

Development of Teaching Modules Based on the Concept Achievement Learning Model to Improve Critical Thinking Skills in Mathematics

Atira Muhidin¹, Wahyuni Abidin², Sri Sulasteri³

Universitas Islam Negeri Alauddin Makassar

Email: sri.sulasteri@uin-alauddin.ac.id

ABSTRACT

This study aims to develop a teaching module based on the Concept Attainment Learning Model to improve students' mathematical critical thinking skills in Grade VIII at SMPN 3 Anggeraja. The research method used is Research and Development (R&D) with the ADDIE development model (Analysis, Design, Development, Implementation, and Evaluation). The instruments used include validation sheets, learning implementation observation sheets, student activity observation sheets, teacher and student response questionnaires, and a mathematical critical thinking skills test. Expert validation results indicate that the module has a very high level of validity with an average score of 4 (very valid category). The module is also considered practical based on the implementation score of 1.84 (fully implemented category) and positive teacher responses with a percentage of 77.08%. In terms of effectiveness, student activity reached 65.47% (good category), student responses to the module were 78.78% (positive category), and test results showed 5 students in the very high category, 11 students in the high category, and 7 students in the medium category for critical thinking skills. Thus, the developed teaching module aligns with the characteristics of the Concept Attainment Model and mathematical critical thinking skills, and it is considered valid, practical, and effective for use in the learning process.

Keywords: *Module, Concept Attainment, Critical Thinking Skills in Mathematics.*

1) INTRODUCTION

Based on Law No. 20 of 2003, education is a conscious and planned effort to create a learning environment and learning process so that students actively develop their potential to have religious spiritual strength, self-control, personality, intelligence, noble character, and the skills needed by themselves, society, the nation, and the state (Ichsan, 2021, p. 283). This means that education has a very important role in all aspects of life, especially in terms of developing students' potential and improving their thinking skills. In order for human thinking skills to improve, it can be achieved by following appropriate learning guidance, namely through education. If we seek knowledge, our thinking skills will increase. Therefore, good education should produce output for students, both in

Paper presented at The 2nd ICONETT, 2025
Faculty of Teacher Training and Education
Universitas Islam Negeri Alauddin Makassar
South Sulawesi-Indonesia

terms of personality (the bad becomes better), increased intelligence, and the abilities of the students themselves.

A student's ability is inseparable from how well they understand the lessons taught at school. One of the subjects studied at school is mathematics. Mathematics is one of the subjects that plays an important role in fostering students' rational thinking patterns to continue to innovate and improve in all aspects of life (Siwi et al., 2018, p. 55). By studying mathematics, it is hoped that students can develop various skills, especially those related to critical thinking. According to Ekayanti (2020) in (Rahmaini and Ogylva Chandra, 2024, p. 2), mathematics is a basic science, so it is very much needed in the learning process. Mathematics and critical thinking skills are interrelated. Critical thinking will train students to get used to taking small steps first before they can become proficient in higher-level critical thinking.

Critical thinking skills are important for students to have. Critical thinking can be defined as a cognitive skill or strategy used in determining goals (Apiati and Hermanto, 2020, p. 167). Critical thinking is one of the skills needed in learning mathematics. Critical thinking is necessary in mathematics learning because mathematics does not only involve learning concepts, but students also need to improve additional skills such as interpretation, analysis, evaluation, and inference. According to Hidayat in (Gunawan et al., 2021, p. 136), critical thinking enables people to develop themselves in making decisions, judgments, and solving problems. Low critical thinking skills among students will affect the quality of education. Therefore, it is necessary to improve teaching methods in the classroom by applying innovative learning models based on concept understanding, concept development, and concept teaching.

