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# Development of Inquiry-Based E-Modules Integrated with STEM in Stoichiometry Material to Improve Creative Thinking Skills and Learning Motivation

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**Abstract:** This research aims to develop an integrated STEM inquiry-based e-module on stoichiometry material to enhance creative thinking skills and learning motivation among high school students, that is feasible, practical, and effective. This study employed a research and development (R&D) method with the 4D model, involving four stages: define, design, develop, and disseminate. The research subjects were 72 students at SMA Negeri 7 Pontianak, selected using cluster random sampling, with a quasi-experimental design with a control group. Data collection techniques included non-test and test methods. Data analysis techniques included qualitative analysis of interview results and feedback, and quantitative analysis of score acquisition. The results showed: (1) an interactive e-module using a STEM-integrated inquiry approach; (2) very feasible quality in terms of material and media, with an average score of 144 out of 160; (3) excellent practicality quality with an average score of 71 out of 80; (4) excellent readability with an average score of 46.22 out of 52; (5) a significant difference in creative thinking ability and learning motivation simultaneously and respectively, with a significance value of 0.000 < 0.05; and (6) the effective contribution of using e-modules to increase creative thinking ability and learning motivation simultaneously by 48.4%, and respectively by 14.8% (creative thinking ability) and 44.0% (learning motivation). The implications of the research show that the use of e-modules significantly improves students' creative thinking skills and motivation, supports teachers in teaching stoichiometry interactively and contextually, and enriches learning media and digital teaching materials for the 21st-century curriculum.

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## Introduction

The Industrial Revolution 4.0 aims to replace the Industrial Revolution 3.0 through automation and cyber technology (Wulandari, 2023), which has been applied in various fields, including education. In Indonesia, the education system needs to adapt to these changes through curriculum updates, redefining the role of teachers, and utilizing Information and Communication Technology (ICT)-based technologies (Lase, 2019). Today's education emphasizes the development of skills such as creativity, critical thinking, teamwork, communication, social skills, and character strengthening (Putriani & Hudaidah, 2021).

These 21st century skills are in line with the four pillars of education according to UNESCO, namely: *learning to know*, *learning to do*, *learning to be*, and *learning to live together* (Zubaidah, 2020). The achievement of these skills can be facilitated through *inquiry-based-learning*, which not only emphasizes learning outcomes, but also the learning process itself (Septiani & Susanti, 2021).

Inquiry-based learning can be optimized by integrating the *Science*, *Technology*, *Engineering*, *and Mathematics* (STEM) approach, which combines concepts, principles, and

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techniques from these four fields to produce solutions or products that are useful in everyday life (Kanza et al., 2020). The goal of the STEM approach is to improve science literacy, 21st century skills, and students' interest in learning (Mulyani, 2019).

One of the materials in chemistry that is relevant to be developed using this approach is stoichiometry. Stoichiometry is a branch of chemistry that studies the quantitative relationship between reactants and products in a chemical reaction (Chang, 2005). However, this material is often considered difficult by students because it involves abstract concepts and complex mathematical calculations (Melini & Azhar, 2019). This difficulty can affect students' understanding of advanced chemistry materials, such as thermochemistry.

An example of the real application of the concept of stoichiometry in everyday life is the forest and land fires that often occur in the Kalimantan region. Indonesia is one of the countries with the largest forest area in the world, and Kalimantan is one of the areas that has large tropical forest reserves (Sari et al., 2023). Forest fires can occur due to natural factors, such as prolonged dry seasons, or human activities, such as land clearing by burning (Karurung et al., 2025).

In a stoichiometric context, the process of forest burning involves a chemical reaction between organic matter (such as wood and leaves) and oxygen ($O_2$) from the air, which produces carbon dioxide ($CO_2$) gas, water vapor ($H_2O$), and heat. The larger the volume of forest burned, the more oxygen consumed and the higher the amount of carbon dioxide emissions released into the atmosphere (Astiani et al., 2015). This not only impacts the balance of local ecosystems, but also contributes significantly to the increasing greenhouse effect and global climate change (Sugiarto et al., 2024). Through the stoichiometric approach, students can understand how combustion reactions work quantitatively, such as calculating the amount of oxygen needed to burn a certain amount of biomass or estimating $CO_2$ emissions resulting from a fire. This approach is expected to improve students' understanding of the relationship between chemical concepts and actual environmental phenomena.

