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Development of Creative Problem Solving-Based Physics Learning Modules to Improve Students' Creative Thinking Skills

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Abstract: This research is a type of research and development (*R&D*) with a 4D model This research aims to (i) design the results of the development of a physics learning module based on *creative problem solving* to improve students' creative thinking skills which are reviewed from a theoretical and empirical point of view, practitioner responses, student responses, and testing the effectiveness of physics-based *learning modules creative problem solving*. The subjects of this study are class X.1 as an experimental class and class X.2 as a control class. The results of the study show that learning modules developed based on theoretical and empirical validity are recommended to be suitable for use. The results of the analysis of practitioners' and students' responses to the developed modules show very practical criteria. The effectiveness test of the physics learning module based on creative problem solving was analyzed based on the results of the students' posttest. The Effectiveness Test of the learning module uses t-test analysis. From the results of the study, it can be seen that the learning modules developed have a significant (effective) increase based on statistical tests. Thus, there is an influence of the use of learning modules on students' creative thinking skills. Based on the results of this study, it can be concluded that the physics learning module based on *creative problem solving* is declared valid and effective so that it is suitable for use as a learning resource.

Keywords*:* Creative Problem-Solving; Creative thinking skills; Empirical validity; Physics Learning Module; Theoretical validity.

Introduction

Education in the 21st century has entered the era of the Industrial Revolution 4.0. The era of the 4.0 revolution emphasizes on *the digital economy*, *artificial intelligence*, *big data* and *robotics.* These developments have an impact on the world of education which requires creativity, critical thinking, mastery of technology, and digital literacy skills. Changes in education and learning are inevitable. Change must start from strengthening the competence of educators as the vanguard of education. (Andrian, 2019)

Through learning physics, students can explore the scientific principles underlying natural phenomena, identify the relationships between physical concepts and develop *an* understanding of the universe (Istiyono, 2018) Physics learning emphasizes understanding physics concepts by being oriented towards the essence of science which includes scientific products, processes and attitudes (Yunika Sari, n.d.). It is not only important in the development of scientific understanding, but also in everyday problem solving. Through scientific measures, students can develop various abilities. One of

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the skills that can be trained through learning activities with scientific methods is creative thinking.

The ability to think creatively is one of the main skills that individuals must possess to face the challenges of the times (Zulyadaini, 2017). The creative thinking skills of students in physics learning are very important because they allow them to understand physics concepts that are often abstract in a more original and innovative way. Through creative thinking, students can look at physics problems from various perspectives (Anisa, 2018). Creative thinking helps learners become more flexible, adaptive, and ready to face the complex future challenges in the world of science and technology.

One of the learning resources that greatly affects the achievement of students' expected creative thinking skills is the use of learning modules. The use of this learning module in addition to helping students understand the learning material can also increase students' interest and motivation (Umiyyah. S., 2023). The development or renewal of the teaching system must be in accordance with current developments, so as to be able to prepare qualified students for the future. This is in line with Borish's opinion about the role of teachers who are role models by showing a positive personality and attitude, experienced in teaching, capable in conveying information, reflective, motivating, and passionate also to participate in learning with students in order to create effective learning and teaching activities (Sujanem, 2012)

According to (Maulida, 2022) learning modules are a unit of learning materials that can be learned by students independently. The learning modules are also systematically and attractively packaged with a range of materials, methods, and evaluations that can be used independently to achieve the expected competencies. Learning using modules can help students gain new knowledge by constructing their knowledge independently and placing teachers as facilitators in learning so that students' dependence on teachers can be reduced. However, ironically, the content of the current learning modules is dominated by theory in general. In fact, students need to understand and accept objectively, concretely and rationally learning, especially in Physics learning.

Through learning physics, students can explore the scientific principles underlying natural phenomena, identify the relationships between physical concepts and develop an understanding of the universe (Sutrisno, 2006). Physics learning emphasizes understanding physics concepts by being oriented towards the essence of science which includes scientific products, processes and attitudes (Sari, 2020) It is not only important in the development of scientific understanding, but also in everyday problem solving. Through scientific measures, students can develop various abilities. One of the skills that can be trained through learning activities with scientific methods is creative thinking.

In line with the above statement, this condition also occurred at YP PGRI 3 Makassar High School. The researcher has made initial observations, first of all on the teaching materials used, namely using only package books provided by the school. Teaching materials are in the form of simple package books that only contain concept enrichment and lack training students to solve problems creatively. This package book is also only distributed during class hours and is not a student handbook, but a teacher's handbook so that its use by students is not optimal, and cannot be used by students outside of class hours. Second, the researcher also observed the characteristics of students at SMA YP PGRI 3 Makassar, namely during teaching and learning activities, most students felt bored so that physics learning was less in demand. Students have difficulty understanding the subject matter and also students' creative thinking skills are still low. This comes from their previous learning experience with the impression that physics lessons are heavy and complicated lessons. Physics is not far from a mathematical calculation problem, so it is very complicated to understand well. As a result, the expected learning goals become difficult to achieve. This can be seen from the ability of students to understand basic concepts of physics and apply mathematical calculation operations is still relatively low.

Third, some learners have difficulty internalizing abstract concepts and relating them to practical applications, such as in solving physics problems. The material is presented in the form of general concepts without the implementation of the material in real life in accordance with the characteristics of the material so that it is difficult for students to apply this knowledge in daily life. In addition, physics learning is still teacher-centered, the learning system can also cause students to become passive. In the learning process, students are less encouraged to solve problems in creative ways so that students are less trained in solving a problem. Teachers often give closed questions where students solve them directly using existing equations.

