International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 08 Issue 12 December 2025
DOI: 10.47191/ijcsrr/V8-i12-24, Impact Factor: 8.048
IJCSRR @ 2025
www.ijcsrr.org

Development of Teaching Module Using Probing Prompting Based on Ethnomathematics to Improve Students' Mathematical Communication Ability

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ABSTRACT: This research aims to develop a teaching module using a probing-prompting learning model based on ethnomathematics on the topic of flat-sided solid geometry to improve the mathematical communication ability of junior high school (SMP) students, ensuring it is valid, practical, and effective. The study employed the 4D development model (Define, Design, Develop, Disseminate), followed by a quasi-experimental study using a non-equivalent control group design. The subjects of this research were ninth-grade students at SMP Negeri 1 Sukosari, Bondowoso. The module validation results showed a very valid criterion with an average validity percentage of 92.5%7. The practicality test results obtained a value of 91.3% in the very practical category. The effectiveness test showed a significant difference in mathematical communication ability between the experimental and control classes with a significant ($p < 0,05$) value. Thus, the teaching module using probing-prompting based on ethnomathematics can be used to improve the mathematical communication ability of junior high school students because it is valid, practical, and effective10. Based on these results, teachers are expected to implement the probing prompting learning module by creating question guides that can enhance students' mathematical communication ability and can be adapted to local cultural contexts as an alternative teaching material.

KEYWORDS: Ethnomathematics, Mathematical Communication, Probing Prompting, Spatial Structures, Teaching Modules.

INTRODUCTION

Communication plays a significant role in the mathematics learning process. Various sources state that communication plays a crucial role (Baroody, 1993; NCTM, 2000; Wijaya & Yusup, 2023). In fact, students' mathematical communication skills are still relatively weak. Some students do not fully understand the problem format and still experience difficulties in the solution process (Rhamdania, 2021). According to Darkasyi et al. in (Nurfitria et al., 2021), students' low communication skills in understanding mathematics are a serious problem in schools because teachers still tend to use conventional methods such as lectures to deliver material. As a result, students are less able to use mathematical communication skills. The indicators of mathematical communication skills in this research are as follows.

Table I. Mathematics Communication Ability Indicators

Oral Mathematical Communication Indicators	Written Mathematical Communication Indicators
Expressing mathematical ideas orally	Expressing mathematical ideas in writing
Explaining the relationship between real objects and images in mathematical ideas	Writing or describing the relationship between real objects and images in mathematical ideas in the form of writing or images
Explain the understanding and interpretation of a mathematical idea	Writing an understanding and interpretation of a mathematical idea
Expressing evaluation of mathematical ideas	Writing an evaluation of a mathematical idea
Using mathematical terms and symbols to explain mathematical ideas	Writing mathematical terms and symbols to explain mathematical ideas in writing

Factors that influence the level of students' mathematical communication skills include students being less thorough in understanding the problems given, students not understanding the concept of spatial geometry, and students not having ideas in solving problems, so that students are only able to reach the stage of understanding the problem (Hasna & Aini, 2019). This finding is relevant to an interview conducted with a mathematics teacher at SMPN 1 Sukosari, Bondowoso. The mathematics teacher at SMPN 1 Sukosari explained that during mathematics lessons, he was faced with students who did not understand, draw, and describe spatial geometry, even though during the lesson, there were not many questions raised by students. This condition reflects that students do not use mathematical communication in learning, and teachers need a learning model that can improve students' mathematical communication skills.

The Probing Prompting approach in learning provides support for teachers in honing students' mathematical communication skills. In this model, teachers provide guiding questions that force students to think actively and formulate their ideas through responses to these questions. Thus, students are more actively involved in the thinking process and deepen their understanding through the experiences gained in this learning model (Depriyanto et al., 2022).

Ethnomathematics is an option for mathematics teachers to integrate local culture into mathematics learning (Carawita et al., 2023). Based on data obtained from Google Scholar using the application, *Publish or Perish* (*PoP*), research interest in ethnomathematics has increased in the last five years, as seen from the number of publications each year, from 2017 to 2022 (Damayanti & Purwaningrum, 2022).

