

[JPP] Submission Acknowledgement

1 message

Dr. Abdurrahman, M.Si. <jurnal@fkip.unila.ac.id> To: "Dr. Binar Kurnia Prahani" <binarprahani@unesa.ac.id>

Tue, Jun 15, 2021 at 10:43 PM

Dr. Binar Kurnia Prahani:

Thank you for submitting the manuscript, "Profile of Students Critical Thinking Skills and the Implementation of PBLRQA based on Blended Learning in Senior High School" to Jurnal Pendidikan Progresif. With the online journal management system that we are using, you will be able to track its progress through the editorial process by logging in to the journal web site:

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Dr. Abdurrahman, M.Si. Jurnal Pendidikan Progresif

Best Regards

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[JPP] Submission Received

1 message

Jurnal Pendidikan Progresif <jurnal@fkip.unila.ac.id> To: binarprahani@unesa.ac.id Mon, Feb 28, 2022 at 11:20 AM

Dear Dr. Binar Kurnia Prahani

Thank you for submitting your manuscript " Profile of Students' Physics Problem Solving Skills and Problem Based Learning Implementation Supported by Website on Gas Kinetic Theory" to Jurnal Pendidikan Progresif.

During the peer review process, you can keep track the status of your manuscript by assessing the following website: http://jurnal.fkip.unila.ac.id/index.php/jpp

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[JPP] Confirmation of Article Evaluation Process

6 messages

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Dear Dr. Binar Prahani

We received your article submission. Thank you very much for your interest in Jurnal Pendidikan Progresif.

After a pre-assessment with careful consideration by the members of the Editorial Board and Executive Committee, your article was decided to be *accepted for further evaluation processes*. However, We are preparing articles for publication in April 2022, so looking at the publication time and our standard peer review policy, it seems that it is no longer possible to process your article through a standard peer-review. See our peer review policy: http://jurnal.fkip.unila.ac.id/index.php/jpp/about/editorialPolicies#peerReviewProcess

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As a note for the fast track option, **if accepted by reviewers**, the author should pay a publication fee of 3,000,000 IDR as an author share of production costs. If it is acceptable for you, let us know, and then we will start the article evaluation process.

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Binar Kurnia Prahani

binarprahani@unesa.ac.id>

To: Jurnal Pendidikan Progresif <jurnal@fkip.unila.ac.id>

Dear Editor

We have accepted it. Thank you very much for positive responds.

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Dr. Binar Kurnia Prahani Univeritas Negeri Surabaya [Quoted text hidden]

Jurnal Pendidikan Progresif <jurnal@fkip.unila.ac.id> To: Binar Kurnia Prahani
dbinarprahani@unesa.ac.id> Mon, Feb 28, 2022 at 1:28 PM

Mon, Feb 28, 2022 at 1:32 PM

Mohon berikan keputusan Anda apakah akan melanjutkan proses evaluasi atau tidak. Salam hormat [Quoted text hidden]

Deae Editor

Kami menerima ini untuk dilanjutkan. Terima kasih banyak atas respon positifnya.

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Dr. Binar Kurnia Prahani Univeritas Negeri Surabaya [Quoted text hidden]

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Kami teruskan proses evaluasi artikel Anda sesuai permintaan penulis. Salam [Quoted text hidden]

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binarprahani@unesa.ac.id>

To: Jurnal Pendidikan Progresif <jurnal@fkip.unila.ac.id>

Dear Editor

Thank you very much [Quoted text hidden]

Mon, Feb 28, 2022 at 1:47 PM

Mon, Feb 28, 2022 at 7:42 PM





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

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JPP;