The above problems are obtained, it is very important to make new breakthroughs in students' creative thinking skills. The achievement of students' thinking skills is greatly influenced by the learning process which depends on the teacher's task in creating, designing, and planning a learning resource by paying attention to the characteristics and social environment of students in order to create fun, creative, and innovative learning so that learning goals are achieved according to

the demands of the curriculum, especially in improving students' creative thinking skills (Sudirma, 2013) Therefore, one of the components that supports efforts to improve students' creative thinking skills through learning is the use of learning modules that are tailored to the characteristics and needs of students. Learning modules that accommodate creative thinking skills are modules that are supported by the use of the right learning model so that they are able to make students learn effectively (Anisa, 2018) The learning model used as a support for the learning module is the *Creative Problem-Solving* model or abbreviated as CPS.

The CPS model is a learning model that centers on problem-solving skills, which is followed by strengthening creativity (Swestyani.S., 2014). The CPS model emphasizes problem-solving skills to select and develop learners' responses. Not only by memorizing without thinking, but problem-solving skills that expand the thinking process. The improved creative thinking skills consist of four, namely, fluency, *flexibility, originality,* and *elaboration*. CPS-based learning modules train students to have the ability to understand, connect, look for variations of ideas and discover new ideas.(Kurnia, 2019)

Method

Research Types and Design

This type of research is research and development *(*R&D*)*. The design of this study uses a 4D development model consisting of 4 stages, namely; *define, design, develop*, and *disseminate* (Thiagarajan, 1974)

Definition Stage

The definition stages in this study include five main steps, namely early-end analysis, student analysis, task analysis, concept analysis and learning objective analysis (Kartikasari H.A., 2015). This is done to find out an overview of the physics learning process at SMAS YP PGRI 3 Makassar, measure students' creative thinking skills, confirm the learning desired by students, and identify the causes of problems that arise in the physics learning process. This analysis was obtained from the results of observations and interviews with one of the physics teachers at the school, especially class X at SMAS YP PGRI 3 Makassar regarding the implementation of learning, the suitability of learning modules, and obstacles in physics learning.

Research Procedures

The research procedure can be seen in the Figure 1.

Planning Stage

The design stage is carried out after finding problems at the definition stage. This stage includes the selection of modules and learning materials, the selection of the learning module format and the initial design of the learning module.

Development Stage

The development stage aims to produce a product in the form of a physics learning module based on *creative probem solving*. At this stage, validation by experts, design revisions, and testing are limited (Rulyansyah. A., 2022)

Stages of Deployment

After the trial is limited and the instrument has been revised, the next stage is the dissemination stage. The purpose of this stage is to disseminate the physics learning modules that have been developed. At this stage, the dissemination and solicitation of practitioners and students is carried out using a questionnaire of practitioners and students that have been validated will be tested on a number of respondents. In this study, the distribution of CPS-based physics teaching modules was given to physics teachers at SMA YP PGRI 3 Makassar, SMA YP PGRI 1 Makassar, SMA YP PGRI 2 Makassar, SMAN 11 Makassar, SMAN 8 Makassar, SMA Terpadu Islam Wahdah Islamiyah and SMA IT Darul Marhamah AlQur'an Boarding School. The distribution was also carried out to students in grades X.1 and X.2 of SMA YP PGRI 3 Makassar.

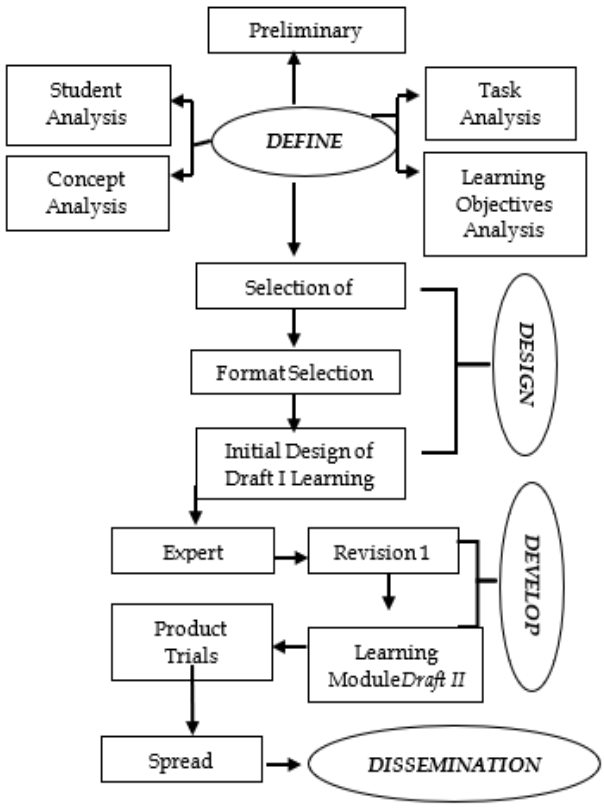

Figure 1. Research Development Procedure by Applying 4D Model (Sugiyono, 2015)

(a) (b) (c) (d)

(e) (f) (g) (h)

Figure 2. Revised Results of CPS-Based Physics Learning Module (*Draff II)*: (a) Cover before revision; (b) Cover after revision; (c) Foreword before revision; (d) Foreword after revision; (e) Competency Map before revision; (f) Competency Map after revision; (g) Learning Activities before revision

Research Subject

This research was carried out at SMA YP PGRI 3 Makassar in the Even Semester of the 2024/2025 Learning Year, namely class X.1 as an experimental class and class X.2 as a control class. The test design used is "Post-test only design". In this design, the test is carried out once, namely after the treatment.