Based on these various problems, researchers are interested in developing a probing-prompting teaching module based on ethnomathematics. The purpose of this study is to describe the process and results of developing a teaching module using the ethnomathematics-based probing-prompting learning model, with the hope of improving students' mathematical communication skills on the material of flat-sided solids phase D with valid, practical, and effective results.

RESEARCH METHODS

This research used a development research method followed by experimental research. Development research is a process or steps to develop a new product or improve an existing product (Selmin et al., 2022). The development model used in this study is the 4D development model. Data collection techniques include construct validation trials and practicality through observations of learning implementation, teacher and student response questionnaires during the learning process (Lantowa et al., 2022). The 4D model includes the following stages: define, design, develop, disseminate, and continue with a quasi-experiment using a non-equivalent control group design.

Each stage is passed by carrying out activities in accordance with the *framework* that the existing system includes four stages known as 4D (Diana et al., 2023). These four stages are define, design, develop, and disseminate.

a) Define phase

The Define phase is carried out to identify the basic requirements for the module and its content. At this stage, the researcher establishes and defines learning needs by analyzing the objectives and limitations of the material. This stage involves preliminary analysis, student analysis, task analysis, concept analysis, and objective analysis (Sumiati, Makhrus, dan Ayub 2022).

b. Design phase

The design phase is the stage of creating a draft of the product being developed. It consists of preparing tests, selecting media, selecting formats, and finalizing the initial design.

c. Develop phase

The develop phase during the development stage, the product is created from the previously created design and validated by a validator. The development stage consists of expert assessment and field trials. The criteria for validity, practicality, and effectiveness are as follows.

1) Validity Analysis

All results of the teaching module validity assessment data are calculated based on the average of each aspect of the indicator value, which will be continued with the determination of the teaching module validity criteria. The interval of the teaching module validity criteria is according to Nesri & Kristanto (2020) is as follows.

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Table II. Teaching Module Validity Criteria

No	Validity Criteria	Validity Level
1	$85\% < V_a \leq 100\%$	Highly Valid
2	$70\% < V_a \leq 85\%$	Valid
3	$50\% < V_a \leq 70\%$	Less Valid
4	$V_a \leq 50\%$	Invalid

2) Practicality Analysis

The teaching module's practicality score is calculated using the formula:

$$P = \frac{\sum TSe}{TSh} \times 100\%$$

Information:

P : Practicality of the module

TSe : Total score of all students' responses

TSh : the macimum possible sum of scores from all students' responses.

The practicality criteria are presented in the following table.

Table III. Practicality Criteria of Teaching Modules

No	Practicality Criteria	Level Practicality
1	$80\% < P \leq 100\%$	Highly Practical
2	$60\% < P \leq 80\%$	Practical
3	$40\% < P \leq 60\%$	Less Practical
4	$20\% < P \leq 40\%$	Impractical
5	$0 \leq P \leq 20\%$	Very Impractical

3) Effectiveness Analysis

During the learning process, each student's activity was observed and assessed using a score ranging from 1 (inactive) to 4 (very active). The following table shows the student response intervals.

Table IV. Student Response Result Data Criteria

No.	Score	Conclution
1	$80 < P_r \leq 100\%$	Very Positive
2	$60 < P_r \leq 80\%$	Positive
3	$40 < P_r \leq 60\%$	Quite Positive
4	$20 < P_r \leq 40\%$	Less Positive
5	$P_r \leq 20\%$	Not Positive

The subjects of the study were ninth-grade students of SMP Negeri 1 Sukosari, Bondowoso, consisting of an experimental class using ethnomathematics-based probing-prompting teaching modules and a control class using conventional modules. The research instruments included: expert validation sheets, student response questionnaires, activity observation sheets, and mathematical communication ability tests. Data were analyzed using descriptive statistics and ANCOVA tests to determine differences in mathematical communication abilities. The prerequisite tests for experimental research consisted of normality tests and homogeneity tests. Then, the ANCOVA test was continued. The ANCOVA test is one type of comparative hypothesis test used on normal and non-homogeneous data. The statistical hypotheses of the ANCOVA test are as follows.

H_0 : There is no significant influence of the ethnomathematics-based probing prompting teaching module on mathematical communication skills.

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H_1 : There is a significant influence of ethnomathematics-based probing prompting teaching modules on mathematical communication skills.

Information:

- If p_{value} < 0,05, then H_0 is rejected and H_1 accepted.
- If $p_{value} \geq$ 0,05, then H_0 accepted and H_1 rejected.