Observations at SMA Negeri 7 Pontianak showed that 53 out of 60 students had difficulty understanding stoichiometry. The main problems included abstract concepts and complex mathematical calculations, as well as difficulty concentrating due to the demands of other subjects. Although the teacher tried to explain stoichiometry regularly, interaction between students remained low. Teacher-centered learning tends to make students less motivated and passive (Salay, 2019). Learners tend to prefer group-based and practical learning (Simanjuntak et al., 2022). In addition, the use of learning resources is still limited, and chemistry learning rarely utilizes electronic modules. Some students even show interest in electronic modules, because they are used to using smartphones in their daily lives.

The results of interviews with chemistry teachers show that the learning process is still dominated by the *Direct Instruction* (DI) approach, where teachers deliver material in a structured manner while students play a passive role as recipients of information. Efforts to encourage class discussions have been made, but students still show low involvement, especially because they still have difficulty in linking mathematical concepts with stoichiometry material. The lecture approach is still the main method, and learning reflection has not been optimized (Susanty, 2022).

Students also show interest in practice-based learning, but still have difficulties in preparing reports and linking experimental results with stoichiometry theory. As a result, teachers tend to explain theory more often than conduct practical activities, even though practical methods are preferred by students. On the other hand, the evaluation system also affects student engagement and understanding. The use of platforms such as Quizizz, which

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offers game elements and instant feedback, has been shown to increase students' interest in learning evaluation (Asria et al., 2021).

Based on these conditions, practical approaches such as the development of an *inquiry-based* E-Module integrated with the STEM approach. This media is designed to present material interactively, linking stoichiometric concepts with contextual practices and phenomena, making it easier to understand and meaningful for students. Equipped with images, videos, HOTS-based questions, and self-evaluation, this E-Module encourages active and flexible learning through digital devices. Recent research shows that *inquiry-STEM-based* learning can significantly increase students' motivation, engagement, and concept understanding (Astuti, 2017). The module is developed with applications such as Canva, Quizizz, and Flip PDF, and presented in the form of digital links that are easily accessible at any time. The uniqueness of this research lies in the combination of the inquiry approach and STEM integration in the development of contextual e-module based on real local environmental issues, namely forest fires. Meanwhile, the purpose of this research is to produce an e-module that is valid, practical, and effective in improving the understanding of stoichiometry concepts as well as creative thinking skills and student learning motivation at the high school level.

## Research Method

This study used a research and development (R&D) method with 4D model, involving four stages: define, design, develop, and disseminate (Thiagarajan *et al*., 1974). The stages of the 4D model are presented in Figure 1.