Group	Treatment	Posttest
R1	X	O1
R2	-	O2

Figure 3. Model *posttest only control design (Sugiyono, 2019)*

Information:

X : Treatment using CPS-based physics learning modules

O1: Post-test results in classes using CPS-based physics learning modules

O2: Post-test results in classes that do not use learning

\- : Not using CPS-based physics learning modules

R : Rambang

Data Analysis Techniques

Data in the form of the results of the validation of the physics learning module based on creative problem solving, the validation of the practitioner assessment questionnaire, the validation of the student assessment questionnaire and the validation of the creative thinking ability test were analyzed by considering inputs, comments, and suggestions from experts. The analysis used to determine the level of relevance by three experts used the content validity coefficient (Aiken's V). Aiken's V formula is used to calculate the content validity coefficient based on the results of each expert's assessment of an item using equations. (Azwar, 2015).

$$V = \frac{\sum s}{n(c-1)} \quad (1)$$

$$s = (r - L_0) \quad (2)$$

Information

V = Aiken's validity index

s = The score assigned by each rater minus the lowest score in the category used

l0 = Lowest validity rating number

c = Highest validity rating number

r = The number given by the assessor

n = Number of raters

Aiken's test requirement, after the calculation is done, if V ≥ 0.4, then the expert agreement index is said to be valid. The analysis of practitioner and student assessments in the form of a questionnaire using the

Likert scale presented 36 positive statements for practitioners and 30 positive statements for students. In answering the statement item, you can select answers that include "4 (strongly agree)", "3 (agree)", "2 (disagree)", "1 (strongly disagree)". The assessment data of practitioners and students on the creative problem solving-based physics learning module listed in the questionnaire sheet was analyzed using the following equations:

$$PRS = \frac{\sum A}{B} x100\% \quad (3)$$

(Riduwan, 2015)

Information:

PRS = The percentage of practitioners who responded to the categories stated in the instrument

∑A = Total the score that Retrieved each category specified in the questionnaire

∑B = Maximum score of each category that responded to the questionnaire

PRS = The percentage of practitioners who responded to the categories stated in the instrument

∑A = Total the score that Retrieved each category specified in the questionnaire

∑B = Maximum score of each category that responded to the questionnaire

For creative thinking skills with a total of 8 questions, with a maximum score of 4 points per question if answered correctly, and a minimum score of 0 points per question if answered incorrectly. Thus, the highest score is 8 x 4 = 32, while the lowest score is 8 x 0 = 0.

Category Creative Thinking Skills Score Experimental Class

The category of creative thinking skills score for students in the experimental class can be seen in Table 2. The category of students' creative thinking skills score in the experimental class using the CPS-based physics learning module is in the class interval 21-27 which means it is in the high category.

Table 2. Category of Creative Thinking Skills Score for Students of Esprerimen Class

Interval Classes	Category
28-34	Very High
21-27	Tall
14-20	Keep
7-13	Low
0-6	Very Low

Source: Primary data processed (2025)

Category Creative Thinking Skills Score Control Class

The category of creative thinking skills score of control class students can be seen in Table 3.

Table 3. Category of Creative Thinking Skills Score for Control Class Students

Interval Classes	Category
28-34	Very High
21-27	Tall
14-20	Keep
7-13	Low
0-6	Very Low

Source: Primary data processed (2025)

The category of creative thinking skills score of students in the control class using conventional methods is in the class in the 14-20 interval class, which means that it is in the medium category.

Result and Discussion

Results of Theoretic Development Validation Analysis

The results of the development validation analysis theoretically consist of preliminary validity, expert validity and logical validity.

Upfront Validity

Validity is measured in terms of the accuracy of the item, measures indicators and clarity of language, and shows interesting graphs. The validity of the advance can be seen in Table 4.

Table 4. Preliminary Validation Results of Physics Learning Module

Aspects assessed			Average	Status
Learning 1 (Energy Forms)	(a)	Shows the accuracy of the measuring item indicator	46.1	ST
	(b)	Demonstrate clarity of the language used	43.0	J
	(c)	Showing the quality of the graphic component	43.0	B
Lesson 2 (The Law of Conservation of Energy)	(a)	Shows the accuracy of the measuring item indicator	47.1	ST
	(b)	Demonstrate clarity of the language used	43.3	J
	(c)	Showing the quality of the graphic component	43.4	B
Learning 3 (Energy Source)	(a)	Shows the accuracy of the measuring item indicator	46.0	ST
	(b)	Demonstrate clarity of the language used	42.3	J
	(c)	Showing the quality of the graphic component	43.6	B

Source: Primary data processed (2025)

The results of the preliminary validation analysis of the CPS-based physics learning module in table 4 were obtained that the average accuracy of the items measuring the indicators for learning 1 with an average of 46.1 was in the very appropriate category (ST). The clarity of the language used with an average of 43.0 is in the clear category (J) and the graphic component with an average of 43.0 is in the good category (B). For Lesson 2, the average accuracy of the item measuring indicators with an average of 47.1 was in the very precise category (ST). The clarity of the language used with an average of 43.4 is in the clear category (J) and the graphic component with an average of 43.3 is in the good category (B). For Learning 3, the average accuracy of the item measuring indicators with an average of 46.0 was in the very precise category (ST). The clarity of the language used with an average of 42.3 is in the clear category (J) and the graphic component with an average of 43.6 is in the good category (B). So that the CPS-based physics learning module can be used in the physics learning process. The results of the validation of the Student and Practitioner Response Questionnaire can be seen in Table 5.