Based on interviews with mathematics teachers at SMPN 3 Anggeraja, the author obtained data showing that a common problem in mathematics learning in grade VIII is students' lack of ability to solve mathematical problems in the form of questions that emphasize conceptual understanding, in this case understanding conceptual definitions, recognizing examples in concepts, connecting concepts with theory, applying concepts in real situations, and analyzing and evaluating concepts. This lack of understanding of mathematical concepts leads to low critical thinking skills among students, as well as a lack of practice and exercises that refer to indicators of critical thinking skills, such as questions that stimulate interpretation, analysis, evaluation, and inference. This can be seen when students are given problems to solve and they immediately answer without first writing down what

they know and do not know (interpretation), students find it difficult to analyze problems and construct them into mathematical forms (analysis), and students use strategies or calculations that are not entirely accurate (evaluation).

In addition to interviewing teachers, the author also interviewed eighth-grade students and found that they had difficulty understanding concepts, felt that mathematics was complicated and involved many formulas that had to be memorized, and were still unfamiliar with solving problems using critical thinking skills such as interpretation, analysis, evaluation, and inference. Another problem faced by students after the interviews with teachers was that although teachers had begun to apply more varied learning models, the obstacle was the students' lack of enthusiasm in participating in learning, both when material was presented and when exercises were given. This was due to the use of learning models that did not attract students' attention, as the teaching materials used were still conventional, namely textbooks. In the learning process, teachers still use textbooks, so students tend to be lazy and unenthusiastic in paying attention to the material in the textbooks. Similarly, the student worksheets used are often just a collection of questions, both fill-in-the-blank and essay questions, without a structured process, so students tend to be lazy and unenthusiastic when working on the questions because the questions given are difficult to understand.

Therefore, it is very important for teachers to develop teaching materials. With teaching materials, students will concentrate on solving the problems given appropriately. Good teaching materials are those that contain systematic learning steps and refer to each critical thinking competency indicator. This is because learning modules are designed to give students the opportunity to work on formulating procedures, analyzing results, and drawing conclusions independently (Pratama et al., 2022, p. 7). A learning module is a set of teaching materials in written or printed form that is systematically arranged, containing learning materials, methods, and learning objectives based on basic competencies and competency achievement indicators that can be learned by students independently (Kosasih, 2021, p. 18). This learning module is considered more effective and more interesting for improving critical thinking skills because the material is presented in a sequence that is in line with the steps of the learning model used and enables students to master concepts more quickly.

Based on this description, this study aims to develop teaching modules based on the concept attainment learning model to improve mathematical critical thinking skills in eighth-grade students at SMPN 3 Anggeraja.

2) METHODS

The type of research used is research and development (R&D) combining qualitative and quantitative approaches. This approach was used because it is in line with the objectives of this study, which are to produce a specific product using needs analysis research (using qualitative methods) and to test the effectiveness of the product (using quantitative methods). The development procedure used in this research is the ADDIE development model, namely, “Analysis, Design, Development, Implementation, and Evaluation”. The research was conducted at SMPN 3 Anggeraja with eighth-grade students as the research subjects. The researcher obtained data using two data sources, namely primary and secondary data. Primary data was obtained directly from informants in the field, namely eighth-grade students and teachers at SMPN 3 Anggeraja. Meanwhile, secondary data was obtained from books and previous research related to this study.

Data collection techniques included interviews, questionnaires, observations, and tests of mathematical critical thinking skills. The instrument of data collection was carried out by conducting data validity instruments such as teaching module validation sheets, teacher response questionnaire validation sheets, student response questionnaire validation sheets, student activity observation validation sheets, learning implementation observation validation sheets, and mathematical critical thinking test validation sheets. Practical data instruments included teacher response questionnaires and learning implementation observation sheets. Effectiveness data instruments included student response questionnaires, student activity observation sheets, and student mathematical critical thinking tests. The data obtained were analyzed using validity, practicality, and effectiveness data analysis techniques.

