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# The development of mathematics module: a literature review

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**ABSTRACT**

Distance learning due to covid-19 presented major challenges for regulators, teachers, students and parents. Consequently, an emergency curriculum could be used to make it easier for teachers to facilitate and monitor student learning and assisted parents in getting tips and strategies in assisting children to learn from home. This study aimed to explore existing study trends in mathematics module development. It conducted a literature review with two steps, including database search and thematic analysis. The study is limited to Indonesian and publications in the last five years with an electronic database search from Google Scholar. The result indicated that most research used the ADDIE model (Analysis, Design, Develop, Implement, and Evaluate) in the development of mathematics modules. The development of mathematics modules is widely used for all level of educational institution. Meanwhile, contextual learning became a favorite approach for researchers. Furthermore, this study suggests developing e-module to support distance learning during covid-19.



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## Introduction

The Covid-19 pandemic has a multidimensional impact on human activities, including educational sector. Many countries have closed educational facilities at various levels, from early childhood education to higher education. The Covid-19 pandemic also threatens the sustainability of education, such as a change from face-to-face learning process to distance learning which has an impact on the preparedness and psychology of parents and children. In addition, uncertainty and inequality between community groups and regions in accessing education facilities [1].

The Indonesian government through the Ministry of Education and Culture issued a Minister Decree Number 719/P/2020 concerning Guidelines for Implementing Curriculum in Education Units in Special Conditions. These regulations provide flexibility for schools to choose a curriculum that suits the learning needs of students [2]. The options available are 1) referring to the current national curriculum; 2) using the emergency curriculum; or 3) simplifying the curriculum independently [3].

Facing these conditions, teachers' innovation in the learning process during pandemic which is based on needs analysis has a crucial role. Such as in mathematics learning process which is abstract, but requires concrete objects and explanations from the teacher. The pandemic which affects the learning goes online, lead the society literate towards technology. However, it has many negative impacts, such as teachers and students

not being able to provide feedback quickly, students' understanding of the material is not in depth, and assessments are only carried out through test results[4].

Mathematics learning strategies in the midst of the Covid-19 pandemic require the development and innovation to overcome the problems and meet learning objectives. Especially with the flexibility in the use of curriculum. One strategy that can be implemented is innovation in the preparation of mathematics learning modules.Module contains a set of learning experiences which planned and designed to help students mastering the specific learning objectives. The module serves as independent learning tool, in order the students are able to learn at their own celerity[5].

This study aims to analyze research trends related to the development of mathematics modules. Both from the aspect of the effectiveness level and the learning approach related to the mathematics module.

## Method

This research was conducted with a literature review approach. Data collection with documentation techniques from secondary sources available on Google Scholar. The keywords used are "Modul Matematika" and "Pengembangan Modul AND Matematika". The inclusion criteria are scientific journals in Indonesian and published between 2016-2020. Based on the search, 21 articles were obtained, but only 9 articles that met the inclusion criteria. Scientific articles that met the criteria were analyzed descriptively.

## Results and Discussions

Based on inclusion criteria, nine scientific articles were analyzed to describe the research trend about the development of mathematics learning modules from various perspectives. Table 1 is the summary of the scientific articles that met the inclusion criteria..

Table 1 <Summary of Scientific Articles that Meet the Criteria>

| No | Object | Approach | Source |
|---|---|---|---|
| 1 | Junior high school | Discovery learning | [6] |
| 2 | Senior high school | Contextual learning | [7] |
| 3 | Higher education | Contextual learning | [8] |
| 4 | Senior high school | Cooperative learning | [9] |
| 5 | Higher education | - | [10] |
| 6 | Elementary school | Contextual learning | [11] |
| 7 | Elementary school | - | [12] |
| 8 | Junior high school | Contextual learning | [13] |
| 9 | Vocational high school | Metacognitive Approach | [14] |

Previous research related to the development of mathematics modules at various levels of education used variety of approaches. For instances, some researchers use the contextual learning approach [7], [8], [11], [13].This approach becomes dominant as it assumed that learning material based on experiences and observations from everyday life will be easier for students to understand. This approach is not only a medium for the knowledge transformation from teacher to student, but also able to facilitate students in developing life skills, including mathematics[5].

