Vol. 12, No. 1, pp. 375-393, 2022 DOI: 10.23960/jpp.v12.i1.202229

Jurnal Pendidikan Progresif

e-ISSN: 2550-1313 | p-ISSN: 2087-9849

http://jurnal.fkip.unila.ac.id/index.php/jpp/

Profile of Students' Physics Problem Solving Skills and Problem Based Learning Implementation Supported by Website on Gas Kinetic Theory

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Received: 09 March 2020 *Accepted: 10 April 2020* *Published: 11 April 2020*

Abstract: Profile of students' physics problem-solving skills and problem based learning implementation supported by website on gas kinetic theory. **Objectives:** To analyze physics problem solving skills as a consideration in the implementation of a website-based PBL model on kinetic theory of gases. **Methods:** The research subjects were 162 high school students in class XI in Madiun Regency based on purposive sampling. Data collection were using problem-solving skills test ACCES indicators, student questionnaires, physics teacher interviews. Data were analyzed descriptive qualitative. **Findings:** The level of problem-solving skills in the kinetic theory of gases is still low, 159 students in low category, 3 students in medium category. On average students only answered questions in the E-Execute the solution. **Conclusion:** Students are not used to solving questions with ACCES indicators. Students tend to learn by memorizing formulas. So, the website-based PBL model can be applied to improve students' problem solving skills.

Keywords: Problem solving skills, Problem based learning, Gas kinetic theory.

Abstrak: Profil keterampilan pemecahan masalah fisika siswa dan pelaksanaan problem based learning berbasis website pada teori kinetik gas. ***Tujuan:*** *Untuk menganalisis profil keterampilan pemecahan masalah fisika siswa sebagai pertimbangan dalam penerapan model PBL berbasis website pada materi teori kinetik gas.* ***Metode:*** *Subjek penelitian adalah 162 siswa SMA kelas XI di Kabupaten Madiun berdasarkan teknik purposive sampling. Instrumen penelitian yaitu instrumen tes kemampuan pemecahan masalah indikator ACCES, angket siswa dan wawancara guru fisika. Data dianalisis secara deskriptif kualitatif.* ***Temuan:*** *Tingkat keterampilan pemecahan masalah pada materi teori kinetik gas masih rendah, yaitu sebanyak 159 siswa dengan kategori rendah dan 3 siswa dengan kategori sedang. Dari hasil penelitian rata-rata siswa hanya menjawab soal pada kategori E-Execute the solution.* ***Kesimpulan:*** *Siswa belum terbiasa menyelesaikan soal keterampilan pemecahan masalah dengan indikator ACCES. Siswa cenderung belajar dengan menghafal rumus. Sehingga model PBL berbasis website dapat diterapkan untuk meningkatkan keterampilan pemecahan masalah siswa.*

Kata kunci: *Keterampilan pemecahan masalah, Problem based learning, Teori kinetik gas.*

To cite this article:

Pristianti, M, C., & Prahani, B, K. (2022). Profile of Students' Physics Problem Solving Skills and Problem Based Learning Implementation Supported by Website on Gas Kinetic Theory. *Jurnal Pendidikan Progresif*, *12*(1), 375-393. doi: 10.23960/jpp.v12.i1.202229.

INTRODUCTION

Learning activities are the process of gaining knowledge by students and the process of sharing knowledge by the teacher so that both interactions occur. It can be said that learning can be done anywhere including school, home, library and other places that aim to get better knowledge. One of the teacher's tasks is to teach, in carrying out learning, knowledge of learning theories and principles can assist teachers in choosing the right action (Suyati & Rozikin, 2021; Ahmadi, 2004). The level of effectiveness of a teaching and learning process is also determined by the level of student learning motivation. Motivation can arise with the presence of internal factors which include physical and psychological, while external factors include the state of the surrounding environment and humans including teachers, parents and also counselors (Arisandi, 2021). To express thinking ability, it can be seen to measure it through problem solving skills (Gredler, 2011; Lestari & Deta, 2021).

