Innovative Teaching Tools: Creating a Guided Inquiry Chemistry E-Module with FLIP PDF Support for Understanding Atom Development and the Periodic System of Elements

ER Mawarnis¹, H Diah¹

¹Tadris Kimia, Universitas Islam Negeri Mahmud Yunus Batusangkar, Indonesia

elvyrahnimawarnis@gmail.com

Abstract. The purpose of this study was to determine the validity level of guided inquiry-based chemistry E-Modules assisted by flip pdf on the material of atomic development and periodic system of elements of class X MAN 2 Tanah Datar developed. This study used a Research and Development method. This development research procedure is adjusted to the stages contained in the 4 D models. These stages include: (1) define, (2) design, (3) develop and (4) disseminate. The E-Modul teaching material validation instrument was used to determine the validity of the E-Modul teaching materials developed. The practicality questionnaire of E-Modul teaching materials is used to determine the responses of teachers and students regarding practicality. The research data were analyzed with descriptive statistics to get average numbers and percentages. The Guided Inquiry-based Chemistry E-Module Aided by Flip Pdf developed by researchers discusses material about the development of atoms and the periodic system of class X IPA elements. The developed Chemistry E-Module was tested on students of class X IPA 11 at MAN 2 Tanah Datar. 2. The results of the practicality test of the Guided Inquiry-Based Chemistry E-Module Aided by Flip Pdf developed by researchers discussing material about the development of atoms and the periodic system of elements meet The percentage validity test results are 78.47%. Practical criteria based on the student response questionnaire with a percentage of 78.42% and based on the educator response questionnaire with a percentage of 80.35%.

Kata Kunci: Flip pdf, E-Modul, Guided Inquiri.

1. Introduction

Chemistry is one of the subjects that emphasizes on providing direct experience to develop competencies so that students are able to explore and understand the natural world scientifically. Learning chemistry through the natural environment scientifically can be done with several methods such as discussion, demonstration and experimentation. Learning is said to be effective if the learning objectives can be achieved, seen from how the strategy used by the teacher, what approaches and methods the teacher applies according to what material the teacher teaches. One of them is the concept of atom (Mufida et al., 2022).

Atomic concepts, especially atomic structure, are basic concepts that must be mastered by learners to understand further chemical concepts. In addition, the development of atoms and the periodic system of elements includes abstract, memorized and calculated things so that it is difficult for students to understand if studied only in the form of two-dimensional images,
therefore it is necessary to develop in explaining atomic structure material and the periodic system of elements, for example using moving images such as videos (Haristah et al., 2019).

In Chemistry subjects, there are various ways to improve the quality of the learning process, some of the ways that can be implemented are by developing learning media or teaching materials. Modules are a form of printed teaching material designed to be studied independently by students in learning. Modules are also called media for self-study because in the In the cognitive aspect, students must understand chemical concepts and their interrelationships as a provision for studying chemistry in college, then in the affective aspect of applying chemical concepts to solve problems in everyday life, and in the psychomotor field, namely gaining experience in applying the scientific method through experiments or experiments, where students conduct hypothesis testing by conducting experiments. Based on this, in the cognitive field the goal that students must have is for students to understand concepts in chemistry learning (Aisyah, 2018).

Based on observations and interviews conducted by researchers at MAN 2 Tanah Datar school, it is known that 1) students receive lesson information through teaching materials in the form of textbooks that only display one level of representation, namely the symbolic level. While the macroscopic and submicroscopic levels are not displayed so that students do not find and understand concepts. These two levels are displays that can be seen by the five senses such as changes in color, temperature, pH of the solution (macroscopic) and display in 3-dimensional images such as the shape of molecules (submicroscopic) 2) atomic development material and the periodic system of elements are materials that are considered difficult by students. This statement is supported by the average daily test scores of students.

Based on interviews with students, it can be seen that students want changes in learning, such as the use of more varied teaching materials in delivering the material. This is because so far the teacher has only used the lecture method and teaching materials in the form of textbooks and blackboards. One solution to solve the problem is to develop teaching materials that can increase students' interest in learning. In addition, teaching materials are needed that are in accordance with the characteristics of the subject matter (Mawarnis et al., 2023). For example, in chemistry, there is a material that needs interactive teaching materials such as atomic development and the periodic system of elements. The material of atomic development and periodic system of elements is one of the materials contained in chemistry learning class X SMA / MA in semester one. The development of atoms and the periodic system of elements is material that contains facts, concepts, principles and procedures. The characteristics of the material are factual and abstract, factual material can be seen and learning can be done using the experimental method, while abstract material is submicroscopic which cannot be seen, learning can be done using teaching materials that can display submicroscopic so that students can understand concepts (Widyanto & Wahyuni, 2020).