3) RESULTS AND DISCUSSION

This study aims to determine the development process and the level of validity, practicality, and effectiveness of the developed teaching module. The teaching module based on the concept attainment learning model was developed to improve students' mathematical critical thinking skills. The ADDIE model will be used in this research and development.

a. Analyze

At the analysis stage, three types of analysis were conducted, namely problem analysis, material analysis, and product manufacturing tool analysis. The results obtained are as follows:

1. Problem Analysis

Problems that often arise in mathematics learning in grade VIII are students' low mathematical critical thinking skills and low interest in learning mathematics, as well as the use of learning models that are inappropriate and do not attract students' attention, where the teaching materials used are still conventional, namely textbooks.

2. Material Analysis

At this stage, the researcher analyzed the material that was difficult for students to understand in the eighth-grade mathematics subject. From the interview results, it was found that the material that was difficult for students to understand was probability.

3. Analysis of product manufacturing tools

The researcher also analyzed product creation applications after searching for information about creating learning modules on the internet. The application was easy to use for beginners and had comprehensive features, so the researcher ultimately used Canva to create the product.

b. Design

The design stage involves creating a teaching module development design based on the results of the previous analysis. The activities carried out at this stage are as follows:

1. Module Design Planning

At this stage, researchers design the modules to be created, starting with creating an initial framework for the modules in accordance with the learning model used, then designing the concepts and flow to be used in the module creation. This module is designed in accordance with the learning model used, namely the concept achievement learning model for probability material with the syntax of the concept achievement learning model, which begins with the data presentation stage, concept achievement testing, and thinking strategy analysis. It is also equipped with real-world questions and indicators of students' mathematical critical thinking abilities.

2. Research Instrument Planning

At this stage, the researchers developed the instruments to be used in this study, namely questionnaires (for teachers and students), observation sheets for student activities and learning implementation, as well as tests of mathematical critical thinking skills.

c. Development

At this stage, the designs created during the planning stage are realized in the development stage. All frameworks, concepts, and flows that have been created are then compiled into a complete product. The following are the stages of teaching module development:

1. Module Development

After the concept created in the design stage has been compiled, the next step is to create modules using Canva.

a) Cover

The Cover Page is the initial display of the module that represents the entire contents of the module.



Figure 1: Cover

b) Introduction page

The introduction page contains an introduction written by the author.

Paper presented at The 2nd ICONETT, 2025
Faculty of Teacher Training and Education
Universitas Islam Negeri Alauddin Makassar
South Sulawesi-Indonesia



Figure 2: *Introduction page*

c) Table of Contents

A page displaying a table of contents for all content contained in the module.

Kata pengantar	2
Daftar Isi	3
Informasi Umum	4
A. Identitas	4
B. Kompetensi Awal	5

Figure 3. *Table of Contents*

d) General information

This section will contain the author's personality, initial competencies, Pancasila student profile, facilities and infrastructure, target students, and the learning model that will be selected for implementation in the classroom.

Figure 4. *General information*

e) The core competency

Core activities include learning objectives, criteria for achieving learning objectives, meaningful knowledge, sparking questions, learning activities, assessment/evaluation, and remediation/enrichment.



Figure 5: *The core competency*

f) Appendix

The appendix contains teaching materials, student worksheets, exercises/evaluations, and a glossary containing lists or definitions of specific words related to the content of the teaching module.



Figure 6: *Appendix*

2. Validation of Product and Instrument Implementation

Next, the modules and instruments were validated by the validation team. The validation team consisted of two lecturers from the Mathematics Education Department of UIN Alauddin Makassar, namely:

Table 1. *Validator*

No.	Nama Validator	Keterangan
1.	Dr. Wahyuni Abidin, S.Pd., M.Pd	Validator 1
2.	Dr. Sri Sulasteri, S.Si., M.Si	Validator 2

The validator will examine the product and instruments to determine their overall validity. The purpose of this validity assessment is to obtain feedback and suggestions for improvement, as well as to evaluate the suitability of the product before use. This assessment is carried out by providing a validation sheet, which is included in the appendix.