Teachers' skills in choosing appropriate learning models and methods will have an very important part in the development of student learning outcomes. The learning method is the method used by educators in interacting with students in the class (Aidah, 2020). Problem solving skills are part of the competencies that must be managed by someone in the 21st century in order to be successful in life (Mulyani et al., 2021). Sometimes students practice on existing theories and concepts so that when given new problems, students will find it difficult to solve these problems. Problem solving indicators are the ability to formulate problems, develop hypotheses, plan solutions and recheck or make conclusions (Palennari et al., 2021).

Physics is a branch of natural science. Physics is a natural science in which it studies about nature and natural phenomena and also all of both interactions (Zahra, 2019; Tayubi, 2005). The results of an experiment as well as observations of various phenomena that exist in nature include the scope of physics (Rachmawati et al., 2019; Diani et al., 2019; Serway & Jewett, 2014; Suyidno et al., 2019). Thus, to be able to explore physics, students must have skills, for the example is problem solving skills. This research will use NTEO and Taxonomy of Introductory Physics Problems (TIPP). With the GW-ACCES strategy instructional protocol (Teodorescu et al, 2013). Indicators of problem solving skills include: A – Understanding the problem, C – Drawing a picture, C – Conceptualizing the strategy, E – Executing the solution and S- Checking the results by selecting sure or not sure.

In the first stage, students will get used to identifying the principles of physics to find out the right way to solve problems. The second stage in problem solving, students will present the existing problems into illustrations or pictures that facilitate the students to imagine so that it leads students to get correct concept. The next stage, students will explain what method or systematic steps are appropriate to get answer from problems quickly. Next stage, students will using formulas to solve problems until they find out the correct answer. The last stage students will record the level of confidence in the form of sure or not sure about the answers along with the theory that underlies students in answering questions (Fitriyanni et al., 2019).

The kinetic theory of gases is a matter of physics which is closely related to the ideal gas law of an invisible material consisting of very small molecules that collide with each other. Verbal explanations will not help much in students' comprehension of the kinetic theory of gases (Putra et al., 2020). In the kinetic gas theory material, students can not explain problem-solving techniques well, this is because students have misinterpretations, students could not understand what concepts are related to the problems given

and often some students only know the idea but do not fully understand the material in depth (Mashurin et al., 2021).).

The selection of an effective learning model to support these skills must be appropriate. The results of a literature review of the recommended learning model that can train problem solving skills is a scientific approach that emphasizes student centered learning with the help of technological media, for example Problem Based Learning (PBL) (Ayudha & Setyarsih, 2021). This PBL is carried out by providing stimulation in the form of problems which are then carried out by problem solving by students in the hope of increasing students' skills (Putriyanti et al, 2021). Strengthened by research conducted Purnama et al. (2021) which aims to review the literature on PBL to improve students' problem solving skills resulted that PBL is a very good model used in physics learning, especially to improve students' problem solving abilities. Thus, this study wants to deep explore whether PBL alone is effective in improving students' problem solving skills because due to research by Ashar et al., (2021) showed that the understanding of the concept of the kinetic theory of gases by students is still low with the percentage of students understanding the concept of 32.59%, not understanding the concept of 25.02% and misconceptions of 41.92%.

With the gap above, it is necessary to support the PBL model with other technology so that it will be successful in improving students' problem solving skills. By using mobile technology in learning, teachers have the opportunity to apply digital technology in teaching physics (Goncharenco et al., 2020; Zakaria, 2019; Ramirezleal et al., 2022). Various innovations prove the flexibility of education can be obtained by students. One of them is found on research by Winarsih et al. (2022) which aims to design teaching materials based on the Wix website on Newton's Law material. From the research, it was found that this website media is effectively used in learning with a percentage of 85% in the very effective category for training high school students' skills. Another study conducted by Mukti et al. (2020) which aims to explain the use of physics teaching and learning process media in the form of a website using the google site on dynamic electrical materials. The outcome of the study stated that media in the form of a website can support students to learn independently and be flexible. Several previous studies have proven that learning using the website can support student learning outcomes.

From the various problems that are currently happening, and from the description above, the researcher intends to conduct a study that has the aim of analyzing the profile of students' problem solving skills as consideration in the implementation of PBL models and also web-based learning media which can improve physics problem solving skills with gas kinetic theory material. In the current era of globalization, students in high school are expected to be more independent and get used in solving physics problems, but in fact, based on the description above, there are still many misconceptions about physics material and difficulties in solving problems. The novelty from this research is to improve the findings of previous research or it can be said to get the latest recommendations regarding the problem solving skills profile of high school students and the implementation of PBL based on the gas kinetic theory material.

