



# Needs Analysis and Design of FlipBook-Based E-Module Development with RME Model to Improve Students' Concept Understanding Ability

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## Abstrak

Penelitian ini dilatarbelakangi dengan belum terdapatnya sumber belajar yang menarik bagi siswa, dan belum tersedianya bahan ajar berupa E-Modul. Penelitian ini merupakan penelitian observasi terkait dengan pentingnya pengembangan bahan ajar terutama pengembangan E-Modul Berbasis Flipbook dengan model pembelajaran Realistic Mathematis Education (RME) untuk meningkatkan kemampuan pemahaman konsep siswa dalam materi Trigonometri. Metode yang digunakan yaitu Research and Development (R&D) dengan menggunakan model pengembangan 4D (defain, Design, Develop, Disseminate). Penelitian ini menggunakan instrumen penelitian berupa angket yang diberikan kepada setiap siswa kelas X SMA, dimana angket ini berisi tentang pertanyaan terkait dengan kebutuhan yang akan digunakan sebagai acuan dalam pengembangan dari E-Modul. Dari hasil angket tersebut maka didapatkan data berupa analisis kebutuhan yang dijadikan sebagai acuan pengembangan E-Modul. Hasil yang didapatkan kemudian disusun berdasarkan kebutuhan siswa. Pengembangan ini dilakukan sebagai upaya untuk menciptakan perubahan terhadap E-Modul. Sehingga diharapkan E-Modul ini dapat menarik minat belajar siswa, dan dapat meningkatkan kemampuan pemahaman konsep siswa.

## Abstract

This research is motivated by the lack of engaging learning resources for students and the absence of instructional materials in the form of E-Modules. The study is an observational research that focuses on the importance of developing teaching materials, particularly the development of Flipbook-Based E-Modules using the Realistic Mathematics Education (RME) instructional model, to enhance students' understanding of Trigonometry concepts. The method used is Research and Development (R&D), employing the 4D development model (Define, Design, Develop, Disseminate). The research utilizes a research instrument in the form of a questionnaire that is given to each 10th-grade high school student, and the questionnaire contains questions related to the needs that will be used as a reference for the development of the E-Module. Based on the questionnaire results, data analysis of the needs is obtained, which serves as a reference for the development of the E-Module. The results are then organized based on the students' needs. This development is conducted as an effort to bring about changes to the E-Module. Therefore, it is expected that this E-Module will attract students' interest in learning and improve their understanding of concepts.

## INTRODUCTION

In enhancing education, instructional tools need careful consideration. According to Utami et al., as cited in Nurhidayat and Asikin (2021), one crucial aspect is the teaching materials used. Teaching materials serve as aids to facilitate the learning process. As stated by Depdiknas, as cited in Gazali (2016), teaching materials constitute a set of systematically organized content, whether written or not, to create an environment that enables students to learn.

Teaching materials undergo significant development tailored to their needs. As articulated by Seels and Richey, as cited in Cahyadi (2019), this development encompasses a wide range of technologies used in learning, inseparable from practices and theories related to learning and design. Furthermore, the development of teaching materials can be implemented

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through products such as print technology, audiovisual technology, computer-based technology, or integrated technology.

The development process occurs due to several reasons, including rapid technological advancements, the need for improving the quality of the subject being developed, adapting to ongoing changes or advancements, increasing competitiveness, and staying abreast of the evolving challenges of the times. One area that undergoes development is instructional materials. As highlighted by Syaspasbandah et al., as cited in Atikah, N, et al. (2021), one cause of students' disinterest and inadequacy in learning is educators using teaching materials that fail to capture students' attention. Meanwhile, Fajri et al., as cited in Atikah, N, et al. (2021), state that the teaching materials employed by educators lack orientation towards real-life situations. Therefore, the development of teaching materials is a necessity that cannot be overlooked.

In this context, development is a conscious effort made to achieve desired goals for greater perfection than before. Based on this understanding, the development of teaching materials is a fundamental principle carried out gradually to create materials or tools that educators use in the teaching process, ensuring that the desired objectives are achieved more perfectly than before.

One of the instructional materials that require development is modules, with one of the transformations being the shift from print-based modules to electronic modules, known as e-modules, accessible digitally. Undoubtedly, in the teaching and learning process, instructional modules play a crucial role in achieving learning objectives. Creating modules in a more efficient and engaging format can be a way to capture the interest of secondary school students in reading modules, as electronic modules often include interactive elements such as animations, videos, images, and audio (Widiana and Rosy, 2021). As expressed by Rifqa Destiyana, as cited in Sutrisno (2019), E-modules are components of electronic-based learning (e-learning) that leverage information and communication technology, primarily electronic devices. E-modules are typically electronic files that can be downloaded, accessed via computers, tablets, or smartphones, and can encompass various media such as text, images, audio, video, and interactivity. The background issue driving the development of instructional materials lies in the need to enhance the learning experience.

