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Problem Based Learning Models in Senior High Schools: A Literature Review on Learning Physics

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ABSTRACT

Objective: *One of the facilities and infrastructure to improve the quality of human resources in education. The challenge must be to create the nation's next generation who can solve a problem, can think creatively, can think critically and make decisions. The way to improve student's abilities is to use an interactive and not monotonous learning model to make physics learning more effective. The purpose of the research is to investigate the benefits of the PBL learning model in senior high school physics instruction and the influence it has on those subjects.* ***Method:*** *In addition, the research method used examines the literature and collects data from 15 articles from various journals. These both national and international scientific journals that are aligned with the problem-based learning model, which is then analyzed descriptively and qualitatively.* ***Results:*** *The conclusions that can be drawn through this research is that a problem-based learning model is very effective for applying to physics subjects in high school.* ***Novelty:*** *Increased student learning outcomes critical thinking, problem-solving skills and understanding of physics concepts evidence this.*

INTRODUCTION

The facilities and infrastructure needed to improve the quality of human resources in the field of education are crucial. In this era, the rapid development of science and technology requires high adaptation to remain relevant. The Republic of Indonesia Law No. 20 of 2003 concerning the National Education System states that the aim of education is to shape students who are dedicated, have good personality, possess positive character, and have knowledge that is beneficial to the homeland, nation, and religion.

There are various challenges in education today, one of which is to create the next generation capable of problem-solving, critical and creative thinking, decision-making, expressing opinions, and working effectively both individually and in groups (Simanjuntak , 2019). According to the Ministry of Education and Culture in 2017, the current learning emphasizes students' abilities to find solutions, formulate problems, analyze, and collaborate in problem-solving. Therefore, communication and collaboration are crucial in improving the quality of education in Indonesia.

According to various sources, the current learning process predominantly relies on conventional teacher-centered methods, which limit student involvement and hinder the development of collaborative and communicative skills (Nurhayati, 2019). Continuously employing these methods in teaching leads to less conducive learning activities and inadequate student learning outcomes. It is necessary to diversify the presentation of materials to facilitate students' comprehension of the lessons. Hence, innovative approaches and models of instruction are required to enhance students' abilities and improve learning outcomes.

Physics is identified as a subject that poses challenges for high school students in terms of practical application in everyday life (Ahmad, 2020). It plays a crucial role in the realm of science and technology. By studying physics, students can develop their intellectual capabilities and problem-solving skills. Many students struggle to grasp physics concepts and tend to rely on memorizing formulas without comprehending their physical significance. Additionally, some students hesitate to seek assistance from teachers when they encounter difficulties with the material. The effectiveness of teaching and learning is measured by students' academic performance and improvements in their abilities (Suliyanah, 2021). Thus, student interest learning is the main factor affecting their learning outcomes.

Many methods and learning models need to be applied to improve student learning outcomes in physics learning in high school. One of which is the *Problem-Based Learning Model*. This learning model can improve student learning experiences that are realistic and relevant for students in dealing with fundamental problems in life. This approach fosters critical thinking, problem-solving abilities, and intellectual skills, as students collaborate to solve physics-related problems. Hence, the objective of this study is to analyze the impact of implementing the PBL model in physics education and assess its benefits in high school settings. In addition, the purpose of this study is to further examine the PBL model and the advantages of this learning model in physics subjects which are used as the latest in this study. Through the study of literature from various sources it can be used as a measuring tool in achieving indicators of success in this subject and can find out what problems students face during physics learning activities, so teachers can apply this learning model to train the skills needed by students in this century.

RESEARCH METHOD

The type of research used is a literature study. The data analysis technique is carried out with a qualitative approach because it produces descriptive data, namely collecting data from 15 articles from various journals, both national and international scientific journals, that are pertinent to the issue PBL model in high school physics learning published in 2019-2022, then describe and examine the information. Moreover, make a conclusion to the collected data. According to Imran and Ahda (2022), in a literature review, researchers must identify theories systematically, find literature, then analyze information according to the specified topic. The following are the stages carried out in qualitative descriptive research.