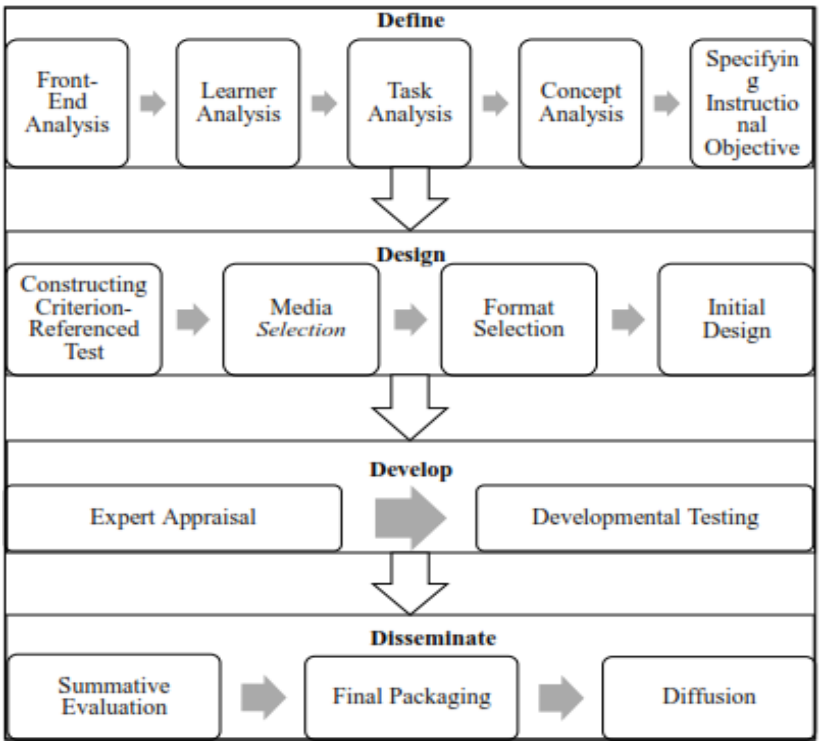


**Figure 1. Research Procedure Scheme**

The subjects in this study consisted of validity test subjects and pilot test subjects. The validity test involved material and media experts, namely two experienced lecturers who evaluated the feasibility of the E-Module, as well as two high school chemistry teachers as product assessors. The readability test was conducted on 44 grade XII students who had studied stoichiometry material to assess the quality and understandability of the e-module.

Meanwhile, the pilot test subjects were selected through *cluster random sampling* from two classes at SMA Negeri 7 Pontianak, which has similar characteristics to other schools with A accreditation and has implemented Merdeka Curriculum for at least two years. A total of 72 grade XI students were involved, consisting of experimental and control classes.

This study used a quasi-experimental method with a pretest-post-test design on two classes, namely the experimental class that received treatment using the STEM-integrated inquiry-based E-Module on stoichiometry material, and the control class that did not use it. Data were collected through test and non-test techniques; the test used description questions to measure creative thinking skills, while the non-test included interviews, observations, and expert validation questionnaires, practicality, readability, and learning motivation. The research instruments were validated theoretically by experts and empirically through Winsteps Rasch application, with the criteria of MNSQ (0.5-1.5), ZSTD (-2.0 to +2.0), and Pt Mean Corr (0.4-0.85); invalid items were improved or eliminated. Reliability was measured using Cronbach's Alpha ($\geq$ 0.7), and ordinal data from the motivation questionnaire was converted to an interval scale using MSI.

Data analysis was conducted qualitatively and quantitatively. E-Module validation and assessment were analyzed using score categories based on the ideal mean (Mi) and ideal standard deviation (SBi) (Widoyoko, 2009). The effectiveness of the E-Module on improving creative thinking skills and learning motivation was tested with the General Linear Model (GLM) after fulfilling the MANOVA prerequisites, with the contribution analyzed through the partial eta squared value. The improvement of learning outcomes was measured using the N-Gain formula with categories of high ($\geq$ 0.7), medium (0.3-0.7), and low ($<$ 0.3) (Hake, 1998).

## Results and Discussion

### Define

The definition stage aims to determine and formulate instructional requirements through various analyses that identify the objectives and limitations of the learning media developed. This stage analyzes the front-end, learners, tasks, concepts, and learning objectives. Interviews with chemistry teachers at SMA Negeri 7 Pontianak revealed challenges in learning stoichiometry. The interview results stated that the implementation of the Merdeka Curriculum had an impact on adjusting learning tools and learning systems. Even though the Merdeka Curriculum has been implemented, teachers still use the Direct Instruction (DI) method, which according to (Zahrah et al., 2018) can make students have difficulty understanding mathematical material and tend to be passive. The practicum carried out also does not support the understanding of the concept of stoichiometry, while the difference in reference books results in a mismatch of material, this is in line with research by (F. Z. Aziz et al., 2022). Therefore, the development of inquiry-based E-Modules integrated with STEM is needed to improve understanding and learning motivation.

