validators

Aspects rated	V	Category
Component content	0.86	Valid
Language component	0.90	Valid
Component serving	0.89	Valid
Graphical component	0.88	Valid
Islamic integration e-module	0.85	Valid
Average	0.88	Valid

Based on table 2, the validation results of the content components obtained an average value of the Aiken V index of 0.86 with a valid category. It shows that the e-modules that have been developed follow core competencies and basic competencies in the 2013 curriculum, in addition to the Competency Achievement Indicators and learning objectives to be achieved following basic competencies [19]. In the assessment of the linguistic component, the average value of the Aiken V index was 0.9 with a valid category. The assessment shows that the e-module that has been developed already uses Indonesian spelling rules is clear, easy to understand, and consistent in the use of symbols so that students can understand the material well [20]. In the assessment of the presentation component, the average value of the Aiken V index is 0.89, with a valid category. The assessment shows that the e-modules that have been developed are arranged systematically both in

terms of presentation. The e-module components, according to the Ministry of Education and Culture (2017), and the production of the guided inquiry stage consist of the orientation, exploration and concept formation, application, and closing stages, according to Hanson (2005). In assessing the graphic component, the average value of the Aiken V index is 0.88 with a valid category. The assessment shows that the e-module that has been developed can be clearly observed. The layout, typeface, font size, and overall design are attractive and good. The physical appearance (graphics) of a teaching material can motivate students to read and study the teaching material [21]. In the assessment of the Islamic integration, the average value of the Aiken V Index is obtained as 0.85 with a valid category. The assessment shows that the e-module that has been developed contains. Quranic verses can motivate students to study chemical equilibrium material, and Al-Quran verses are also associated with daily life to increase students' religious values in the learning process. The average Aiken V index of the five components of the content validation assessment of the developed e-modules is 0.88 with a valid category. The results of the content validity test of the e-modules can be illustrated in the following figure 5.

The evaluation of the validity of the e-module media consists of 3 aspects of the assessment component: the assessment of the display aspect, the programming aspect, and the utilization aspect with 15 assessment items. The results of the media validation questionnaire analysis from material experts can be seen in table 2.

Table 2. The results of the media validation analysis of 5 media expert validators

Aspects rated	V	Category
Display aspect	0.93	Valid
Programming aspect	0.92	Valid
Utilization aspect	0.88	Valid
Average	0.91	Valid

Based on table 3, the results of the validation of the display aspect obtained the average value of the Aiken V. Index of 0.93 with a valid category. The index shows that the e- modules that have been developed as a whole have a good appearance both from the use of fonts, layouts, covers, images, videos, and animations. Assessment of the programming aspect obtained the average value of the Aiken V. Index of 0.92 with a valid category. The index shows that the e- module that has been developed is overall easy to use [22]. Assessment of the utilization aspect obtained the average value of the Aiken V index of 0.88 with a valid category. The index shows that the e-module that has been developed has pictures, animations, and videos that

can clarify understanding of the material and make it easier for students in the learning process. In addition, the material presented is up-to-date or contextual. Teaching material should be highly adaptable to science and technology (adaptive) [19]. The average Aiken V index of the three

components of the media validation assessment of the developed e-module is 0.91 with a valid category. The results of the media validity test of the e-modules can be illustrated in the following figure 6.

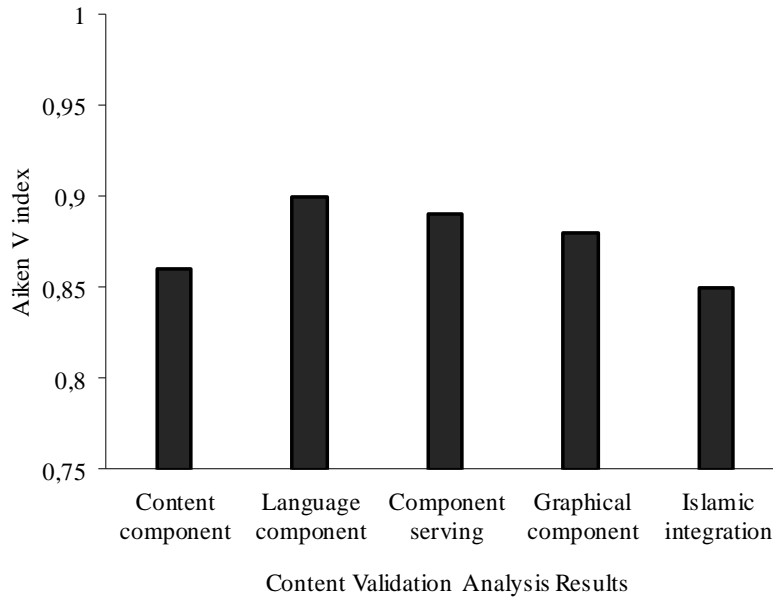


Figure 5. Graph of content validation analysis results for five material expert validators

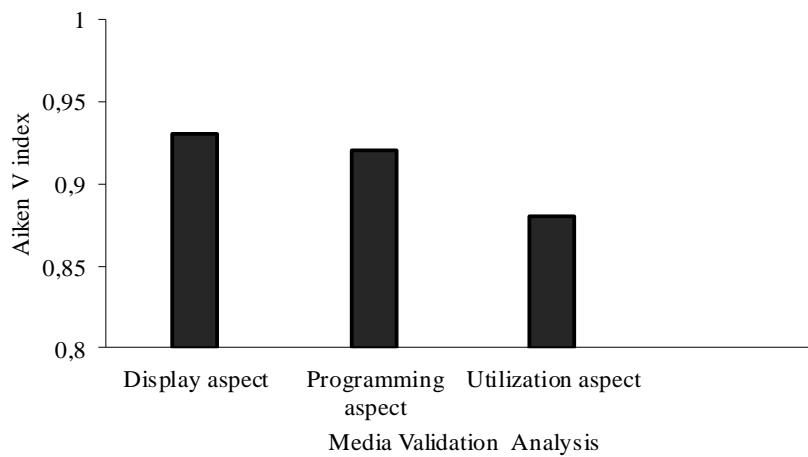


Figure 6. Graph of media validation analysis results from 5 media expert validators

b. One-to-one evaluation

A one-to-one test (one-to-one evaluation) is an activity carried out intending to know the student's response to the prototype that has been produced so that a valid prototype III is obtained. Based on the results of interviews conducted with three students, it was found that the e-module has an overall attractive appearance, both in terms of

design, color, font display, and layout, so that it makes students interested in learning. The overall appearance of the cover is good and attractive. However, improvements need to be made; namely, the color design on the cover should be in harmony with the colors in the supporting image. The language and presentation of the material are clear and structured so that the e-module is easy to

understand. Using guided inquiry learning syntax in e-modules can help students find concepts, and integrating Al-Quran verses in the orientation section can motivate students to learn the material in the e-modules.

CONCLUSION

The e-module of chemical equilibrium based on guided inquiry integrated with the Quran has been developed using the Plomp development model for class XI MA. The guided inquiry-based integrated chemical equilibrium e-module that has been produced has a content validation level of 0.88 with a valid category and a media validation of 0.91 with a valid category.

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