Table 5. Results of Validation of Practitioner and Student Responses

Aspects assessed			Average	Status
Practitioner Response Questionnaire	(a)	Shows the accuracy of the measuring item indicator	45.4	ST
	(b)	Demonstrate clarity of the language used	44.6	J
	(c)	Showing the quality of the graphic component	44.8	B
Learner Response Questionnaire	(a)	Shows the accuracy of the measuring item indicator	45.2	ST
	(b)	Demonstrate clarity of the language used	45.6	J
	(c)	Showing the quality of the graphic component	45.6	B

Primary data sources (2025)

The results of the analysis in table 5 were obtained that the average determination of the item measuring indicators for practitioner responses was 45.4 on average and for student responses with an average of 45.2, both were in the very appropriate category (ST). The clarity of language used in the practitioner's response with an average of 44.6 was in the very clear category (SJ) and in the students' response with an average of 45.6 was in the clear category (J) and the graphic component for the practitioner's response with an average of 44.8 was in the very good category (SB) and for the practitioner's response with an average of 45.6 was in the good category (B).

Results of Development Validation Analysis Reviewed from Expert Validity

The validity of the content by the Expert/Expert aims to determine the validation of the content of the product developed and research instruments. After the instrument item is validated by an expert, then the score is calculated and then revised as necessary according to the validator's suggestion. The results of expert validation of the physics learning module, the response of teachers and students are as follows:

Results of Expert Validation of Physics Learning Module

The results of the content validity test analyzed using the Aiken's V index with the components of content feasibility assessment, presentation feasibility, language feasibility and graphic feasibility will provide a quantitative assessment of the extent of the feasibility of the content of the instrument that has been developed. The results of the coefficient of validity of the content of the expert agreement index for each component of the feasibility of content, presentation, language, and graphography are tabulated in the following table 6:

Table 6. Results of Analysis of the Validity of the Content of the Physics Learning Module based on creative problem solving

Aspects	Total Item Score Validity	V	Criterion
Content Eligibility	14.22	0.84	Valid
Serving	12.84	0.80	Valid
Language	12.78	0.75	Valid
Graphics	11.00	0.73	Valid

Source: Terprocessed Primary Data (2025)

The results of the data analysis in table 6 are known that in the content feasibility aspect, the average expert agreement index (V) of 0.84 is obtained in the valid criteria, the presentation aspect is obtained the average expert agreement index (V) of 0.80 is in the valid criteria, the language aspect is obtained the average expert agreement index (V) of 0.75 is in the valid criteria, and the graphic aspect is obtained the average expert agreement index (V) of 0.73 is in the valid criteria. The percentage of CPS-based physics learning modules in each aspect is depicted through the bar chart in Figure 3.

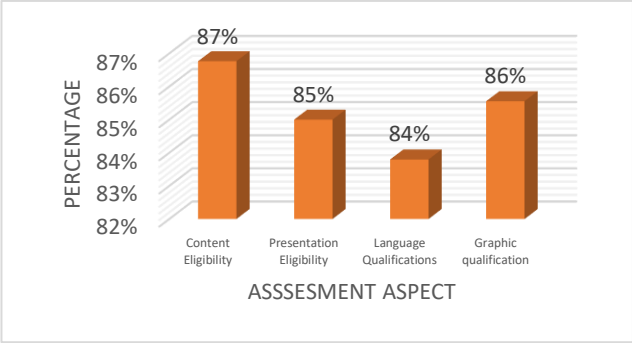

Figure 3. Feasibility of Physics Learning Modules Based on *Creative Problem Solving*

Expert Validation Results of Practitioner Response Questionnaire

Expert validation results from practitioner response questionnaires. Data from expert validation instrument practitioner assessment questionnaire consisting of several statements were analyzed using Aiken's V expert agreement index. From the results of the analysis of the V Aiken index, it can be presented in Table 7.

Table 7. Validity Analysis Test of Practitioner Assessment Questionnaire with Aiken V Index

Aspects	V	Category
Questionnaire Filling Instructions	0.80	Valid
Fill	0.84	Valid
Language	0.81	Valid
Average	0.81	Valid

Source: Terprocessed Primary Data (2025)

The results of the validity analysis test of the practitioner assessment questionnaire instrument from table 7 using the Aiken's index, in the aspect of instructions for the use of the questionnaire, a validity index (V) was obtained with an average of 0.80 and was in the valid category, the feasibility aspect of the content was obtained a validity index (V) with an average score of 0.84 and was in the valid category, then for the language feasibility aspect, a validity index (V) was obtained with an average score of 0.81 and was in the valid category with an average 0.81 is in the valid category.

Results of Expert Validation of Student Response Questionnaire

The results of the content validity test analyzed using the Aiken's V index with the assessment components of questionnaire filling instructions, content feasibility and language feasibility will provide *a quantitative judgment* of the extent of the feasibility of the content of the developed instrument. The results of the analysis of the validity of the content of the expert agreement index for each component of the questionnaire, content and language are presented in Table 8.