Abstract: Profile of students' physics problem-solving skills and problem based learning implementation supported by website on gas kinetic theory. Objectives: This preliminary study aims to analyze the profile of students' physics problem solving as a deliberation in the implementation of the PBL model and website-based learning media that can improve physics problem solving skills with gas kinetic theory material. Methods: The research subjects were 162 high school students in class XI in Madiun Regency, East Java Province based on purposive sampling technique. Data collection were using problem-solving skills test with ACCES indicators, student questionnaires and physics teacher interviews. The data obtained were analyzed using descriptive qualitative. Findings: The level of problem-solving skills in the kinetic theory of gases is still low, that is, from the test results, 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 including 2 female and 1 male. From the research results, on average, students only answered questions in the E category - Execute the solution. Conclusion: Students are not used to solving problem solving skills with ACCES indicators. Students tend to learn by memorizing formulas but do not understand the concept in depth. So that the websitebased PBL model of gas kinetic theory material 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: Penelitian pendahuluan ini bertujuan untuk menganalisis profil keterampilan pemecahan masalah fisika siswa sebagai pertimbangan dalam penerapan model PBL dan media pembelajaran berbasis website yang dapat meningkatkan keterampilan pemecahan masalah fisika SMA materi teori kinetik gas. **Metode:** Subjek penelitian adalah 162 siswa SMA kelas XI di Kabupaten Madiun Provinsi Jawa Timur berdasarkan teknik purposive sampling. Data penelitian dikumpulkan menggunakan instrumen tes kemampuan pemecahan masalah dengan indikator ACCES, angket siswa dan wawancara guru fisika. Teknik analisis data yaitu deskriptif kualitatif. **Temuan:** tingkat keterampilan pemecahan masalah pada materi teori kinetik gas masih rendah, yaitu dari hasil tes sebanyak 159 siswa mendapat nilai dengan kategori rendah dengan rincian 119 siswa meliputi 2 perempuan dan 1 laki-laki. Jumlah siswa untuk kategori sedang terdapat 3 siswa soal pada kategori E - Execute the solution. **Kesimpulan:** Siswa belum terbiasa menyelesaikan Commented [A1]: Ubah kedalam format berikut:

Department of xxx, Universitas xxx, Indonesia

Commented [A2]: Penerapan model PBL berbasis website pada materi teori kinetika gas soal keterampilan pemecahan masalah dengan indikator ACCES. Siswa cenderung belajar dengan menghafal rumus namun belum paham konsep dengan mendalam. Sehingga model PBL berbasis website materi teori kinetik gas dapat diterapkan untuk meningkatkan keterampilan pemecahan masalah siswa.

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

Commented [A3]: Jumlah kata dalam abstrak (Indonesia+Inggris) adalah 300 kata... Mohon disesuaikan

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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). In learning the problem-solving aspect is the focus of learning that must be considered. 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, especially complex problems related to real life, 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).

In addition to the skills that must be trained to students, 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.

At the beginning of the covid-19 pandemic, learning began to use various digital technologies. 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.

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 understanding of the concept of the kinetic theory of gases by students is low with the percentage of students understanding the concept of 32.59%, not understanding the concept of 25.02% and misconceptions of 41.92% (Ashar et al., 2021).

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

Commented [A4]: Tidak terlihat apa masalah penelitian Anda sehingga perlu dilakukan penelitian ini?

Apakah selama ini penerapan PBL tidak efektif karena tidak ada kajian profil keterampilan pembecahan masalah sebelumnya? Atau memang dalam setiap implementasi PBL harus dianalisis keterampilan problem solving terlebih dahulu? Atau apa yang menjadi masalah penelitian ini...? Mohon berikan alasan yang detil

Ungkapkan pentingnya mengkaji keterampilan pemecahan masalah fisika siswa dalam pembelajaran fisika?

Ungkapkan juga pentingnya PBL berbantuan website...

high school students and the implementation of PBL based on the gas kinetic theory material.

METHOD

This research is a preliminary research. 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 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 Desult, Students are given about 45 minutes to answer the questions. 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). Statements in the answer questionnaire included students' learning experiences and the learning process teachers conducted in the classroom, and the answer questionnaire was standardized and tested for validity and reliability. 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

Commented [A5]: Hapus kalimat ini

Commented [A6]: Berikan referensi terkait hal ini

Commented [A7]: Result???

Commented [A8]: Apakah soal-soal tes keterampulan problem solving ini Anda kembangkan sendiri atau diadaptasi dari literatur???

Jika dikembangkan sendiri, bagaimana validitas dan reliabilitasnya?

Jika diadaptasi dari literatur, sebutkan literatur yang digunakan untuk setiap soal...

Commented [A9]: 1.Sebutkan indicator-indikator apa saja dalam students' response questionnaire ini? Dan setiap indicator diwakili oleh berapa item statement?