Furthermore, students were analyzed to understand the character of students as the basis for developing learning media. Observations of 60 students in class XI Chemistry 2 and 3 at SMA Negeri 7 Pontianak showed that 53 students had difficulty and were less motivated to learn independently. A total of 37 students prefer group learning, because according to (Widayanti, 2013), it can increase self-confidence and motivation. In addition, 54 learners have an audio-visual learning style and often use smartphones, so they are interested in using E-Modules. Electronic-based media development can support independent learning resources by taking into account the learning styles of students (Cholifah, 2018).

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Task analysis is carried out to determine the competencies that students need to master in learning, by determining the content and tasks according to the learning outcomes (CP) and the flow of learning objectives (ATP). Concept analysis is conducted to determine the main concepts in stoichiometry material, such as chemical reaction equations, mole concepts, chemical formulas, and chemical reaction calculations. Concept analysis aims to develop efficient learning steps (A. A. Aziz et al., 2020). These concepts are the basis for developing E-Modules to improve creative thinking skills and connect material with everyday life, which can increase learning motivation (Fadilah, 2018). The learning objectives are compiled referring to the task and concept analysis that has been carried out.

**Design**

The design stage aims to design the initial product as the initial stage in the development of E-Modules. In this stage, the preparation of test standards is carried out, as well as determining learning media, formats, and initial design. The preparation of test standards follows learning objectives and learner analysis to produce reliable information (Rapono et al., 2019). The instruments compiled include validation sheets, reviewer assessments, readability questionnaires, pretest and posttest questions, and student learning motivation questionnaires.

The research instruments were designed based on the instrument grids and assessment rubrics. The pretest and posttest questions of creative thinking ability each amounted to 5 different questions which were arranged based on aspects of flexibility, elaboration, originality, rationalism, and novelty. Meanwhile, the questionnaire for students' learning motivation was designed in the form of a closed questionnaire with 30 questions consisting of 15 positive statements and 15 negative statements arranged based on aspects of self-efficacy, self-regulation, enthusiasm, achievement, and stimulation of the learning environment.

The selection of learning media aims to convey stoichiometry material effectively. The STEM-integrated inquiry-based E-Module was chosen with a customized framework that is easy for students to understand (Rahdiyanta, 2016). E-Modules can be accessed via a link and are compatible with smartphones or laptops. The development of E-Modules uses software such as Flip PDF Corporate Edition, Microsoft Word, Canva, Quizizz, and OpenAI. The E-Module uses a portrait format that can be changed according to the landscape, with a Bahnschrift font size 14 for the material and 16 for the subchapter titles. The paper background is white with shades of light orange, light blue, and gray. Flip features include page navigation, page zoom, keyword search, and sound settings.

Next, the initial design of the E-Module was carried out. The initial design aims to present the right learning media and in the right order. The E-Module is designed in the form of an initial prototype as a reference for further development, based on the storyboard that has been designed. Storyboard serves to create visual sketches that explain the storyline of the media developed (Rustamana et al., 2023). This prototype includes the placement of text, images, and videos, with media sections consisting of the opening (cover page, maker profile, instructions for use, preface, table of contents (tables, images, and videos)), content (concept map, introduction, material), and closing (summary, exercises, glossary, bibliography, and closing cover page). The storyboard is presented in Table 1.

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**Table 1. Initial Design of E-Modules**

| No. | Description | Image | No. | Description | Image |
|---|---|---|---|---|---|
| 1 | Cover Page |  | 6 | Learning Video |  |
| 2 | Instructions for Use |  | 7 | Practice Questions through Chemistry and Quizizz Apps |  |
| 3 | Learning Outcomes |  | 8 | Summary of Material |  |
| 4 | Concept Map |  | 9 | The Relationship of Stoichiometry Material in Everyday Life |  |
| 5 | Stoichiometry Learning |  | 10 | STEM-integrated Student Worksheet |  |

**Develop**

The development stage aims to modify the prototype that has been made in the previous stage and assess the feasibility of the initial product. In this stage, the E-Module was revised referring to the input of experts and *reviewers*. The E-Module was assessed by material and media experts by reviewing two aspects, namely instructional and technical. Instructional assessment includes suitability, effectiveness, and feasibility, while technical assessment includes language, media, and format. The results of this review were used for product revision to improve suitability, effectiveness, usability, and technical quality.

