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Efforts to Improve Learning Outcomes in Physics Courses of PVTO IKIP PGRI East Kalimantan Students Through Asynchronous dan Synchronous System (PASS) Approach

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Abstract:- This research is a classroom action research that aims to determine the improvement of student learning outcomes through the Asynchronous and Synchronous System (PASS) approach. The research was carried out in two cycles and at the end of the meeting, a final test was carried out. Data were collected utilizing observation, documentation, tests, and questionnaires. Analysis of the impact of the PASS model with the SPSS 20.0 statistical program and the Excel program. Pretest and posttest data were analyzed by pair t-test, N-Gain, and Anova with a significance of 5%. The results showed that the PASS model was effective in improving the learning outcomes of students' problem-solving skills with the average achievement of N-Gain consistent for all learning outcomes indicators and N-Gain in the high category and student responses obtaining a high validity coefficient value and all student responses in the strong category.

I. INTRODUCTION

Important physics courses are given to all students of the Faculty of Engineering, Vocational Education, Automotive Technology, IKIP PGRI, East Kalimantan, starting from the first semester to equip students with the ability to think logically, analytically, systematically, critically, and creatively, as well as the ability to use physics in problem-solving. However, the development of these various competencies has not been achieved optimally. Among the learning competencies that still need to be considered are problem-solving abilities.

The purpose of learning physics is the ability to solve problems. These abilities include the ability to understand problems, design physical models, complete models, and interpret the solutions obtained. Physics teaching is generally dominated by the verbal introduction of formulas and concepts, without sufficient attention to student understanding. Textbooks used in learning still discuss a few questions that can develop students' problem-solving abilities. According to (Slavin, Yusron, & Zubaedi, 2015), problem-solving is the application of knowledge and skills to achieve the right goals. Thus the acquisition of knowledge and skills in problem-solving occurs from experiences as initial knowledge that can be synthesized. Following the Regulation of the Minister of Research, Technology and Higher Education of the Republic of Indonesia Number 44 of 2015, university graduates must master the attainment of attitudes, knowledge, and skills (general skills and special skills) which are formulated in graduate learning outcomes (Wakit & Hidayati, 2020).

The core competencies of KKNI and SNPT Permenristekdikti No.44 of 2015 can apply their fields of expertise and utilize science and technology in problem-solving; 2. have initiation and persistence in problem-solving; 3. able to make the right decisions/conclusions based on the analysis of information and data independently, both individually and in groups; 4. be responsible for their work and can be given responsibility for the achievement of the organization's work results; 5. able to utilize multimedia and information technology to support the learning of science physics practicum in daily life; 6. able to participate in practical activities to apply the basic concepts of science physics.

Skills are something that we are born with. Ability in physics is important for success in social life. A superficial understanding of the fundamentals of physics is no longer sufficient. Today, students must be able to think logically, collect, analyze, and organize data, make decisions, and solve complex problems in several steps. Students must master a variety of critical thinking skills at a high level. Effective physics instruction can build skills like this (Firdaus & Zahroh, 2018).

Based on the results of observations made to students of Automotive Technology Vocational Education IKIP PGRI East Kalimantan, it was found that the problems faced in class, namely: students still consider physics to be a difficult subject to learn and scary for them, low problem-solving skills, and student communication is still lacking.

The problem that becomes the focus in learning physics is the lack of student problem-solving skills. This is because problem-solving skills are a general goal of learning physics, in the sense that problem-solving can help in solving problems both in other lessons and in everyday life. In addition, problem-solving is a basic ability in learning physics. Several factors that indicate the low level of students' ability to solve problems are that only 30% of students can correctly answer numeracy questions related to static electricity. In addition, the ability of students to solve problems related to static electricity is still lacking, many students have difficulty understanding the meaning of the question, formulating what is known from the problem, the calculation process or strategy for solving the answers made by students is not correct. The student's error in solving the problem is due to the lack of students' ability to design physics models, complete the model and interpret the solutions obtained.

Factors that cause various problems in learning physics, are the learning process that has not been effective, the atmosphere is not conducive to teaching and learning activities, the level of student activity is still low, even only a few students are able and willing to express ideas, the learning methods used by teachers have not been able to activate students in the teaching and learning process, the learning process is more centered on the lecturer, namely the learning process is dominated by the lecturer, the lecturer explains, the students listen and then take notes, and the students work on practice questions. As stated (Anri, Darsikin, & Syamsu, 2012) one of the factors causing the lack of student problem-solving abilities is the factor of study habits, students are only used to learning by memorizing, this method does not train mathematical problem-solving skills, this method is a result of conventional learning because the teacher teaches physics by applying physics concepts and operations, providing examples of working on problems, and asking students to work on similar questions with questions that have been explained by the teacher. From the problems above, it can be assumed that the way of learning physics must be updated to improve students' problem-solving abilities for the better, to improve this, an active and innovative learning model is needed. From previous studies, there are several alternative solutions to problem-solving skills, including through physics approaches, Problem Based Learning models, Multi-Representation Discourse (DMR), Metacognitive approaches, investigations, and Think-Pair-Share cooperative learning models. One of the learning models used is the Synchronous Asynchronous Learning approach. The result conducted by (Narayana, 2016) shows that learning using the PASS model can improve learning outcomes. The synchronous approach is when students and instructors exchange information and interact simultaneously in an online learning community using a predetermined time using learning technologies including internet conference, satellite, video teleconferencing, and chat. Meanwhile, asynchronous learning is learning that is independent and not bound by time, where students can interact with specific materials and with each other at the time they choose. One thing that can be done is when students post their thoughts, on a day that is determined by themselves and other students comment on posts such as discussion forums (Clarke & Clarke, 2007).