2. Tuliskan satu contoh statement untuk setiap indicator...

RESULT AND DISCUSSION

Student Problem Solving Skills Test Results

High school physics problem solving skills test on gas kinetic theory material is needed to support students' understanding which in turn will have an impact on the problem solving ability of students. Therefore, in this study, 5 questions on the kinetic theory of gases were given in the form of essays. These questions using indicators of problem solving skills. These indicators include A-Assen the problem, C-Create a drawing, C-Conceptualize the strategy, E-Execute the solution, S-Scrutinize your result. The research that has been carried out has resulted in answers to students' problem solving skills which are shown in Figure 2.



Value Category

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

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. Of the 5 questions given to students, each ACCES indicator has a maximum score of 4. In each ACCES indicator, if students include the indicators and answer correctly, they will get a score of 4, but if they are wrong, the score given is 1. If you do not answer using the ACCES indicator, then each indicator will get a score of 0. Thus, for 1 question the maximum score is 20 and the maximum total score for 5 questions is 100.

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 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. This is confirmed in Figure 3.

Commented [A10]: 1.Format jurnal JPP adalah results and discussion. Artinya setiap hasil penelitian yang ditampilkan harus langsung diberikan pembahasan.

2.Pembahasan harus merujuk pada literatur dari jurnal internasional. Bandingkan hasil penelitian Anda dengan penelitian-penelitian orang lain, apakah cenderung sejalan atau kontradiktif dengan penelitian orang lain.

Commented [A11]: Figure 2. The test results on students' problem solving skills for male (blue) and female (red)

Commented [A12]: Tidak ada pembahasan yang relevan terkait data pada gambar 2...

Misalnya mengaoa profil problem solving skills untuk perempuan lebih tinggi dibandingkan laki-laki..

Ungkapkan penelitian-penelitian yang mendukung atau malah kontradiktif dengan temuan penelitian Anda

Average student's score on each indicator



riotien solving shin indicator

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

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 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. The influencing factor is that students do not have the confidence to evaluate their answers whether they are correct or not, whether they are sure or not. 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 is Gay-Lussac's law.

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. 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.



Figure 5. Student answer on the indicator C-Drawing

Commented [A13]: Tidak ada pembahasan dari literature terkait data pada Figrue 3

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.

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.

| E | (execute | the | solu | tion |) = |
|---|-------------|-----|-------|------|---------|
| | <u>Pi</u> . | P2 | | | ••••• |
| | Ti | 7- | 2 | | ••••••• |
| | 7,0 | = 3 | - | | |
| | 77 | 2 | 7 | | |
| | 7.0×27 | = | 3 * 7 | +7 | |
| | 189 | = | 23 | ۱ | |
| | 18 | 39 | = 9 | = 0 | i : 11 |
| | 1 | 131 | 11 | | .0. |

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.

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.

| - S (Scrutinize | result) |
|-----------------|---------------|
| sure | not sure |
| Because by u | sing Gay- |
| Lussac's law | and calculate |
| all the pressu | res (P) and |
| temperatures | (T), the |
| mass ratio | 15 g:u |

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. 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 1. Student Response Questionnaire Results

| | Percentage (%) | | | |
|--|-----------------------------|-----------------|----------------|--------------------------|
| Statement | 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) |

Commented [A14]: Tidak ada pembahasan dari literature terkait data penelitian Anda

| | Percentage (%) | | | |
|---|----------------|----------------|----------------|----------------|
| Statement | 1 | 2 | 3 | 4 |
| Statement | (Strongly | (Disagree) | (Agree) | (Strongly |
| | Disagree) | | | Agree) |
| 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) |

Commented [A15]: ubah menjadi titik, bukan koma... dalam Bahasa inggris

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.