Table 8. Analysis of the Validity of the Contents of the Student Response Questionnaire with the Aiken'V Index

Aspects	V	Category
Questionnaire Filling Instructions	0.78	Valid
Fill	0.76	Valid
Language	0.78	Valid
Average	0.77	Valid

Source: Terprocessed Primary Data (2025)

In the aspect of instruction in the use of questionnaires, a validity index (V) was obtained with an average score of 0.78 and was in the valid category, the feasibility aspect of the content was obtained a validity index (V) with an average score of 0.76 and was in the valid category, then for the language feasibility aspect, a validity index (V) was obtained with an average score of 0.77 and was in the valid category.

Results of Validation of Creative Thinking Skills Test Instrument Experts

The results of the Expert Validation Instrument The Creative Thinking Skills Test instrument was validated by three experts to determine the feasibility of each question item that was prepared. The instrument that is declared feasible will be used to measure the improvement of students' creative thinking skills. The number of question items validated consisted of 8 essay questions on renewable energy. The validation scores of the three experts were analyzed using the V Aiken index equation.

Table 9. Results of the validity analysis of the creative thinking skills test instrument

Question Indicator	No. Item	V	Category
Energy Sources	1	0.78	Valid
Renewable Energy Sources	2	0.67	Valid
Energy use efficiency	3	0.89	Valid
Utilization of Energy Sources	4	0.89	Valid
The Urgency of Energy Needs	5	0.79	Valid
Potential use of Energy	6	0.79	Valid
Energy use efficiency	7	0.78	Valid
Energy sources in Nature	8	0.78	Valid
Renewable Energy Sources	9	0.89	Valid
Renewable Energy Sources	10	0.78	Valid
The Law of	11	0.78	Valid

Question Indicator	No. Item	V	Category
Conservation of Energy			
The Urgency of Energy Needs	12	0.78	Valid
Average		0.80	Valid

Source: Processed Primary Data(2025)

The results of the analysis in table 9 obtained the Aiken's V index for the creative thinking skills test obtained an average (V) of 0.80 and were in the valid category. Thus, this creative thinking skills test instrument is declared feasible to be used in measuring the improvement of students' creative thinking skills.

Results of Empirical Development Validation Analysis

Empirical analysis was carried out through field trials on the question of creative thinking skills of renewable energy materials. Some of the results of the field trial are the analysis of the validity of the question items and the reliability of the creative thinking skills test instruments. In the analysis of the validity of the question items, 8 valid question items were obtained with a biserial point coefficient value greater r table = 0.276 with a significance value of 0.05. As for reliability, the creative thinking skills test has a reliability of 0.83, which means it is reliable. This shows that 83% of the variations of the creative thinking skills test consist of elements that contain truth and the remaining 17% contain elements of error. So that the instrument is said to be good and suitable for use as an assessment instrument.

Practitioner Assessment of Physics Learning Module Based on Creative Problem Solving

The practitioner's assessment of the physics presentation module based on *creative problem solving* was obtained from a questionnaire by the teachers of Physics subjects. The questionnaire used has gone through the validation stage by experts/experts and is agreed to be a valid instrument. The practitioner assessment questionnaire was filled out by 10 physics teachers from several schools that are members of the Makassar City High School physics MGMP group. Each assessment component available on the practitioner questionnaire sheet consists of 36 statements that are assessed on a likert scale with a score range of 1 to 4 according to the specified category. The aspects assessed by practitioners are related to the feasibility of content, presentation, language and graphics. The results of the analysis of practitioners' assessments of the creative problem-solving-based physics learning module *developed* can be seen in the following table 10:

Table 10. Results of Practitioner Assessment of CPS-Based Physics Learning Module

Assessment Scope	∑A	∑B	PRS%	Criterion
Contents Eligibility	346	400	87	Very Practical
Serving	293	320	92	Very Practical
Language	323	360	90	Very Practical
Graphic	311	360	86	Very Practical
Average			89	Very Practical

Source: Processed Primary Data (2025)

The practitioner assessment image is shown in the form of a graph in Figure 4.

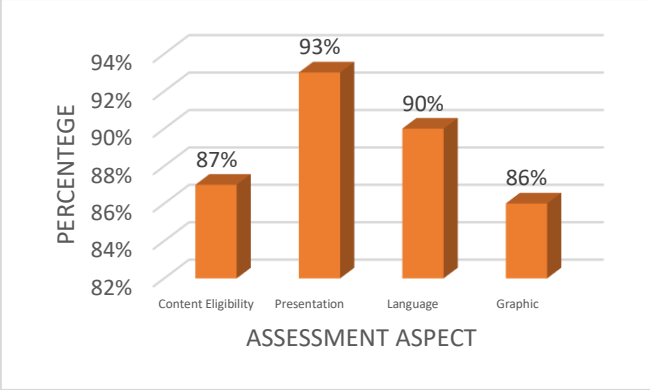

Figure 4. Practitioner Assessment on CPS-Based Physics Learning Module

The assessment of practitioners in the learning module can be seen in table 10 and Figure 4 above, the practitioners' response to the CPS-based physics learning module for all aspects is on very practical criteria. For the content feasibility aspect, a total score of 346 was obtained with a percentage of 87%, the presentation aspect obtained a total score of 293 with a percentage of 92%, the language aspect obtained a total score of 323 with a percentage of 90%, and the graphic aspect obtained a total score of 311 with a percentage of 86%.