METHODS

This kind of research is descriptive so it doesn't need a hypothesis test. The results of this study will be taken into consideration in the implementation of website-based physics PBL model of gas kinetic theory material that can improve the ability of high school physics

problem solving skills. The subjects in this study were 162 high school students for the 2021/2022 academic year consisting of classes XI MIPA 1 until XI IPA 5 in one of the high school in Madiun Regency, East Java Province. This research was conducted face-to-face during one meeting starting on February 3, 2022. The research instruments used in this study included a test of problem-solving skills, student response questionnaires and interviews with physics teachers.

Problem solving skills test questions consist of 5 essay questions. The questions equipped with ACCES indicators consisting of A-Assen the problem, C-Create a drawing, C-Conceptualize the strategy, E-Execute the solution, S-Scritinize your result (Teodorescu et al, 2013). Students are given about 45 minutes to answer the questions. The questions given have been validated by 3 physicist lecturers and declared valid so the questions can be used.

Distribute student response questionnaires after students complete the test questions. Response questionnaires were used to determine student responses to physics lessons (Anisa, 2018). Student Response Questionnaire contains 10 statements that students answer using scores (4=strongly agree, 3=agree, 2=disagree, 1=strongly disagree). In the questionnaire there are 3 guidelines used, including:

1. Learning experiences
   Example statement: Difficult understand physics especially for kinetic theory of gases, physics lesson is boring, etc.
2. Learning process
   Example statement: I learned physics not only from books and teachers but also tried to learn using websites and online practice, etc.
3. Learning media
   Example statement: I prefer to study practice using interactive simulation online, etc.

In the next research step, physics teachers were interviewed. The purpose of this interview was to find out more about the teaching and learning process in the classroom, whether they used the website as a learning medium, and whether the students were trained in problem-solving skills. Interviews were conducted with the intention of aligning the answers of teachers and students.

The data analysis technique which used in this study is a qualitative descriptive technique that describes the real situation according to the actual situation. Qualitative descriptive analysis is an analysis of the data obtained in the form of pictures, words or behavior related to a condition being studied with a narrative description (Ariesca, 2021). For more details on the research steps, it showed in Figure 1.

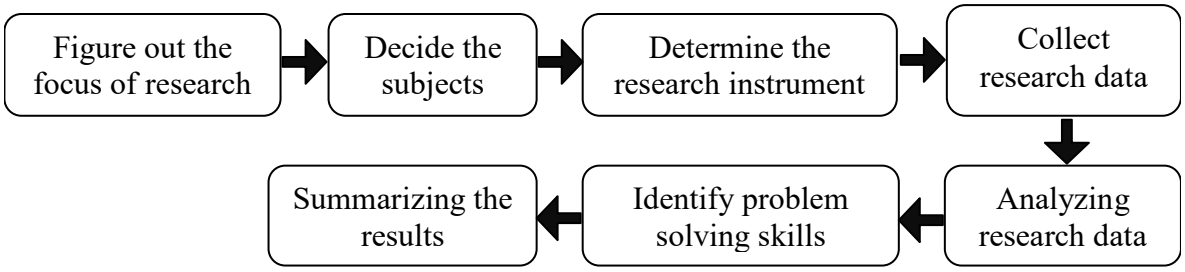

Figure 1. Research method

■ RESULT AND DISCUSSIONS

The Validity and Reliability of Questions Based on Student Test Results

Questions can be said to be valid if they meet the level of validity and reliability. Validity is a measure of the accuracy of an instrument so as to produce precise data, while reliability means that the instrument can have consistent results in repeated measurements (Arikunto 1998; Sugiyono 2005; Mashurin 2021). The validity and reliability results below used IBM SPSS Statistics 25.