Literature Review

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 2.

| Author, (Year) | Research Design | Results |
|-----------------------------|---|---|
| Ningrum et al., (2022) | 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) | Quantitative Pre-Experimental in the form of The One Group Pretest- Post-test Design. | Improved student problem solving ability |
| Suhardiman et al., (2021) | Meta-Analysis Research Quantitative descriptive analysis | Using PBL can improve high school student learning outcomes |
| Asiyah et al., (2021) | 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) | 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) | Pre-experimental research One group pretest-posttest design Essay test instrument | The interactive demonstration method with variety of visual media can improve the understanding of the concept in physics material |

| Author, | Research Design | Results |
|---------------------------------------|--|--|
| (Year) Nelvianti et al., (2020) | Descriptive qualitative approachPurposive sampling | PBL learning using 2-learning can improve student learning outcomes |
| Melinda et al., (2020) | 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) | Quantitative research with Quasi-experimentalRandom sampling technique | Problem solving skills and student learning independence in learning with PBL are higher than conventional learning |
| Lestari et al., (2019) | 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) | RnD Instrument is a questionnaire | Produce interactive websites that are enhanced with the PBL model |
| Setyowidodo et al., (2018) | 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) | Qualitative descriptive methodEssay 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) | 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) | Thiagarajan 4D development strategyDiscovery 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).

CONCLUSION

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 got scores 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 including 2 girls and 1 boy. There are no students with high category. The provision of indicators of problem solving skills which include ACCES makes students feel that problem solving is very complicated and difficult to describe. From the research results, on average, students only answered questions in the E category -Execute the solution. The factors that cause it are 1) Students are not used to solving problem solving skills with ACCES indicators. This is related with 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. This is related with the results of the student questionnaire as many as 49,4% agree that it is difficult to understand physics material, especially the kinetic theory of gases. Therefore, there is a need for innovation 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 website-based PBL model of gas kinetic theory material can be applied to improve students' problem solving skills.

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

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Abstract: Profile of students' physics problem-solving skills and problem based learning implementation supported by website on gas kinetic theory. Objectives: This preliminary study aims to analyze physics problem solving skills as a consideration in the implementation of a website-based PBL model to the kinetic theory of gases. **Methods:** The research subjects were 162 high school students in class XI in Madiun Regency, East Java Province based on purposive sampling technique. Data collection were using problem-solving skills test with ACCES indicators, student questionnaires and physics teacher interviews. The data obtained were analyzed using descriptive qualitative. **Findings:** The level of problem-solving skills in the kinetic theory of gases is still low, 159 students (119 female and 40 male) scored in the low category. 3 students (2 female and 1 male) scored in medium category. From the research results, on average, students only answered questions in the E category - Execute the solution. **Conclusion:** Students are not used to solving problem solving skills with ACCES indicators. Students tend to learn by memorizing formulas but do not understand the concept in depth. So that the website-based PBL model of gas kinetic theory material 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: Penelitian pendahuluan ini bertujuan 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 Provinsi Jawa Timur berdasarkan teknik purposive sampling. Data penelitian dikumpulkan menggunakan instrumen tes kemampuan pemecahan masalah dengan indikator ACCES, angket siswa dan wawancara guru fisika. Teknik analisis data yaitu deskriptif kualitatif. Temuan: tingkat keterampilan pemecahan masalah pada materi teori kinetik gas masih rendah, yaitu dari hasil tes sebanyak 159 siswa (119 perempuan dan 40 laki-laki) dengan kategori rendah. 3 siswa (2 perempuan dan 1 laki-laki) 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 namun belum paham konsep dengan mendalam. Sehingga model PBL berbasis website materi teori kinetik gas dapat diterapkan untuk meningkatkan keterampilan pemecahan masalah siswa.

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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 using the website can support student

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.

• METHOD

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 websitebased 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 DISCUSSION

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 | | <mark>0.842</mark> | Valid | | |
| <mark>3</mark> | 0.182 | <mark>0.867</mark> | Valid | | |
| <mark>4</mark> | | <mark>0.662</mark> | Valid | | |
| <mark>5</mark> | | 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 | <mark>0,182</mark> | 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.



The Result of Student's Test

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

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

Value Category

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 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.



Average student's score on each indicator

Problem solving skill indicator



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 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.

