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*Research Article*

# Development of an Adaptive Enrichment Module Aligned with the Learning Outcomes of the Kurikulum Merdeka

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## ABSTRACT

This research aims to develop an enrichment module on chemistry materials in class XI odd semesters that are in accordance with the principles of the kurikulum merdeka. Development is carried out using the Research and Development (R&D) model from Borg and Gall which is simplified into eight stages, including needs analysis, design, expert validation, teacher feasibility test, and student response. The results of validation by subject matter experts showed a validity rate of 86% (very valid category), while validation by media experts reached 91.42%. The feasibility test by the teacher obtained a score of 92.35%, and the students' response showed an acceptance rate of 84.56% (the category strongly agreed). These findings show that the enrichment modules developed are not only feasible and valid in terms of content and appearance, but also effective in supporting independent learning and improving students' understanding of chemical concepts. Thus, this enrichment module has proven to be effective and applicable as additional teaching materials in chemistry learning based on the kurikulum merdeka. This module can facilitate students in understanding the material in a more in-depth and structured way, as well as encourage independent learning. In addition, this module can also function as a solution to the limitations of contextual and systematic teaching materials in the school environment. Therefore, the results of this research are expected to be a real contribution in efforts to improve the quality of education, especially in the development of learning media that are adaptive to curriculum changes.

**Keywords:** Module Development; Adaptive Modul; Learning Outcomes; Chemistry; Kurikulum Merdeka

## 1. INTRODUCTION

Education is a medium to transfer knowledge, insights, and skills to individuals so that they are able to hone their talents and develop the potential that exists within them (Fitriani et al., 2021). Improving the quality of education refers to the curriculum that functions as a guide in achieving educational goals (Astuti, 2019). The education system will definitely have such a change, as well as the curriculum. The 2013 curriculum requires students to be active, critical and innovative (Alvina et al., 2022). At this time, the 2013 curriculum began to be replaced with an independent curriculum. The 2013 curriculum focuses on the development and balance between competencies, attitudes, skills, and knowledge (Iwan, 2023). The reason for the transition from the 2013 curriculum to the kurikulum merdeka is because the kurikulum merdeka is simpler and deeper, besides that the standard of achievement of the kurikulum merdeka is much simpler than the 2013 curriculum. According to (Ramadhan, 2021) The kurikulum merdeka makes students more independent in learning, this can be seen from the high school program where there is no longer a specialization program for schools that have implemented an kurikulum merdeka. In changing the curriculum because it is in accordance with the changing times. This curriculum change certainly has an impact on various aspects of learning in schools, including in the teaching and learning process of chemistry subjects that require more innovative and adaptive learning approaches and strategies.

The teaching and learning process of chemistry requires a teacher to have the right strategy in carrying out teaching and learning activities, so that it will stimulate students to be more active during learning activities (Imanda et al., 2021). A teacher needs to apply a method that directs students to play an active role and explore the potential that exists in themselves, so that students are able to develop certain skills in order to be able to carry out learning optimally (Fitriani et al., 2020). To support this effective learning strategy, teaching materials are needed that are able to facilitate students in learning independently and in a directed manner, one of which is the use of modules as learning media(Setiawaty et al., 2020).

Modules are a type of teaching materials that are made individually. Students are expected to be able to improve learning achievement independently by using these modules (Riza et al., 2020). Modules can also be said to be learning tools in the form of systematic and complete teaching materials that can be used to learn with or without teachers (Lestari, 2019). The enrichment program is a program to deepen learning materials. The enrichment program emphasizes on strengthening the competency aspects that students have mastered. Enrichment programs can be carried out through group learning, independent learning, and theme-based learning (Kismiati, 2021). One way to improve students' ability and understanding in chemistry learning is to provide learning facilities. The learning facilities in question are in the form of teaching materials that are used as learning resources for students. Teaching materials that function individually that can be used as learning support are modules (Nurdyansyah, 2018). Although modules have an important role as individual teaching materials that can support independent learning and enrichment programs, the reality in the field shows that the availability of modules in schools is still very limited.

