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Development of learning model problem investigation discussion sharing to improve science literacy and collaboration

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Abstract: Science literacy and collaboration skills in schools are still very low and the learning models applied by teachers still have shortcomings that need to be improved. Based on this, researchers are interested in developing a learning model called Problem Investigation Discussion Sharing (PIDS), which combines three learning models: Problem Based Learning (PBL), Inquiry Learning, and Discovery Learning. The purpose of this study is to test the validity, practicality and effectiveness of the PIDS learning model. This study uses the ADDIE design with the phases Analyze, Design, Development, implementation, and evaluation. The research was conducted in three schools with three validators. Validation results obtained a score of 89% in valid categories. Practicality results of 86% in highly practical categories; N-gain results in science literature of 0.65 in medium categories and collaboration results of 78.3% in collaborative categories. In conclusion, the PIDS learning model is valid, practical and effective.

Keywords: collaboration skill; learning model; problem investigation discussion sharing; science literacy

1. Introduction

Science literacy and collaboration are essential to education in Indonesia. This is because science literacy can be used as a benchmark because it can develop the learning of the 21st science century (Mustofa et al., 2023). Science literacy refers to the importance of thinking and doing skills that involve mastering thinking skills and applying scientific thinking patterns in the study and understanding of social issues (Wulandari *et al.*, 2023). While collaboration is very necessary in science learning because science lessons not only learn about knowledge of facts, principles, but also learn in the process of discovery (Sufajar & Qosyim., 2022). But in reality, on the ground the ability of science literacy and student collaboration is still quite low.

Indonesian PISA results for 2022 indicate that Indonesia again experienced a fall in science scores when in 2018 Indonesia scored 396 but in 2022 it dropped by 13 points to 383 (OECD, 2024). Some studies have shown that science literacy is relatively low. According to a study by Sujudi et al., (2020), the science literacy of Islamic high school students in Pekanbaru is in the lowest category.

The factors that are believed to be the cause of the low literacy of science in Indonesia are the educational system applied, the choice of models, approaches, strategies, learning methods used, the selection of learning sources, student learning styles, as well as the means used in learning (Novita et al., 2021). The low level of science literacy of students in the science subjects is because one of them is a form of learning that is non-contextual and the mastery of the concepts of science is not associated with things related to everyday life (Suparya et al., 2022).

In the 21st century, in addition to requiring science literacy skills, it also requires the ability to collaborate. The importance of collaborative skills to be taught to pupils turns out to be incompatible with those on the ground. In fact, there are still many students with low collaborative abilities. According to Mashud et al., (2022) said that it is actually in Indonesia by 2022 in the independent curriculum of collaboration competence into the sub-elements of gotong royong, but the effectiveness of collaborative competence in learning is still not maximum. Based on the results of interviews conducted by Putri & Qosyim, (2021) with three science teachers at SMPN 5 Gresik showed that the collaborative skills of eighth grade students are still low.

The low collaborative ability of the students is due to the fact that teachers never apply the Student Cantered Learning (SCL) learning model, so students tend to never group and interact with each other in the classroom. This is in line with the opinion put forward by Hamdani (2019), class teachers rarely apply group work in using a learning model so making students' skills do not develop one of these collaborative and learning skills like this makes students quickly get bored and cannot concentrate for a long time. The current learning problem is the lack of student activity, where the average teacher still implements less interactive learning systems, so that the teacher-student feedback is lacking (Putri & Qosyim, 2021).

In order to improve science literacy and collaboration skills, a student cantered learning (SCL) learning model is needed, which is easy to use and contextual and can be a case learning model or case learning. The case learning method is done by placing students in a learning group and giving a case to be solved (Siswati & Suratno, 2023). The context-based, SCL and case-based model is the Inquiry learning model. But according to the opinion of Khoiriyah et al., (2020) the deficiency of inquiry Learning is that the teacher feels failing to detect problems and misunderstandings between teacher and student. So, in the learning process students must be prepared / given stimulation first and the initial problems that arise are made in the form of questions. Learning model that contains stimulation and problem statement in the format of questions is the discovery learning model (Wulandari *et al.*, 2023). To enhance collaboration, group work in the classroom is required. According to Zainal (2022), the PBL model has the advantages of improving the social and communication skills of students so that they can study and work in groups. Based on this; by combining the three learning models mentioned above, it can address the shortcomings of each model to enhance students' collaboration and science literacy skills.

Based on the above background, there is a need for the development of learning models that can help students to be more active, collaborative, and able to understand concepts independently based on the characteristics of the three learning models namely PBL, Discovery and Inquiry. Therefore, researchers are interested in conducting research entitled "Development of Learning Model Problem Investigation Discussion Sharing (PIDS) to Improve Science Literacy and Collaboration in Science Learning".