The inquiry-based e-module integrated with STEM for stoichiometry material was declared very feasible to use in learning activities, with an average score of 144 in the "Very Feasible" category. The average value of each aspect of the assessment is: (1) content feasibility 28.50; (2) presentation feasibility 24.50; (3) language feasibility 27.50; (4) graphics 22.50; and (5) media feasibility 41. All input from validator lecturers has been accepted and used as a reference for product revision. The results obtained state that this E-Module is very feasible and ready to be assessed by the *reviewer* (chemistry teacher) after revision. Learning media can be said to be ready for use after being validated by experts (Sunita, 2020).

After being revised based on expert validation, the E-Module was assessed by *reviewers* to measure practicality. The assessment was conducted by two chemistry teachers using an assessment sheet. The measured aspects include content feasibility, presentation feasibility, language feasibility, and graphical aspects. The inquiry-based E-Module

integrated with STEM on stoichiometry material was considered practical to use in learning activities, with an average score of 71 in the "Very Good" category. The average value of each aspect is: (1) content feasibility 17.50; (2) presentation feasibility 22.50; (3) language feasibility 14; and (4) graphics 17. The practicality of the product is based on the opinions of users, especially teachers and students, regarding ease of use and the ability to describe the actual learning process (Nuryadi & Khuzaini, 2017).

After going through validation and practicality assessment, this E-Module was tested on students. The E-Module has very good readability, with an average score of 46.22 in the "Very Good" category. The average value of each aspect is: (1) presentation 21.54; (2) language 10.89; and (3) practicality 13.79. However, based on the open-ended questionnaire, there are some recommendations for improvement, such as changing the table background to white, adding animation, and using brighter colors. A product can be considered practical if the assessments from teachers and students are consistently at least in the good category (Nuryadi & Khuzaini, 2017). After going through validation, practicality assessment, and readability test, it was stated that the inquiry-based E-Module integrated with STEM on stoichiometry material was widely tested.

Before testing the creative thinking ability and learning motivation of students, the instruments used must be validated terroristically by a validator lecturer and empirically by students. The results of the validation test show that the instrument is suitable for use. All suggestions or input given were taken and revisions were made so that the creative thinking ability questions could be tested in a limited and broad manner. Improvements aim to produce a description of validity that is close to the truth, so that the test score reflects the construct being measured and represents the level of each test (Muzaffar, 2016). Meanwhile, in the motivation questionnaire, there were no suggestions or input, so no improvements were made.

Furthermore, empirical validation of the instrument was carried out on 44 students of class XII Chemistry at SMA Negeri 7 Pontianak. The results of the empirical validation test for the items of creative thinking ability and learning motivation using the Winsteps Rasch program. Based on the results of the validation test, it can be concluded that the number of 10 creative thinking ability questions and 30 learning motivation questionnaire statements are valid, meeting at least two criteria. The Rasch model is used in the validity of questions and questionnaires because it is able to define item construct validity, which states that the item is valid and can measure what should be measured (Maulana & Aroyandini, 2024).

Then the instrument reliability test is carried out. This reliability can also provide information about the consistency of statement items on an instrument, as well as the detailed relationship between the properties of items on the instrument and how individuals respond to these items (Bodzin et al., 2020). Based on the results of the reliability test, it can be concluded that the question of creative thinking ability has item reliability with a very high category and person reliability and Cronbach alpha are sufficient. Meanwhile, the learning motivation questionnaire has item reliability, person reliability, and Cronbach alpha in the moderate category.