Guided inquiry, is a learning approach that directs students to develop their understanding through exploration, investigation and reflection. This approach involves students actively in the learning process, rather than passively receiving information. Through guided inquiry, students are invited to investigate a topic or concept in depth. They not only memorize facts, but also understand the concepts behind the information. Guided inquiry encourages students to develop critical thinking skills (Clandinin & Caine, 2008).
2. Methods
In this study, researchers used a type of research and development method (Research and Development). According to (Sugiyono, 2018), "research and development methods are research methods used to produce certain products and test the effectiveness of these products". This research aims to develop a guided inquiry-based E-Module on the material of atomic development and the periodic system of elements of class X SMA / MA through systematic steps to then be tested for feasibility in terms of material and appearance and its attractiveness for students (Castellanos-reyes et al., 2020).

This development research procedure is adjusted to the stages contained in the 4 D models. These stages include: (1) define, (2) design, (3) develop and (4) disseminate. The data collection instruments used in this study were teacher interview guidelines and student questionnaires (Initial Investigation). The E-Modul teaching material validation instrument was used to determine the validity of the E-Modul teaching materials developed. The practicality questionnaire of E-Modul teaching materials is used to determine the responses of teachers and students regarding practicality. The research data were analyzed with descriptive statistics to get average numbers and percentages. Data analysis techniques for each research result data can be described as Validity Analysis Technique. The validity analysis was carried out by analyzing all aspects filled in by each validator. Practicality Analysis Technique Practicality analysis technique is carried out to students. Questionnaires were given to students after the Guided Inquiry-based chemistry E-module was distributed by researchers, then the results of the questionnaire were analyzed using a Likert scale (Wennerberg et al., 2003).

3. Results and Discussion
The research was conducted at MAN 2 Tanah Datar. This research was conducted using the 4D model, namely (define, design, development, and disseminate), but the researcher only did up to the development stage (Zwama, 2021).

The define stage is carried out to find out an overview of the conditions and problems found in schools and find solutions, the needs of students, and learning objectives. To find out all that, several analyzes were carried out such as the initial analysis of the end, literature, and learning objectives.

1) In the initial analysis of the end
Interviews and observations were conducted with chemistry educators in class X MAN 2 Tanah Datar. This analysis also analyzes the needs of students, teaching materials and curriculum. The following are the steps:

a) Interview with grade X chemistry educators
At this stage, an analysis of the chemistry learning process carried out with chemistry educators was carried out. In conducting the interview, there were several questions that the researchers asked related to learning tools that would be prepared by educators before entering the classroom, including models, approaches, methods, teaching materials, media, and learning facilities and infrastructure (Yunita et al., 2017).

Educators said that chemistry learning at school had been carried out in accordance with the demands of the curriculum used at school. One example is that educators have used
a discovery learning model with student centered learning and the method used is discussion. The learning model used by educators in delivering the material is good. This is because before the educator teaches the material to be delivered, the educator first prepares a learning model that is in accordance with the material to be delivered. The learning model is prepared by the educator as a guide in conducting learning that is systematically arranged to achieve learning objectives (Fathurrohman, 2003).

During the learning process, educators also use learning media. The learning media that educators use are adjusted to the material being taught. Educators also said that the chemistry learning media used were varied, such as whiteboards, learning videos, image media, atomic model KIT, and presentation files. In addition, the facilities and infrastructure provided by the school to support the learning process to run smoothly are quite adequate, such as the existence of blackboards, LCD projectors, and chemistry laboratories. In the chemistry laboratory, educators said that there are some chemicals that do not exist if the practicum is adjusted to the textbook that educators use. Therefore, there are some practicums that can be done in the laboratory and some that cannot be done (Rohani, 2020).