2. Materials and Methods

2.1 Types of research

This research is research development (research and development) is the development of the learning model of Problem Investigation Discussion Sharing (PIDS). The design of the development model of learning problem investigation discussion sharing (PIDS) uses the ADDIE development model that covers five stages: analyze, design, development, implementation, and evaluation.

a. Analyze

Phase Analysis (Analyze) At the analysis stage, the researchers perform needs analysis through interviews with teachers at each school. The analysis carried out includes

methods, strategies, means, and tools that have been done and exist in the school to find methods and strategies of implementation suitable to be applied at the time of science learning. Based on the needs analysis, it was found that in the three schools, the models used are Inquiry Learning and Discovery Learning. However, there are difficulties in identifying the problems that need to be discussed during the learning process. The learning methods used are lectures and question-and-answer sessions, but the students appear very passive and lack motivation during the Q&A in class. The facilities and infrastructure at the school are quite complete, with laboratories and LCD projectors that assist in the science learning process.

b. Design

The planning phase (design) at the planning stage starts with designing concepts and content for the product developed. Each product concept that has been designed is described in detail. At this stage, the product design of the learning model is still a concept that forms the basis of development at the next stage.

c. Development

The development stage refers to the process of implementation and realization of the product design that has been made at the previous stage. If at the previous stage a conceptual framework is produced related to the product developed, at this stage the conceptual structure is transformed into a real product. This stage includes material manufacture, media development, and all the elements necessary to implement a product that has been made. After the product is completed, a validation process is carried out to determine the feasibility of the product and to obtain feedback from the validators as a reference for improvements to the product.

d. Implementation

At the implementation stage, the product is applied to determine the practicality and effectiveness of the created product. The implementation process must align with the product design created in the previous stage to ensure that the product remains consistent with the initial concept. The results from this implementation stage are used to make improvements and refinements to the product before it ultimately moves on to the evaluation and revision stage. At this stage, the researcher applies the developed product to test its practicality and effectiveness.

e. Evaluation

Evaluation The evaluation phase aims to provide feedback to users of products that have been developed. This feedback is the result of the implementation of the product in a real-life situation. Evaluation is carried out so that the product produced not only meets the needs of the user but also meets the quality standards and objectives that have been set.

2.2 Research Subjects and Objects

The PIDS learning model development research was carried out face-to-face in 1st Kencong State High School, 1st Jombang State High school, and 2nd Kents State Highschool in May 2024 with an allocation of 2x45 minutes of lessons per meeting. The subject of this study is a full-term high school student in the 7th grade.

2.3 Data Types and Sources

The instruments used in this research are:

1. Interview Guidelines

The interview guidelines contain questions relating to some important aspects of some of the things that are required for the variable to be measured and the desired data to be collected fully and have clear limits.

2. Validation Sheet

Validation sheets are given to experts and practitioners to obtain feedback on the products developed.

3. Raise Sheet

The leaflet is given to the learner in order to know the response to the learning model that has already been applied.

4. Pre-test and Post-test Sheet

The preliminary test and the final test are written tests with essays that have been systematically compiled according to indicators of scientific literacy.

2.4 Data collection technique

The data collection techniques used in this study are tests, observations and lifting.

a. Validation data collection techniques

The validation data collection technique is carried out by giving the validation leaflet along with the product developed to the validator. The validator then gives an assessment on each aspect. Validator also commented on the product developed.

b. Practicality data collection techniques

The practicality data is obtained through the observation sheet and the elevation response of the student. The observation of the performance sheet is used to see whether the application of the syntax of the learning model used is appropriate or not. The student response is used to find out the student's opinion of the learning model used.

c. Efficiency data collection techniques

Effectiveness data is obtained through the results of pretests and posttests. Pretests are performed by providing an initial test to determine the ability of students in the early stages. Posttests are given at the end of learning to know the ability after learning.

2.5 Data Analysis Techniques

Validation of the product is carried out by 3 validators consisting of IPA University Jember educational lecturer and the teacher of science subjects of the State secondary school 2 Kencong class VIII, following Formula 1.

$$P = \frac{\Sigma X}{\Sigma Xi} \times 100\% \quad (1)$$

Description:

P = Presentation
ΣX = Respondent score in one item
Σxi = The ideal score in one item
100% = Constant

Data is a scoreboard and a suggestion. Assessments include content validity, format components, literacy, and compatibility with science literacy and collaboration indicators. The determination of the degree of validity following the Table 1.

Table 1. Validation Level

No	Percentage (%)	Criteria
1	76 – 100	Valid
2	51 – 75	Quite Valid
3	26 – 50	Less Valid
4	8 – 25	Invalid

(Carlina et al., 2021).

Practicality Analysis

Practicality analysis is done from observations of the implementation of learning given to the observer. If the percentage obtained from the implementation sheet indicates a practical or highly practical category then science learning using the PIDS learning model can be said to be practical. The obtained data is then entered using the Formula 2.

$$P = \frac{\text{Item Score Obtained}}{\text{Maximum Score}} \times 100\% \quad (2)$$

Once the presentation value is obtained, then it is categorized according to the Table 2.

Table 2. Practicality Criteria

No	Level of Achievement (%)	Criteria
1	75.01 – 100	Very practical
2	50.01 – 75.00	Practical
3	25.01 – 50.00	Less Practical
4	06.00 – 25.00	Not Practical

(Kumalasani, 2018).

Effectiveness Analysis

The instrument used in the analysis of effectiveness is a test of student science literacy and observation of student collaboration skills. The test of scientific literacy is a pretest and posttest as well as a collaboration observation sheet filled by 3 observers.

a. Analysis of science literacy tests

This study was conducted to measure the literacy of students in science. In this study, N-gain was used to determine the improvement in literacy, following Formula 3.

$$< g >= \frac{(\%\langle Sf\rangle)-(\%\langle Si\rangle)}{(100)-(\%\langle Si\rangle)} \quad (3)$$

Description:
<g> = gainscore
Si = pretestscore
Sf = posttest score

The results of the calculation are then compared to the criteria presented in the Table 3.