E-Modules that have gone through the validation process, practicality assessment, and readability as well as revisions, can then be used in classroom learning activities. The E-Module was widely tested on students who had not studied stoichiometry material, namely students of class XI Chemistry of SMA Negeri 7 Pontianak. This trial aims to determine the effect of the inquiry-based E-Module integrated with STEM on stoichiometry material on improving students' creative thinking skills and learning motivation.

This field trial was carried out in three stages: (1) *pretest* to determine the creative thinking ability and learning motivation of students on stoichiometry material before treatment; (2) learning in experimental and control classes for four meetings; and (3) *posttest* to measure changes in students' creative thinking ability and learning motivation on stoichiometry material after treatment.

The results of the field trials that have been carried out are as follows: (1) the creative thinking ability of students before being given treatment, stated that there was no significant difference with an average value of 70.64 in the experimental class and 67.95 in the control class. Meanwhile, after being given treatment in the experimental class learning using E-Modules, it states that there is a significant difference between the two classes with an average value of 87.91 in the experimental class and 79.89 in the control class, (2) student learning motivation before being given treatment, states that there is no significant difference with an average value of 67.13 in the experimental class and 68.42 in the control class. Meanwhile, after being given treatment in the experimental class learning using E-Modules, it states that there is a significant difference between the two classes with an average value of 83.19 in the experimental class and 80.09 in the control class.

After that, statistical tests were carried out to analyze the results of students' creative thinking skills and learning motivation on stoichiometry material. This analysis aims to determine the feasibility of the E-Module empirically by knowing its effectiveness to improve students' creative thinking skills and learning motivation. All data results of students' creative thinking ability and learning motivation towards stoichiometry material were analyzed using the manova test to see whether or not there was a difference between the experimental class and the control class. Before the manova test, it is necessary to do some assumption tests.

After the nine assumption tests are completed, the manova test can be conducted. The manova test is divided into two, namely the manova test of creative thinking ability *pretest* data and learning motivation *pretest*, and creative thinking ability *posttest* data and learning motivation *posttest*. This decision can be made by analyzing *Pillae Trace*, *Wilk Lambda*, *Hotelling Trace*, *Roy's Root*. The analysis results obtained are as follows: (1) pretest data, has a significance of 0.056 greater than 0.05 (Sig. > 0.05) simultaneously, a significance of 0.146 greater than 0.05 (Sig. > 0.05) on creative thinking ability, and a significance of 0.058 greater than 0.05 (Sig. > 0.05) on learning motivation. This states that there is no significant difference in the creative thinking ability and learning motivation of students simultaneously and respectively, between the experimental class and the control class, and (2) posttest data, has a significance of 0.000 which is smaller than 0.05 (Sig. <0.05) simultaneously and respectively. This states that there is a significant difference in the creative thinking ability and learning motivation of students simultaneously and respectively, between the experimental class and the control class.

The difference in students' creative thinking ability and learning motivation towards stoichiometry material as well as the different improvement between the experimental class and the control class shows that the E-Modul has an effect simultaneously and respectively on creative thinking ability and learning motivation. The magnitude of the influence of E-Modules on creative thinking skills and learning motivation on stoichiometry material can be seen by calculating the *effect size* with the *partial eta square* value. The results of the calculation of the *effect size* on the effect of the STEM Integrated Inquiry-Based E-Module on Stoichiometry Material on creative thinking ability is 0.148, meaning that the effective contribution given is 14.8%. Meanwhile, the learning motivation is 0.440, meaning that the

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effective contribution given is 44.0%. Simultaneously, the effective contribution is 0.484, meaning that the effective contribution given is 48.4%.

Analysis of the improvement of creative thinking skills and learning motivation on stoichiometry material between experimental and control classes. This can be seen through the calculation of *Gain Score*. Based on the data obtained, the *Gain Score of* creative thinking skills in the experimental class and control class is included in the medium category, with a value of 0.60 in the experimental class and 0.37 in the control class. However, the *Gain Score* in the experimental class was higher than the control class. This shows that there is a higher increase in creative thinking skills in the experimental class than the control class. This agrees with research (Sutrimo et al., 2019), showing that inquiry-based learning media can improve students' creative thinking skills. Meanwhile, the results of the Gain Score of students' learning motivation in the experimental class and control class were included in the moderate category, with a value of 0.49 in the experimental class and 0.37 in the control class. However, the *Gain Score* in the experimental class is higher than the control class.