One software tool utilized for creating attractive e-modules is the flipbook. Flipbook software, as described by Hayati, Budi, Handoko (2015), serves as an editing tool to add hyperlinks, images, videos, and sound to support content, enhancing the learning experience by creating interactive pages that mimic flipping through a physical book. Flipbooks aim to aid students in understanding the material, improve learning outcomes, enhance creative thinking skills, and boost student motivation. Thus, the use of digitally-based flipbook e-modules presents an intelligent solution to create an engaging and interactive learning environment that supports students' understanding of the material. In the development of e-modules, the research incorporates the Realistic Mathematics Education (RME) learning model.

In 1973, Freudental introduced a new model in mathematics education known as Realistic Mathematics Education (RME), or alternatively termed as PMR (Pembelajaran Matematika Realistik). Realistic Mathematics Education (RME) was initially developed in the Netherlands, as cited by Andriani in (Sari & Yuniati, 2018).

Realistic Mathematics Education is an instructional approach that starts from the real world to develop mathematical concepts and ideas, integrating mathematics into everyday life. This approach makes the learning process more meaningful and memorable for students (Sari & Yuniati, 2018). According to Hadi, as mentioned in Ananda (2018), the real world serves as the starting point for developing ideas and mathematical concepts within RME.

The characteristics of Realistic Mathematics Education (RME), as outlined by Tarmudi in (Rodiyana, Cahyaningsih, & Halimah, 2019), include the use of context, employing models for progressive mathematization, utilizing students' construction results, interactivity, and interconnectedness in realistic learning activities.

Therefore, as future educators, it is crucial to choose the right teaching model for the learning process. By employing the RME model, mathematics education in the classroom prioritizes the connection between mathematical concepts and students' everyday experiences.

Educators should further apply mastered mathematical concepts in students' daily lives or other fields, following the steps outlined in the Realistic Mathematics Education (RME) approach. Proficiency in mathematical concepts involves mastery of the material, the ability to understand, absorb, and apply it in mathematical learning. Moreover, individuals should express these concepts in alternative forms for better understanding and apply them to solve both simple and complex problems.

According to research conducted by Suherman in 2021, the ability to comprehend concepts plays a central role in the mathematics learning process. Suherman emphasizes that mathematical concepts are systematically, logically, and hierarchically organized, ranging from the easiest and simplest to the most complicated and complex. This perspective aligns with the theory proposed by Jerome Bruner, renowned for the Bruner theory. Bruner states that the success of mathematical learning can be achieved more effectively by focusing the teaching process on underlying concepts and structures. Additionally, it is crucial to consider the interrelated connections between these concepts and existing structures (Suherman, 2021; Bruner, 1998).

In this context, the research conducted serves a highly relevant purpose. The study aims to perform a Needs Analysis and Design Development of FlipBook-Based E-Modules by applying the Realistic Mathematics Education (RME) Model. The RME Model is recognized as a mathematics learning approach that emphasizes real and contextual experiences to help students better understand mathematical concepts. By utilizing FlipBook-Based E-Modules, this research aims to enhance students' conceptual understanding in mathematics learning (Handican, 2023).

This research aligns with the broader understanding that effective mathematics education involves a focus on concept comprehension and the utilization of innovative teaching models. The integration of the RME Model and technology-based tools, such as FlipBook-Based E-Modules, demonstrates a forward-looking approach to improving the learning experience and outcomes in mathematics education. In conclusion, Suherman's research underscores the significance of conceptual understanding in mathematics learning, a notion supported by Bruner's theory. The current study, adopting the RME Model and E-Modules, aims to contribute to this understanding by enhancing students' conceptual grasp in mathematics. This research not only aligns with established theories but also reflects a progressive approach in leveraging technology for more effective learning outcomes in mathematics education (Barel, 2022).