Concept development can be done by utilizing learning module media. However, what happened in the field based on the results of observations made by researchers at SMAN 6 Lhokseumawe that the learning materials at the school were very minimal. This is evident from the results of interviews with chemistry teachers who said that teaching materials in the form of modules did not exist, the school only provided teaching materials in the form of package books in accordance with the current curriculum. The implementation of the kurikulum merdeka in the school is still relatively new and is in the process of learning and adapting. The implementation itself follows instructions and directions from the government. The Ministry of Education and Culture has conducted training on making modules, implementing learning models, and procedures for making good and correct learning traps. However, due to the relatively short training time, teachers still do not fully understand how to create and develop good modules. So it is necessary to develop an enrichment module as a teaching material.

The main advantage of this enrichment module can be done by students at school or at home. This module can be the answer to an kurikulum merdeka that emphasizes the independent learning aspect of students. According to the opinion (Patimah, 2022) Learning independence is an active learning activity that is driven by the intention or motive to master a competency to overcome a problem by not depending on others. Based on the background that has been explained above, the author is interested in conducting a research entitled "Development of Enrichment Modules in Chemistry Materials in Class XI Odd Semester of the Kurikulum Merdeka"

## 2. RESEARCH METHOD

The development model in this study uses a type of research known as research and development (R&D) developed by Borg and Gall which consists of 10 stages, namely research and initial information collection, planning, development of initial product formats, initial trials, product revisions, field trials, product revisions, field trials, final product revisions and dissemination. Based on the ten steps of implementation, the researcher limited it to 8 stages.

### 2.1. Validity Data Analysis

The developed module wais tested for validity by providing a validation sheet to experts consisting of media and material experts to clarify the level of product validity, the researcher uses a likert scale. The validity criteria can be seen in table 1. of the **Table 1**.

**Table 1**. Validity Criteria

| Percentage | Category |
|---|---|
| 81% - 100% | Highly Valid |
| 61% - 80% | Valid |
| 41% - 60% | Quite Valid |
| 0% - 20% | Invalid |

Source: Modification (Sugiyono, 2013).

The method of calculating the validity and response of the subject can be done using the equation formula (sugiyono, 2013): Validity Value = (total validation score)/(maximum score) x 100%.

### 2.2. Feasibility Data Analysis

Modules that have been tested for validity by validators will then be tested by the teacher by providing a feasibility test sheet. The researchers used a likert scale of 1-4. The eligibility criteria are referred to in **Table 2**.

**Table 2**. Eligibility criteria

| Percentage (%) | Criteria |
|---|---|
| 81% - 100% | Highly Worth It |
| 61% - 80% | Proper |
| 41% - 60% | Quite Decent |
| 0 - 20 % | Not Eligible |

Source: Modification (Sugiyono, 2013).

The method of calculating the feasibility value and the subject's response can be done using the equation formula 3.1

### 2.3. Respondent Data Analysis

The weight of the questionnaire assessment given to students to see the responses to the chemistry learning module of class XI on Hydrocarbons, Petroleum, Thermochemistry and Reaction Rate materials is on the respondent value criteria from the subject can be seen in **Table 3**.

**Table 3**. Respondent Score Criteria

| Percentage (%) | Criterion |
|---|---|
| 80% - 100% | Strongly agree |
| 60% - 80% | Agree |
| 40% - 60% | Quite agree |
| 0 – 20 % | Disagree |

Source: modification (Asthma, et al. 2018)

The calculation method to see the response response can be done using the formula:

$$NP = \frac{R}{SM} \times 100\%$$

Information:

NP = Percentage value searched

R = score obtained

SM = maximum/high score

## 3. RESULTS AND DISCUSSION

His research was conducted at SMAN 6 Lhokseumawe school in grade XII Science 1 Odd Semester Academic Year 2024/2025. which consists of 1 class with a total of 30 students/class. The selection of subjects in this study used a purposive sampling technique based on the criteria of the class with the most students in the other twelfth grade. The object of this study is an enrichment module on odd semester material.