Table 3. N-Gain Criteria

No	Boundary	Category
1	$g > 0.7$	High
2	$0.3 \leq g \leq 0.7$	Average
3	$g < 0.3$	Low

(Wahab et al., 2021).

b. Collaborative ability analysis

This study measured the students' ability to collaborate. In this study, using the observation of the ability of collaboration observed by 3 observers. If the results of the observations on the sheet of observations are categorized as collaborative, then learning using the PIDS learning model can be said to improve the ability to cooperate. The obtained data is then inserted into the Formula 4.

$$P = \frac{\text{Item Score Obtained}}{\text{Maximum Score}} \times 100\% \quad (4)$$

Once the presentation value is obtained, then it is categorized according to the table of criteria of scores following to the Tabel 4.

Table 4. Collaboration Skill Criteria

No	Boundary	Criteria
1	>80	Very collaborative
2	>60 – 80	Collaborative
3	>40 – 60	Pretty collaborative.
4	>20 – 40	Less Collaborative
5	≤20	Non-Collaborative

(Sufajar & Qosyim, 2022).

Analys of Student Response

Students' responses are measured by elevating student responses to the PIDS learning model. The response lift is given after treatment using the PIDS learning model. The percentage of student responses is calculated using the Formula 5.

$$\text{Student Response Percentage} = \frac{\text{Student's Proportion of Student Choosing}}{\text{The Number of Student}} \times 100\% \quad (5)$$

Once the percentage value is known then the student response criteria can be seen in Table 5.

Table 5. Student Response Criteria

No	Percentage (%)	Criteria
1	75 – 100	Very good.
2	50 – 74.99	Good.
3	25 – 49.99	Average
4	0 – 24.99	Low

(Yahya & Bakri, 2017).

3. Results

3.1 Validity of the PIDS (Problem Investigation Discussion Sharing) Learning Model

The validation process is carried out by three educational experts, two experts and one practitioner. Two experts are lecturers from Jember University. The results of the validation data analysis obtained from the three validators, can be seen in Table 6.

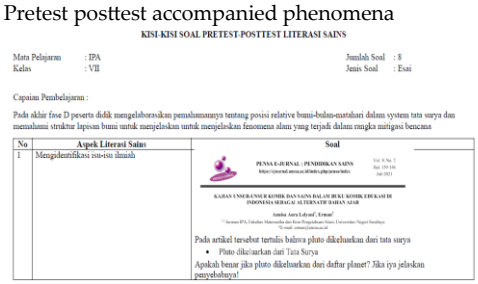
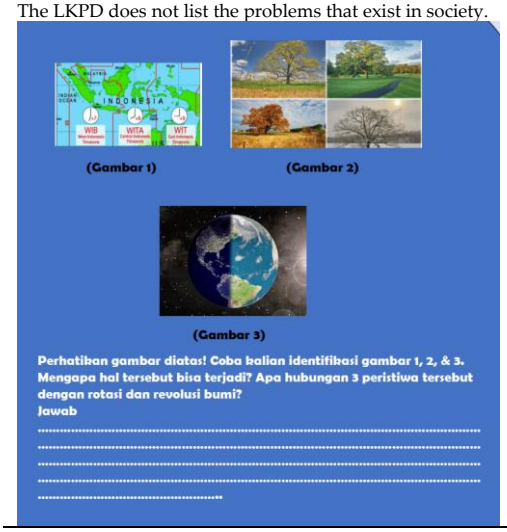
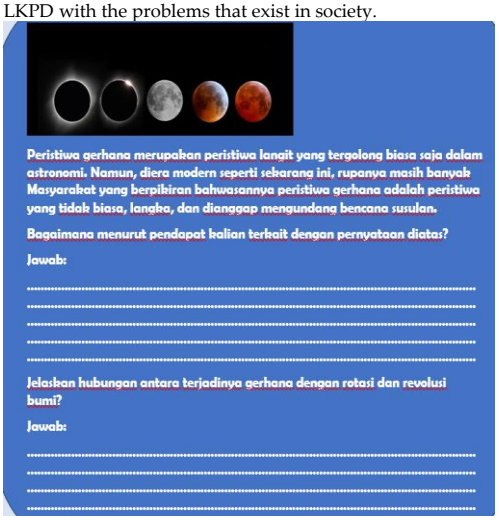
Table 6. Validation Results of Developed Products and Instruments

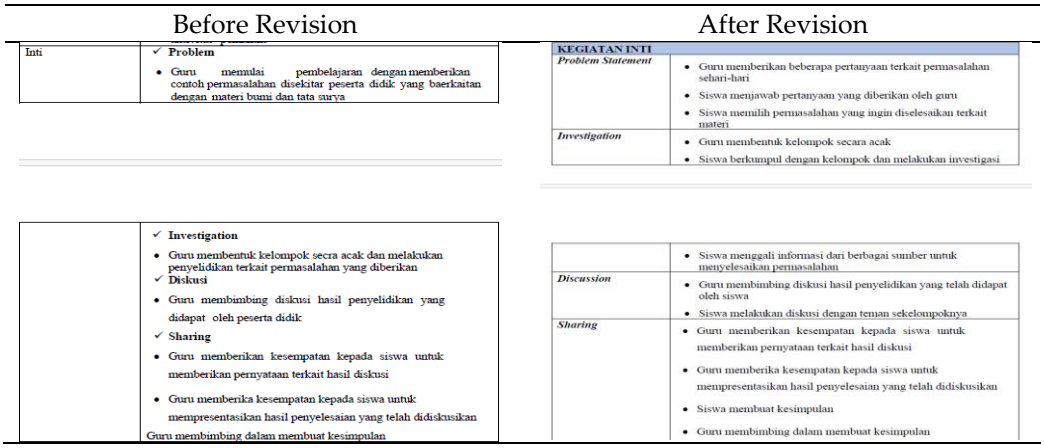
No	Validated Products	Average Score	Criteria
1.	PIDS Learning Model Format		
	▪ Syntax of learning model	91	Valid
	▪ Compatibility with science literacy	84	Valid
	▪ Compatibility with collaboration	93	Valid
	Average score	89	Valid
2.	PIDS Learning Model Guide Book		
	▪ Supportive theory	92	Valid
	▪ Contents	92	Valid
	▪ Language	96	Valid
	Average score	93	Valid