Table 1. Validity result

Question Number	Rtable	Rcount	Description
1		0.777	Valid
2		0.842	Valid
3	0.182	0.867	Valid
4		0.662	Valid
5		0.575	Valid

The question is said to be valid if it produces Rcount > Rtable. Based from Table 1. for question 1-5 has a table Rcount in a row, namely 0.777 ; 0.842 ; 0.867 ; 0.662 ; 0.575. Of the five questions, they have Rcount > Rtable, which means that the questions given by students are valid.

Table 2. Reliability result

Cronbach's Alpha	N	Description
0.806	0,182	Consistent/reliable

The question is said to be reliable if Rcount > Rtable. N is 0.182 resulting from the Rtable value in the Table 1. From Table 2. resulted Rcount is 0.806. So that Rcount > Rtable which is 0.806 > 0.182 then all questions are declared consistent or reliable.

Student Problem Solving Skills Test Results

The research that has been carried out has resulted in answers to students' problem solving skills which are shown in Figure 2.

Figure 2. shows the test scores for the problem-solving skills of the kinetic theory of gases. For test results with a value of (0-50) included in the low category, (51-75) moderate and (76-100) high. The graph shows that there are 159 students in the low category, namely 119 female students and 40 male students. The number of students for the medium category there are 3 students, namely 2 girls and 1 boy. There are no student with high category. This indicates that the level of problem solving skills in students is still low. The problem-solving skill scores of

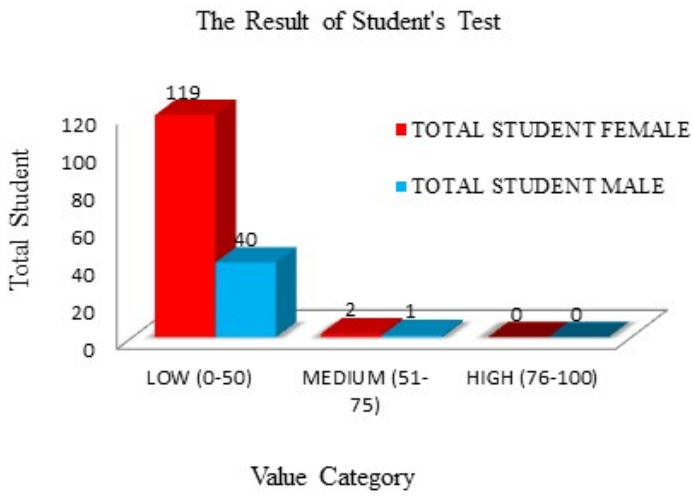

Figure 2. Graph of the result of student's test

male students are lower than female students because male students tend to prioritize the final answer rather than systematic steps to answer, resulting in answers that are less precise and do not meet the ACCES indicator. Female students are more selective than male students in solving problems, other factor is because learning focused on the teacher only (Sahyar & Fitri, 2017; Mashurin et al., 2021).

The success of students to solve physics problems cannot be separated from knowledge of physical concepts and also the way students connect all information and concepts to solve problems (Ince, 2018). The answers to each student's questions indicate their level of problem-solving skills regarding the questions given. Not all students answered fully using the ACCES indicator. There are some students who leave their answers blank on certain indicators.

Figure 3. shows that E - execute the solution has the highest score of the other indicators, which is 4.58. This means that an average of 162 students can show the steps of applying the formula used to find the answer that

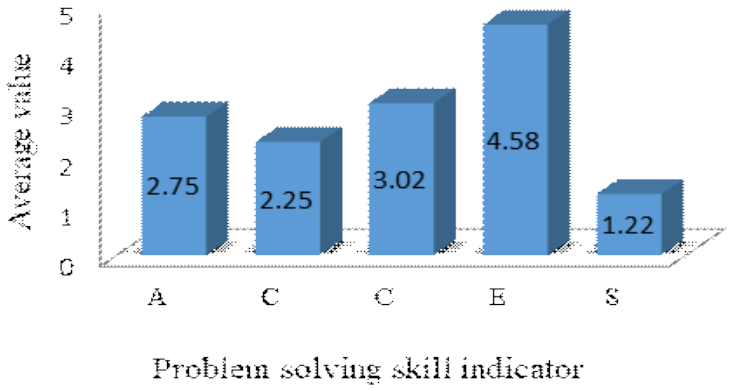

Figure 3. Graph of average student's score on each indicator

they think is the most appropriate. S - Scrutinize your result has the lowest score of 1.22. This means that the average student has not answered on these indicators. In questions that use problem-solving indicators, students tend to have difficulty in providing an overview of the problem from an analytical problem so that they are less confident whether the answer is right or wrong (Putra et al., 2020). Details of students' answers regarding problem solving skills include:

1. A - Understand the problem

This indicator contains the principles that used base on the problem and used to solve the questions. Students are asked to write down what principle is appropriate to use to answer a question. Based on the analysis of students' answers, it was found that there were still many students who did not mention which principles or laws were appropriate to use.