A - (ASSEN THE PROBLEM): The relationship between moles and mass

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.

| - S (SCrutinize result) |
|----------------------------|
| sure not sure |
| Because by using Gay- |
| Lussac's law and calculate |
| all the pressures CP) and |
| temperatures (T), the |
| mass ratio is g:ll |

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.

| | Percentage (%) | | | |
|--|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| Statement | 1 (Strongly Disagree) | 2 (Disagree) | 3 (Agree) | 4 (Strongly Agree) |
| Difficult understand physics, especially for kinetic theory of gases | 1.9 % (3) | <mark>34.6 %</mark> (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) | <mark>46.9 %</mark> (76) | <mark>36.4 %</mark> 59 |
| Physics lesson is boring | <mark>8.6 %</mark> (14) | <mark>50 %</mark> (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 | <mark>6.8 %</mark> (11) | 18.5 % (30) | 40.7 % (66) | <mark>34 %</mark> (55) |
| I prefer the online physics learning process rather than face-to-face | <mark>40.1 %</mark> (65) | 27.8 % (45) | 14.8 % (24) | 17.3 % (28) |
| My physics teacher is fun when teaching and learning in class | 7.4 % (12) | <mark>16 %</mark> (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) | <mark>8.6 %</mark> (14) |
| I find it difficult when working on test questions in the problem-solving skills design | <mark>3.1 %</mark> (5) | <mark>53.1 %</mark> (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) | <mark>16.7 %</mark> (27) | 43.2 % (70) | <mark>35.8 %</mark> (58) |

 Table 3. Student Response Questionnaire Results

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.

| 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 | Meta-Analysis Research Ouantitative | Using PBL can improve high school student |

| | Table 4. | Relevant | Research | 2018-2022 |
|--|----------|----------|----------|-----------|
|--|----------|----------|----------|-----------|

| | teaching and learning process | descriptive analysis | 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 interactive demonstration method with various of visual media | Pre- experimental research One group pretest-posttest design Essay test instrument | The interactive demonstration method with variety of visual media can improve the understanding of 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 | PBL learning device material kinetic gas theory is good for use in physics class in |

| | | | validity instruments with a Likert . rating scale | 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 | • | Survey research Questionnaire instruments and open-ended choice test | The misconception of the kinetic theory of gases by 28.57% can be minimized with meaningful |

| | nurul ummah yogyakarta | • | questions Test validity using Aiken's-V . formulation | 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).

CONCLUSION

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.

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

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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.

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- 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 using the website can support student

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.

• METHOD

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 websitebased 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 DISCUSSION

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 result | ts below us | ed IBN | A SPSS Sta | tistics 2 | <mark>25.</mark> | | | | |

| Table 1. Validity Result | | | | | |
|--------------------------|--------------------|--------------------|--------------|--|--|
| Question Number | Rtable | Rcount | Description | | |
| 1 | | 0.777 | Valid | | |
| 2 | | 0.842 | Valid | | |
| <mark>3</mark> | <mark>0.182</mark> | <mark>0.867</mark> | Valid | | |
| <mark>4</mark> | | 0.662 | Valid | | |
| <mark>5</mark> | | 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.



The Result of Student's Test



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

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 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.

Average student's score on each indicator



Problem solving skill indicator

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

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 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.

A - (ASSEN THE PROBLEM): The relationship between moles and mass

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. 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.

| - S (SCrutinize result) |
|----------------------------|
| Sure not sure |
| Because by using Gay- |
| Lussac's law and calculate |
| all the pressures (P) and |
| temperatures (T), the |
| mass ratio is 9:11 |

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.

| I uble et | bradem respons | e Questionnun | e nebulto | | |
|----------------------|----------------|---------------|---------------|-----------|--|
| | Percentage (%) | | | | |
| Statement | 1 | 1 2 | | 4 | |
| Statement | (Strongly | (Disagree) | (Agree) | (Strongly | |
| | Disagree) | | | Agree) | |
| Difficult understand | 1.9 % | 34.6 % | 49.4 % | 14.2 % | |

| Table 3. Student Response | Questionnaire Results |
|---------------------------|-----------------------|
|---------------------------|-----------------------|