II. RESEARCH

Research activities consist of 4 main activity components, namely planning, action, observation, and reflection. The subjects in this study were all students of class I A PVTO Study Program IKIP PGRI Kaltim total of 23 people. This research was carried out from June 2021 to July 2021 because the time was estimated to provide static electricity. Mr. Agus Perianto, M.Pd as the assessor and observer in the research who carried a series of activities to fill in the research instrument.

A. Research Stages

The research procedure carried out in this study used the Classroom Action Research method. The activities of designing and implementing learning improvements by applying Classroom Action Research can be described in the form of a classroom action research model and can be seen in Picture 1.

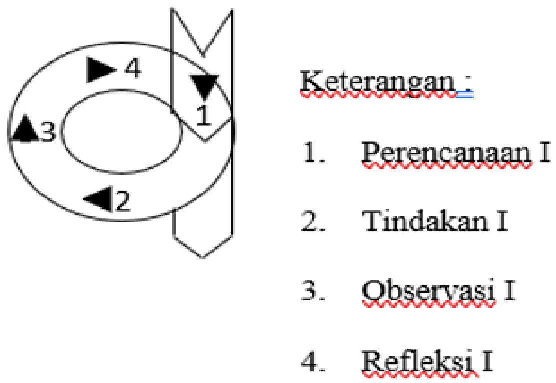

Fig 1

The research steps were carried out in 2 cycles. for each learning cycle in this research procedure are as follows:

❖ *Cycle I*

A. Planning Stage

At this stage the lecturer plans improvements with the following steps:

- Lecturers plan improvements based on the results of pre-remedial reflections, namely compiling steps to overcome the problem of low learning outcomes of physics problem-solving skills.
- Develop a Semester Learning Plan (RPS) as a reference for the implementation of the learning process based on the Indonesian National Qualifications Framework (KKNI). The preparation of the RPS also adjusted to the steps in the applied learning model. In this case, the PASS model uses the assignment method (doing questions), discussions, questions and answers, and lectures.
- Designing static electricity applications as learning aids.
- Designing an Assessment Instrument Sheet to measure learning outcomes measuring static electricity problem-solving skills.

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- Designing Student Activity Sheets (LKM) will be used by students individually, which contain tasks that students need to complete.
- Designing Lecturer Activity Sheet
- Designing Student Activity Sheets
- Designing Student Response Sheets

B. Implementation Stage

At this stage, using the Microsoft Teams Platform in an implementation based on the Semester Learning Plan (RPS) was prepared previously with the following activities:

➢ *Initial activity (15 minutes)*

- The lecturer shares the Microsoft team link to students to join the online physics class
- The lecturer conveys the learning objectives, hopes students can explain how to solve problems related to static electricity.
- Lecturers show pictures of the interaction of two and three charges related to static electricity.

Fig 2

➢ *Core Activities (45 minutes)*

- The lecturer invites students to learn and practice further, using the PhET Application related to static electricity using the LKM guide. The MFI links are: Balloons and Static Electricity (colorado.edu).
- The lecturer gives contextual problems in the form of questions. In an experiment to prove Coulomb's law, a set of tools is provided in the form of two objects, each a woolen cloth and a balloon. Balloons made of rubber are rubbed on wool for a certain period so that the balloon is negatively charged and the wool is positively charged.

If Q_1 is positively charged and Q_2 is negatively charged a distance r apart, then:

- Make at least one problem statement related to the experiment and determine the independent variable and the dependent variable.
- Create at least one hypothesis that can describe two quantities that influence each other.
- If from the experimental results obtained the following data $Q_1 = x$ C, $Q_2 = y$ C, $Q_3 = z$ C, predict at least three things that will happen if the charge of Q_2 is placed between Q_1 and Q_3.

- The lecturer invites students to practice solving problems related to Coulomb's law. As the question that has been present above.
- The lecturer asks students to understand the condition of the question or problem that exists in the question. Thus students can find out what is the core problem of the problem that requires solving?
- The lecturer asks students to think about what steps are important and mutually supportive to be able to solve problems related to Coulomb's law involving the interaction of two and three contents in the LKM book.
- Lecturers ask students to re-check and review carefully every step of the solution they did. There are: 1) Formulate the problem; 2) Create a hypothesis; 3) Experimental planning and observation; 4) Analysis; 5) Make conclusions.

➢ *Final Activity (10 minutes)*

- Lecturers assess the results of static electricity problem-solving skills using an assessment rubric.
- Together, students make conclusions/summaries of learning outcomes using their own words.
- Action
- The researcher prepared an action learning design I on static electricity material, namely the interaction of two and three charges with the LKM and formative tests.
- Implementation

✓ As a continuation of the previous action, it is focused on making students master and improve their understanding of the concept of understanding electrical material. Namely solving problems related to Coulomb's law.