Student Assessment of Creative Problem Solving-Based Physics Learning Module

Students' assessment of the physics presentation module based on *creative problem solving* was obtained from a questionnaire by students in grades X.1 and X.2 of SMA YP PGRI 3 Makassar. The questionnaire used has gone through the validation stage by experts/experts and is agreed to be a valid instrument. The student assessment questionnaire was filled out by 60 students in grades X.1 and X.2 Each assessment component available on the student questionnaire sheet consisted of 30 statements that were assessed on a likert scale with a score range of 1 to 4 according to the

specified category. The aspects assessed by students are related to the feasibility of content, presentation and language. The results of the analysis of students' assessments of the creative problem-solving-based physics learning module developed can be seen in Table 11.

Table 11. Student Assessment Results of CPS-Based Physics Learning Module

Assessment Scope	∑A	∑B	PRS %	Criterion
Contents Eligibility	1701	1920	89	Very Practical
Serving	847	940	88	Very Practical
Language	3852	4320	89	Very Practical
Average			89	Very Practical

Source: Terprocessed Primary Data (2025)

The practitioner assessment image is shown in the form of a graph in Figure 5.

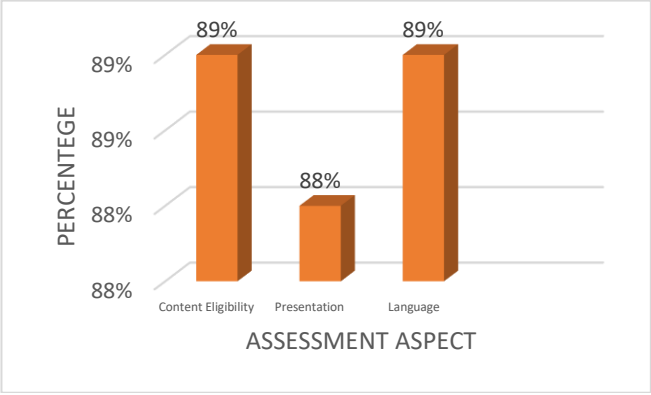

Figure 5. Student Assessment in the CPS-Based Physics Learning Module

Students' assessment of the CPS-based physics learning module can be seen in Table 11 and Figure 5 above, the students' responses to the CPS-based physics physics learning module for all aspects are on very practical criteria. For the content feasibility aspect, a total score of 1701 was obtained with a percentage of 89%, the presentation aspect obtained a total score of 1701 with a percentage of 89%, the presentation aspect obtained a total score of 847 with a percentage of 88% and the language aspect obtained a total score of 3852 with a percentage of 89.

Results of Analysis of the Effectiveness of Physics Learning Modules Based on Creative Problem Solving

The results of the Effectiveness Analysis of the Physics Learning Module Based on creative problem solving consist of descriptive analysis and Inferential Statistical Analysis analysis.

Descriptive Analysis

After being given different treatment between the *experimental* class and the control class, then the end of the learning is given *a* posttest in the form of a description question that has been declared valid. This test consists of 8 questions that measure four indicators: fluency, flexibility, authenticity, and elaboration. The scoring conditions are that the ideal maximum score = 24 and the ideal minimum score = 0 apply, so that table 12 and 13 is obtained. The results of the descriptive analysis of the creative thinking ability test are presented in Table 12.

Results of descriptive analysis of creative thinking ability test in experimental class

The results of the descriptive analysis of the creative thinking ability test of the experimental class are presented in Table 12.

Table 12. Categories of Creative Thinking Skills Score for Experimental Class Students

Interval Classes	Category
28-34	Very High
21-27	Tall
14-20	Keep
7-13	Low
0-6	Very Low

Source: Terprocessed Primary Data (2025)

The category of creative thinking skills score of students in the experimental class using the CPS-based physics learning module is 23.97 in the interval class of 21-27 which means that it is in the high category.

Results of descriptive analysis of creative thinking ability test in experimental class

The results of the descriptive analysis of the creative thinking ability test of the control class are presented in Table 13.

Table 13. Categories of Creative Thinking Skills Score for Control Class Students

Interval Classes	Category
28-34	Very High
21-27	Tall
14-20	Keep
7-13	Low
0-6	Very Low

Source: Terprocessed Primary Data (2025)

The category of creative thinking skills score of students in the control class taught by conventional methods is 19.71 in the 14-20 interval class, which means that it is in the medium category**.** After being given a creative thinking skills test, then a prerequisite test and hypothesis testing calculation were carried out. The

posttest results from the experimental class and the control class are as follows (Table 14).

Table 14. Descriptive Data on Students' Creative Thinking Ability Scores

	Statistical Score	
Sample Size	Experiment	Control
Sample Size	32	28
Ideal Highest Score	32	32
Ideal Lowest Score	0	0
Highest Score	30	28
Lowest Score	18	11
Score Range	12	17
Average Score	23.97	19.71
Standard Deviation	3.03	4.52
Variance	9.18	20.42

Source: Processed Primary Data (2025)

Descriptive data on creative thinking ability scores in table 14 can be seen that the average score obtained by students taught using CPS-based physics learning modules is 23.97 with the highest score of 30 and the lowest score of 18 and the standard deviation obtained is 3.03 with a variance of 9.18. Meanwhile, the average score obtained by students taught by conventional methods was 19.71 with the highest score of 28 and the lowest score of 11 and the standard deviation was 4.52 with a variance of 20.42.

Inferential Statistical Analysis

The data obtained from this study in addition to being descriptively analyzed also used inferential analysis with t-test statistics aimed at hypothesis testing. Before using the t-test, a normality and homogeneity test is first carried out.