RESULT AND DISCUSSION

The product of this research is a deep learning teaching module that uses an ethnomathematics-based probing-prompting learning model equipped with LKPD, teaching materials/summaries of spatial figures, pretest, and posttest questions. The purpose of creating this research product is to apply the teaching module in the learning process of grade IX junior high school. Based on the implementation of the research, the following research results were obtained.

Define Phase

The define phase aims to determine learning needs through a pre-final analysis of students, assignments, concepts, and learning objectives. Interviews revealed that teachers still use the lecture method with textbooks without supporting media such as LCDs or mobile phones, resulting in passive learning. Students simply listen, take notes, and complete assignments without enthusiasm due to the less-than-conducive classroom atmosphere and monotonous methods. The analysis revealed the need for additional teaching materials in the form of modules with student worksheets (LKPD) that are engaging, contextual, and actively engage students. The material developed was for Grade IX Junior High School (SMP) Flat-Sided Solid Geometry (FGS) with three meetings, each containing activities and probing-prompting questions to foster understanding. This module is based on the Independent Curriculum with a deep learning approach and the learning outcomes of phase D geometry elements, that students are able to determine the surface area and volume of solid geometry, explain the effects of proportional changes, and create nets and models of solid geometry. The learning objectives include creating nets, determining surface area and volume, explaining proportional changes, and solving related problems.

Design Phase

In the Design stage, an initial draft of the ethnomathematics-based probing prompting teaching module was prepared to see its influence on students' mathematical communication skills on the material of flat-sided solid shapes. This stage includes four main activities, namely: (1) Preparation of tests, in the form of pretests and posttests containing five essay questions compiled based on material analysis, tasks, and learning objectives; (2) Selection of media, using ethnomathematics-based teaching aids such as besek tape, prol tape, gelung teleng, and woven bamboo to foster interest in learning and link learning to students' cultural context; (3) Selection of formats, which refer to the components of the Kemendikbudristek (2023) and deep learning guidelines Kemendikdasmen (2025); and (4) Initial design, which includes the preparation of module identity, learning design, and attachments in the form of LKPD, teaching materials/material summaries, glossaries, and bibliographies. The module is designed for three meetings with a probing prompting syntax adapted to an ethnomathematics-based contextual approach, containing learning outcomes, steps for teacher and student activities, and assessments in accordance with the principles of the independent curriculum.

Develop Phase

1) Validity Test

Validity test began developing a product in the form of a teaching module accompanied by student worksheets (LKPD), teaching materials, pretest, and posttest questions. The teaching module developed during the development stage was submitted and validated by two validators to obtain suggestions and revisions. The revisions are explained as follows:

a) Revision of the module cover part. The cover emphasizes the differences between the module and the student worksheet. The logo has been revised from right to left.

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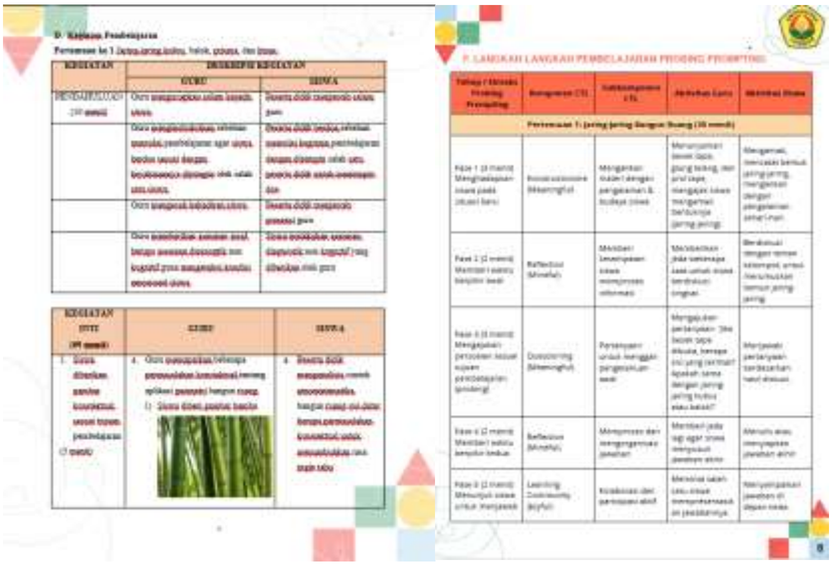
(a) (b)