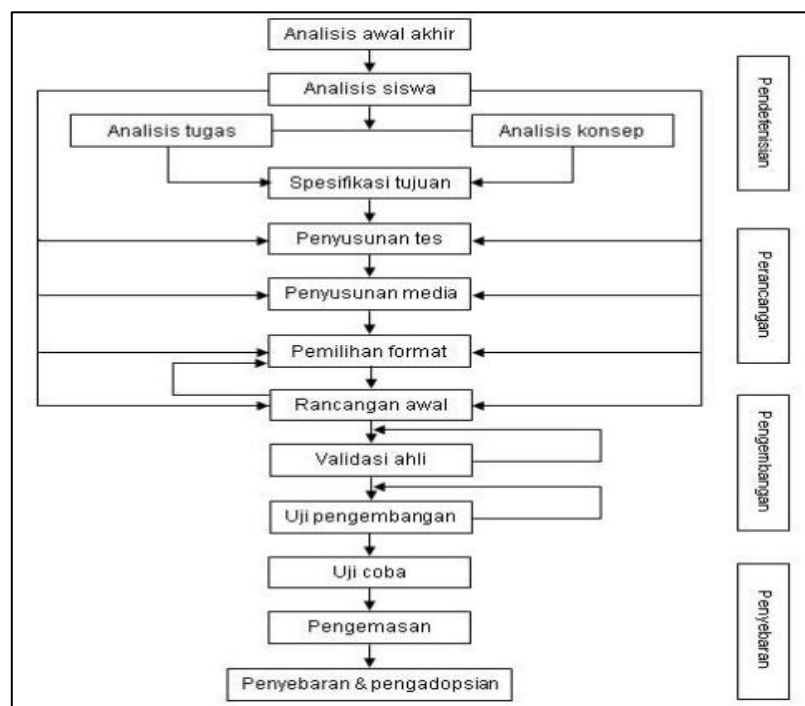
This research introduces significant innovation through two main aspects: the unavailability of engaging learning resources for students and the absence of teaching materials in the form of E-Modules. The scarcity of captivating learning resources can pose a hindrance in the learning process, potentially reducing students' interest and motivation to comprehend mathematical concepts, especially in Trigonometry. Additionally, the presence of FlipBook-based E-Modules represents a substantial innovation, considering technological advancements and the trend of using digital media in education. The incorporation of technology in learning, such as FlipBook, can provide a more interactive and engaging learning experience for students, enabling them to actively participate in the learning process.

The analysis of innovation can be conducted by comparing this research with previous studies. Most earlier research may not have focused on the development of FlipBook-based E-Modules with the Realistic Mathematics Education (RME) learning model in the context of Trigonometry. Therefore, this research can be considered an innovative step in addressing the lack of engaging learning resources and enhancing student involvement through the utilization of technology. This comparative analysis provides a strong foundation to assess the uniqueness and contribution of this research to the advancement of more effective methods in mathematics education. In conclusion, this research not only identifies challenges in traditional learning resources but also proposes innovative solutions through the development of FlipBook-based E-Modules. By employing the RME model, it strives to create a more engaging and effective

learning environment, marking a significant contribution to the evolution of mathematics education methods.

## METHOD

In the development of this E-Module, the researcher utilizes the Research and Development method, which is a research method employed to develop and test products within the educational context. According to Sugiyono (as cited in Haryati, 2012), the research and development method is an approach used to generate specific products and test their effectiveness. Amali et al (as cited in Maydiantoro, A, 2021) state that there are several research models that can be referenced in this research and development process. One of them is the 4D development model. The 4D development model, developed by Thiagarajan et al (as cited in Zahid, 2018), follows four main stages in the development process. These stages include define (definition), design (designing), develop (development), and disseminate (dissemination).



**Figure 1.** Stages of the 4D Development Model

The define stage in the development of FlipBook-based E-Module involves various analyses related to the learning material and the learners who will use it. Front-end analysis is conducted by examining the curriculum, establishing learning objectives, and analyzing relevant learning theories that can be integrated into the E-Module. In the learner analysis stage, characteristics of learners are studied to gain a clear understanding of the E-Module design that aligns with their needs. Concept analysis is performed to determine the material that will be taught using the developing E-Module.

In the design stage, the designed outcomes (storyboard) are then translated into interactive media displays. The next stage is the development stage, involving validation by experts and testing. The results of expert validation serve as a basis for revising and improving the E-Module. Subsequently, the E-Module is tested with a small number of learners. In this trial, learners use the E-Module and provide feedback on its suitability, usefulness, and user-friendliness. The results from expert validation and testing serve as a foundation for developers to make improvements, adjustments, and refinements to the E-Module before moving it to the dissemination stage.

The final stage is the dissemination stage. In this stage, the developed product will be disseminated, promoted, and distributed to the audience. The goal of the dissemination stage is

to obtain information about the acceptance of the developed product. At this stage, feedback and critiques may arise regarding the product, which can be used as evaluative input for making improvements to the E-Module.