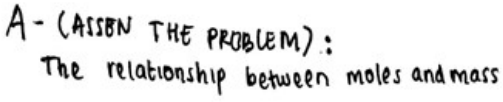

Figure 4. Student answer on the indicator A

Figure 4. represents about students have not correctly identified the principle used because

the answer is not related to the laws of the kinetic theory of gases. The correct answer for this question is Gay-Lussac's law. Students are not used to finding principles or procedures that should be used when solving problem solving questions (Hidaayatullaah et al., 2020).

2. C - Create a drawing

In this indicator, students should describe a situation that corresponds to the question. So that students will asked to translate the question (sentences form) into picture illustrations and accompanied by detailed instructions used to solve the problem.

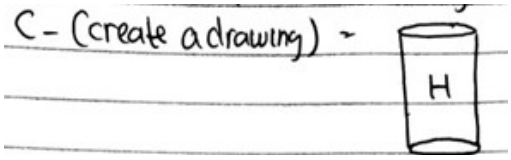

Figure 5. Student answer on the indicator C-Drawing

Based on the analysis of student answers, it was found that there were still many students who did not include detailed numbers and precise instructions. Students are not accustomed to illustrating problems caused by the lack of students' skills in identifying key concepts (Alami et al., 2018).

3. C – Conceptualize the strategy

This indicator contains a description of the steps that students will use to answer questions. Students are asked to write down what formulas will be used and indicate the steps needed. Examples of student answers can be seen in figure 6.

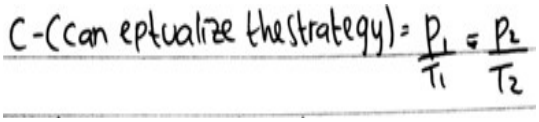

Figure 6. Student answer on the C-conceptualize the strategy indicator

Figure 6. represents that students only write the correct formula without showing the steps needed to solve the problem. If students are shallow in understanding the problem, it will result in failure to identify the concept of the problem which has an impact on problem solving failure (Jua et al., 2018).

4. E – Execute the solution

In this indicator students should write the steps of applying formula used to find the most appropriate answer. Students will apply the appropriate formula until the final result of solving the problem is found.

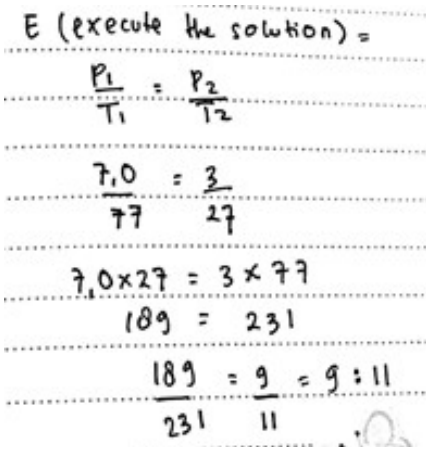

Figure 7. Student answers on the indicator E

Figure 7. represents that students must show the correct formula for Gay Lussac's Law, but are still not quite right in applying the formula to find the correct answer. With this condition, there is a need for more in-depth learning in the future related to physics material so that students avoid the situation of only memorizing formulas without understanding more deeply. Students have understood the right formula, but there needs to be deep learning the final answer is also right (Zamil et al., 2021).

5. S – Scrutinize your result

This indicator can measure how confident students are in solving a given problem. Students

have to indicate their level of confidence and explain why. Students will write a sure or no answer on this indicator.