From this validation process, researchers obtained data from validators with a rating percentage of 4.0 in the highly valid category, which means that validators stated that the developed module was highly valid based on the given assessment indicators. Since all aspects of the module validation were categorized as highly valid, the developed teaching module is suitable for use.

d. Implementation

The implementation stage is a stage for conducting research or field trials with the aim of measuring the practicality and effectiveness of the teaching modules that have been created. The learning schedule is outlined in the following table:

Table 2. *Learning Implementation Schedule*

e.	f.	Hari/Tanggal	g.	Jam dan Kegiatan
h	i.	Kamis, 10 April 2025	j.	3-4 (Proses Pembelajaran)
k	l.	Senin, 14 April 2025	m.	4-5 (Proses Pembelajaran)
n	o.	Kamis, 17 April 2025	p.	3-4 (Proses Pembelajaran)
q	r.	Senin, 21 April 2025	s.	4-5 (Pemberian tes dan angket)

The subjects in this study were 26 students in class VIII B at SMPN 3 Anggeraja. There were four meetings, consisting of three learning processes, ending with a test of mathematical critical thinking skills.

From this implementation stage, researchers obtained data on the practicality and effectiveness of the teaching modules that had been tested. From the trial conducted for practicality, the results showed that the teaching module that was tested was practical. This was based on the results of the learning feasibility analysis, which obtained an average score of 1.84, which was in the interval $1.5 \leq M < 2$ with the category of fully implemented.

The results of the teacher response questionnaire analysis obtained a percentage of 77.08%, which was in the interval $70\% \leq RS < 85\%$ with a positive category. Then, from the trial conducted to determine the level of effectiveness, it was found that the teaching module that was tested could be considered effective. This can be seen from the results of the analysis of student activities conducted over three meetings, with a total average of 65.47%, which is in the interval $60\% \leq p < 80\%$ with a good category based on the predetermined assessment aspects. The results of the student response questionnaire analysis showed a percentage of 78.78%, which is in the interval $70\% \leq RS < 85\%$ with a positive category. Based on the results of the students' mathematical critical thinking test, there were

5 students with very high learning outcomes, 11 students with high learning outcomes, and 7 students with moderate learning outcomes.

e. Evaluation

This stage is the final stage of the ADDIE development model. At this stage, an evaluation is carried out based on suggestions after the trial process has been carried out, so that only minor revisions are made to the teaching module in order to improve any shortcomings found during the trial. The evaluation includes changes such as page numbering, where some pages of the teaching module did not have page numbers, which were then added after the trial process was completed. Therefore, at this evaluation stage, there are no significant changes to the teaching module product.

Based on the results of the development research described above, the development of teaching modules was carried out using the ADDIE development model, which consists of the analysis stage, the design stage, the development stage, the implementation stage, and the evaluation stage, resulted in a teaching module based on the concept achievement learning model to improve mathematical critical thinking skills in eighth-grade students at SMPN 3 Anggeraja, which was declared valid by validators, practical for use by teachers and students, and effective in improving students' mathematical critical thinking skills. The teaching module meets the validity criteria based on format, material and content, language, and media. The teaching module that was developed has complete components as stipulated in Permendikbudristek No. 16 of 2022 concerning process standards.

According to Nasution (2018), students can have the opportunity to build knowledge independently so that they will have a deep understanding of a subject and the quality of students will improve by using a student-oriented learning model. This is in line with the module developed in this study, namely learning activities that are student-oriented and focused so that students are actively involved in the learning process and activities as outlined in the teaching module.

The teaching module developed can improve mathematical critical thinking skills and has practical categories for teachers and students. The results of the learning implementation analysis are in the fully implemented category. This means that most of the assessment aspects by observers conducted during the learning process using the teaching module have been implemented. Research by Setiawan, et al. (2020) also shows that learning tools developed based on a specific model and validated systematically demonstrate high practicality if teachers can easily understand and use these tools in the

field. Thus, the implementation results showing the “fully implemented” category are an indicator that this teaching module has met the practicality aspect and can be implemented in daily learning activities.