Image 1. (a) cover before revision, (b) cover after revision

b) Revision of the module identity section. The module creation used the old version of the Merdeka curriculum, necessitating changes to parts adjusted for the *deep learning* teaching module

c) Revision **of the learning design part:** The *deep learning* teaching module has many changes in its learning design, so the parts still related to the old version of the teaching module needed to be updated.

d) **Revision of the learning activity's part:** Input from the validator was that the learning activities should explicitly detail the steps of the probing-prompting learning model and the ethnomathematics-based contextual approach. This was done to clearly show the syntax part, the contextual approach components, and the contextual approach subcomponents with teacher and student activities.



(a) (b)

Image 2. (a) learning activities before revision, (b) learning activities after revision)

e) **Revision of the LKPD cover:** The attention section was made into a separate page. The student's name was made per group on a different page from the cover.

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(a) (b)

Image 3. (a) LKPD cover before revision, (b) LKPD cover after revision)

f) **Revision of the LKPD material:** The LKPD was created using probing-prompting questions, and students were guided to find formulas by answering probing-prompting questions based on ethnomathematics.
g) **Revision of the assessment part:** There was a question related to the price of *Prol Tape* was unrealistic, so it needed to be adjusted to the actual price of *Prol Tape*.
h) **Revision of the material summary part:** The material summary was supplemented with a more in-depth explanation related to cubes, cuboids, prisms, and pyramids. More example images of nets for cubes, cuboids, prisms, and pyramids were required in the material summary.

Based on the validator evaluation results, there were several changes. All suggestions and recommendations for changes to the teaching module and test instrument were used to revise the teaching module so that it could be developed and applied appropriately. The following is the recapitulation table of the research instrument validation.

Table V. Rekapitulation of Research Instrument Validation

Validation Result	Aspect	Average	Total Average	Precentage
Teaching Module complete with LKPD and Teaching Materials	Format	3,4	3,53	88%
	Content	3,6		
	Language	3,8		
	Presentation	3,3		
Pretest and Posttest Instrument	Format	4	3,61	90%
	Content	3,17		
	Language	3,67		
Rata-rata keseluruhan			3,57	89%

Based on the validation results in Table V, each validation sheet has a value above 85%. It can be concluded that the teaching module created is very valid.

During the module trial phase, the validated product was applied to two classes: the experiment class (IX-D, 29 students) and the control class (IX-B, 28 students) at SMPN 1 Sukosari, under the supervision of the mathematics teacher, to assess the module's practicality and effectiveness through observation, test results, and student response questionnaires. Learning was conducted for three meetings using the developed teaching module. In the first meeting, students took the pretest and engaged in activities to recognize the shapes of solid geometry, open the teaching aids, and create pop-up nets of solid geometry. In the second meeting, students worked in groups using the LKPD to discover formulas and calculate the surface area of solid geometry through probing-prompting questions based on ethnomathematics. In the third meeting, students again answered probing-prompting questions while

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conducting experiments to discover the volume formula using unit cubes and pyramid-shaped teaching aids filled with flour, and then calculating the volume of contextual objects such as *besek tape* and *prol tape*. At the end of the activities, students completed the posttest and response questionnaire, and all learning outcome data were used to assess the module's practicality and effectiveness before the final product refinement.

2) Practicality Test

The analysis of the teaching module's practicality was obtained from the results of the learning implementation observation sheet. The teaching module can be deemed practical if the observation results of the learning implementation fall into at least the good category. The results of the learning implementation observation can be seen in the following table:

Table VI. Learning Implementation Observation Results

Assessed Aspect	Score	Precentage
Ability to Start the Lesson	3,4	85%
Teacher's Attitude in the Learning Process	3,5	87,5%
Mastery of Learning Material	4	100%
Teaching and Learning Activities	3,25	81,25%
Ability to Use Learning Media	3,33	83,35%
Learning Evaluation	3,33	83,35%
Ability to Conclude Learning Activities	3,33	83,25%
Follow-up in Learning	3,67	91,75%
Average	3,46	**86,5%**

The results of the recapitulation of the practicality test showed that the learning implementation observation sheet received an average score of 3.46 with a presentation of 86.5%, which means it is very practical.