When learning, educators usually use teaching materials. The main teaching materials used by educators during learning are textbooks and teaching modules. Teaching materials are usually made by educators themselves or made together with other fellow educators. For teaching modules used by educators, modules for learning materials are separate from modules for practicum. In addition, teaching materials made by educators have not specifically made E-Modules based on guided inquiry (Al Azka et al., 2019).

b) Learner Analysis

Learner analysis was conducted by conducting interviews with class X students at MAN 2 Tanah Datar. During interviews with students, researchers also asked questions related to learning media, learning facilities and infrastructure, learning models, and teaching materials used during chemistry learning (Simbolon, 2020).

Some students said that the learning model, learning methods, and learning media used by educators when learning chemistry were good enough. Because educators have used models, learning methods that vary when learning chemistry. However, some students said that the teaching materials were less varied, seen from the school only using textbooks. From teaching materials that are less varied, students expect simple and interesting teaching materials. With this E-Module, teaching materials will be more attractive and practical when used by students.

c) Analysis of teaching materials for educators

Based on the teacher's explanation described in the sub-section of the analysis of interviews with educators from the observation of teaching materials used by students are Chemistry books by Unggul Sudarmo Erlangga independent curriculum and Chemistry books by Unggul Sudarmo Erlangga 2013 curriculum revised Class XI Semester 1 and teaching modules (Fitriani & Putri, 2020).

d) Curriculum analysis

The chemistry subject of class XI Phase F based on the independent curriculum is known on the material of atomic development and the periodic system of elements consisting of Learning Outcomes (CP), Flow of Learning Objectives (ATP). Based on the problems in the
analysis of teaching materials above, the demands of the curriculum lead students to be more active in the learning process which can improve student learning outcomes, therefore each teaching material must have a learning model so that students better understand the learning material. The teaching material development approach outlines the methods and approaches that will be used in the Flip PDF-based E-Module which is expected to increase student motivation in the learning process.

2) Literature analysis

E-modules are interactive teaching materials that make it easier for students to navigate equipped with graphics, audio, video, images, and formative exercise questions that allow automatic feedback. Research conducted by Hasibuan & Andromeda (2021) on the use of Guided Inquiry-based e-modules can improve student learning outcomes.

Subsequent research conducted by Aulia & Andromeda (2019) produced a Guided Inquiry-based e-module that was not only based on virlabs but also equipped with multirepresentation. Multirepresentation is the use of two or more representations in the form of verbal, numeric, graphic or image to explain a concept. Multirepresentation can improve students' understanding of the information provided. This is because each person has their own multi-intelligence so that they need different displays to understand the information they get. The use of multirepresentation can help students in abstract chemical concepts in this material because it is represented at three levels, namely, macroscopic, submicroscopic and symbolic (Ilahi et al., 2023).

3) Analysis of learning objectives

The analysis of learning objectives ensures the achievement of the chemistry e-module from each Learning Outcome (CP), and the Flow of Learning Objectives (ATP) can be achieved. The learning objectives that have been formulated on the material of atomic development and the periodic system of elements are through the guided inquiry learning model by exploring information from various learning sources such as printed books, especially in teaching materials that contain macroscopic, sub-microscopic and symbolic displays (Muradi, 2014).

It is expected that students actively observe, analyze and answer questions in order to process the information contained in the E-Module and can distinguish the development of atomic theory; atomic number, mass number and isotope; electron for elements with atomic number; electron configuration; elemental paternity; and the relationship between electron configuration and elemental periodic system. based on the e-Module created (Andani et al., 2023; Mawarnis et al., 2018).

The next step is a design stage. The steps are as follows:

1) Selection of Teaching Materials

E-Module Chemistry based on guided inquiry assisted by flip pdf is an electronic teaching material that is selected and then made using the canva application. This is in accordance with the needs of educators and students, where MAN 2 Tanah Datar is still lacking in teaching materials for chemistry learning. The school has not yet used a chemistry practicum guide.

2) Format Selection
Format selection will fulfill all the components of the chemistry E-module. The display of the chemistry E-module also contains images and material related to the development of atoms and the periodic system of elements.

3) Designing guided inquiry-based chemistry E-modules aided by flip pdf. The following is part of the guided inquiry-based E-Module

The last step is the development stage. At this stage, guided inquiry-based e-modules that have been discussed with the supervisor will be tested for validity and practicality by three validators.

1) Validation results

a) Research instrument validation results

Before validating the chemistry e-module based on the guided inquiry learning model for SMA / SMA class X, what must be done first is to validate the validity test instrument with a validation questionnaire sheet.