| | Percentage (%) | | | | |
|--|----------------------------|-----------------------------|---|-----------------------------|--|
| Statement | 1 (Strongly | 2 (Disagroo) | $\frac{3}{(\Lambda \operatorname{grag})}$ | 4 (Strongly | |
| | (Strongry Disagree) | (Disagi ee) | (Agree) | (Strongly Agree) | |
| physics, especially for kinetic theory of gases | (3) | <mark>(56)</mark> | (80) | (23) | |
| The material for the kinetic theory of gases is necessary to study because it correspond to events in daily life | <mark>1.9 %</mark> (3) | 14.8 % (24) | <mark>46.9 %</mark> (76) | <mark>36.4 %</mark> 59 | |
| Physics lesson is boring | <mark>8.6 %</mark> (14) | <mark>50 %</mark> (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 | <mark>6.8 %</mark> (11) | <mark>18.5 %</mark> (30) | <mark>40.7 %</mark> (66) | <mark>34 %</mark> (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) | <mark>16 %</mark> (26) | <mark>42.6 %</mark> (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) | <mark>8.6 %</mark> (14) | |
| I find it difficult when working on test questions in the problem-solving skills design | <mark>3.1 %</mark> (5) | <mark>53.1 %</mark> (86) | 17.9 % (29) | <mark>25.9 %</mark> (42) | |
| I prefer to study practice using interactive simulation online | 15.4 % (25) | 25.3 % (41) | <mark>39.5 %</mark> (64) | 19.8 % (32) | |
| I am interested in getting physics lessons using a website that contains learning video material | 4.3 % (7) | <mark>16.7 %</mark> (27) | 43.2 % (70) | <mark>35.8 %</mark> (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.

| 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 |

Table 4. Relevant Research 2018-2022

| 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 interactive demonstration method with various of visual media | • | Pre- experimental research One group pretest-posttest design Essay test instrument | The interactive demonstration method with variety of visual media can improve the understanding of 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 | 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 |

| | | a Likert . rating scale | 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 | The misconception of the kinetic theory of gases by 28.57% can be minimized with meaningful learning, practicum, videos, animations, |

| | | using Aiken's-V . formulation | 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).

CONCLUSION

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.

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[JPP] Editor Decision

1 message

Jurnal Pendidikan Progresif <jurnal@fkip.unila.ac.id> To: Binar Kurnia Prahani <binarprahani@unesa.ac.id> Sun, Mar 6, 2022 at 12:17 PM

Dear Dr. Binar Kurnia Prahani:

We have reached a decision regarding your submission to Jurnal Pendidikan Progresif, "Profile of Students' Physics Problem Solving Skills and Problem Based Learning Implementation Supported by Website on Gas Kinetic Theory".

Our decision is: Revision Required

Please see the reviewers' comments on the journal website and send your revision back to us **no later than 13 March 2022**. Your revision must be clear for every single reviewers' comments. <u>We will double check</u> <u>your revision and the decision to accept or not depends on the results of your revision</u>. The reference issues should be fixed as requested by the editor.

We look forward to seeing your revision as soon as possible. Thank you. Regards

Best Regards Editorial Team Jurnal Pendidikan Progresif (JPP)

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

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Abstract: Profile of students' physics problem-solving skills and problem based learning implementation supported by website on gas kinetic theory. Objectives: This preliminary study aims to analyze the profile of students' physics problem solving as a deliberation in the implementation of the PBL model and website-based learning media that can improve physics problem solving skills with gas kinetic theory material. Methods: The research subjects were 162 high school students in class XI in Madiun Regency, East Java Province based on purposive sampling technique. Data collection were using problem-solving skills test with ACCES indicators, student questionnaires and physics teacher interviews. The data obtained were analyzed using descriptive qualitative. Findings: The level of problem-solving skills in the kinetic theory of gases is still low, that is, from the test results, 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 including 2 female and 1 male. From the research results, on average, students only answered questions in the E category - Execute the solution. Conclusion: Students are not used to solving problem solving skills with ACCES indicators. Students tend to learn by memorizing formulas but do not understand the concept in depth. So that the websitebased PBL model of gas kinetic theory material 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: Penelitian pendahuluan ini bertujuan untuk menganalisis profil keterampilan pemecahan masalah fisika siswa sebagai pertimbangan dalam penerapan model PBL dan media pembelajaran berbasis website yang dapat meningkatkan keterampilan pemecahan masalah fisika SMA materi teori kinetik gas. Metode: Subjek penelitian adalah 162 siswa SMA kelas XI di Kabupaten Madiun Provinsi Jawa Timur berdasarkan teknik purposive sampling. Data penelitian dikumpulkan menggunakan instrumen tes kemampuan pemecahan masalah dengan indikator ACCES, angket siswa dan wawancara guru fisika. Teknik analisis data yaitu deskriptif kualitatif. Temuan: tingkat keterampilan pemecahan masalah pada materi teori kinetik gas masih rendah, yaitu dari hasil tes sebanyak 159 siswa mendapat nilai dengan kategori rendah dengan rincian 119 siswa perempuan dan 40 siswa laki-laki. Jumlah siswa untuk kategori sedang terdapat 3 siswa meliputi 2 perempuan dan 1 laki-laki. 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 namun belum paham konsep dengan mendalam. Sehingga model PBL berbasis website materi teori kinetik gas dapat diterapkan untuk meningkatkan keterampilan pemecahan masalah siswa.