✓ In this implementation, students can develop the concept of understanding the static electricity material that has been explained in learning.

- *Observation and Data Collection Phase*

The data collection stage was carried out by the researcher who was also a Physics lecturer at the PVTO IKIP PGRI East Kalimantan Study Program. With other lecturers as observers during the learning improvement process. As an observation, an implementation observation sheet was provided.

C. Research data collected:

- Lecturer Activity Data
- Student activity data in completing the LKM.
- Student skills in doing assignments include indicators: 1) Formulating problems; 2) Create a hypothesis; 3) Experimental planning and observation; 4) Analysis; 5) Make conclusions carefully every step of the solution taken regarding static electricity.
- Data collected using the Problem-Solving Ability Assessment Sheet regarding static electricity, namely Coulomb's law.
- At this stage, in addition to working on the observation sheet to prove the observations carried out, documentation evidence is needed in the form of taking pictures if necessary so that the interpretation of the data can be clearly and more accurate.

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D. Reflection

In this stage, the researcher with the observer lecturer carries out activities on the results that have been achieved, the obstacles, and the impact of improving learning on teachers and students in the first cycle. The results of this reflection are then used by the author and colleagues as a basis for efforts to improve learning in the second cycle. Reflection is carried out based on data obtained by the author and colleagues from notes from observations, evaluation results in the process, and the end of learning improvements. Furthermore, the results of this reflection are used by the author and his colleagues as a basis for efforts to improve learning in cycle II.

❖ *Cycle II*

Cycle II is an improvement from cycle I. Cycle II is the second stage of this classroom action research. The researchers in cycle II there is an increase in learning outcomes of physics problem-solving skills and all students can solve problems with a high percentage.

The steps are the same as the previous cycle, namely:

A. Planning Stage

At this stage the lecturer plans improvements with the following steps:

- Lecturers plan improvements based on the results of pre-remedial reflections, namely compiling steps to overcome the problem of low learning outcomes of physics problem-solving skills.
- Develop a Semester Learning Plan (RPS) as a reference for the implementation of the learning process based on the Indonesian National Qualifications Framework (KKNI). The preparation of the RPS is adjusted to the steps in the applied learning model, in this case, the PASS model and uses the assignment method (doing questions), discussions, questions and answers, and lectures.
- Designing static electricity applications as learning aids.
- Designing an Assessment Instrument Sheet to measure learning outcomes measuring static electricity problem-solving skills.
- Designing Student Activity Sheets (LKM) that will be used by the students individually which contain tasks that students need to complete.
- Designing Lecturer Activity Sheet
- Designing Student Activity Sheets
- Designing Student Response Sheets

➢ *Implementation Stage*

At this stage, using the Microsoft team platform in the implementation based on the Semester Learning Plan (RPS) was previously prepared with the following activities:

➢ *Initial activity (15 minutes)*

- The lecturer shares the Microsoft team link to students to join the online physics class
- The lecturer conveys the learning objectives, hopes students can explain how to solve problems related to dynamic electricity.
- Lecturers show pictures of the interaction of two and three charges related to the dynamic electric matter.

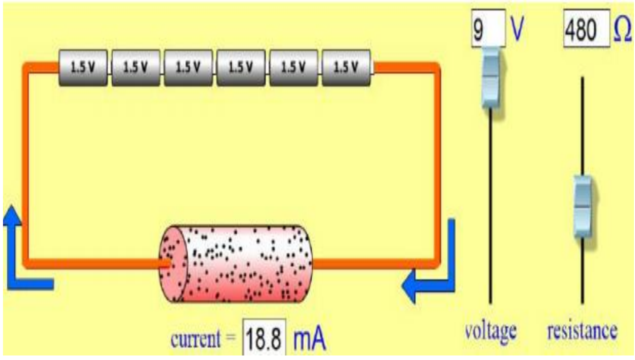

Fig 3

➢ *Core Activities (45 minutes)*

- The lecturer invites students to study and practice further using the PhET Application related to dynamic electricity using the LKM guide. The link for the MFI is: : [Ohm's Law (colorado.edu)]
- The lecturer gives contextual problems in the form of questions:

✓ In an experiment to prove Ohm's law, equipment is provided in the form of 6 batteries of 1.5 volts each, cables, 25 W/ 110 V lamps, an ampere meter, and a voltmeter that can be connected in series or parallel.

✓ The lecturer invites students to practice solving problems related to Coulomb's law. As the problem that has been present in Figure 3.

✓ The lecturer asks the students to understand the condition of the question or the problem in the question. Thus students can find out, what is the core problem of the problem that requires solving?

✓ The lecturer asks students to think about what steps are important and mutually supportive to be able to solve problems related to Ohm's law involving simple electrical circuits as in the LKM book.

✓ After that, students are ready to do calculations with all the necessary data including concepts and appropriate formulas or equations. Students are asked to solve story problems by generating initiative and persistence, accepting responsibility for their learning, having discipline and great curiosity, having confidence and a strong desire to learn, managing time and managing study time well, enjoying learning, and meeting planned targets.