In addition, other studies use different approaches, such as discovery learning [6], cooperative learning [9], and metacognitive approach [9].*First*, the development of mathematics module with discovery learning approach is aimed at directing students to independently discover and investigate the concept from mathematics learning[6].*Second*, the cooperative learning approach that prioritizes student collaboration in solving math problems[9]. *Ketiga*, metacognitive approach where the learning module is designed to train students to explore the best strategies in choosing, remembering, recognizing, and organizing the information and solving the math problems [9].

The different approaches used in module development are based on students' needs in solving math problems. On the other hand, the development of mathematics module is carried out using the Research and Development (R&D). As a complement to the R&D approach, researchers in the development model use the ADDIE(Analysis, Design, Development, Implementation, and Evaluation)concept[6]–[8], [13].ADDIE concept is done in five steps. *First*, the analysis consists of two stages, namely performance analysis and need analysis.*Second*, the design consists of several stages, such as 1) determining the title of the module, 2)

preparing relevant references, 3) identifying basic competencies and designing appropriate learning activities, 4) identifying indicators of competency attainment and designing forms and types of assessments, and 5) designing the module. *Third*, product development which made with several indicators, such as module form (print or electronic); designed in an attractive, varied, and communicative; equipped with information in the form of text and images; compiled in a good writing format; and adapted to the approach used. *Fourth*, implementation, which is in the form of testing the effectiveness of module practicalization in class. *Fifth*, an evaluation to analyze the feasibility of the module developed at the implementation stage and to revise the product based on feedback.

Furthermore, data on the module effectiveness in mathematics learning from previous studies are presented in Figure 1.

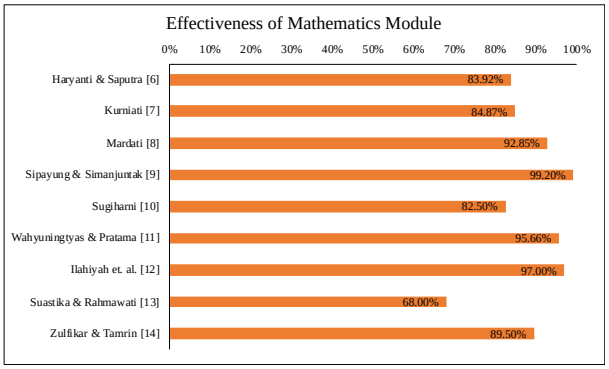


**Figure 1 <Effectiveness of the Use of Mathematics Module in the Learning Process>**

Based on Figure 1, eight studies reach the effectiveness level above 80% and one study below 80%. The assessment is taken from two sides, namely the expert and student perspectives. The expert perspective is carried out before implementation and the student's perspective after the module is implemented in real groups.

Quality assessment of mathematics learning modules from the expert is generally seen from two aspects, namely the material and module design [6]–[9], [11].More specifically, the feasibility analysis is also viewed from the language, graphics, and presentation methods [12]–[14].As for the electronic math module, expert judgement is reviewed from the main discussion, learning materials, learning objectives, file format accuracy, cover design, web blog design, and accessibility[10].Furthermore, the instrument of module assessment from students' perspective is relatively varied. The most important indicator is related to learning materials [6], [12]–[14].Language aspect [6], [12], [14], presentation, usefulness, and attractiveness [12][13]are also possible aspects as math module assessment.

## Conclusions

This study aims to analyze research trends on the development of mathematics modules in Indonesia. The results of the literature review reveal that most research used the ADDIE model (Analysis, Design, Develop, Implement, and Evaluate) in the development of mathematics modules. The development of mathematics modules is widely used for all level of educational institutions. Meanwhile, contextual learning became a favorite approach for researchers. Furthermore, this study suggests developing e-modules to support distance learning during covid-19.

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