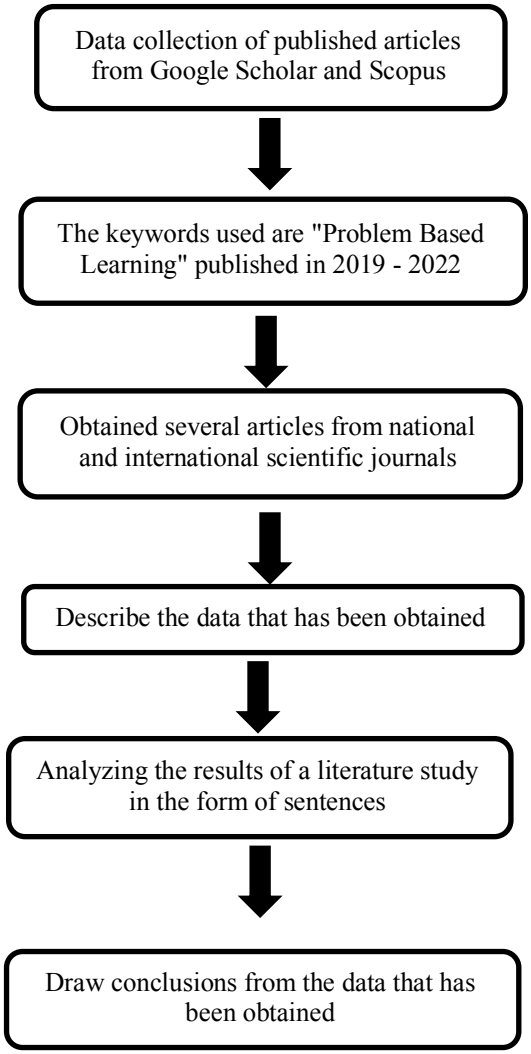

Figure 1. Stages of PBL model research in high school physics learning

RESULTS AND DISCUSSION

Results

From the study of the available literature, a summary of several national and international scientific journals from 2019 – 2022 regarding the Problem based learning model in high school physics learning is obtained below:

Table 1. Based on Physics in high school, the PBL Learning Model can be used

Author (Year)	Finding
Asiyah, A., Topano, A., & Walid, A. (2021)	The PBL model significantly contributes on learning outcomes for students.
Prahani, BK, Rizki, IA, Citra, NF, Alhusni, HZ, & Wibowo, FC (2022)	The PBL learning model assisted by 3D digital books is very valid and reliable for students.
Nasution, SWR, & Siregar, LH (2022)	PBL Learning Model is viable in improving student learning result

Author (Year)	Finding
Aulia, IM (2022)	Student's problem-solving abilities are influenced by the PBL learning model.
Asuri, AR, Suherman, A., & Darman, DR (2021)	PBL learning model assisted by mind mapping has an effect on improving student problem solving.
Juliani, H., Setiawan, I., & Putri, DH (2021)	PBL learning model assisted by crocodile physics has an effect on students' mastery of physics concepts
Ramadani, E., M. & Nana. 2020	Phet-assisted PBL learning model can improve students' conceptual understanding
M. Marnita,M. Taufiq, I. Iskandar, R. Rahmi. 2020.	The PBL learning model has an effect on improving critical thinking skills.
Sitinjak, L., & Banurea, JS (2022).	PBL learning model using macro flash has an effect on problem solving skills.
Ariswati, et al. 2018.	The PBL model affects the understanding of high school students' physics concepts.
Ayudha, C., F., H. & Setyarsih, W. 2021.	The PBL learning model can train students' problem solving skills
Desnita, D. (2021).	The PBL model is very influential on students' physics learning outcomes
Pujiyanti, A., Ellianawati, E., & Hardyanto, W. (2021).	The true experiment-based PBL model significantly affects student learning outcomes
Patabang, I., Yusuf, I., Allo, AY, & Widyaningsih, SW (2020).	The application of the PBL model greatly influences students' critical thinking processes
Nurazmi, N., & Bancong, H. (2021).	The STEM-integrated PBL model affects students' critical thinking skills.

Discussion

The PBL learning model is an educational model of a curriculum designed to achieve instructional goals. This model emphasizes and introduces students to a real problem they must solve. This model trains students' ability to solve a problem. During the process of teaching and learning activities, , students will build the knowledge they have and improve their skills in solving a problem at hand. Subjects that are often faced with real problems in everyday life are physics subjects in high school. The essential factor in learning activities lies in the quality of the process, whose results can be seen from students' reactions during the learning process.

Based on the data obtained from several articles and national and international journals, the results are as in Table 1 above; In senior high school, the use of PBL learning

models in physics learning is very influential on student learning outcomes. In addition to increasing student learning outcomes, using this learning model can also improve some of the skills students need today, such as problem-solving skills, critical thinking, and mastery of physics concepts. Through this innovative learning model, students are more motivated to learn physics. This is because learning is student-centered, so students are taught to communicate and be able to construct their knowledge.