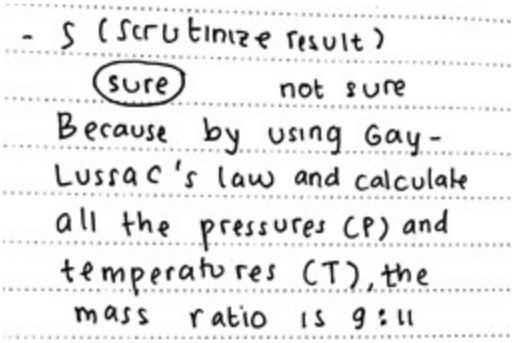

Figure 8. Student answers on the indicator S

Figure 8. shows that students are quite confident in solving problems on the questions given even though the answers are not correct. The reasons given are still not able to provide strong evidence as to why the answer is considered correct.

Based on the data analyze above, it is known that the level of problem solving skills of students is still low. Factors that can cause students still have difficulty solving problems, namely students are not accustomed to answering questions using the ACCES indicator, students are not accustomed to solving problems in the Higher Order Thinking Skill (HOTs) category, students only memorize physics formulas but do not understand the concept correctly. The results of a similar study by Hernández-Suarez et al., (2022) show that students have difficulty solving problems in symbolic representation and numerical representation. Strengthened by research conducted Meisaroh et al., (2021) that students are still weak in solving problems so they are still not skilled (low category) in solving the kinetic theory of gases.

Student Response Questionnaire Results

Student questionnaires are distributed using an online platform, namely Google Form. Students are asked to fill in their identities first on the google form then students will be given 10 statements. The statement will collect student answers by choosing one of strongly agree (score 4), agree (score 3), disagree (score 2) or strongly disagree (score 1).

From the questionnaire, it can be seen that students' opinions are related (1) It is difficult to understand physics material, especially the kinetic theory of gases, (2) The material for the kinetic theory of gases i is necessary to study because it correspond to events in daily life, (3) Physics lessons are boring, (4) I learn physics not only from books and teachers, but have also tried to learn using websites and online practicums, (5) I prefer the online physics learning process to face-to-face, (6) My physics teacher is fun when the teaching and learning process at class, (7) I always ask the teacher when I find it difficult to solve physics problems, (8) I find it difficult when working on test questions in the form of problem-solving skills, (9) I prefer to study practicum using online interactive simulations, (10) I am interested in getting physics lessons using a website that contains learning video material.

Table 3. Student response questionnaire results

Statement	Percentage (%)			
	1 (Strongly Disagree)	2 (Disagree)	3 (Agree)	4 (Strongly Agree)
Difficult understand physics, especially for kinetic theory of gases	1.9 % (3)	34.6 % (56)	49.4 % (80)	14.2 % (23)

The material for the kinetic theory of gases is necessary to study because it correspond to events in daily life	1.9 % (3)	14.8 % (24)	46.9 % (76)	36.4 % 59
Physics lesson is boring	8.6 % (14)	50 % (81)	25.9 % (42)	15.4 % (25)
I learned physics not only from books and teachers, but also tried to learn using websites and online practice	6.8 % (11)	18.5 % (30)	40.7 % (66)	34 % (55)
I prefer the online physics learning process rather than face-to-face	40.1 % (65)	27.8 % (45)	14.8 % (24)	17.3 % (28)
My physics teacher is fun when teaching and learning in class	7.4 % (12)	16 % (26)	42.6 % (69)	34 % (55)
I always ask the teacher when I find it difficult to solve physics problems	9.3 % (15)	40.7 % (66)	41.4 % (67)	8.6 % (14)
I find it difficult when working on test questions in the problem-solving skills design	3.1 % (5)	53.1 % (86)	17.9 % (29)	25.9 % (42)
I prefer to study practice using interactive simulation online	15.4 % (25)	25.3 % (41)	39.5 % (64)	19.8 % (32)
I am interested in getting physics lessons using a website that contains learning video material	4.3 % (7)	16.7 % (27)	43.2 % (70)	35.8 % (58)

Results of Interviews with Physics Teachers

After getting the results of the student questionnaire, to strengthen the research data, interviews were conducted with physics teachers at the schools concerned. From the interviews, the teacher explained that the school had implemented an independent learning curriculum. In learning, they have applied problem-based learning, but there are still obstacles. Constraints in the application are students are still less independent and some students are still taking a long time to adapt. During the covid-19 pandemic, learning activities are carried out online.