Normality Test Results

The normality test was carried out by Kormogorov Smirnov analysis using SPSS. The sample is said to be normal if the calculated r-value is greater than the table r-value or the significance level is less than 0.05. The results of the normality test calculation in this study are as follows (Table 15).

Table 15. Normality Test Results of Creative Thinking Skills Score for Experimental Class and Control Class

Data	Experiment	Control	Verdict
N	32	28	Normal
Calculation	0,57	0,67	Distributed
rtables.	0,35	0,37	
Sig<0.05	0,01	0,01	

Source: Terprocessed Primary Data (2025)

The results of the normality test calculation were obtained that the calculation value in the experimental class was 0.57 and the rtable value was 0.35 and the significance level was 0.01. While the calculated value in the control class is 0.67 and the r-value$_{\text{of the table}}$ is 0.37. This means that the calculation > rtable, h_0 is accepted or the data of creative thinking skills that use *creative problem solving-based learning modules* and classes that do not use creative problem solving-based learning modules are normally distributed.

Homogeneity Test Results

The Homogeneity Test using Barret analysis is used to compare variants or homogeneity on each variable. If Barret's test yields a value, it shows that x^2 counts < x^2 of the table which means H_0 is accepted. The results of the homogeneity test calculation in this study are as follows (Table 16).

Table 16. Results of the Homogeneity Test of Creative Thinking Skills Score in Experimental and Control Classes

Data	Experiment	Control
Variance	1.85	2.21
X2Count	0.237	
X2Table	0.445	

Source: Terprocessed Primary Data (2025)

From the results of the analysis, the x^2 value of the calculation is 0.237 and the x^2 value of the table is 0.455. This means that H_0 is accepted or the regression error data of the control class variable and the experiment have the same or homogeneous variance.

Mann Whiteney U Test

The price of P for Z = -3.490 and the significant level of 0.05 is 0.0002 so that P < significant level or 0.0002 < 0.05 or H_0 is rejected.

Hypothesis Test

Because the significance value is 0.0002 < 0.005, H_0 is rejected, meaning that the average results of the creative thinking skills test in classes that use the creative problem-solving-based physics learning module are higher (effective) than the average results of the creative thinking skills test in classes that do notuse the CPS-based physics learning module.

Discussion

Development results reviewed from upfront validity

The results of the preliminary validation analysis of the CPS-based physics learning module obtained that the average accuracy of the items measuring the indicator was in the very appropriate category (ST) for learning 1, learning 2 and learning 3. The language clarity in learning 1, learning 2 and learning 3 used is in the clear category (J). The graphic components for

learning 1, learning 2 and learning 3 are in the good category (B).

The results of the preliminary validation of practitioners' responses to the CPS-based physics learning module are in the very appropriate category (ST) in measuring indicators, clear (J) in the use of language and in terms of the component of good graphic quality (B). The results of the initial validation of students' responses to the CPS-based physics learning module were in the very appropriate category (ST) in measuring indicators, clear (J) in the use of language and in terms of the good graphic quality component (B). So it can be concluded that all the instruments used are reviewed from the validity of the face are in the category of very appropriate (ST) and are suitable for use in the research process.

The development results are reviewed from the validity of experts

The CPS-based physics learning module was validated by 3 (three) Physics lecturers at the State University of Makassar with the results of the assessment of the three validators on the learning module based on aspects of format, material/content, language, presentation and graphics. The results of expert validation that have been analyzed using the Aiken'V theory show that each instrument developed has a V value of each instrument at least 0.73. .

Results of the development of the Empirical Creative Problem Solving Based Physics Learning Module

Based on the creative thinking skills test, the validity analysis of the question items was obtained 8 valid question items with a biserial point coefficient value greater than r table = 1.67 with a significance value of 0.05. The reliability of the creative thinking skills test instrument has a reliability of 0.83 which means reliable.

Results of Analysis of Practitioners' Responses to Creative Problem Solving-Based Physics Learning Modules

The response given by practitioners to the Physics learning module developed had a criterion interval≥41% with an average score of 336 with a percentage of 81% which was in the very practical category. The results of the practitioner's response showed that the physics learning module developed had learning materials and activities that were easy to understand and materials for carrying out activities that could be obtained easily, an attractive cover display and an attractive and clear illustration of the images used. The language/terms used in the learning module are easy to understand, the sentences are simple and in accordance with the level of development of the students.

Results of Analysis of Students' Responses to Creative Problem Solving-Based Physics Learning Module

The responses given by students to the Physics learning module developed had a criterion interval≥41% with an average score of 987 with a percentage of 89% which was in the very practical category.

Results of the Analysis of the Effectiveness of Physics Learning Modules based on Creative Problem Solving on Students' Creative Thinking Skills

A test of creative thinking skills was given to students after learning activities using CPS-based physics learning modules. The creative thinking skills test given to students is a description test consisting of 8 questions. This test is carried out to determine the level of achievement and understanding of students with creative thinking skills. After using the CPS-based physics learning module, the creative thinking skills test was tested in 2 classes, namely class X.1 as an experimental class and class X.2 as a control class. Normality test to find out if the data distribution follows or approaches the normal distribution. The test is carried out using the test technique can be seen in Appendix C16. The rcal value in the experimental class was 0.57 and the rtable value was 0.35 and the significance level was 0.01. While the calculated value in the control class is 0.67 and the r-value$_{\text{of the table}}$ is 0.37. This means that the calculation > the table then h0 is accepted or the data on creative thinking skills that use *creative problem solving-based learning modules* and classes that do not use creative problem solving-based learning modules are normally distributed.