3) Effectiveness Test

The effectiveness of the teaching module is determined by the analysis of student completion in the mathematical communication ability test, the observation results of student activities during learning activities, and the results of the student response questionnaire about the learning. The following are the student effectiveness analysis results.

a) Completion of the mathematical communication ability test

Based on the students' responses in the mathematical communication ability test, it can be concluded that 26 students scored above 70. Students also achieved overall completion. In this regard, the analysis of student completion in the mathematical communication ability test has been fulfilled.

b) Student response results

Based on the student response questionnaire sheets, the recapitulation of student response data is as follows.

Table VII. Recapitulation of Student Response Questionnaire Results

Aspect Responded	Aspect Responded
Interest in the teaching module	88.84%
Images in the teaching module	88.91%
Text and font size of the teaching module	93.09%
Material of the teaching module	95.31%
Language comprehension	89.84%
Presentation of the teaching module	95.94%
Interest in appearance	90.78%
Ability to understand the teaching module	86.72%
Average	**88.09%**

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The recapitulation results of the student response questionnaire show a positive percentage of 88.09%250. Based on the criteria, the student response questionnaire results show a very positive result. As the results of the student completion analysis in the mathematical communication ability test and the student response questionnaire indicate, the teaching module is considered effective.

Disseminate Phase

This research will be presented to mathematics teachers. and the module will be distributed to other schools. This aims to determine whether the module functions effectively in learning activities. Furthermore, feedback, corrections, suggestions, and assessments for the module will be obtained from this distribution to improve it.

The data results for the control class and experimental class were obtained from the students' mathematical communication ability test results based on pretest and posttest scores2. Students with a score ≥ 70 declared to have passed the Minimum Mastery Criteria (KKM). The posttest completion data in the control and experiment classes can be seen in Table VIII as follows:

Table VIII. Posttest Results of Control and Experiment Classes

Class		Result
Control Class	Pass	21
	Did not Pass	8
Ecperiment Class	Pass	26
	Did not Pass	4

The number of students who passed the posttest in the experimental class was 25, and in the control class was 20. The control class's completion rate was 71.43%, while the experimental class was 86.217%. The difference in passing rates was 14.78%. This difference indicates a positive effect of the teaching module given to the experimental class.

Data analysis to determine the effect of the ethnomathematics-based probing prompting teaching module on students' mathematical communication skills began with normality and homogeneity tests. The SPSS normality test used the Shapiro-Wilk statistic because $n < 50$.. The sample of class D, the experimental class ($n = 29$), and class B, the control class ($n = 28$). The normality test for class B's pretest, class D's pretest, class B's pretest, and class D's pretest can be seen in Table IX below.

Tabel IX. Normality Result

Result	Class	Kolmogorov–Smirnov Statistic	df	Sig.	Shapiro–Wilk Statistic	df	Sig.
Pretest	B Class	.142	28	.153	.939	28	.107
Pretest	D Class	.125	29	.200*	.967	29	.473
Posttest	B Class	.174	28	.030	.935	28	.084
Posttest	D Class	.155	29	.072	.940	29	.100

Based on Table IX, the pretest significance value for the control class was 0.107, and the posttest significance value was 0.084. The pretest significance value for the experimental class was 0.473, and the posttest significance value was 0.100. Therefore, it can be concluded that the pretest and posttest data for both classes were normally distributed. The normality test is met because the sig value is >0.05. Therefore, the main requirement for using parametric statistical tests is met.

The homogeneity test using the Levene Statistic from the pretest and posttest results for the experimental and control classes can be seen in Table X and Table XI. The following table shows the results of the pretest homogeneity test for the control and experimental classes.

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Table X. Pretest Homogeneity Test Result

Hasil	Levene Statistic	df1	df2	Sig.
Based on Mean	4.342	1	55	.042
Based on Median	3.742	1	55	.058
Based on Median and with adjusted df	3.742	1	38.787	.060
Based on trimmed mean	4.065	1	55	.049

Based on Table X, the results of the pretest homogeneity test for the control and experimental classes show that, based on the mean, the sig value is very close to 0.05, but the sig value is still less than 0.05. Thus, there is an indication that the variance is not homogeneous. The results of the posttest homogeneity test can be seen in table XI below.