### 3.1. Initial Information Collection Stage

At this stage, the identification process is carried out on the type of product that is most in line with the development goals and needs of learning materials applied in the school environment. This identification process includes adjustments between the content of the material with the characteristics of the students and the learning approach adopted by the school. Based on the results of direct interviews with chemistry teachers who teach in grade XI of SMAN 6 Lhokseumawe, information was obtained that so far the learning process in the classroom has not utilized learning media in the form of

modules. Learning activities tend to be conventional and have not been facilitated by systematic and contextual teaching materials such as enrichment modules.

This shows that there is a real need for the development of teaching materials that can support the learning process to be more effective and meaningful. In this case, (Mashami et al., 2021) learning modules are seen as one of the solutions that can help teachers in delivering material in a more targeted manner and give flexibility to students to learn independently. In accordance with the opinion of Muderawan et al. (2019), teachers in the current era are required to have competence not only in terms of mastery of teaching materials, but also in the ability to manage learning creatively and innovatively. One of the efforts that can be made is to develop and utilize the right learning media, including modules, as a tool to improve the quality of the teaching and learning process. Thus, the development of learning modules at this stage is a response to real needs in the field, as well as a form of effort to support the role of teachers in creating active, interesting, and in accordance with the demands of the kurikulum merdeka.

## 3.2. Planning Stage

In the second stage of the development process, the researcher continued the activity by conducting careful planning based on the information that had been obtained through direct observation at school and the results of interviews with chemistry teachers. This information is an important basis for designing product development strategies that suit the conditions and needs of learning in the classroom. In this planning stage, the researcher compiles a number of main points that are a reference in the preparation of the module, so that the content and structure are relevant to the characteristics of the students, the curriculum used, and the learning objectives to be achieved. In addition, the researcher also prepared the supporting instruments necessary for the module validation and testing process, including: expert validation sheets, which aim to assess the quality of the content and presentation of the module from an expert perspective; feasibility sheets, to assess aspects of suitability and suitability with user needs; and student response questionnaire sheets, which will be used to measure responses and product acceptance rates from the user's perspective The end, namely the students. This stage also includes determining the schedule for the implementation of the research, including the appropriate time to conduct field trials, which in this case is scheduled in an odd semester to match the content of the ongoing chemical material at that time. As stated by Islahiyah et al. (2021), learning modules are a form of learning resources that can be used as an effective alternative in supporting the learning process. The module provides students with the flexibility to learn independently, follow a systematic learning flow, and access materials more flexibly. Therefore, this planning stage has a very crucial role in ensuring that the modules developed are not only academically appropriate, but also practical to be applied in the context of learning in schools.

## 3.3. Initial Product Development Stage

In the third stage, known as the "develop preliminary form of product", researchers begin to enter the concrete design phase of the module to be developed. At this stage, the researcher conducts the initial design of the product by comprehensively drafting a concept that includes various visual and functional aspects of the module. The design process begins with the selection of aesthetic elements that are an important part of creating the visual appeal of the product. Some of the specially designed components include: the selection of a harmonious and inconspicuous background color for comfortable viewing; writing formats and image layouts that support readability and clarity of information; selection of font types and font sizes that are in accordance with the readability standards for high school levels; as well as a cover design that describes the contents of the module in a representative and attractive manner. The initial design of this product was made with the visual psychology of learners in mind, where an attractive display is believed to increase learning motivation and interest in learning materials. Therefore, the visual aspect is not only focused on beauty, but also on functionality in conveying learning messages effectively. The researcher strives to make modules not only ordinary teaching materials, but also a communicative and inspirational learning medium, both when used in classroom learning activities with teachers and when used independently by students outside of class hours. According to (Adawiyah et al., 2022),, with a design that is designed to be as attractive as possible, it is hoped that students will feel more motivated, interested, and comfortable in utilizing the module as the main learning resource and companion.