## **RESULT AND DISCUSSION**

### ***Results of Needs Analysis***

Module is one of the teaching materials that can be used by teachers and students as a reference in learning, especially for the subject of mathematics. Modules need to be designed to enhance students' learning activities, particularly to improve their understanding of concepts. In presenting a learning module, innovation can be achieved by combining the learning module with existing teaching models. One model that can be integrated with a learning module is a model that assists students in understanding the concepts of the learning material. The development of FlipBook-based learning modules using the Realistic Mathematics Education (RME) model aims to improve the mathematical conceptual understanding of 10th-grade students in high school.

In designing the E-Module, a needs analysis is essential as a reference in module development. Analyzing needs is a crucial activity in designing learning materials. In this case, it aligns with the design objective developed to assist in addressing students' learning needs and teachers' teaching needs, manifested in the learning process. As expressed by John Mc Neil (cited in Nasrullah & Ismail, 2017), needs analysis is an integral cycle with program development, implementation, and evaluation. In the analysis phase, a needs analysis for student learning is conducted. Designing learning that begins with a needs analysis allows the results to be optimally utilized by individuals who require it in relation to learning using the E-Module.

The results of the needs analysis obtained through questionnaires given to each student aim to determine whether mathematics learning requires an e-module as a necessary teaching material. As stated by Siregar & Safitri (cited in Nasrullah & Ismail, 2017), students need teaching tools that can be used for self-learning, are flexible, easily accessible, and have materials that are easy for students to learn. The following are the needs analysis results based on the questionnaires given to 10th-grade high school students.

Based on the analysis results, it was found that students who like the color blue were , black, and white . Therefore, the colors used in creating this E-Module are a combination of these three colors or based on the favorite color data of the students. In addition, based on questions about the preferred font type, it was found that, on average, students prefer font number 1. A total of 71.4% of students chose font number 1, which is the "Time New Roman" font.

Based on the analysis results, 66.7% of students more frequently use electronic devices such as smartphones, while the usage of laptops and smartphones combined is 33.3%. A smartphone is an electronic communication device with basic capabilities similar to conventional fixed-line telephones but is portable or mobile, allowing it to be carried anywhere without the need for a wired telephone network (Mokalu, Mewengkang & Tangkudung, 2016). Besides being more portable, students are also more proficient in using smartphones because they have used them during online schooling. Therefore, creating an E-Module can be utilized by students to support better learning. It was also found that all students frequently use electronic devices in their daily lives. Additionally, based on data from KOMINFO, Indonesia ranks 6th globally in terms of internet usage (kominfo.go.id). Hence, the development of electronic-based modules is highly feasible and can be effective.

The availability of facilities in schools, such as projectors or infocus screens, also supports electronic-based learning. According to Safitri & Dafit (2021), using infocus media makes learning more lively and varied. The use of infocus is merely a supporting means to capture students' attention.

Based on the needs questionnaire results, it is evident that 100% of students require modules in the learning process, especially in mathematics. According to them, mathematics is one of the difficult subjects that is challenging to learn, and they need easily understandable

learning resources to improve their conceptual understanding and solve problems in mathematics lessons. The understanding of mathematics is more meaningful when built by students themselves and not forced upon them, as mentioned by Marpaung (Lasmiyati & Harta, 2014).

Based on the survey results, 85.7% of students express a preference for an E-Module that can be accessed both online and offline, while 14.3% prefer an E-Module accessible only offline. According to the respondents, the presence of electronic modules (E-Modules) can aid students in better understanding mathematical concepts, and they emphasize the need for modules that can be accessed in both online and offline modes.

The survey findings also highlight the importance of electronic modules (E-Modules), especially in the field of mathematics. Utilizing electronic modules allows for a transformation of static content found in print modules into a more dynamic and interactive format (Najuah, Lukitoyo, & Wirianti, 2020). Respondents believe that having electronic modules can significantly contribute to enhancing students' understanding of mathematical materials.

### **Results of E-module Design**

Design is commonly used in the context of art, building techniques, architecture, and so on, both as a noun and a verb. As a verb, design can mean to plan or develop a plan for the structure, product, or component. As a noun, design refers to a final plan or solution, such as a proposal, drawing, model, or description, or the result of implementing a plan, like creating an object or the outcome of a process (Nugroho, 2021).

The design stage comes after the analysis of needs, where according to Hildani & Safitri (as cited in Nurjanah, et al., 2022), after identifying the main problems and generating ideas to effectively address them in the previous stage, the next step is the design phase. In this design phase, various elements need to be considered, including color, font type, material, and the design's form. Romaito et al. (as cited in Nurjanah, et al., 2022) emphasize that in design, attention should be paid to creating questions, additional components of the developed E-Module, such as Core Competencies (CC), Basic Competencies (BC), learning objectives, and learning content.