<p>| Table 1. Analysis of the Results of the Module Validity Test Instrument Validation Sheet. |
|---|---|---|---|---|---|---|---|</p>
<table>
<thead>
<tr>
<th>No</th>
<th>Validated aspects</th>
<th>Validator</th>
<th>Jml</th>
<th>Skor Max</th>
<th>%</th>
<th>Ket</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Questionnaire format</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>11</td>
<td>12</td>
</tr>
<tr>
<td>2</td>
<td>Language used</td>
<td>8</td>
<td>7</td>
<td>6</td>
<td>21</td>
<td>24</td>
</tr>
<tr>
<td>3</td>
<td>Itemized questionnaire statements</td>
<td>12</td>
<td>10</td>
<td>7</td>
<td>29</td>
<td>36</td>
</tr>
<tr>
<td>Total</td>
<td>24</td>
<td>21</td>
<td>16</td>
<td>61</td>
<td>72</td>
<td>84.72</td>
</tr>
</tbody>
</table>

Based on Table 1 above, it can be said that the questionnaire format, the language used, and the questionnaire statement items as a whole obtained a percentage of 84.72% which means very valid. Before the practicality test with educators and students, the questionnaire used in the practicality test was validated first. Analysis of the results of the response questionnaire validation sheet for e-guided inquiry-based Chemistry modules can be seen in full in the appendix. Broadly speaking, the analysis of the results of the validation sheet of the learner response questionnaire can be seen in Table 1.

<p>| Table 2. Analysis of the Results of the Learner Response Questionnaire Validation Sheet |
|---|---|---|---|---|---|---|</p>
<table>
<thead>
<tr>
<th>No</th>
<th>Validated aspects</th>
<th>Validator</th>
<th>Jml</th>
<th>Skor max</th>
<th>%</th>
<th>Ket</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Questionnaire format</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>2</td>
<td>Language used</td>
<td>8</td>
<td>8</td>
<td>5</td>
<td>21</td>
<td>24</td>
</tr>
<tr>
<td>3</td>
<td>Itemized questionnaire statements</td>
<td>12</td>
<td>12</td>
<td>9</td>
<td>33</td>
<td>36</td>
</tr>
<tr>
<td>Total</td>
<td>24</td>
<td>24</td>
<td>18</td>
<td>66</td>
<td>72</td>
<td>91.66</td>
</tr>
</tbody>
</table>

Based on Table 2, it can be said that the questionnaire format, the language used, and the questionnaire statement items as a whole obtained a percentage of 91.66% which means very valid.

b) Guided Inquiry-Based Chemistry E-module validation results
After the validity test instrument is valid, the instrument can be given to the validators. Analysis of the results of the guided inquiry-based Chemistry e-module validation sheet can be seen in full in the appendix. Broadly speaking, the analysis of the results of the guided inquiry-based Chemistry e-module validation sheet can be seen in Table 3.

**Table 3. Analysis of the Results of the Guided Inquiry-Based Chemistry E-Module Validation Sheet.**

<table>
<thead>
<tr>
<th>No</th>
<th>Validated aspects</th>
<th>Validator</th>
<th>Jml</th>
<th>Skor max</th>
<th>%</th>
<th>Ket</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Aspects of content feasibility</td>
<td>15 16 15</td>
<td>46</td>
<td>60</td>
<td>76.66</td>
<td>Valid</td>
</tr>
<tr>
<td>2</td>
<td>Aspects of presentation feasibility</td>
<td>28 24 28</td>
<td>80</td>
<td>96</td>
<td>83.33</td>
<td>Very Valid</td>
</tr>
<tr>
<td>3</td>
<td>Aspects of linguistic feasibility</td>
<td>19 17 18</td>
<td>54</td>
<td>72</td>
<td>75</td>
<td>Valid</td>
</tr>
<tr>
<td>4</td>
<td>Aspects of feasibility of graphics</td>
<td>15 17 14</td>
<td>46</td>
<td>60</td>
<td>76.66</td>
<td>Valid</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>77 74 75</td>
<td>226</td>
<td>288</td>
<td>78.47</td>
<td>Valid</td>
</tr>
</tbody>
</table>

Based on Table 3 above, it can be said that the overall validity test obtained a percentage of 78.47% which means valid. After the practicality test response questionnaire instrument is valid, the instrument can be used. Analysis of the results of the practicality response questionnaire sheet of the guided inquiry-based Chemistry e-module can be seen in full in the appendix. Broadly speaking, the analysis of the results of the Chemistry-based e-module response questionnaire sheet can be seen in Table 4.