✓ The lecturer asks students to re-check and review carefully every step of the solution they do, namely: 1) Formulate the problem; 2) Create a hypothesis; 3) Experimental planning and observation; 4) Analysis; 5) Make conclusions.

➢ *Final Activity (10 minutes)*

- Lecturers assess the results of static electricity problem-solving skills using an assessment rubric.
- Together, students make conclusions/summaries of learning outcomes using their own words.

➢ *Action*

The researcher prepared an action learning design I on static electricity material, namely the interaction of two and three charges with the LKM and formative tests.

➢ *Implementation*

- As a continuation of the previous action, it is focused on making students master and improve their understanding of the concept of understanding electrical material, namely solving problems related to Ohm's law.
- In this implementation, students can develop the concept of understanding dynamic electricity material that has been explained in learning.
- *Observation and Data Collection Phase*

The data collection stage was carried out by the researcher, who was also a Physics lecturer at the PVTO IKIP PGRI East Kalimantan Study Program with other lecturers as observers during the learning improvement process. As an observation, an implementation observation sheet is provided.

➢ *Research data collected:*

- Lecturer Activity Data
- Student activity data in completing the LKM.
- Student skills in doing assignments include indicators: 1) Formulating problems; 2) Create a hypothesis; 3) Experimental planning and observation; 4) Analysis; 5) Conclude carefully every step of the solution made regarding dynamic electricity.
- Data collected using the Problem Solving Ability Assessment Sheet regarding static electricity, namely Ohm's law.

At this stage, in addition to working on the observation sheet to prove the observations carried out, documentation evidence is needed in the form of taking pictures if necessary so that the interpretation of the data can be clear and more accurate.

➢ *Reflection*

In this stage, the researcher with the observer lecturer carries out activities on the results that have been achieved, the obstacles, and the impact of improving learning on teachers and students in the first cycle. The results of this reflection are then used by the author and colleagues as a basis for efforts to improve learning in the second cycle. Reflection is carried out based on data obtained by the author and colleagues from notes from observations, evaluation results in the process, and the end of learning improvements. Furthermore, the results of this reflection are used by the author and his colleagues as a basis for efforts to improve learning in cycle II.

➢ *Reflection stage*

In this stage, the researcher conducts discussions with colleagues to analyze and reflect on the collected data so that the success or failure of the second cycle improvement will be known and if the improvement has succeeded in increasing the student's physics problem-solving ability, the learning improvement has been complete.

B. Operational Definition of Research Variables

The implementation of learning is the level of achievement of the stages in the RPS carried out in the learning process using the PASS model. The implementation of learning was assessed by two observers and measured using the implementation observation sheet instrument. Observational data is a description of the suitability of the implementation of the learning stages based on the developed RPS.

Student activity is the frequency of activities carried out by students during the learning process using the PASS model which was observed with the student activity observation instrument. Learning Outcomes Test Problem Solving Skills is an organized process that involves mental processes (cognitive skills) that follow the steps: formulating problems; making a hypothesis; planning experiments; analysis; conclusion to find a solution to the problem of the concept of static electricity, dynamic electricity. The operational verbs used to determine the level of student mastery are identify, connect, integrate, estimate, conclude.

Obstacles in the implementation of learning that arise are descriptions of various things such as time, supporting facilities/infrastructure, and other things that are not suitable for improving problem-solving skills and students' metacognition taught with the PASS model as a factor inhibiting learning in each meeting.

C. Data Collection Techniques

Observations were carried out during the research to obtain research data about the implementation of the PASS model learning process, and student activities during the learning activities observed by three observers, as well as observe obstacles during learning. Documentation is carried out to record activities during the research. The test is the implementation of the test by the indicators of students' problem-solving skills and metacognition for the trial class of each class group. Student response questionnaires were used to reveal respondent data on the application of the PASS model and learning tools that have been developed. Student response questionnaires in the study were given to students at the end of the teaching and learning process.

D. Data Analysis Techniques

1. Data Analysis to Measure Mathematical Problem Solving Ability

According to Meltzer (Isnaini, 2012), calculating data gain is to determine the quality of improving mathematical problem-solving abilities before and after learning. The gain index is the normalized gain which is calculated using the following formula:

$$\text{N-gain index} = \frac{Skor\ postes - Skor\ pretes}{Skor\ maksimal\ ideal - Skor\ pretes}$$

According to (Hake, 1999), the gain index of each student is then interpreted as Table 1.

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Indeks *N-Gain*	Kriteria
$g > 0{,}70$	Tinggi
$0{,}3 < g \leq 0{,}7$	Sedang
$g \leq 0{,}3$	Rendah

Table 1. Gain Indes Criteria Interpretation

To calculate the average percentage of each indicator of the ability to solve mathematical problems, use the following formula:

The average percentage of each indicator

$$= \frac{jumlah\ siswa\ yang\ menjawab\ tiap\ level}{jumlah\ siswa\ x\ jumlah\ soal} \text{x}100\%$$

Persentase	Criteria
75% < x ≤ 100%	Very Skilled
50% < x ≤ 75%	Skilled
25% < x ≤ 50%	Less Skilled
0% < x ≤ 25%	Unskilled