Table XI. Posttest Homogeneity Test Result

Hasil	Levene Statistic	df1	df2	Sig.
Based on Mean	.049	1	55	.825
Based on Median	.013	1	55	.910
Based on Median and with adjusted df	.013	1	53.297	.910
Based on trimmed mean	.085	1	55	.772

Based on Table XI, it can be said that the significance based on Levene Statistic based on the results based on the mean is 0.825. Nilai Sig. > 0.05 indicates that the variance is homogeneous. The prerequisite tests show that the normality test for the experiment and control classes indicates normal data, while the homogeneity test for initial equivalence (pretest) shows non-homogeneous variance. Therefore, a correction test using Welch's correction (equal variances not assumed row) was performed. In this case, the researcher conducted a pretest t-test, which can be seen in Table XII and Table XIII below.

Tabel XII. Pretest Group Statistics Results

Class	N	Mean	Std. Deviation	Std. Error Mean
Pretest Control Class	28	60.21	10.196	1.927
Pretest Eksperimental Class	29	55.17	5.689	1.056

Tabel XIII. Pretest Independent Sample Test Results

Hasil	**Levene's Test for Equality of Variances**		**t-test for Equality of Means**					**95% Confidence Interval of the Difference**	
	F	**Sig.**	**t**	**df**	**Sig. (2-tailed)**	**Mean Difference**	**Std. Error DIfference**	**Lower**	**Upper**
Equal variances assumed	4.342	.042	2.316	55	.024	5.042	2.177	.679	9.404
Equal variances not assumed			2.294	42.011	.027	5.042	2.197	.607	9.476

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Based on the descriptive statistical analysis of the table, the average pretest of the control class (60.21) is higher than that of the experimental class (55.17). The standard deviation of the control class (10,196) is much greater than that of the experimental class (5,689). In addition, the results of the t-test in the row equal variances not assumed show a Sig.(2-tailed) is 0,027. Because Sig.=0,027≤0,05, then H_0 is rejected, so there is a statistically significant difference in the pretest average between the control class and the experimental class. This inequality requires control treatment for pretest differences. Therefore, the researcher used Analysis of Covariance (ANCOVA) as the main hypothesis test to control the effect of pretest differences, where the pretest was used as a covariate. Based on the results of the homogeneity of the posttest values with a Sig.=0.825, the posttest results data showed homogeneous variance, so this further supports the use of ANCOVA as a hypothesis test.

Tabel XIV. ANCOVA Test Results

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1668.248^a	2	834.124	14.680	<.001
Intercept	1886.123	1	1886.123	33.194	<.001
Pretest	1179.331	1	1179.331	20.755	<.001
MODEL_PEMBELAJARAN	982.414	1	982.414	17.290	<.001
Error	3068.314	54	56.821		
Total	317609.000	57			
Corrected Total	4736.561	56			

The ANCOVA results show a significance value of 0.001. If the Sig. value is < 0.05, then H_0 rejected and H_1 is accepted. Therefore, it can be concluded that there is a significant effect of the ethnomathematics-based probing prompting teaching module on students' mathematical communication ability. This difference can be seen in the adjusted posttest means (*estimated marginal means*) in Table XV below.

Tabel XV. Learning Model Estimates

Learning Model	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Conventional Learning Device	69.661^a	1.459	66.735	72.587
Probing Prompting Teaching Module	78.361^a	1.433	75.489	81.234

Based on the mean estimate results, the difference in initial ability controlled by the covariate variable used as the control reference point is 57.65. The posttest mean of the experiment class is 78.361, while the control class is 69.661. This indicates that the experiment class achieved a higher posttest result than the control class. Therefore, the implementation of the probing prompting teaching module has a significant effect on students' mathematical communication ability compared to conventional learning devices.

DISCUSSION

The research results show that the probing prompting based on the ethnomathematics teaching module on flat-sided solid geometry material is able to improve the mathematical communication ability of ninth-grade SMP students. Through structured and in-depth guiding questions, the teacher can help students express mathematical ideas and correct misconceptions directly. Unlike other models such as PBL, Problem Solving Discovery, or Inquiry Learning, which tend to present problems and rely on independent investigation ability, probing-prompting provides guidance at every thinking step. Thus, this learning model is effective for use in heterogeneous classes, as is the condition at SMPN 1 Sukosari. This aligns with Ritonga et al. (2020) research, which shows an effect of the probing prompting learning model on students' mathematical.