### 1. Initial trial

Thereis a development stage where the media will be validated by 1 material expert and 1 media expert. The results of learning media validation were obtained from the assessment of media experts, which are as follows:

*a. Material Expert*

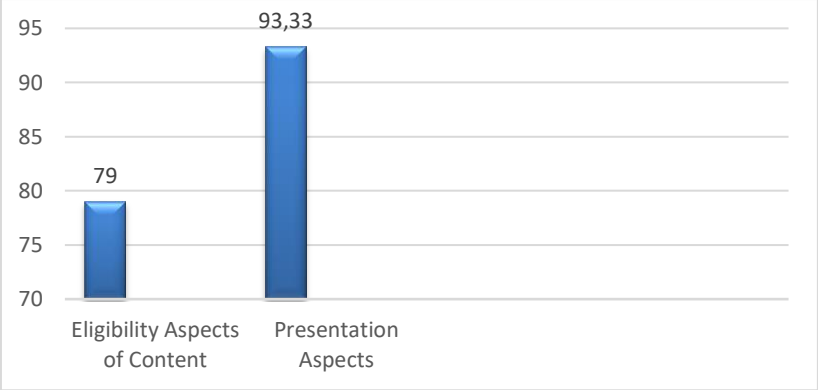


**Figure 1**. Diagram of Material Expert Validation Results

Based on the **Figure 1**, the results of the validity of the material experts show that the chemistry learning module as an enrichment medium is included in the "valid" category. The content aspect is related to the suitability of the material delivered with the standards or needs that have been set. This category can be seen from the average score in the content feasibility aspect of 22 out of a maximum score of 28 with a percentage of 79% with the "valid" category, the presentation feasibility aspect with a percentage of 93.33% with the "very valid" category. The average of all aspects assessed was 86%, with a criterion of "very valid". These findings are in line with the results of research conducted by Mashami et al. (2021) which stated that learning using module media has a significant impact on the quality of the learning process.

*b. Media Members*

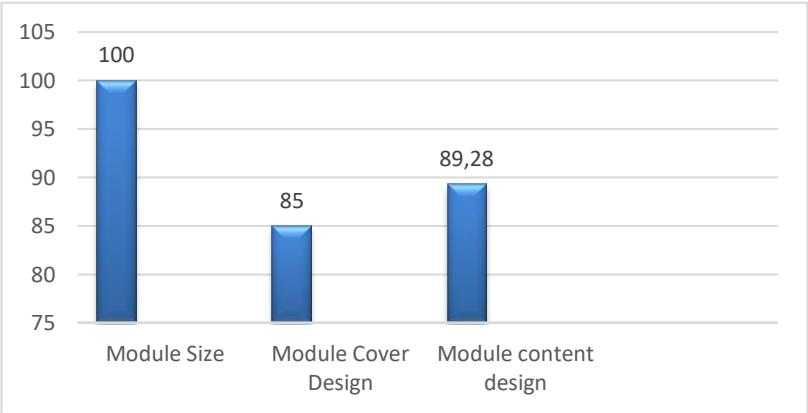


**Figure 2**. Media Expert Validation Results Diagram

Based on the diagram above, the validation results of media experts show that the learning media developed is included in the category of "very valid". The overall score produced is 8 with a percentage of 100% with the category "very valid". In the aspect of module cover design, the overall score is 17 out of a maximum score of 20 with a percentage of 85%, the category "very valid". The design aspect of the content of the module The overall score produced was 25 out of a maximum score of 28 with a percentage of 89.28% in the "very valid" category.

## 2. Products

The product produced is a chemistry learning module that is compiled based on the principles of the independent curriculum. This module was developed as additional teaching materials to enrich students' understanding of chemistry materials.