Several obstacles were encountered, such as the teacher not being able to fully monitor student activities so that on average students were still passive in learning apart from that there were also unstable network constraints. The method

used by the teacher to minimize student cheating during online exams is to make a variety of questions (starting from pictures, multiple choice questions, matchmaking, true/false, essays), create question codes, and randomize questions.

The material for the kinetic theory of gases is taught to students using a system of example questions with pictures, explanations with illustrations. This material is taught at the end of semester 1 in 4 to 5 meetings. Problem solving skills have been taught but are only known, asked, answered (not including ACCES). There are many obstacles in its implementation, for example, students find it difficult to make correct illustrations according to the questions. Problem solving skills are important to practice because they will form the correct thinking scheme in students.

The training of students' problem solving skills is very important. Physics problem solving will help students to skillfully solve problems in everyday life (Sukarsih et al., 2020; Abtokhi et al., 2021). Efforts made by teachers to improve problem solving skills are by giving examples first during learning. Then give practice questions to students and then evaluate them. For material in the form of a website, it is rarely used. For online practicum, PhET has been used, but for material on gas kinetic theory, the interactive simulation has not been utilized. The obstacle experienced is that there are student devices that do not support opening the PhET application, the network is not stable. So there is no practical material for the kinetic theory of gases.

Relevant research

Effectiveness in a learning method is a very important aspect. So that in the implementation of website-based problem-based learning, it is necessary to analyze several studies that have been carried out by raising linear topics. The articles or journals taken are in the range of 2018-2022. The outcome from the analysis can be observed in Table 4.

From previous research, it was stated that there was a good effect caused by PBL on problem solving skills experienced by students (Sari et al., 2021). On the other hand, website-based learning can integrate a lot of information that is customized to the needs of students and can be used by students for free (Mardin & Nane, 2020; Ismawati et al., 2021; Rikani et al., 2021). The website-based student teaching and learning process with the PBL model deserves to be developed with the aim of increasing students' problem solving skills (Ramli et al., 2019) and providing an interesting physics learning experience (Prasetyo et al., 2020; Shabrina & Diani, 2019).

Table 4. Relevant Research 2018-2022

Author, (Year)	Research Aim	Research Design	Results
Ningrum et al., (2022)	Analyze problem solving skills in implementing PBL using VLP software and student responses to integrated volcano physics learning	• Quasi experiment with post-test only design • Instruments are questionnaires and also problem solving tests design	The students' problem solving ability increased and got a good learning response after being given PBL assisted by VLP simulation.

Indriyani et al., (2021)	Knowing the improvement of students' problem solving skills by way of application of the Double Loop Model	• Quantitative • Pre-Experimental in the form of The One Group Pretest-Post-test Design.	Improved student problem solving ability
Suhardiman et al., (2021)	Find out how much influence the PBL work on physics teaching and learning process	• Meta-Analysis Research • Quantitative descriptive analysis	Using PBL can improve high school student learning outcomes
Asiyah et al., (2021)	Find out the effect of pbl on problem solving skills and student cognitive learning result in a school in bengkulu	• Quasi experiment • Random pretest-posttest control group design • Using instruments in the form of test questions	There is an effect of PBL on increasing the value of high school students' problem solving abilities. PBL significantly affects the improvement of student learning outcomes
Safithri et al., (2021)	Find out the effect of pbl and project based learning (pjbl) on problem solving skills based on students' self efficacy	• Quasi-experimental research with nonequivalent control group design • Questionnaire instruments, problem-solving ability tests, observation sheets on the implementation of student and teacher learning	There is an effect of implementing PBL learning on students' problem solving abilities
Yusal et al., (2021)	Describes the level of comprehension of the concept of kinetic gas theory in intended physics teachers with the	• Pre-experimental research • One group pretest-posttest design	The interactive demonstration method with variety of visual media can improve the understanding of