Table 2 Criteria for Learning Outcomes Problem Solving Skills

Student Response Questionnaire Data Analysis

To obtain data on student responses to physics learning using the PASS model, a questionnaire was used by making statements related to the PASS model in physics learning. To calculate the percentage of student responses, the following formula can be used:

$$P = \frac{f}{n} x100\%$$

Keterangan:

P = Persentase

$\sum_x$ = Jumlah keseluruhan responden dalam seluruh item

$\sum_i$ = Jumlah skor ideal dalam per item

No	Score (%)	Rating category
1	80-100	Very well
2	66-79	well
3	56-65	Enough
4	40-55	Not enough
5	30-39	Fail

Table 3 Category of Lecturer and Student Activities

III. RESEARCH

A. Learning Problem Solving Ability of students in Cycle I and Cycle II

The results of the sensitivity analysis of the problem-solving skills learning outcomes test (KPM) in the first cycle are shown in Figure 4

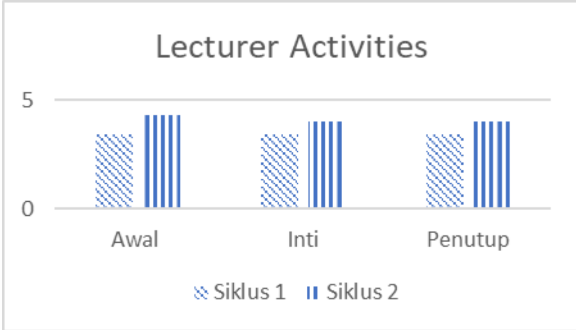

Fig 4

Figure 4 shows that the sensitivity index value of the problem-solving skill test item with an average sensitivity index of 0.54 (KPM) is in the sensitive category obtained from calculating the pretest score and posttest score in the sensitive category. This is by (Aiken, 1997), that questions that have a sensitivity index greater than or equal to 0.3 then the category is sensitive or sensitive to the effects of the PASS model. Based on the sensitivity analysis, the implementation of the PASS model is effective in teaching problem-solving skills. The results of the N-Gain analysis of the Learning Outcome Indicators of Problem Solving Skills are shown in Table 4.

stundent	Problem solving skill			
	Skor			Criteria
	Pretest	Posttest	*N-Gain*	
SW01	35	132	0,61	currently
SW02	54	150	0,53	currently
SW03	57	152	0,67	currently
SW04	54	152	0,52	currently
SW05	59	147	0,67	currently
SW06	57	149	0,60	currently
SW07	57	154	0,69	currently
SW08	58	153	0,62	currently
SW09	58	156	0,64	currently
SW10	51	151	0,71	height
SW11	59	151	0,71	height
SW12	55	149	0,53	currently
SW13	53	148	0,65	currently
SW14	50	152	0,67	currently
SW15	62	154	0,58	currently
SW16	52	153	0,60	currently
SW17	56	151	0,60	currently
SW18	49	148	0,66	currently
SW19	57	149	0,66	currently
SW20	51	150	0,60	currently
SW21	51	146	0,57	currently
SW22	55	148	0,66	currently
Mean	52,75	148,2	0,62	currently

Table 4 N-Gain Indicator of Learning Outcomes Problem Solving Skills

Table 4 shows the average N-Gain of the problem-solving skill test obtained from calculating the pretest score and posttest score, which is 62%, meaning that there is an increase from the average pretest score of 52.75 which increased to 148.20 after the implementation of the PASS model.

The effectiveness or effect of the PASS model that has been implemented, is supported by the results of the sensitivity analysis and N-Gain analysis, namely the items are generally sensitive with a range of 0.3; while for N-Gain KPM, 62% is in the medium category with a range of > 0.3 and < 0.7. The results of the analysis showed that the scores obtained by students before and after implementation showed a difference. Pretest activities are carried out so that lecturers can find out students' initial knowledge of teaching materials so that in learning the lecturers can give minimal treatment appropriate to reduce students' understanding of static electricity and dynamic electricity teaching materials. The increase in student learning outcomes is also caused by the valid syllabus, lesson plans, worksheets, student textbooks used. The results of the analysis of the normality test of the Problem Solving Skills test are shown in Table 5.

Problem solving skill				
Score	Mean	SD	*Sig.*	Normal
Pretest	52,74	5,135	0,200	Yes
Postest	148,20	4,523	0,072	Yes

Table 5 Normality Test KPM and PM Test Cycle I

Table 5 shows that the post-test and pre-test of problem-solving skills were normally distributed for the cycle I. Therefore, to analyze the impact of learning the PASS model further, it was carried out using the Paired Sample t-test. The results of the Paired Sample t-test analysis are shown in Table 6.

Pair	Problem solving skill				
	Mean	*SD*	*t*	*df*	*Sig.*
Pretest-Postest	95,46	3,24	174,36	21	0,001

Table 6. Paired Samples t-test KPM Test

Table 6 shows that the t-score on KPM gives a value of 174.36 for degrees of freedom, df = 21, the score is considered significant because of Sig. 0.01 <0.05, meaning that there are differences in KPM learning outcomes before and after the implementation of the PASS model with the mean giving a value of 95.46, meaning that there is an increasing trend after the implementation of the Asynchronous and Synchronous System approach models.