The homogeneity test is used to find out whether or not some population variants are the same. The results of the homogeneity test analysis used the Barret test. From the results of the analysis, the x^2 value of the calculation is 0.237 and the x^2 value of the table is 0.455. This means that H_0 is accepted or the regression error data of the control class variable and the experiment have the same or homogeneous variance. The results of the barret test can be seen in Appendix C18. The last step is for the researcher to conduct a hypothesis test to find out if there is a difference between the experimental class and the control class. To obtain these results, the researchers used Microsoft Excel with analysis for the Mann Whitney U test which can be seen in appendix C19. To test the hypothesis, it can be seen from the table by comparing the significance value of 5% which is 0.05 with the value p = 0.0002 obtained from the table of possibilities related to the price of Z = -3.490. So the result is 0.0002 < 0.05 proving that H_0 is rejected.

So it can be concluded that the average results of the creative thinking skills test in classes that use CPS-based physics learning modules are higher than the average results of creative thinking skills test in classes that do

not use CPS-based physics learning modules. Further differences can be seen from the descriptive analysis of the experimental class and the control class. Based on the results of the descriptive analysis, the average score of the experimental class was 23.97 while the average score of the control class was 19.71, the standard deviation of the experimental class was 3.03 while the standard deviation of the control class was 4.52 and the variance of the experimental class was 9.18 while the variance of the control class was 20.42. From the results of the descriptive analysis of the two classes, it can be concluded that the experimental class has a higher value than the control class. So that with the use of this CPS-based physics learning module, it is effective to be used in physics learning.

Conclusion

Based on the results of the research and discussion, it can be concluded that the results of the development of physics learning modules based on *creative problem* solving are reviewed theoretically and empirically and are suitable for use in the following research:

Based on the preliminary validation of 10 respondents, it was shown that the accuracy of the items measuring the indicators, the clarity of the language used, and the graphic components for all instruments used were feasible and could be used in the research. The response of practitioners and students to the physics presentation module based on creative *problem solving* is in the very practical category. The average test of creative thinking skills of students in classes who use creative problem *solving*-based physics learning modules is higher (effective) than the average results of creative thinking skills test in classes that do not use creative problem solving-based physics teaching modules.

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References

Andrian, Y. & Rusman. (2019). *Implementation of 21st Century Learning*. *12*(1), 14–23.

Anisa, R. E. M. H. D. M. (2018). Improving Students' Creative Thinking Ability by Using STEAM-Based Project Based Learning Model (Science, Technology, Engineering, Arts and Mathematic) on Acid and Base Materials at SMAN 11 Jambi City. *Journal of the Indonesian Society of Integrated Chemistry*, *10*(2).

Azwar, S. (2015). *Reliability and Validity*. Library of Learning.

Istiyono, E. , D. W. B. , & R. F. (2018). Developing of computerized adaptive testing to measure physics higher order thinking skills of senior high school students and its feasibility of use. *European Journal of Educational Research*, *9*(1), 91–101.

Kartikasari H.A., S. Wahyuni. , and A. D. Lesmono. (2015). Development of Teaching Materials Based on Scientific Approach on the Subject of Size and Unit in High School. *Journal of Physics Learning*, *4*(1), 64–68.

Kurnia, G. (2019). *Creative problem solving learning book*. Salemba Teknika.

Maulida, U. (2022). Development of Independent Curriculum-Based Teaching Modules. *Tarbawi*, *5*(2), 130–138.

Riduwan. (2015). *Measurement Scale of Research Variables*. Alphabet.

Rulyansyah. A. (2022). *Enhancing Creative Thinking through Multiple Intelligence-Oriented Creative Problem-Solving*. *6*(1).

Sari, C. E. , A. K. , & Y. A. (2020). Identification of Scientific Attitudes in Conducting Physics Practicum for Students of SMAN 12 Makassar. . *Journal of Physics Science and Education*, *16*(1), 27–3

Sudirma, M. (2013). *Development of Creative Thinking Skills*. PT Rajagrafindo Persada.

Sugiyono. (2015). *Educational Research Methods of Quantitative, Qualitative, and R&D Approaches*. Alfabeta.

Sugiyono. (2019). *Research & Development Methods and Development*. Alfabeta.

Sujanem, R. , S. I. N. P. , & T. I. K. (2012). Development of web-based interactive contextual physics modules for high school grade I students. *Journal of Education and Teaching*, *42*(2), 97–104.

Sutrisno. (2006). *Physics and Its Learning*. University of Education Indonesia.

Swestyani.S. (2014). Development of Creative Problem Solving (CPS)-Based Science Modules to Improve Students' Creative Thinking Skills. . *Journal of Biology Education*, *6*(2), 36–41.

Thiagarajan, S. S. (1974). *Instructional development for training teachers of exceptional children*. University of Minnesota, Minneapolis.

Umiyyah. S. (2023). Meta-Analysis of the Development of Creative Problem Solving (CPS)-Based Biology Modules to Improve Students' Creative Thinking Skills. *Journal of Science and Education Research*, *3*(2).

Yunika sari, f. (n.d.). Development of Physics Module Based on Creative Problem Solving the Subject of Electromagnetic Induction in Physics Learning in High School Thesis Prepared by.

Zulyadaini. (2017). Effects of Creative Problem Solving Learning Model on Mathematical Problem Solving Skills of Senior High School Students. *IOSR Journal of Research & Method in Education*, *7*(3), 33–37.