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

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- 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). In learning the problem-solving aspect is the focus of learning that must be considered. 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, especially complex problems related to real life, 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).

In addition to the skills that must be trained to students, 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.

At the beginning of the covid-19 pandemic, learning began to use various digital technologies. 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.

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 understanding of the concept of the kinetic theory of gases by students is low with the percentage of students understanding the concept of 32.59%, not understanding the concept of 25.02% and misconceptions of 41.92% (Ashar et al., 2021).

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.

• METHOD

This research is a preliminary research. 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 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 Desult. Students are given about 45 minutes to answer the questions. 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). Statements in the answer questionnaire included students' learning experiences and the learning process teachers conducted in the classroom, and the answer questionnaire was standardized and tested for validity and reliability. 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 DISCUSSION

Student Problem Solving Skills Test Results

High school physics problem solving skills test on gas kinetic theory material is needed to support students' understanding which in turn will have an impact on the problem solving ability of students. Therefore, in this study, 5 questions on the kinetic theory of gases were given in the form of essays. These questions using indicators of problem solving skills. These indicators include A-Assen the problem, C-Create a drawing, C-Conceptualize the strategy, E-Execute the solution, S-Scrutinize your result. The research that has been carried out has resulted in answers to students' problem solving skills which are shown in Figure 2.

The Result of Student's Test



Value Category

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

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. Of the 5 questions given to students, each ACCES indicator has a maximum score of 4. In each ACCES indicator, if students include the indicators and answer correctly, they will get a score of 4, but if they are wrong, the score given is 1. If you do not answer using the ACCES indicator, then each indicator will get a score of 0. Thus, for 1 question the maximum score is 20 and the maximum total score for 5 questions is 100.

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 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. This is confirmed in Figure 3.

Average student's score on each indicator



Problem solving skill indicator

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

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 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. The influencing factor is that students do not have the confidence to evaluate their answers whether they are correct or not, whether they are sure or not. 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.

A - (ASSEN THE PROBLEM): The relationship between moles and mass

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 is Gay-Lussac's law.

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. 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.



Figure 5. Student answer on the indicator C-Drawing

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.

C-(can eptualize the strategy) =
$$P_1 = P_2$$

Ti Tz

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.

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.

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.

| - S (SCrutinize result) |
|----------------------------|
| sure not sure |
| Because by using Gay- |
| Lussac's law and calculate |
| all the pressures (P) and |
| temperatures (T), the |
| mass ratio is g: 11 |

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. 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.

| | Percentage (%) | | | |
|--|-----------------------------|-----------------|----------------|--------------------------|
| Statement | 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) |

 Table 1. Student Response Questionnaire Results

| | Percentage (%) | | | |
|---|------------------------|----------------|----------------|----------------|
| Statement | 1 | 2 | 3 | 4 |
| | (Strongly Disagree) | (Disagree) | (Agree) | (Strongly |
| 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.

Literature Review

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 2.

| Author, (Year) | Research Design | Results |
|------------------------------|---|---|
| Ningrum et al., (2022) | 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) | Quantitative Pre-Experimental in the form of The One Group Pretest- Post-test Design. | Improved student problem solving ability |
| Suhardiman et al., (2021) | Meta-Analysis Research Quantitative descriptive analysis | Using PBL can improve high school student learning outcomes |
| Asiyah et al., (2021) | 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) | 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) | Pre-experimental research One group pretest-posttest design Essay test instrument | The interactive demonstration method with variety of visual media can improve the understanding of the concept in physics material |

Table 2. Relevant Research 2018-2022

| Author, (Year) | Research Design | Results |
|-------------------------------|--|--|
| Nelvianti et al., (2020) | Descriptive qualitative approachPurposive sampling | PBL learning using 2-learning can improve student learning outcomes |
| Melinda et al., (2020) | 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) | 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) | 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) | RnD Instrument is a questionnaire | Produce interactive websites that are enhanced with the PBL model |
| Setyowidodo et al., (2018) | 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) | 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) | 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) | 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).