Furthermore, the ANOVA test which aims to test the consistency of the impact of the PASS model on improving student learning outcomes after meeting the assumptions of normality and homogeneity shown in Table 11. Before the ANOVA parametric test, the N-Gain KPM must meet the homogeneity requirements and be tested with a test of homogeneity of variance. Levene Statistics. The results of the KMP homogeneity test are shown in Table 7.

Variable	*Test of Homogeneity of Variances*			
	Levene Statistic	*df1*	*df2*	*Sig.*
Problem solving skill	0,477	1	68	0,492

Table 7 KPM Homogeneity Test

Table 7 shows that the homogeneity value (Levene Statistics) gives a significance (p-value) of 0.477 > 0.05; this means that the decision taken is to accept Ho. This means that the variance of the KPM value is homogeneous. Therefore, the next statistical test using the ANOVA parametric statistical test is shown in Table 8.

Table 8 shows that the calculated F KPM gives a value (p-value) of 0.001 < 0.05, this indicates that the decision taken is to fail to reject Ho, which means that there is a difference in the average value of the KPM accepted. Meaning that there is an effect of the PASS model on the increase in KPM value. Because the data are normal, homogeneous, and significantly different. Further tests were not carried out using the LSD (Least Significant Difference) test to find the location of the real differences in the data.

The results of the N-Gain analysis of the KPM indicator are shown in Table 8.

N	Skor	Indicator				
		Problem solving skill				
		1	2	3	4	5
22	*Pretest*	277	303	511	458	304
	Posttest	736	749	1498	1425	779
	N-Gain	0,77	0,78	0,80	0,75	0,83

Table 8 N-Gain KPM Test Indicator

Table 8 shows that the results of the average N-Gain achievement in the test class show that the average posttest score in the limited trial has increased from the average pretest score in the high category as seen from the average N-Gain score of 0.70. Based on these results, the PASS model that was developed along with the model supporting learning tools was declared effective to improve the results of students' problem-solving skills. The increase in students' ability to answer each item in the test also increased for indicators 1) Formulating problems (77%); 2) Create a hypothesis (78%); 3) Experimental planning and observation (80%); 4) Analysis (75%); and 5) Making conclusions (83%).

Increasing students' ability to answer each item in the problem-solving skills test shows that there is an increase in student learning outcomes after being taught using the PASS model. The ability of students to write analyzes using their sentences is an indicator of learning outcomes for problem-solving skills which have a lower increase even though they are still in the good category. This result is reinforced by the sensitivity of the items which indicate that the items can be used to measure students' analytical skills such as item number 4, and item number 5 has a lower sensitivity index even though it is still categorized as sensitive. Based on these results, it can be stated that the PASS model is effective in improving students' learning outcomes of problem-solving

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skills by paying more attention to activities that teach students procedural knowledge.

The results of the analysis of the normality test indicators of the learning outcomes of problem-solving skills are shown in Table 9

Indicator	Problem Solving Skill				
	Score	*Mean*	*SD*	*Sig.*	Normal
Formulate the problem	*Pre-Test*	7,91	1,71	0,016	Not
	Post-Test	21,03	1,58	0,018	Not
Create a hypothesis	*Pre-Test*	8,66	1,26	0,001	Not
	Post-Test	21,40	1,29	0,017	Not
Experimental planning and observation	*Pre-Test*	14,60	2,50	0,014	Not
	Post-Test	42,80	2,22	0,001	Not
Analysis	*Pre-Test*	13,09	40,71	0,009	Not
	Post-Test	40,71	2,89	0,001	Not
Make conclusions	*Pre-Test*	8,69	2,11	0,010	Not
	Post-Test	22,26	1,42	0,001	Not

Table 9 Normality Test KPM Test Indicator

Table 10 shows that the post-test and pre-test of problem-solving skills were not normally distributed for the limited trial. Therefore, to analyze the impact of learning the PASS model further, it was carried out using the Paired Sample t-test. The results of the Paired Sample t-test analysis are shown in Table 11.

Pair	Problem Solving Skill				
	Mean	*SD*	*t*	*df*	*Sig.*
Pair 1	13,114	1,827	42,456	22	0,001
	12,743	1,462	51,560	22	0,001
Pair 2	28,200	2,720	61,329	22	0,001
	27,629	2,102	77,775	22	0,001
Pair 3	13,571	2,227	36,058	22	0,001
	13,114	1,827	42,456	22	0,001
Pair 4	12,743	1,462	51,560	22	0,001
	28,200	2,720	61,329	22	0,001
Pair 5	27,629	2,102	77,775	22	0,001
	13,571	2,227	36,058	22	0,001

Table 10 Paired Samples t-Test KPM Test

Table 10 shows that the t-score on the KPM for degrees of freedom, df = 21, score is considered significant because of Sig. 0.0001 < 0.005, meaning that there are differences in learning outcomes of KPM before and after the implementation of the PASS model. Meaning that there is an increasing trend after the implementation of the PASS model.