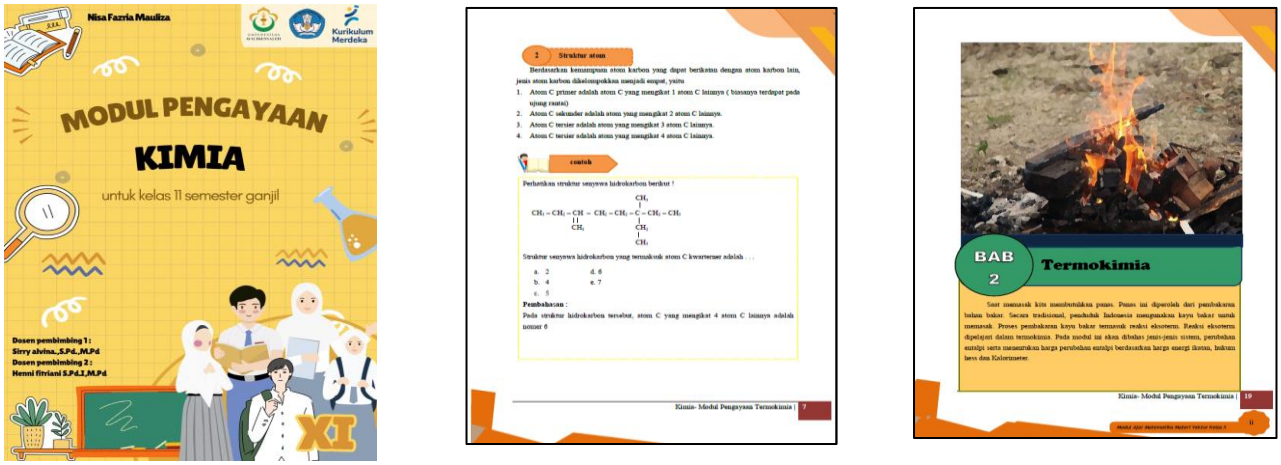


**Figure 3**. Module Design

## 3. Field trials

The assessment of the feasibility of the media is carried out by a chemistry teacher by reviewing three main aspects, namely the feasibility of the content, the feasibility of presentation, and the feasibility of language. The assessment is given on the basis of a Likert scale with a score range of 1 to 4 for each statement submitted. At this stage, the learning media is tested on a limited basis to one chemistry teacher at SMAN 6 Lhokseumawe as a form of initial validation of the product. The purpose of this feasibility test is to find out the extent to which the enrichment modules developed have met the standards and are suitable for use in the learning process. The average assessment results from the product feasibility trial are shown in the following figure.

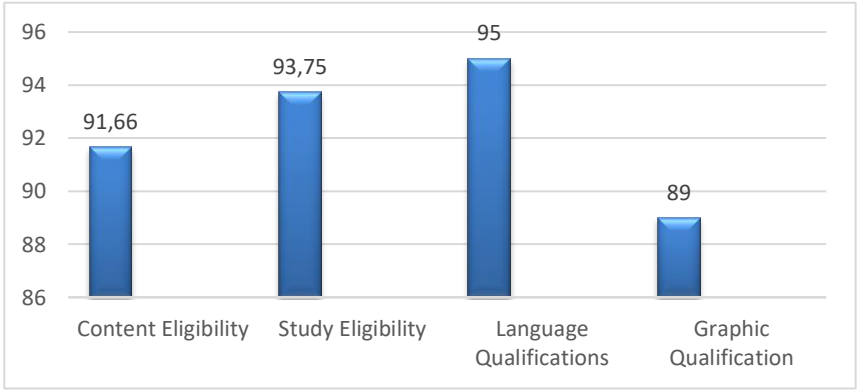


**Figure 4**. Teacher Eligibility Results Diagram

Based on the diagram displayed, it can be concluded that the results of the assessment of four aspects in the developed learning media show the category of "very feasible". This assessment was obtained from the results of an evaluation conducted by one chemistry teacher who had assessed as many as 24 statements that reflected the quality of the media. The four aspects assessed include important components in the development of learning media, such as the feasibility of content, presentation, language, and graphics. The results of this high assessment indicate that the learning media developed has met the set standards and is considered very good in supporting the teaching and learning process, both in terms of materials, appearance, and the integration of learning components in it.