No	Validated Products	Average Score	Criteria
3.	PIDS Learning Module		
	▪ Format	90	Valid
	▪ Learning Activities	86	Valid
	▪ Language	92	Valid
	Average score	89	Valid
4.	LKPD PIDS Learning Model		
	▪ LKPD Design	88	Valid
	▪ Activities	85	Valid
	▪ Language	81	Valid
	Average score	84	Valid
	Pretest Posttest	89	Valid

Based on the results of the above validation analysis, it was found that the product developed as a learning model of Problem Investigation Discussion Sharing (PIDS) along with validated instruments obtained a value between 89-93 with a valid category. This is in accordance with the opinion of Fajaruddin et al., (2021) that is a valid high category when the V value is more than 0,8. In view of the above view, it can be concluded that the products and instruments developed are said to be worthy of revision. As for some of the revisions submitted by the validator, follow in Table 7.

Table 7. Product Revision Results

Before Revision	After Revision
Pretest posttest not accompanied by phenomena	Pretest posttest accompanied phenomena
 KISI-KISI SOAL PRETEST-POSTTEST LITERASI SAINS Mata Pelajaran : IPA Kelas : VII Esai Jumlah Soal : 8 Jenis Soal : Capaian Pembelajaran : Pada akhir fase D peserta didik mengelaborasikan pemahamannya tentang posisi relative bumi-bulan-matahari dalam system tata surya dan memahami struktur lapisan bumi untuk menjelaskan untuk menjelaskan fenomena alam yang terjadi dalam rangka mitigasi bencana No / Aspek Literasi Sains / Soal 1 Mengidentifikasi isu-isu ilmiah — Apakah benar jika pluto dikeluarkan dari daftar planet? Jika iya jelaskan penyebabnya! 2 Mengidentifikasi isu-isu ilmiah — Apakah meteor, meteorit dan meteoroid sama? Jika tidak jelaskan perbedaannya! 3 Menjelaskan fenomena ilmiah — Jelaskan bagaimana terjadinya siang dan malam! 4 Menggunakan bukti ilmiah — Apa yang terjadi jika poros bumi tegak dan tidak miring? 5 Mengidentifikasi isu ilmiah — Pergantian musim sangat dipengaruhi oleh gerak revolusi bumi	 KISI-KISI SOAL PRETEST-POSTTEST LITERASI SAINS Mata Pelajaran : IPA Kelas : VII Jumlah Soal : 8 Jenis Soal : Esai Capaian Pembelajaran : Pada akhir fase D peserta didik mengelaborasikan pemahamannya tentang posisi relative bumi-bulan-matahari dalam system tata surya dan memahami struktur lapisan bumi untuk menjelaskan untuk menjelaskan fenomena alam yang terjadi dalam rangka mitigasi bencana No / Aspek Literasi Sains / Soal 1 Mengidentifikasi isu-isu ilmiah Pada artikel tersebut tertulis bahwa pluto dikeluarkan dari tata surya • Pluto dikeluarkan dari Tata Surya Apakah benar jika pluto dikeluarkan dari daftar planet? Jika iya jelaskan penyebabnya!
The LKPD does not list the problems that exist in society.	LKPD with the problems that exist in society.
	
RPP hasn't detailed the activities of teachers and students.	RPP has detailed the activities of teachers and students.



3.2 Problem Investigation Discussion Sharing (PIDS) Model Learning

The development of the learning model PIDS produced a learning model format that combines the three learning models Problem Based Learning, Inquiry Learning and Discovery Learning. PIDS Learning Model Syntax following Table 8.