Furthermore, the ANOVA test aims to test the consistency of the impact of the PASS model on improving learning outcomes of the KPM indicator after the assumptions of normality and homogeneity are met is shown in Table 18. Before the ANOVA parametric test, N-gain and KPM must meet the homogeneity requirements that have been proven by the test results by using the test of homogeneity of variance Levene Statistics. The results of the KPM homogeneity test are shown in Table 11.

Variabel	*Test of Homogeneity of Variances*			
	Levene Statistic	*df1*	*df2*	*Sig.*
KPM	0,086	1	68	0,372

Table 11 PKM Indicator Homogeneity Test

Table 11 shows that the Levene Statistics value gives a significant (p-value) of 0.086 > 0.05; and (p-value) of 0.372> 0.05. This indicates that the decision taken is to accept Ho, which means that the variance of the KPM value is homogeneous. Furthermore, the Anova inferential statistical test is shown in Table 12.

N-Gain		*SS*	*df*	*MS*	*F*	*Sig.*
KPM	*Between Groups*	2378,057	1	2378,057	895,818	0,0001
	Within Group	180,514	68	2,655		
	Total	2558,571	69			

Table 12 KPM ANOVA test results

Table 12 shows that the F count of KPM gives a value (p-value) of 0.0001 < 0.05, this indicates that the decision taken is to accept Ho, which means that there is a difference in the average value of the declarative indicator accepted, meaning that there is an influence of the approaching model. Asynchronous and Synchronous System to increase the value of KPM. Because the data are normal and homogeneous and significantly different, further tests were not carried out using the LSD (Least Significant Difference) test to find the location of the real differences in the data.

A. Reflection

At the end of each cycle, a reflection is carried out based on the results of observations, field notes, and the results of the first cycle of test questions. This aims to improve the learning process which will be applied to the next cycle of actions:

No	Reflection	Results	Follow-up
1.	Lecturer Activities	Lack of knowledge so that the scope of the material presented is not broad.	At the next meeting, the lecturer must master the material and increase understanding of the material from several references.
		The ability to encourage students to ask questions about the material is relatively low.	At the next meeting, the lecturer must be more assertive in guiding students so that students can be more active in asking questions.
		Students do not understand the physics sentences contained in the questions, cannot distinguish between known information and requests in the questions.,	At the next meeting, the lecturer directed students to be more thorough in identifying existing problems.
		Less active in asking questions about static electricity and dynamic electricity.	At the next meeting, the lecturer must provoke students to ask questions about the material being studied by giving rewards
2.	Student Activities	Students are less able to apply the steps or procedures of the KPM model in working on individual questions/LKS.	For the next meeting, students are expected to be able to apply the steps of the KPM model procedure in working on individual questions/worksheets.
	The results of the problem-solving ability test stage 1	There are still many students who have low physics problem-solving skills in solving problems, especially on indicators 1 and 2 (understanding problems and planning solutions). This is because there are still many students who have difficulty understanding the concepts of static electricity and dynamic electricity.	For the next meeting, more emphasis should be placed on the concepts of static electricity and dynamic electricity and solving contextual problems.

Table 13 Findings and Revisions During the Learning Process Cycle I and Cycle II

3. Description of Student Response Results

Based on the results of observations obtained by researchers through student responses to learning tools and implementation of learning through the application of the KPM model on fractional material, the researchers provided student response questionnaires to be filled in by 33 students after the learning process took place. The student responses can be seen in Table 14.

No	Questions	Results			
		Yes		No	
		Σ	%	Σ	%
1	I can identify known data or queried data for troubleshooting by applying the KPM model.	(22)	100		
2	I can construct physics sentences through the application of the KPM model.	(22)	100		
3	I am more careful when determining strategies in problem-solving with the KPM model.	(22)	100		
4	I can solve problems with the KPM model coherently or sequentially.	(22)	100		
5	The KPM model can be used to solve non-story questions.			(22)	100
6	The KPM model is too complicated, so it is difficult to apply it in physics learning of static electricity and dynamic electricity.			(22)	100

7	I feel more independent in solving problems related to static electricity and dynamic electricity using the KPM model because I can respond to problems in my way.	(22)	100		
8	I can develop my reasoning skills in dealing with story problems while learning by using the KPM model.	(22)	100		
9	I find it challenging to solve the problem with the KPM model.	(22)	100		
10	The questions given by the lecturer can be solved by various completion processes (more than one way).	(22)	100		
	Total Score	264		66	
	Maximal Score	330		330	
	The percentage of student responses answering "yes" is= $\frac{264}{330} \times 100\,\%_0 = 80\%$ The percentage of student responses answering "no" is= $\frac{66}{330} \times 100\,\%_0 = 20\%$				

Table 14 Results of Student Responses to Physics Learning

Based on the table above, it can be seen that (80%) of the entire sample chose “yes” while (20%) of the whole sample chose “no”. Based on the criteria for the percentage category of student response scores to the KPM model, it seems that the results of student responses show a range, which is 70-84% can be categorized as good. This proves that the KPM model can be used in physics learning, especially material related to story problems.

IV. DISCUSSION

This research was carried out as an effort to improve the learning outcomes of students' physics problem-solving skills through the application of the PASS model to the physics of static electricity and dynamic electricity. By applying this model in physics learning, students will be more active and can better understand the material in depth.