	interactive demonstration method with various of visual media	• Essay test instrument	the concept in physics material
Nelvianti et al., (2020)	Describes the characteristics of PBL assisted by e-learning home learning portal	• Descriptive qualitative approach • Purposive sampling	PBL learning using 2-learning can improve student learning outcomes
Melinda et al., (2020)	Validate the PBL model on the gas kinetic theory learning device	• Quantitative descriptive research • Data collection techniques with validity instruments with a Likert . rating scale	PBL learning device material kinetic gas theory is good for use in physics class in terms of theoretical aspects with a very valid category of 93.75%.
Kurniyawati, (2019)	Describes the effectiveness of PBL in terms of problem solving skills and independent learning of mathematics	• Quantitative research with Quasi-experimental • Random sampling technique	Problem solving skills and student learning independence in learning with PBL are higher than conventional learning
Lestari et al., (2019)	To determine the ability to learn material on the kinetic theory of gases using real and virtual laboratory activities	• Comparative research with experimental design • Random sampling technique • The instrument is a multiple choice test	Students' science process skills on the kinetic theory of gases are higher when using a reactor than a virtual one
Diani et al., (2018)	Developing interactive learning media for basic physics II	• RnD • Instrument is a questionnaire	Produce interactive websites that are enhanced with the PBL model

Setyowidodo et al., (2018)	Describes the effect of real time data on website of student independence	• Qualitative research (RnD) • The data analys, namely the results of learning observations and student questionnaire analysis	The implementation of PBL can increase students' independence and provide hands-on experience to develop scientific exploration competency
Putri et al (2018)	Analyze profile of student's understanding in kinetic theory of gases	• Qualitative descriptive method • Essay test instrument	The outcomes of the gas kinetic theory test are in the low category of 50.00%, medium 29.17%, high 10.42%
Barra, W.N (2018)	Identify of the misconceptions of the kinetic theory of gas in class XI students of MA nurul ummah yogyakarta	• Survey research • Questionnaire instruments and open-ended choice test questions • Test validity using Aiken's-V . formulation	The misconception of the kinetic theory of gases by 28.57% can be minimized with meaningful learning, practicum, videos, animations, websites
Bakri et al., (2018)	Describes website development based on high school physics digital module	• Thiagarajan 4D development strategy • Discovery learning	Learning website for high school physics learning

From previous research, it was stated that there was a good effect caused by PBL on problem solving skills experienced by students (Sari et al., 2021). On the other hand, website-based learning can integrate a lot of information that is customized to the needs of students and can be used by students for free (Mardin & Nane, 2020; Ismawati et al., 2021; Rikani et al., 2021). The website-based student teaching and learning process with the PBL model deserves to be developed with the aim of increasing students' problem solving skills (Ramli et al., 2019) and providing an interesting physics learning experience (Prasetyo et al., 2020; Shabrina & Diani, 2019).

■ CONCLUSIONS

From the research results obtained and analyzed, it can be concluded that the level of problem solving skills in the kinetic gas theory material is still low, namely from the test results as many as 159 students scored in the low

category with details of 119 female students and 40 male students. The number of students for the medium category is 3 students consisting of 2 girls and 1 boy. There are no students with high category.

Giving indicators of problem solving skills which include ACCES makes students feel that problem solving is very complicated and difficult to explain. From the research results, on average, students only answered questions with category E - Execute the solution. The causative factors are 1) Students are not used to solving problem solving skills with ACCES indicators. This is related to the physics teacher's statement at the time of the interview that students are accustomed to being trained with the ACCES indicator. 2) Students tend to learn by memorizing formulas but do not understand the concept in depth.

The implications in education from the research that has been done are that students know how to solve problems in detail following the ACCES indicator which has never been done before and teachers can improve problem solving skills training by students because it can form systematic thinking schemes for students. The limitation of this research is that the time given by the school to conduct this research is only 30 minutes, so it is less flexible to explain in more detail to students about problem solving skills using the ACCES indicator.

Therefore, for further research it is necessary to innovate in the teaching and learning process to increase students' interest and problem solving skills that are more fun, flexible and in accordance with technological developments. So that the PBL model of the website-based gas kinetic theory material can be applied to improve students' problem solving abilities.

■ ACKNOWLEDGMENT

The researcher's first thanks are addressed to Allah SWT. Thank you to parents, and Universitas Negeri Surabaya, who have helped in the preparation of this scientific article. Especially for the supervisor who has spent a lot of time directing the preparation of this article.

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