**Table 4. Analysis of Educator Response Questionnaire Sheet Results**

<table>
<thead>
<tr>
<th>No</th>
<th>Practicality aspect</th>
<th>Jml</th>
<th>Skor max</th>
<th>%</th>
<th>Ket</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ease of use</td>
<td>8</td>
<td>12</td>
<td>66.66</td>
<td>Practical</td>
</tr>
<tr>
<td>2</td>
<td>Display</td>
<td>17</td>
<td>20</td>
<td>85</td>
<td>Very Practical</td>
</tr>
<tr>
<td>3</td>
<td>Learning material</td>
<td>14</td>
<td>16</td>
<td>87.5</td>
<td>Very Practical</td>
</tr>
<tr>
<td>4</td>
<td>Language</td>
<td>6</td>
<td>8</td>
<td>75</td>
<td>Practical</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>45</td>
<td>56</td>
<td>8.35</td>
<td>Practical</td>
</tr>
</tbody>
</table>

Based on Table 4, it can be seen that the results of the practicality test with educators on guided inquiry-based Chemistry e-modules as a whole obtained a percentage of 80.35% which means practical.

**Table 5. Analysis of the Results of the Learner Response Questionnaire Sheet**

<table>
<thead>
<tr>
<th>No</th>
<th>Practicality aspect</th>
<th>Jml</th>
<th>Skor max</th>
<th>%</th>
<th>Ket</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ease of use</td>
<td>340</td>
<td>432</td>
<td>78.70</td>
<td>Practical</td>
</tr>
<tr>
<td>2</td>
<td>Display</td>
<td>569</td>
<td>720</td>
<td>79.02</td>
<td>Practical</td>
</tr>
<tr>
<td>3</td>
<td>Learning material</td>
<td>458</td>
<td>576</td>
<td>79.51</td>
<td>Practical</td>
</tr>
<tr>
<td>4</td>
<td>Language</td>
<td>214</td>
<td>288</td>
<td>74.30</td>
<td>Practical</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>1581</td>
<td>2016</td>
<td>78.42</td>
<td>Practical</td>
</tr>
</tbody>
</table>

Based on Table 5, it can be seen that the results of the practicality test with students on the guided inquiry-based Chemistry e-module as a whole obtained a percentage of 78.42% which means practical. Research and Development research has been completed with the 4-D development model (define, design, develop, and disseminate). The stages in this research with the 4-D model are not carried out until the disseminate stage. This is because researchers...
have limited time while the disseminate stage takes a long time, besides that researchers also have other limitations in terms of ability, energy, and funds (Zwama, 2021).

The first stage of the research conducted was the define stage. In the define stage, a beginning-end analysis, literature analysis, and learning objectives analysis were conducted. In the beginning-end analysis, there are several analyses carried out, namely interviews with educators, analysis of students, analysis of teaching materials, and curriculum analysis. Analysis of educators and learners is done by observation and interviews so that it can be determined what will be developed in the study. In the interview system, problems are faced regarding the use of teaching materials. The main teaching materials used by educators during learning are textbooks and teaching modules. Teaching materials are usually made by educators themselves or made together with other fellow educators. The teaching materials used are still in the form of bullet points that do not explain the material in detail.

The second stage, the design stage, can be done after the define stage. The purpose of this stage is to design the initial design of the guide and design research instruments. The instrument is a validation sheet and a practicality response questionnaire. The design of the E-module is adjusted to the Learning Outcomes, Learning Objectives, and Flow of Learning Objectives of the independent curriculum. This is done so that later the contents of the E-module have material coverage that is synchronized with the demands of the curriculum. The material included in the designed guide is atomic development material and elemental periodic system.

The third stage is the develop stage. At this stage, the initial module produced from the design stage will be tested for validity and practicality. To see the validity of the e-module, a validity test was conducted with several validators. After going through the validation and revision process, a practicality test was carried out on the E-module to see its practicality (Idrus et al., 2022; Ilahi et al., 2023; Iskandar & Idrus, 2022). The validation process is carried out on research instruments and the design of guided inquiry-based chemistry E-modules assisted by flip pdf on atomic development material and elemental periodic system. Before the research instruments in the validity test and practicality test are used, they will be validated first. The research instrument is validated to determine whether the research instrument is valid for use. The research instrument validation process was carried out through a validation sheet in the form of a questionnaire. Aspects of validation of research instruments in the form of format, language, and statements from the questionnaire. After the research instruments in the validity test and practicality test are valid, the instruments can be used.