The results of the teacher response questionnaire analysis were positive. It was concluded that the teacher response questionnaire analysis was practical, meaning that the teachers' assessments were relatively positive in all aspects of the observation. This finding is in line with the results of research by Sari et al. (2020), who developed a teaching module based on a conceptual learning model to improve students' critical thinking skills in mathematics. In their research, teachers responded positively to the practicality of the developed module, mainly because it facilitated a deep and systematic understanding of concepts. Wahyuni (2019) found similar results when developing a learning module based on the concept attainment model, where teachers responded that the module was easy to use in learning and helped students develop critical thinking skills in a more structured manner. Thus, the results of the teacher response questionnaire in this study reinforce the findings of previous studies that teaching modules designed based on the concept attainment learning model have a high level of practicality and support the development of students' critical thinking skills in mathematics.

Based on the results of the learning implementation assessment and teacher response questionnaires, both of which meet the minimum criteria for practicality, it can be concluded that the module based on the concept achievement learning model for probability material can be considered practical. This is in line with the research conducted by Ujiati and Dede in 2020 with the title of research on the development of elementary school mathematics teaching materials based on the realistic mathematics education learning model oriented towards critical thinking skills, where based on the results of the practicality test, it was found that the implementation of the teaching materials was considered valid and therefore practical for use (Cahyaningsih and Nahdi, 2020, p. 601). The need for a level of practicality in product development is very important because, based on Van den Akker's theory, practicality refers to the extent to which users (such as teachers or students) can use the development product easily and appropriately in a real context.

The teaching module developed is effective for both teachers and students. The results of the analysis of student activities are in the good category based on the predetermined assessment aspects. Thus, student activities in the learning process can be said to be effective using the teaching module developed. The results of the analysis of the student response questionnaire are in the positive

category, which means that students responded positively to the module used in learning based on the available observation aspects. The analysis of the results of the students' critical thinking skills test showed that 5 students achieved very high learning outcomes, which means that they were able to understand all the indicators of critical thinking skills in mathematics included in the learning test. Eleven students achieved high learning outcomes, which means that they were able to understand at least 1-3 of the established indicators of critical thinking skills in mathematics. Seven students achieved moderate learning outcomes, which means that they only understood 1 -2 indicators that had been set.

The effectiveness of teaching materials can be considered effective if each effectiveness analysis value is at its minimum effectiveness value. The percentage value of student activity based on Arsyad (2016) can be considered effective if student activity is in the minimum good category with a percentage of $60\% \leq p < 80\%$. then for the mathematical critical thinking test according to the standard categories set by the Ministry of Education and Culture, it can be said to be effective if the percentage of mastery on the mathematical critical thinking test is in the minimum category, which is in the score range of 60-74. As for student responses according to Arsyad (2016), they can be considered effective if student responses to the teaching module are in the minimum positive category with a score range of $70\% \leq RS < 85\%$.

Based on the results of student activity assessments, student response questionnaires, and mathematical critical thinking tests, all of which meet the minimum criteria for effectiveness, it can be concluded that the teaching module based on the concept achievement learning model for probability material is effective. This is also in line with research conducted by Hartina, et al. in 2020 with the title of research on the development of teaching materials based on multiple intelligences to improve critical thinking skills, where the teaching materials developed, namely modules based on multiple intelligences, were in the effective category because the average ability of teachers in managing learning was 4.28, which was in the good category, the average percentage of student activity was 64.53%, which was in the good category, and the percentage of student learning completeness was in the high category, namely 80.65% (Hartina et al., 2020: 170). The effectiveness of this teaching module is also based on teaching modules that are structured according to the syntax of the concept attainment model according to Joyce et al. (2020, p. 233), which not only helps students understand the material conceptually but also encourages them to actively engage in critical thinking processes. By

incorporating activities that indicate critical thinking skills according to Facione in (Karim, 2015, p. 93), such as data interpretation, concept analysis, evaluation of understanding, and pattern inference, the teaching module becomes more than just a medium for delivering material, but also a tool for shaping students' critical thinking skills.