The researcher in this study designs a learning tool in the form of an Electronic Module (E-Module). The E-Module is developed according to the material to be taught through the developed Lesson Implementation Plan (LIP). In this research, the researcher focuses on the topic of Trigonometry, covering angle measurement and basic concepts of angles, trigonometric ratios in right-angled triangles, and trigonometric ratios for related angles.

### **Flowchart**

According to Batubara, H. H. (2018), it is stated that in designing instructional materials for mathematics learning based on E-Module, several stages are carried out. These stages include mapping basic competencies and learning objectives, determining assessment tools, structuring material content, and designing the flowchart model of the instructional media program. The developed instructional media flowchart is as follows.

Flowchart plays a crucial role in the development of mathematics learning modules. The main idea behind the use of flowcharts is to provide visualization of the steps in mathematics learning, enabling teachers and students to better understand complex mathematical processes. By illustrating the thought flow, concepts, and connections between mathematical topics, flowcharts can assist in designing systematic and structured modules. Relevant references supporting this concept include research by Jones and Childers (2007) on the use of flowcharts in mathematics learning, enhancing student understanding, and the textbook by Cai and Hwang (2015) discussing the application of technology in mathematics module development. Additionally, Mayer's (2009) research on multimedia learning emphasizes the importance of visualization in mathematics education. Flowcharts can help maximize the potential of mathematics modules as effective and efficient learning tools. In conclusion, the use of flowcharts in developing mathematics learning modules can enhance student understanding and facilitate the teaching and learning process in a structured and systematic manner.

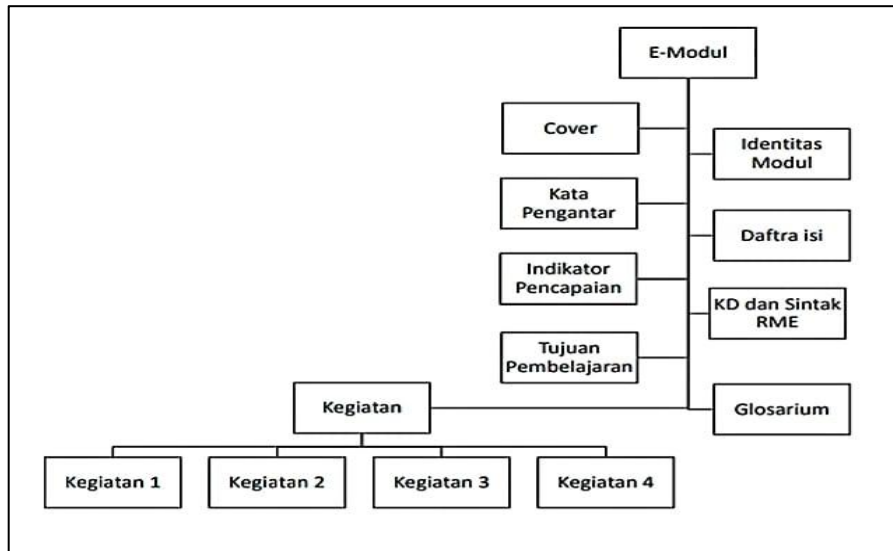


Figure 2. flowchart of E-Module Design

### Storyboard

According to Kencaanawaty et al. (2021), storyboards are created to determine the display of the application screen containing menus tailored to the needs. The screen layout is crafted based on the proposed storyboard in alignment with the screen display. The main idea behind using storyboards is to provide detailed and structured visual guidance for module developers, aiding in designing more engaging and effective mathematical content. Research by Paolini et al. (2013) highlights the importance of storyboards in facilitating interactive and creative design in mathematics education. Other references include the work of Guo and Zhang (2017), emphasizing the role of storyboards in visualizing abstract mathematical concepts, and research by Ben-Ari (2015) describing the use of storyboards to plan the use of technology in mathematics education. Over the past decade, the use of storyboards has become a tool that not only facilitates module development but also enhances the quality and appeal of mathematics education. Therefore, storyboards have become a crucial element in the process of designing effective and engaging mathematics learning.