## 3.4. Product revision

In the seventh stage, after the field trial was carried out, the researcher continued with product revision activities based on the findings and inputs obtained during the trial process. This revision aims to improve the chemistry learning modules that have been developed to be more effective, relevant, and in accordance with user needs. Improvements are made both in terms of content, appearance, and presentation techniques so that the product is really ready to be used in the next learning implementation. Thus, the revised modules can be retested or directly applied in the learning process more optimally.

### 3.5. Field implementation trials

Thereis an eighth stage, namely the field implementation test. The researcher provided response questionnaires and modules that had been designed/printed to 30 students of class XII Science 1.

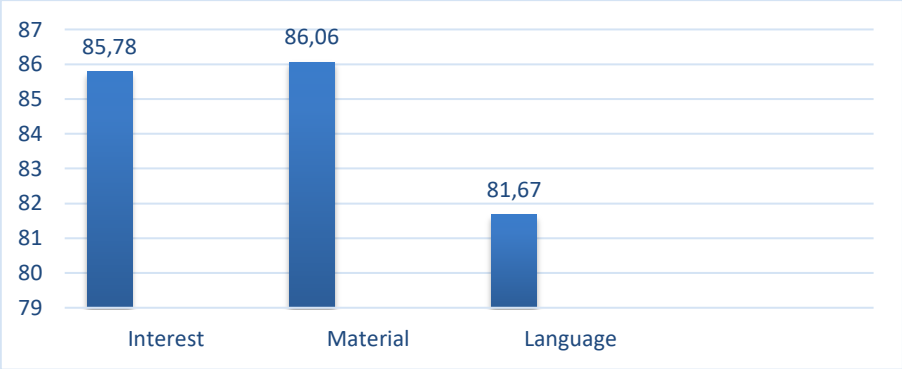


**Figure 5**. Teacher Eligibility Results Diagram

Based on the results of the research that has been conducted by the researcher, data was obtained that the average percentage of the results of the questionnaire responses of students to the product trial showed a figure of 84.56%, which is included in the category of "strongly agree". These results indicate that the enrichment modules developed are considered very feasible by students to be used in the learning process. The positive assessment reflects that the module is able to meet students' expectations both in terms of content, appearance, and usefulness in supporting learning activities. Furthermore, through systematic stages in accordance with the Borg and Gall development model, the development of this enrichment module has gone through a process that includes needs analysis, design, development, validation, and limited testing. The final results show that the enrichment module on chemistry materials in class XI odd semesters based on the kurikulum merdeka is not only relevant and applicable, but also plays an important role as an effective learning tool. This module can be used by teachers as a supporting medium in delivering teaching materials in a more structured and interesting manner, as well as being an independent learning resource for students to deepen their understanding of the chemical concepts taught. Thus, the products developed have great potential in improving the quality of chemistry learning in the classroom in accordance with the principles of the kurikulum merdeka which emphasizes differentiation, independent, and meaningful learning.

## 4. CONCLUSION

Based on the results of the data analysis that has been carried out in this study, it is concluded that the chemical enrichment module developed for grade XI students in odd semesters in the kurikulum merdeka shows a very high level of validity. This is evidenced by the results of the assessment conducted by media experts, which showed that the module obtained a validity score of 91.42%. This score indicates that in terms of design, appearance, and presentation, this module has met the criteria as an additional learning medium that is feasible and effective to use in an educational environment. In addition, from the aspect of content and material, this enrichment module also received a very valid assessment from material experts, with a percentage of 86%. This assessment reflects that the material presented in the module is in accordance with the basic competencies, learning objectives, and applicable chemical science principles, so that it can support the learning process optimally. Not only from the perspective of experts, the usefulness of this module is also reflected in the results of the trial for students, where the enrichment module obtained a feasibility rate of 92.35%. The results show that this chemical enrichment module is very good to use as additional teaching materials that are able to improve students' understanding of chemical materials.

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