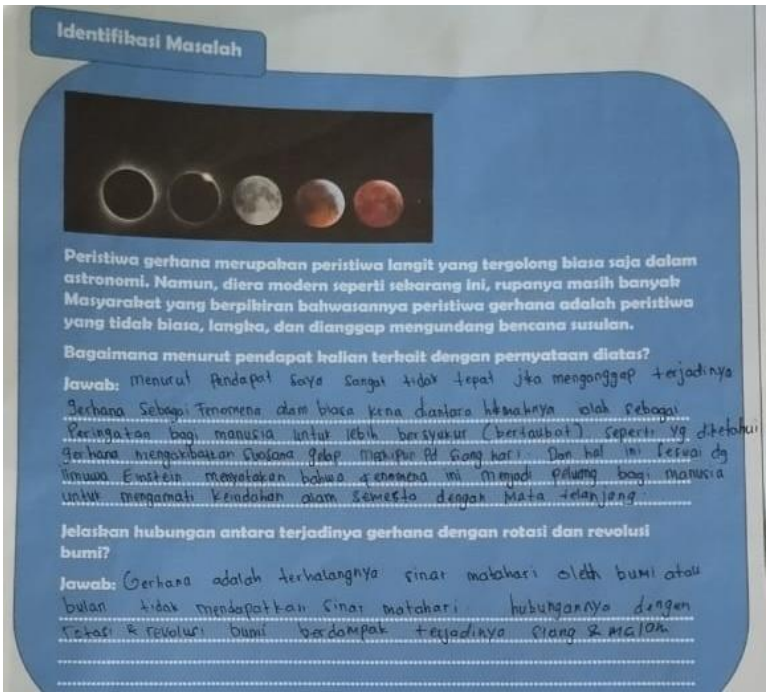
Table 8. PIDS Learning Model Syntax

No	Learning Steps	Teacher Activities	Student Activities
1	Problem	Teacher gives answers to questions related to everyday problems	Students choose interesting problems that want to be solved related to material
2	Investigation	Teachers form random groups and conduct research related to selected issues	Students gather with groups and carry out research and dig information needed
3	Discussion	Teacher guides discussion of research results obtained by students	Students discuss with their group related to the selected issue
4	Sharing	Teachers give students the opportunity to present the results of the conclusions that have been discussed	Students present the outcome of group discussions in front of the classroom
		Teacher guides students in making conclusions	Students make conclusions

The PIDS learning model is a learning model developed based on a problem-based learning model that is integrated with the learning model of discovery and discovery learning.

1. Problem

This phase begins with the question-and-answer forms of questions related to the problem that exists around. These questions serve to stimulate the student to be able to follow the learning well and in a condition that is ready to receive the material. At this stage also happens there is a process of identification of the problem given, Follow in Figure 1.


Identifikasi Masalah

Peristiwa gerhana merupakan peristiwa langit yang tergolong biasa saja dalam astronomi. Namun, diera modern seperti sekarang ini, rupanya masih banyak Masyarakat yang berpikiran bahwasannya peristiwa gerhana adalah peristiwa yang tidak biasa, langka, dan dianggap mengundang bencana susulan.

Bagaimana menurut pendapat kalian terkait dengan pernyataan diatas?

Jawab: Menurut Pendapat Saya Sangat tidak tepat jika menganggap terjadinya Gerhana Sebagai Fenomena alam biasa kena diantara hikmahnya ialah sebagai Peringatan bagi manusia untuk lebih bersyukur (bertaubat) seperti yg ditetahui gerhana mengakibatkan Ciptaan Gelap Maksimal di siang hari. Dan hal ini sesuai dg ilmuwa Einstein menyatakan bahwa fenomena ini memodi Peluang bagi manusia untuk mengamati kejadian alam semesta dengan Mata telanjang.

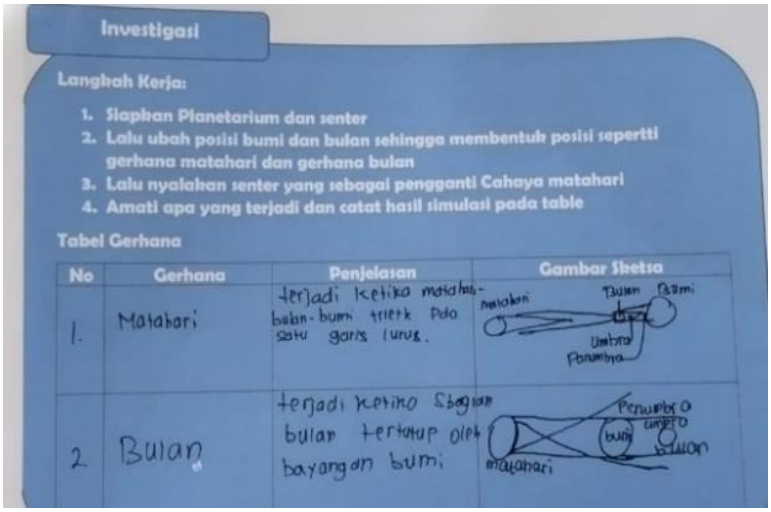
Jelaskan hubungan antara terjadinya gerhana dengan rotasi dan revolusi bumi?

Jawab: Gerhana adalah terhalanghnya sinar matahari oleh bumi atau bulan tidak mendapatkan sinar matahari hubungannya dengan rotasi & revolusi bumi berdampak terjadinya siang & malam

Figure 1. Problem Statement

2. Investigation

Students investigate problems with steps that have been designed in accordance with the concepts of science literacy so that the process of building new knowledge takes place correctly, follow in Figure 2.


Investigasi

Langkah Kerja:

1. Siapkan Planetarium dan senter
2. Lalu ubah posisi bumi dan bulan sehingga membentuk posisi seperti gerhana matahari dan gerhana bulan
3. Lalu nyalakan senter yang sebagai pengganti Cahaya matahari
4. Amati apa yang terjadi dan catat hasil simulasi pada table

Tabel Gerhana

No	Gerhana	Penjelasan	Gambar Sketsa
1.	Matahari	terjadi ketika matahari-bulan-bumi tletk pda satu garis lurus.	Matahari, Bulan, Bumi, Umbra, Penumbra
2.	Bulan	terjadi ketika sebagian bulan tertutup oleh bayangan bumi	Penumbra, Umbra, bumi, bulan, matahari

Figure 2. Investigation on LKPD

3. Discussion

Students solve problems in collaboration and sharing among members. Students will engage in discussions with logical arguments and scientific evidence, follow in Figure 3.