No.	VISUAL	KETERANGAN
I.		Pada halaman ini berisi tentang judul bahan ajar e-modul, identitas penulis, beserta logo.
2.		Pada halaman ini berisi tentang identitas e-modul dan identitas dari penulis.
3.		Pada halaman ini berisi tentang kata pengantar sebagai ucapan terimakasih dari penulis.
4.		Pada halaman ini berisi tentang daftar isi untuk membantu memudahkan mencari materi yang diinginkan.
4.		Pada halaman ini berisi tentang kompetensi inti dan kompetensi dasar sebagai acuan standar kelulusan peserta didik.
5.		Pada halaman ini berisi tentang indikator pencapaian kompetensi sebagai ukuran pencapaian kompetensi dan tujuan pembelajaran sebagai capaian hasil belajar.
6.		Pada halaman ini berisi tentang tahapan atau langkah-langkah dalam memahami materi sesuai dengan modul pembelajaran.
7.		Pada halaman ini berisi tentang materi pertama yang akan diajarkan.
8.		Pada halaman ini berisi tentang materi kedua yang akan diajarkan.
9.		Pada halaman ini berisi tentang materi ketiga yang akan diajarkan.
10.		Pada halaman ini berisi tentang materi terakhir yang akan diajarkan.
II.		Pada halaman ini menjelaskan tentang istilah-istilah yang baru ditemui atau yang baru dikenalkan.

Figure 3. Storyboard

### Cover Design

According to Nurjanah et al. (2022), it is stated that at the high school level, the material is packaged in a concise and systematic manner to assist students in understanding the content with simple and engaging concepts, along with the use of appropriate color combinations. The concept of the module can be seen in the image below.

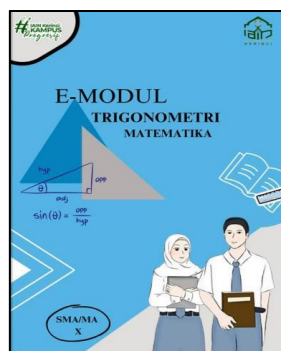


Figure 4. Cover of E-Modul

The importance of having an attractive cover in mathematics learning modules should not be overlooked. The main idea behind this is that an appealing cover can serve as an effective gateway to capture students' interest in the taught mathematical content. Psychological and educational research, as discussed by Zan et al. (2017), indicates that aesthetics and visual appeal can influence students' perception of learning materials. Therefore, an attractive cover can create positive expectations and initial interest, motivating students to actively engage in the learning process. Another supporting reference emphasizing the importance of an engaging cover is the work of Liu and Kim (2020), stating that visually appealing designs on the cover can enhance the module's attractiveness.

### Results of instructional material design in the e-module

The materials included in the E-Module are obtained based on the survey results. According to Latif et al. in (Nurjanah et al., 2022), the learning media materials are produced, organized, and packaged in a concise and systematic manner. The content is presented using engaging and colorful texts. The materials are displayed as follows:

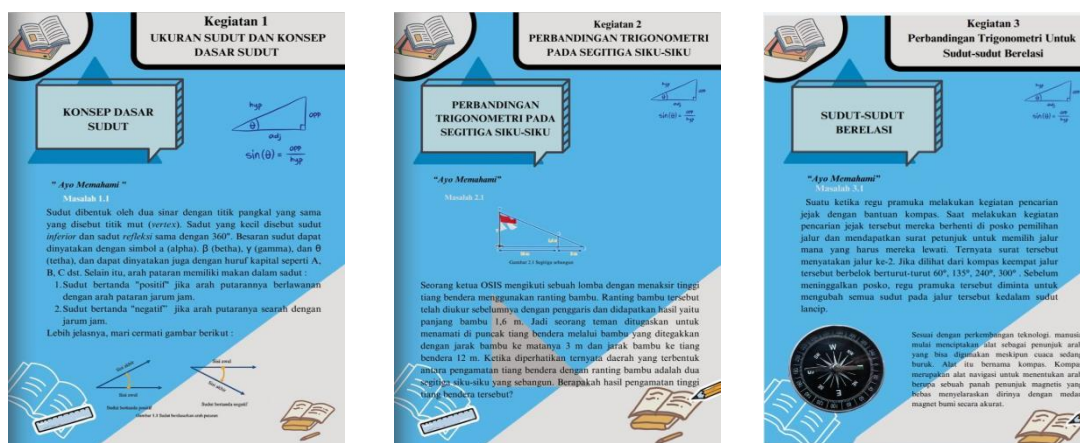


Figure 5. Content of Module

A systematic arrangement of content in mathematics learning modules is crucial for enhancing understanding and the effectiveness of learning. The main idea here is that an organized structure aids students in following the progression of material more effectively. Relevant references supporting this concept include research by Hiebert and Grouws (2007), emphasizing the importance of sequence and arrangement of material in quality mathematics education. Research by Van den Heuvel-Panhuizen (2008) also highlights the significance of



layout and organization of content in mathematics modules that support student understanding. In the past decade, the development of learning technology has further reinforced the importance of a systematic content structure by enabling the use of multimedia and interactive elements organized within modules. In conclusion, a systematic arrangement of material is key to providing a structured mathematics learning experience, helping students follow the progression of content more effectively, and enhancing their understanding.