The research cycle was carried out twice, namely: cycle I and cycle II which aimed to test the practicality and effectiveness of the PASS model and was carried out in one class of 35 students, using static electricity RPP and dynamic electricity RPP carried out in cycles. Before holding a meeting in each cycle, a pretest was carried out and after the meeting, a posttest was carried out to determine the increase in KPM, as well as student responses to the subject matter of static electricity and dynamic electricity. Conditions in the field indicate that KPM has not been explicitly trained by teachers to students, so the researchers provide training on the PASS model to students. This training is carried out to ensure that the PASS model can later be implemented by teachers practically and effectively so that it is expected to be able to improve student learning outcomes of student KPM problem-solving skills. During the trial, the students were very enthusiastic, indicated by their responses and curiosity (curiosity) in attending meetings and asking questions for the development of KPM.

The PASS model is said to be effective when there is an increase before and after learning by observing the difference in the N-Gain scores obtained by students on indicators of problem-solving skills. The analysis and discussion of improving problem-solving skills for each indicator can be explained as follows.

The results of the PASS model questionnaire consist of indicators having initiation and persistence in learning, accepting responsibility for their learning, having the discipline and great curiosity, having self-confidence and a strong desire to learn, being able to organize time and manage time well, happy learning and meeting the planned targets can be shown in Figure 7.

Based on Table 16, found that problem-solving skills are 1) Formulating problems (77%); 2) Create a hypothesis (78%); 3) Experimental planning and observation (80%); 4) Analysis (75%); and 5) Making conclusions (83%). This shows that students' problem-solving skills are very good, so it can be stated that learning physics using the PASS model can be declared effective and has an impact or influence on students' problem-solving skills.

This finding is in line with the findings (Fahmi, 2020) showing that the current learning process, mostly combines both types of synchronous and asynchronous communication. This combination of communication types is often referred to as hybrid communication. Because this communication is applied to online PJJ, it can also be termed hybrid online PJJ. In choosing the communication media used for online PJJ (e-learning), educators consider several factors, including: (1) data quota consumption, (2) ease of use (user friendly), and (3) network infrastructure conditions, and (4) suitability with learning activities.

In more detail, the Director-General of PAUD, Primary and Secondary Education of the Ministry of Education and Culture noted that 97.6% of schools have implemented distance learning. Meanwhile, 2.4% have not done so because the area has not been infected or because the supporting equipment is inadequate. Educational institutions are experiencing chaos because the format of education that has been accustomed to face-to-face cannot be done massively. In addition, there was also a deadlock in terms of learning from home.

Another factor that can lead to an increase in student learning outcomes is the environment learning that supports the creation of an atmosphere of student inquiry in carrying out experiments either through laboratory equipment or by using PhET. A conducive learning environment can improve students' ability to obtain valid data, be able to perform analysis and be able to conclude. This can be seen from the results of student work in analyzing data and drawing conclusions significantly increased from the first meeting to the fourth meeting. These findings are in line with research (Finkelstein, Adams, Keller, Perkins, & & Wieman, 2006) which states that PhET is interactive and interesting packaged in a game-like form, emphasizes the relationship between real-life phenomena and the underlying science, supports an interactive and constructivist approach. , provide feedback, and provide a creative workplace. Analysis of student responses to the first statement that explores the novelty of the IPML model and IPML tools, as shown in Table 4.16. The data shows that the attractiveness and novelty of the IPML model and its devices (BAS and LKS) seen from the components of the material/lesson content, student textbooks, student activity sheets, and learning atmosphere were responded to by students strongly. This finding is by the results of the study (Celikler & & Aksan, 2012); which states that the use of worksheets and simulation techniques has a positive effect on hypotheses, student correlation, and combinational thinking skills, as the main tool consisting of steps and processes needed by students and helps students to form knowledge and participate fully in all classroom activities in the same time.

The practicality of the PASS model is known based on the results of observations of student activities on the implementation of learning through the designed syntax model. The elements that are seen when observing student activities in the PASS model of social system learning are the activeness and participation of students when following the learning process through the implementation of the PASS model.

The obstacles encountered by students are not yet skilled in using the PASS model so that they have not focused on practicing problem-solving skills and learning outcomes are based on many factors so that not every student can do practical activities themselves; some students are less skilled in the use of practical/simulation tools; some students do not understand the steps of problem-solving skills; interpersonal relationships and effective communication between teachers and students have not been well established.

V. CONCLUSION

In Conclusion, the activities of lecturers when teaching by applying the Asynchronous Synchronous System learning model have increased from cycle I to cycle II. Student activity in learning activities by using the PASS model increased from cycle I to cycle II, students activity has increased. Learning Outcomes Students' mathematical problem-solving ability by applying the PASS model has increased from cycle I to cycle II. Students' responses to learning activities by using the PASS model are in a great category. Some suggestions can be put forward, the lecturers should apply the PASS model more often by implementing it in problem-solving so that it can stimulate students to think more realistically and can improve understanding or analyze a problem. In solving mathematical problems by applying the PASS model, students should be more guided in making plans or solving problems, this is because each problem has different constraints. In the stage of re-examining the answers, students are not only led to prove the answer but students are guided to be able to use other ways to solve the problem so that students are more creative in solving other problems.

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