The validation process of guided inquiry-based chemistry E-modules assisted by flip pdf on atomic development material and elemental periodic system, involved 3 validators, consisting of 2 lecturers and 1 Chemistry educator. The validity test instrument is a validation sheet questionnaire with a Likert scale. Before the E-Module validation sheet was filled in by the validator, the validation sheet had been validated and obtained very valid results. There are several things that are analyzed in the validation test, namely aspects: 1) aspects of content feasibility, 2) aspects of language feasibility, 3) aspects of presentation feasibility, 4) aspects of graphic feasibility. The four aspects of validation must be fulfilled so that the teaching materials developed are said to be suitable for use as learning resources.
The four elements of feasibility are measured for validity based on the Likert scale formula with information 61% - 80% valid and 81% - 100% very valid.

When viewed from the content feasibility test, there are three indicators that must be considered, namely 1) the suitability of the material description with, 2) The accuracy of the material, (3) learning support material, so that after conducting a validity test for the content feasibility aspect, it reached a percentage of 81.06% assessment from the validator so that it was included in the very valid category. This is because the material coverage in the module is in accordance with the Learning Objectives. The results of the validity test for the feasibility aspect of the presentation in this E-Module is to reach a percentage of 88.17% assessment from the validator so that it is included in the very valid category. There are tables and pictures supporting the presentation of the material. Images that support and clarify the content of the material are a substantial component in the design of the practicum because they can increase interest and reduce boredom for students when studying it (Gustiniasari et al., 2017). When viewed in terms of language feasibility, there are seven indicators that must be considered, namely (1) communicative; (2) dialogical and interactive; (3) straightforward; (4) the consecution of the train of thought; (5) coherence; (6) conformity with the correct rules of Indonesian; and (7) the use of terms and symbols or symbols that are appropriate to the development of learners.

The validity test results for the language aspect reached an assessment percentage of 91.66% from validators so that they were included in valid. E-Modules use language adapted to Indonesian rules. It is necessary to use good language in teaching materials. If part of the subject matter in the teaching material uses language that is difficult to understand or has a double meaning, students can misinterpret and have difficulty understanding the content of the material. In the E-Module the use of terms and symbols of the consistent And at the end of the module there is a glossary that can help students understand the terms in the material. The overall validity test results of the e-module obtained a percentage of 81.32%. With the category already valid. Eligibility requirements are being able to measure what will be measured, the material is in sync with the validity of knowledge and this e-module is in accordance with the competencies / objectives to be achieved in learning. Valid E-Modules are expected to attract the attention of students and can prepare students who are able to think critically, actively, and find discoveries based on experiments so as to increase student learning motivation.

In the practical results carried out to students, it was concluded that students' suggestions for the results of this E-Module that many of the students could not access this PDF FILP application on their cellphones. However, E-Modules can support students to learn in balance with their learning speed. The use of practicum guides during learning also supports the role of educators as facilitators, educators do not have to repeat explaining the material, thus facilitating the work of educators, and educators can observe student activities more carefully.

4. Conclusion
E-Module Chemistry Based on Guided Inquiry Assisted by Flip Pdf developed by researchers discusses material about the development of atoms and periodic systems of class X science
elements. The Chemistry E-Module developed was tested to grade X Science 11 students in MAN 2 Tanah Datar. Based on the research and the results of data analysis that has been carried out, conclusions were obtained. The results of the validity test of the Flip Pdf-Assisted Guided Inquiri Based Chemistry E-Module developed by the researcher discuss material about the development of atoms and periodic systems of elements meet valid criteria based on validator validation sheets with a percentage of 78.47%. The results of the practicality test of the Chemistry E-Module Based on Guided Inquiry Assisted by Flip Pdf developed by researchers discuss material about the development of atoms and periodic systems of elements meet practical criteria based on student response questionnaires with a percentage of 78.42% and based on educator response questionnaires with a percentage of 80.35%.

5. References
with Quranic Verses Based on Discovery Learning on Reaction Rate Material (Issue ICoeSSE). Atlantis Press SARL. https://doi.org/10.2991/978-2-38476-142-5