### Results of the Design of E-module Components

The individual components of this E-Module product are the preface, table of contents, core competencies, basic competencies & RME syntax, indicators of learning goal achievement, and glossary.

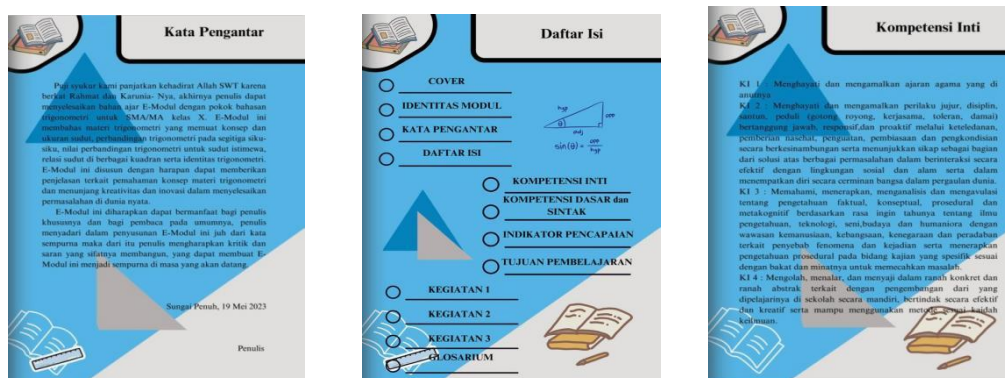
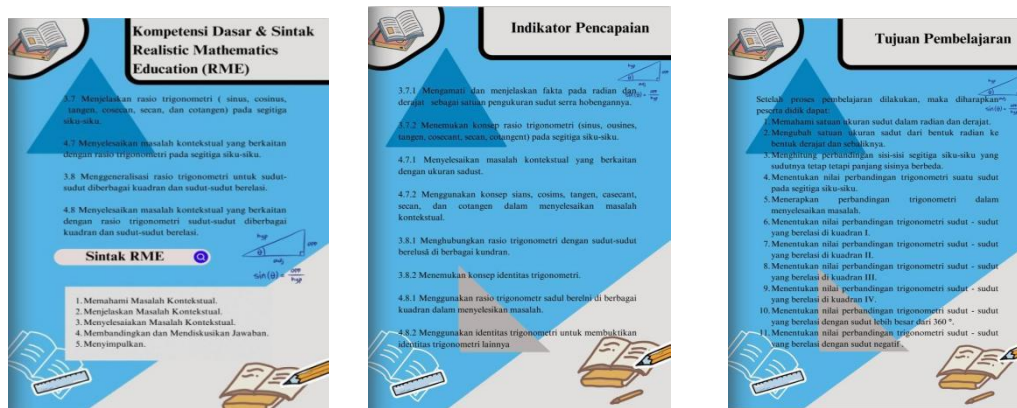


Figure 6. Core Competencies, Preface, Table of Contents

The importance of explanations regarding Basic Competencies, RME Syntax (Realistic Mathematics Education), Achievement Indicators, and Learning Objectives in modules developed in mathematics education is key to ensuring effectiveness and transparency in learning. The main idea here is that Basic Competencies provide guidance on what students should achieve and serve as a foundation for designing appropriate modules. Relevant references include the Curriculum 2013 guidelines that emphasize the significance of Basic Competencies as the starting point for designing mathematics learning. RME Syntax, referring to the realistic mathematics education approach, was introduced by Gravemeijer (2004) to ensure that mathematical material is presented in a relevant and contextual way for students, enhancing their understanding. Achievement Indicators and Learning Objectives assist in measuring student success and guide the evaluation process. In conclusion, clear explanations of Basic Competencies, RME Syntax, Achievement Indicators, and Learning Objectives in modules help teachers and students understand the direction of learning, maximize student understanding, and achieve desired learning outcomes.



**Figure 7.** Basic Competencies & RME Syntax, Achievement Indicators, and Learning Objectives.  
**Discussion**

The development of instructional materials such as E-Modules using tools like flipbooks can aid in enhancing students' fundamental skills, including their understanding of concepts. This is because the E-Module developed employs the Realistic Mathematics Education (RME) instructional model. The interactive nature of this technology involves audio, visual displays, animations, and harmonious color compositions, creating a comfortable viewing experience for students. As expressed by Andini et al. in (Hamid, A & Heffi Alberida 2021), flipbooks use technology to simulate a similar experience to physically opening a book. With animated effects, videos, and music, flipbooks become more attractive and interactive than printed books. Users can feel a different sensation, as if they are physically turning the pages of a book. This makes flipbooks an appealing choice for students, providing a more interactive learning experience and direct engagement with the material.