CONCLUSION

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 got scores 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 including 2 girls and 1 boy. There are no students with high category. The provision of indicators of problem solving skills which include ACCES makes students feel that problem solving is very complicated and difficult to describe. From the research results, on average, students only answered questions in the E category -Execute the solution. The factors that cause it are 1) Students are not used to solving problem solving skills with ACCES indicators. This is related with 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. This is related with the results of the student questionnaire as many as 49,4% agree that it is difficult to understand physics material, especially the kinetic theory of gases. Therefore, there is a need for innovation 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 website-based PBL model of gas kinetic theory material can be applied to improve students' problem solving skills.

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Kami meninjau ulang hasil revisi Anda dan terlihat bahwa revisi pada bagian abstrak belum sesuai permintaan Editor. **Kami tidak bisa mempublikasikan manuskrip Anda sebelum dilakukan revisi dengan benar.**

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Toppi

Manuscript Acceptance Letter

Dear Authors: Mila Candra Pristianti & Binar Kurnia Prahani

We are pleased to inform you that our Editorial Board has been accepted and approved your manuscript entitled "**Profile of Students' Physics Problem Solving Skills and Problem Based Learning Implementation Supported by Website on Gas Kinetic Theory**", for publication in Volume 12, Issue 1 (April 2022) of Jurnal Pendidikan Progresif after successfully passing the review process and revision made by the authors.

The authors will recieved the galley proof of the final revision after all of the quality control checks and prior to publishing the manuscript. Thank you very much for considering our journal as your publication partner.

Best Regards,

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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 2020Accepted: 10 April 2020Published: 11 April 2020Abstract: Profile of students' physics problem-solving skills and problem based learningimplementation supported by website on gas kinetic theory. Objectives: To analyze physicsproblem solving skills as a consideration in the implementation of a website-based PBL model onkinetic theory of gases. Methods: The research subjects were 162 high school students in class XIin Madiun Regency based on purposive sampling. Data collection were using problem-solving skillstest ACCES indicators, student questionnaires, physics teacher interviews. Data were analyzeddescriptive qualitative. Findings: The level of problem-solving skills in the kinetic theory of gases isstill low, 159 students in low category, 3 students in medium category. On average students onlyanswered questions in the E-Execute the solution. Conclusion: Students are not used to solvingquestions 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.

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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 webbased 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 problemsolving 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 | Rtable | Rcount | Description |
|----------|--------|--------|-------------|
| Number | | | |
| 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 | Ν | Description |
|------------|-------|---------------------|
| Alpha | | _ |
| 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 skills cores of



The Result of Student's Test

Value Category 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 problemsolving 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



Problem solving skill indicator

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 problemsolving 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.

| - 5 | (Scrutinize result) | ••• |
|-----|---------------------------|-----|
| | sure not sure | |
| B | ecause by using Gay- | |
| L | ussac's law and calculate | |
| a | ll the pressures (P) and | |
| + | emperatures (T), the | |
| | mass ratio is g:11 | |

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 faceto-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 problemsolving 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.

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

Table 3. Student response questionnaire results

| 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, websitebased 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).

| 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. |

Table 4. Relevant Research 2018-2022

| Indriyani et al., (2021) | Knowing the improvement of students' problem solving skills by way of application of the Double Loop Model | Quantitative Pre- Experimental the form of Th One Group Pretest-Post-te Design. | Improved student problem solving ability ne est |
|------------------------------|---|---|---|
| Suhardiman et al., (2021) | Find out how much influence the PBL work on physics teaching and learning process | Meta-Analysi Research Quantitative descriptive analysis | is 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 preto posttest contr group design Using instruments in the form of te 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-solvi ability tests, observation sheets on the implementatic 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-posttes 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 | 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 | • | analysis 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, websitebased 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.

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