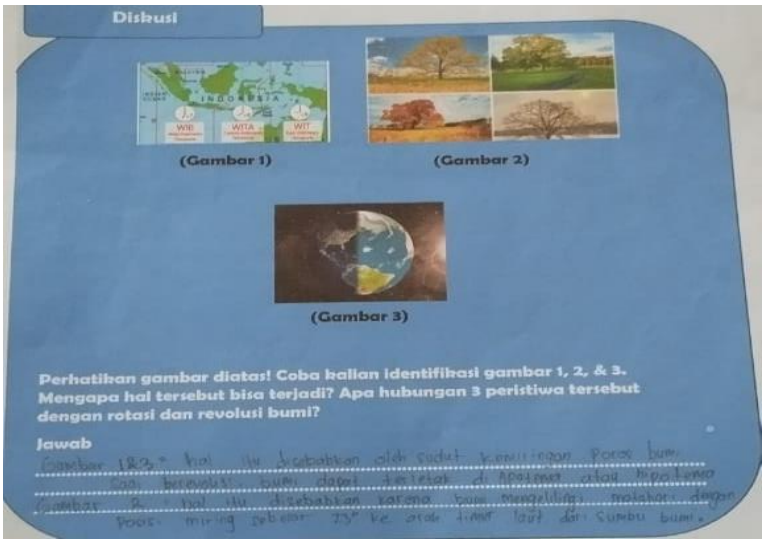


Figure 3. Discussion on LKPD

4. Sharing

All information collected by each group will be presented and communicated in front of the class. So, at this stage there's sharing between groups. Teachers guide the process of sharing between groups so that there are no misconceptions on the material. Teacher also guides the formulation of conclusions and explains the benefits of the materials taught so that students feel that what is learned is useful and beneficial for their lives, follow in Figure 4.


Figure 4. presentation in front of the class

3.3 Practicality of the PIDS (Problem Investigation Discussion Sharing) Learning Model

Data on practicality is obtained from the observation sheet on learning that has been adapted to the PIDS learning model syntax. The observations sheet is filled by 3 observers with a total of 4 meetings. Data from the observation analysis of the implementation of the learning process has been obtained as follows Tabel 9.

Table 9. Result of Learning

No	Aspect	School			Average (%)	Criteria
		A	B	C		
1.	Problem	91	84	87	87.3	Very Practicality
2.	Investigation	86	82	85	84.3	Very Practicality
3.	Discussion	87	86	93	88.7	Very Practicality
4.	Sharing	82	78	85	81.7	Very Practicality
5.	Learning process	91	94	90	91.7	Very Practicality
Average Score		87.4	84.8	88	86.7	Very Practicality

Based on the results of the observation analysis of the implementation of the learning process, the average performance of the three schools was obtained. In school A, the performance of learning was 87.4%. In school B, the score was 84.8%, while in school C, the result was 88%. According to the performance results of three schools, the mean performance of observation of implementation was 86.7%, with a very practical category.

Data on the practicality of a product is also reviewed from the elevator of student responses given at the end of learning. Response angles are used to determine student responses related to the PIDS learning model used. In addition, to measure the practicality of learning models used lifts. Here's an analysis of the student response from the three schools. Student response elevation result, presented in Table 10.

Table 10. Student Response Elevation Result

Aspect	7A	7C	7D	Average	Category
Attention	83.6	87.5	86.2	85.8	Very Good
Motivation	81.5	85.4	83.9	83.6	Very Good
Interest	88.5	89.6	89.3	89.1	Very Good
Knowledge	83.9	86.6	85.9	85.5	Very Good
Average Score	84.4	87.3	86.3	86	Very Good

Based on the results of elevation analysis student responses obtained that the response of the three school to the learning model PIDS used got a score of 86% with a good category. This indicates that the PIDS learning model applied at the time of learning gets a good response, the learning done becomes enjoyable and can improve the motivation of students as well as the knowledge acquired by students.

3.4 Effectiveness of the PIDS (Problem Investigation Discussion Sharing) Learning Model

Effectiveness data is obtained from two analyses, namely analysis of science literacy skills using test questions and analysis of collaboration using collaboration observation sheets. Analysis of scientific literacy abilities using test instruments are pretest and posttest performed by students.

1. Science Literacy

Science literacy skills are measured using tests completed by students in each school, namely, 1st State High School Kencong, 1th State High school Jombang and 2nd State Highschool Kenconga. The test instrument used is the pretest given before learning and the posttest given after learning. Here are the results of the analysis of science literacy skills that have been acquired in three schools, N-Gain science literacy results, presented in Table 11.

Table 11. N-Gain Science Literacy Results

School	Pretest		Posttest		N-Gain	Average	Category
	Low	High	Low	High			
A	19	56	67	96	0.73		
B	30	59	63	93	0.5	0.65	Average
C	19	74	56	96	0.71		

Based on the analysis of the N-gain values of the three schools, the results were obtained, namely, in school A the result was 0,73 with higher categories. In school B the result of 0.5 with medium categories was N-gein. Whereas, school C the score was 0,71 with high categories and the average of three schools was 0,65 with medium.