4) CONCLUSIONS

The development of teaching modules based on the concept achievement learning model to improve mathematical critical thinking skills facilitates their use, helps students understand the material, and attracts students in the learning process, especially in improving students' mathematical critical thinking skills. The teaching modules developed by the author can be used as an alternative to mathematics learning that makes it easier for students to understand learning concepts, especially in probability material.

REFERENCES

- Apiati, V., & Hermanto, R. (2020). Kemampuan Berpikir Kritis Peserta Didik dalam Memecahkan Masalah Matematik Berdasarkan Gaya Belajar. *Mosharafa: Jurnal Pendidikan Matematika*, 9(1), 167–178. <https://doi.org/10.31980/mosharafa.v9i1.630>
- Cahyaningsih, U., & Nahdi, D. S. (2020). Pengembangan Bahan Ajar Matematika Sd Berbasis Model Pembelajaran Realistic Mathematics Education Yang Berorientasi Kemampuan Berpikir Kritis. *Jurnal Educatio FKIP UNMA*, 6(2), 598–604. <https://doi.org/10.31949/educatio.v6i2.622>
- Gunawan, G., Kartono, K., Wardono, W., & Kharisudin, I. (2021). Analisis Kemampuan Berpikir Kritis Ditinjau dari Kemandirian Belajar Siswa SMP Negeri 3 Kalibagor. *Prosiding Seminar Nasional Pascasarjana*, 136–140.
- Ichsan, F. N. (2021). Implementasi Perencanaan Pendidikan dalam Meningkatkan Karakter Bangsa melalui Penguatan Pelaksanaan Kurikulum. 4(3), 541–551.
- Joyce, Bruce, Weil, Marsha, dan Calhoun, E. (2020). *Models of Teaching*. Pustaka Pelajar.
- Karim, K., & Normaya, N. (2015). Kemampuan Berpikir Kritis Siswa dalam Pembelajaran dalam Pembelajaran Matematika dengan Menggunakan Model Jucama di Sekolah Menengah Pertama. *EDU-MAT: Jurnal Pendidikan Matematika*, 3(1). <https://doi.org/10.20527/edumat.v3i1.634>
- Kosasih. (2021). *Pengembangan Bahan Ajar*. Bumi Aksara.
- Kurniawati, D., & Ekayanti, A. (2020). Pentingnya berpikir kritis dalam pembelajaran matematika. *PeTeKa*, 3(2), 107-114.
- Pratama, R., Alamsyah, M., & Noer, S. (2022). Analisis Kebutuhan Guru Terhadap Pengembangan Modul dalam Meningkatkan Kemampuan Berpikir Kritis Peserta Didik. *EduBiologia*: Paper presented at The 2nd ICONETT, 2025
Faculty of Teacher Training and Education
Universitas Islam Negeri Alauddin Makassar
South Sulawesi-Indonesia

Biological Science and Education Journal, 2(1), 7.
<https://doi.org/10.30998/edubiologia.v2i1.9769>

Rahmaini, N., & Ogylva Chandra, S. (2024). Pentingnya Berpikir Kritis dalam Pembelajaran Matematika. *Griya Journal of Mathematics Education and Application*, 4(1), 1–8. <https://doi.org/10.29303/griya.v4i1.420>

Siwi, A., Astuti, M. D., & Yuliani, Anik, Purwandari. (2018). Evaluasi Kemampuan Komunikasi Matematis Siswa SMP Pada Materi Sistem Persamaan Linear Dua Variabel. *IndoMath: Indonesia Mathematics Education*, 1(1), 55. <https://doi.org/10.30738/indomath.v1i1.2219>