This shows that there is a higher increase in student learning motivation in the experimental class using the STEM Integrated Inquiry-Based E-Module on Stoichiometry Material than the control class without using the E-Module. This agrees with research conducted by (Awwaliyah et al., 2021), showing that the use of E-Module Flipbook can increase student learning motivation.

**Disseminate**

The last stage in this development model is dissemination, which aims to distribute the revised product and show consistent results, as well as obtain positive responses from experts, reviewers, and learners. At this stage, three main activities are carried out, namely summative evaluation, final packaging, and product dissemination.

Summative evaluation aims to assess the impact of learning materials in e-modules on the achievement of learning objectives in real conditions. This e-module is applied to learners who are not involved in the previous development testing stage, so that the results can reflect the effectiveness objectively. Evaluation results that show effectiveness and product acceptance are in line with the findings of (Waruwu, 2024), which states that a product is suitable for use if it has passed the effectiveness test through the involvement of experts, users, and field tests.

After implementation, the E-Module enters the final packaging stage, which aims to present the product in a practical, effective and efficient manner. Good packaging is essential in visual communication design, as it affects how the product is received and understood by users. This research is in line with the findings of (Kaihatu, 2014), which emphasizes the importance of visual aspects in improving user comprehension and engagement with learning media. An attractive and functional design is proven to facilitate access and use of the module by learners.

Furthermore, the diffusion stage is carried out, which is the process of spreading the innovation so that it is recognized and adopted by the community. Furthermore, the diffusion stage is carried out, which is the process of spreading the innovation so that it is recognized and adopted by the community. This research is in line with the concept of innovation diffusion proposed by (Muntaha & Amin, 2023), which states that product adoption is strongly influenced by the effectiveness of innovation communication through the right channel and appropriate time. The publication of this e-module in an indexed scientific journal is a form of formal diffusion strategy to introduce the product to teachers, researchers and other stakeholders. Thus, this e-module is not only practically useful, but also has the potential to become a reference for the development of learning media and further research.

This research has important practical implications for educators, students, and curriculum developers. For educators, this STEM-integrated inquiry-based e-module can be used as an innovative learning media to create a more interactive and meaningful learning process. For students, the use of this e-module can significantly improve creative thinking skills through explorative and inquiry activities, as well as encourage learning motivation due to its interesting, contextual, and easily accessible presentation independently. Meanwhile, for curriculum developers, the results of this study can be a reference in designing digital teaching tools that integrate the STEM approach to support the development of 21st century competencies.

## Conclusion

Referring to the research findings, it can be concluded that the STEM-integrated inquiry-based E-Module on stoichiometry material can be categorized as very feasible, very good in practicality, and effective. This E-Module can be accessed via a link and is compatible with *smartphones* or laptops. The score obtained based on expert validation is 144 out of 160, reviewer assessment is 71 out of 80, and student responses are 46.22 out of 52. Field trials showed that there were significant differences in creative thinking ability and learning motivation simultaneously and respectively, with a significance value of 0.000 <0.05, and obtained an effective contribution to the use of E-Modules to increase creative thinking ability and learning motivation simultaneously by 48.4% and respectively by 14.8% (creative thinking ability) and 44.0% (learning motivation).

## Recommendation

Teachers are advised to use the inquiry-based STEM-integrated e-module as an alternative learning media in stoichiometry material to increase student motivation, engagement, and creative thinking skills. In addition, teachers can link chemistry concepts with contextual issues such as forest fires to make learning more relevant and meaningful. Simple training in the use id module developer applications should also be considered so that teachers can adapt similar media independently. The link of the inquiry-base e-module integrated with STEM on stoichiometry material is as follows: https://online.flipbuilder.com/hartn/agqi/.

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