Then we analyze the N-gain value per indicator of science literacy to see the value of N- gain on each indicator selected. The science literacy indicators tested have three indicators, namely, identifying scientific issues, explaining scientific phenomena, and using scientific evidence. The analysis of science literacy indicators, presented in Table 12.

Table 12. N-Gain result on each indicator

School	Indicator	N-gain	Category
A	Identify scientific issues	0,6	Average
	Explaining scientific issues	0,86	High
	Using scientific evidence	0,72	High
B	Identify scientific issues	0,44	Average
	Explaining scientific issues	0,68	Average
	Using scientific evidence	0,4	Average
C	Identify scientific issues	0,6	Average
	Explaining scientific issues	0,81	High
	Using scientific evidence	0,71	High

Based on the analysis of N-Gain results on each indicator, it was obtained that in schools A, B, and C the highest N-Gain results were found in the second indicator that explains scientific phenomena with a score in school A of 0,72 in the high category. In school B of 0,68 in the medium category. Whereas in school C the N- Gain result was of 0,81 in the higher category.

The second increase in schools A and C is the same, but in schools B it is not the same. In schools A & C the second increase is in the third indicator using scientific evidence with each result obtained is 0.72 and 0.71 with high categories. In school B, there was a second increase in the first indicator, namely, identifying scientific issues with a score of 0.44 with a medium category.

The lowest increase in the A&C school on the first indicator was to identify scientific issues with a score of 0.6 in the medium category. In school B, the lowest increase was in the third indicator, using scientific evidence with a score of 0.4 in the medium category.

2. Collaboration Skill

Collaboration skills are measured using a collaboration observation sheet conducted by 3 observers. Collaborative abilities are evaluated individually in each class in three schools. Collaborative skills are observed each meeting with a total of 4 meetings. The analysis of the collaborative abilities of each school, can be seen in Table 13.

Table 13. Results Collaborative Skills

School	Meeting				Average	Category
	I	II	III	IV		
A	73.3	77.2	79	80	77.4	Collaborative
B	73.2	77.1	80.2	82.8	78.3	Collaborative
C	75.2	75.8	80.9	85	79.2	Collaborative

Based on the results of the analysis of the students' ability to collaborate from the three schools obtained the respective A, B & C scores of 77,4; 78,3 & 79,2 in the collaborative category. If you look at every meeting that has been held, it turns out that every meeting has increased.

Analyze the value of the collaboration capability of the indicator of collaboration to see the value on each indicator selected. The collaboration indicators tested have five indicators, namely, positive interdependence, social interaction, responsibility, interpersonal relationships & group processes, following Table 14.

Table 14. Indicator collaboration results

School	Indicator	Average	Category
A	Positive interdependence	72.5	Collaborative
	Social interaction	78.8	Collaborative
	Responsibility	79.1	Collaborative
	Interpersonal relationships	79.6	Collaborative
	Group process	77.2	Collaborative
B	Positive interdependence	75.1	Collaborative
	Social interaction	78.8	Collaborative
	Responsibility	82.8	Very Collaborative
	Interpersonal relationships	78.1	Collaborative
	Group process	76.8	Collaborative
C	Positive interdependence	75.9	Collaborative
	Social interaction	81.1	Collaborative
	Responsibility	78.6	Collaborative
	Interpersonal relationships	80	Collaborative
	Group process	80.5	Very Collaborative

Based on the results of the analysis of the ability to collaborate on each indicator obtained the result that in school A the first indicator is positive interdependence has the lowest score among other indicators is 72,5 with the collaborative category. The second indicator, social interaction gets a score of 38,8 with the cooperative category; the third indicator the responsibility gets a rating of 79,1 in the collaboration category. the fourth indicator interpersonal relationship gets the highest score between the other indicator of 79,6 with the medium category. The fifth indicator is that the group process gets a score of 77,2 with a medium category.

In school B, you get a score on every indicator. In the first indicator, positive interdependence is the lowest score of the other indicator of 75,1 with the collaborative category. The second indicator is social interaction has a score of 78,8 with collaborative categories. The third indicator the responsibility has the highest score from other indicators with a rating of 82,8 with the highly collaborative Category. The fourth indicator, interpersonal relationships, scored 78,1 in the collaborative category, and the fifth, in the group process, 76,8 in the collaborative category.

In school C, each indicator was scored, in the first indicator positive interdependence was the lowest score of the other indicator of 75,9 in collaborative categories. In the second indicator, social interaction was the highest rating of other

indicators of 81,1 in highly collaborative Categories. In the third indicator, responsibility gets a score of 78,6 in collaborative categories. In the fourth indicator interpersonal relationships get a rating of 80 with collaborative category. The fifth indicator is group processes get a value of 80,5 with highly collaborative category.

4. Discussion

Based on the results of the above validation analysis, it was found that the product developed as a learning model of Problem Investigation Discussion Sharing (PIDS) along with validated instruments obtained a value between 89-93 with a valid category. This is in accordance with the opinion of Fajaruddin et al., (2021) that is a valid high category when the V value is more than 0,8. Meanwhile, according to Ibrahim et al., (2023), if a product is said to be valid with revision, improvements must be made according to input from the validator. This is because the product developed already meets all the assessed aspects, namely, the compatibility of learning models with science literacy indicators and indicators of collaborative ability.