The probing prompting based on the ethnomathematics teaching module facilitates students' understanding of concepts that are relevant to the cultural context. This is consistent with Rizal et al., (2021) research that ethnomathematics-based e-modules can foster students' mathematical communication ability and learning interest. Furthermore, Iskandar et al. (2022) research shows a significant difference in students who use ethnomathematics-based teaching materials.

This type of research uses the 4D development model, which includes define, design, develop, and disseminate. In the define stage, initial-final, student, task, and concept analysis were performed. It was identified that learning was still teacher-centered with minimal use of contextual media, leading to low student mathematical communication ability. This aligns with Zamsiswaya et al. (2024) research that the 4D define model stage includes analysis of learning problems, teacher and student analysis, and concept and learning outcome analysis to establish the basis for development.

The design stage produced the module design in the form of probing prompting learning steps, LKPD, teaching materials, and the selection of local cultural media such as *besek tape*, *gelung teleng*, *prol tape*, and bamboo weaving. The media were selected based on an analysis of student cultural relevance to optimize the ethnomathematics-based contextual approach. This is consistent with Zamsiswaya et al. (2024) research that the planning stage begins with selecting media, format, and media design.

The develop stage involved expert validation and limited trials. If there were deficiencies, revisions were made until the eligibility criteria were met, consistent with Jasmine et al., (2023). The module validity result reached 89% and the instrument validity reached 90%, categorized as very valid. Furthermore, the practicality score of 86.5% and the positive student response of 88.09% indicate that the module is easy for teachers to use and attractive to students. This finding is reinforced by Lastri, (2023) that quality teaching materials can facilitate students in understanding the material well and will certainly lead to good learning outcomes

The disseminate stage was carried out by distributing the teaching module to other schools affiliated with the mathematics teacher group (MGMP) as a form of expanding benefits and gaining additional suggestions/input from all module users. This aligns with Maharani et al., (2023) research that the dissemination stage is useful so that the results of interactive e-module development can be used anywhere and anytime.

Based on the experimental research results using the ANCOVA hypothesis test with a significance value of 0,001 (<0,05) it is represented that there is a significant effect of the teaching module on the improvement of students' mathematical communication ability. This result is consistent with Erianto & Dewi (2024) research, which proves the effectiveness of probing prompting on mathematical communication, as well as Ramdhana et al., (2024) research, which states that ethnomathematics-based LKPD improves students' representation and communication ability.

Several previous studies show consistent results that the probing prompting model and ethnomathematics are effective in improving students' mathematical communication ability. Aisyah et al., (2022) showed the effectiveness of *probing-prompting* on an online platform (Google Meet) also increased mathematical communication. Lestari & Hasratuddin, (2023) research showed that students' mathematical communication increased with the implementation of ethnomathematics-based mathematics learning. Therefore, these research results are not only statistically valid but also consistent with relevant findings from previous research.

Based on the research results, teachers are expected to implement the probing prompting learning model by creating question guides that can enhance students' mathematical communication ability and can be adapted to the local ethnomathematics context as an alternative teaching material. Furthermore, future researchers are suggested to conduct follow-up research with different materials and grade levels to expand the utilization of the teaching module in improving various mathematical skills.

CONCLUSION

Based on the research results, it can be concluded that the Ethnomathematics-Based Probing Prompting Teaching Module on Flat-Sided Solid Geometry material was successfully developed through the 4D model (Define, Design, Develop, and Disseminate). This development included needs analysis, local cultural-based design (*besek tape, gelung teleng, prol tape*), validation, trials, and limited dissemination. The module meets the criteria of being very valid, practical, and effective. The ANCOVA test results show a significance value of 0,001 (<0,05), indicating a significant influence on improving students' mathematical communication ability. The posttest mean of the experiment class (78.361) is higher than that of the control class (69.661), showing the effectiveness of the module's use. The Probing Prompting Model is proven to improve students' ability to express mathematical ideas and reasons systematically, while the Ethnomathematics approach helps students relate mathematical concepts to daily life, making the learning more meaningful, contextual, and communicative.

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