According to Dedi in (Hamid, A & Heffi, A 2021), interactive E-Module flipbooks, involving audiovisual displays, sound, movies, and more, are easily understandable, making them an excellent learning tool. Meanwhile, according to Etanastia (2022), previous research indicates that electronic modules can enhance students' learning motivation due to the inclusion of interesting images and illustrations. Additionally, the development of these E-Modules aligns with the curriculum needs, specifically the 2013 curriculum (K-13).

Previous research conducted by (Surtini, et al., 2023), focusing on the development of contextual electronic modules based on flipbooks for understanding mathematical concepts, revealed that learning using these modules was more effective than conventional learning models on the topics of sequences and series. The study found that these electronic modules are suitable as a learning resource. The key difference between this research and previous studies lies in the inclusion of examples and materials related to daily life. Unlike earlier research, the presented images in this study are not only in animated form but also include real-life examples.

The research with the title "Needs Analysis and Design of FlipBook-Based E-Module Development with RME Model to Improve Students' Concept Understanding Ability" provides a significant contribution in the context of developing FlipBook-based electronic modules with the Realistic Mathematics Education (RME) approach. Through needs analysis, this research successfully identified the main requirements in mathematics learning and designed electronic modules that align with the RME model. According to Van den Heuvel-Panhuizen (2003), the RME approach focuses on real experiences, representations, and interactions, enhancing students' understanding of mathematical concepts.

This research also refers to previous studies supporting the use of electronic modules to improve conceptual understanding. According to Hmelo-Silver (2004), the use of technology, such as FlipBook, can facilitate active and exploratory learning, enabling students to build a deeper understanding of concepts. Additionally, research by Suhendar et al. (2018) shows that integrating the RME model in module development can enhance students' understanding of concepts and mathematical problem-solving skills.

In the context of needs analysis, this research relies on the Dick and Carey framework (2009), emphasizing the importance of understanding student characteristics and the learning environment before designing instructional materials. Thus, the results of this research contribute to the development of appropriate instructional design in line with student needs.

In conclusion, this research provides a strong foundation for the development of FlipBook-based electronic modules with the RME approach to enhance students' understanding of mathematical concepts. The references include the RME concept (Van den Heuvel-Panhuizen, 2003), the effectiveness of technology use in mathematical learning (Hmelo-Silver, 2004), integration of the RME model in module development (Suhendar, et al., 2018), and the Dick and Carey needs analysis framework (2009). This study establishes a solid basis for educators and curriculum developers to design modules that meet students' needs and support a better understanding of mathematical concepts.

## CONCLUSION

Based on the needs analysis, data on students' responses to the FlipBook-based E-Module show that, particularly in mathematics learning, there is a need for instructional materials in the form of E-Modules. This is because the percentage of students' needs for E-Modules is 100%, with 100% of students responding that they need E-Modules and 0% stating otherwise. The detailed percentage for each aspect within the E-Module is as follows: the percentage of color preference for the E-Module based on students' favorite colors shows that students who like the color blue are, black, and white. The percentage of the aspect of electronic device operation is 100%, where every student can operate the available electronic devices. The software commonly used by students includes 66.7% more frequent use of electronic devices such as smartphones and 33.3% use of laptops and smartphones. Regarding the aspect of the need for electronic E-Modules, 85.7% of students want E-Modules that can be accessed online and offline, while 14.3% prefer E-Modules that can be accessed offline. Based on this needs analysis, the development of this E-Module is tailored to the needs of the students.

In accordance with the results of the needs analysis, the researcher develops instructional materials in the form of an E-Module that is adapted to the previously obtained data. The E-Module, utilizing flipbook technology, is more in demand at present, prompting the researcher to develop this electronic-based E-Module. In this development, the researcher uses the Research and Development method with the 4D development model and the Realistic Mathematics Education (RME) learning model to enhance students' conceptual understanding. The instructional material product, in the form of an E-Module, has advantages such as being more effective and efficient, and easily accessible. Within the E-Module, the teaching material is aligned with the students' curriculum, namely Curriculum 13 (K 13), and adjusted to the daily life context so that students can comprehend the mathematical concepts presented. In developing the E-Module, the module design is adjusted to the needs of the students, starting from color harmony, font types, animations used, learning objectives, and implementation steps aligned with the syntax of the learning model employed.

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