According to the performance results of three schools, the mean performance of observation of implementation was 86.7%, with a very practical category. This is in line with the statement by Sahrul et al., (2022) that observations of the implementation of the learning model are said to be performed very well if the percentage of results shows values above 75%. This is in line with research from Sari et al., (2022) which states that a product is said to be practical if it gets a practicality value above 75%. Implementation observations are carried out to review the implementation of the measures contained in the RPP and the conformity with the indicators that have been measured. Based on the results of the analysis of the observation sheet of implementation, it is found that syntax implementation in the learning process can be implemented very well. This indicates that the product can be said to be practical.

Data on the practicality of a product is also reviewed from the elevator of student responses given at the end of learning. Response angles are used to determine student responses related to the PIDS learning model used. This is in line with the opinion of Anggraeni et al., (2022) that the practicality of the learning model is defined as the percentage of the average assessment of learning achievement by the learning observer, which is measured using the observation sheet of minimum learning achieving on the practical category. In addition, to measure the practicality of learning models used lifts. Based on the results of elevation analysis student responses obtained that the response of the three school to the learning model PIDS used got a score of 86% with a good category. This indicates that the PIDS learning model applied at the time of learning gets a good response, the learning done becomes enjoyable and can improve the motivation of students as well as the knowledge acquired by students. This is in line with the opinion of Kartini & Putra, (2020) that interesting learning makes students happier and easier to absorb the knowledge seen from students' responses during the learning process.

Analysis of increased literacy of science using the values derived from the questions pretest and post-test by loading the questions containing indicators of literacy skills of science. Based on the analysis of scores pretest & post-test obtained results that there was an improvement in literacy ability of science of three schools in the middle category. This is because the PIDS learning model presents problems related to phenomena that are often encountered by students. Thus, students begin to be trained to be able to find solutions, ideas and evidence related to the problem. Students' science literacy skills can be enhanced through the implementation of appropriate models, methods, approaches, and the use of suitable learning media (Muyassaroh et al., 2022). The ability to understand science literacy is needed to comprehend scientific issues, the risks and benefits of science, as well as to understand the nature of science, including its relationship with culture (Wibowo & Ariyatun, 2020). The benefits of scientific literacy are offering understanding & knowledge about scientific processes and concepts to support life in modern times, gaining skills to answer questions related to everyday life that come from curiosity, the ability to explain a phenomenon that appears to be better, improving social skills that

involve reading skills, especially about science, having the ability to formulate problems and answer questions related to the problem in order to solve them, increasing abilities in terms of technology and information, having the ability to evaluate and draw conclusions based on available evidence (Hayati & Utomo, 2020).

On each science literacy indicator has a different improvement score. The highest increase is in the explanation of scientific phenomena because students are able to solve questions related to the phenomenon that students often encounter. This is in line with the opinion of Mellyzar et al., (2022) that the highest percentage in the aspect of explaining scientific phenomena is due to students being able to work on the evaluation that requires students to explain scientific phenomena and connect them with everyday life. The lowest increase in the A&C school on the first indicator was to identify scientific issues with a score of 0.6 in the medium category. This is because students are not accustomed to identifying the various issues that occur. This is in line with the opinion of Fadlika et al., (2020) that identifying scientific issues includes identifying possible problems for scientific research, identifying keywords for searching for scientific information, recognizing key features of scientific research. In school B, the lowest increase was in the third indicator, using scientific evidence with a score of 0.4 in the medium category.

The improvement in students' science literacy skills can be seen from the activities conducted in class based on the learning model used. In the learning process, the PIDS (Problem Investigation Discussion Sharing) model is used with steps that can enhance students' science literacy. In the first step, which is the problem, students are required to analyze and identify scientific issues occurring around them. The identification of scientific issues is carried out through group collaboration. This is because collaboration skills can enhance problem-solving abilities (Anggelita et al., 2020). In the second step, which is investigation, students are expected to think about and explain the chosen issue. In the third step, which is discussion, students are tasked with finding scientific evidence that can support the explanation of the issue they have discovered. This activity trains students to identify and analyse problems carefully and in a structured manner, so that students are able to ask and answer questions (Alatas & Fauziah, 2020). Finally, in the last step, which is sharing, students are required to explain to their classmates in front of the class what their groups have found and analyzed.

Analysis of improved student collaboration skills using values derived from the observation sheet of collaboration abilities filled by 3 observers. Based on the observations obtained results of improvement in collaboration ability in 3 schools with a moderate category. This is due to the PIDS learning model that is applied to classroom learning using a group system on each learning. So, students are trained to collaborate with other students. This is due to the ability to cooperate well within the group, exchanging knowledge to solve problems and generate ideas, presenting the tasks that have been completed, and having a sense of responsibility in carrying out both individual and group tasks that are part of achieving common goals (Wati, 2022). According to Ulhusna et al., (2020) the lack of collaboration has an influential effect on student learning and knowledge retention. At every meeting, collaboration improves. This is because learning using the PIDS learning model uses a group learning system to solve issues so that the activities are conducted with fun.

5. Conclusion

Based on the validation results of the product developed obtain results that are classified as valid and worthy of use with the revision. Based upon the data of practicality results obtained through the observation and elevation of student responses is produced that the learning model of Problem Investigation Discussion Sharing (PIDS) is categorized as practical. Based on data from science literacy results, N-gain improvement results were obtained in two high school categories and one middle school, while collaboration results were achieved in three schools with collaborative categories. Based on the above exposure,

it can be concluded that the learning model of Problem Investigation Discussion Sharing (PIDS) obtains valid, practical and effective results.

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