Some of the advantages of this PBL model are (1) Learning is more problem-oriented in real life, and students must seek as much information as possible to solve these problems so that students do not only study theory. (2) Can help students solve problems quickly because it is more flexible, (3) more efficient and easy for students because students can see directly the objects they are studying. (4) Can activate students in learning physics, (5) the learning process focuses more on student activities. (6) based on the constructivist paradigm, it can help students build their knowledge. (7) more exciting and make group learning activities because it comes from real-world context problems. (8) can overcome the boredom of student learning because learning is more student-centered. (9) can help students develop thinking skills to solve problems intellectually. (10) can overcome student boredom because students can set learning strategies (11) can make students more interactive, practical, and enthusiastic and make students motivated to learn. (12) is more meaningful, relevant, and contextual. (13) can increase students' interest in studying physics. (14) Students have a dominant role in solving a problem. (15) is more interesting because it focuses on students and the teacher only as a facilitator so that they can construct their knowledge.

The 15 articles show the benefits of the PBL model in physics subjects, one of which is that it can make students more interactive, practical and also enthusiastic in learning. This is because in the PBL model at the beginning of learning students are presented with contextual problems that they often encounter in everyday life. Thus, students will be addicted and motivated in learning the material. They will find their own solutions in solving these problems and the teacher becomes a facilitator. That way learning becomes effective and interactive.

The PBL learning model is carried out through 5 stages, including problem orientation, organizing learning, guiding group investigations, presenting the work, and evaluating the problem-solving process. Meanwhile, the characteristic of the PBL model is that the learning always begins with providing the context of the problem that is relevant to the real world. In Asuri's et al. opinion (2021), which states that the PBL model require students carry out problem-based orientation, organize for learning, guide the experiences gained by students individually and in groups, present and analyze work and evaluate problem-solving processes, what they have done.

CONCLUSION

Fundamental findings: Based on the findings results that have been obtained and analyzed, problem-based learning models are very effectively applied to physics subjects in high school. Increased student learning outcomes, problem-solving skills, critical thinking, and understanding of physics concepts evidence this. This model can be utilized as a learning model in the classroom since students will be more dynamic and ready to take care of genuine issues in day to day existence. **Implication:** From this research there are several implications, namely that teachers must act as facilitators and learning is centered on students so they can solve their own problems. Apart from that, teachers must also pay attention to the difficulties experienced by students. **Limitation:**

in this study only focuses on physics material in general. Therefore, the results of this research do not explain in detail the problems experienced by students in one of the materials. **Future Research:** so that the research can be even better, we suggest using the bibliometric analysis method to find out the distribution of article publications and to analyze the contribution of articles with a statistical approach.

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REFERENCES

Adawiyah, V.R., Bektiarso, S. and Sudarti, S., 2022. Pengaruh Model Pembelajaran Problem Based Learning (PBL) Dengan Vee Map Terhadap Hasil Belajar Dan Kemampuan Berpikir Kritis Siswa SMA Pada Pokok Bahasan Alat-Alat Optik.

Agustina, K., Kristiyanto, W. and Noviandini, D., 2017. Learning design of problem based learning model based on recommendations of sintax study and contents issues on physics impulse materials with experimental activities. *International Journal of Active Learning*, *2*(2), pp.68-81.

Ahmad, E.Z. and Hartono, H., 2020. Pengembangan Pocket Book Fisika Berbasis Problem Based Learning untuk Meningkatkan Pemahaman Konsep Fisika Kelas XI. *UPEJ Unnes Physics Education Journal*, *9*(3), pp.264-275.

Akhyar Musthofani. 2021. Meningkatkan hasil belajar sisiwa SMA dalam pelajaran online fisika materi elastisitas menggunakan model problem based learning. *Navigation Physics: Journal of Physics Education*, *3*(1), pp.1-7.

Aldila, S. and Mukhaiyar, R., 2020. Efektivitas model pembelajaran problem based learning pada mata pelajaran dasar listrik dan elektronika di kelas X SMK Negeri 1 Bukittinnggi. *Ranah Research: Journal of Multidisciplinary Research and Development*, *2*(2), pp.51-57.

Anwar, C., 2014. *Hakikat manusia dalam pendidikan: sebuah tinjauan filosofis*. Suka-press.

Aristawati, N.K., Sadia, I.W. and Sudiatmika, A.A.I.A.R., 2018. Pengaruh model problem based learning terhadap pemahaman konsep belajar fisika siswa SMA. *Jurnal Pendidikan Fisika Undiksha*, *8*(1), pp.31-41.

Asiyah, A., Topano, A. and Walid, A., 2021. Pengaruh problem based learning (PBL) terhadap kemampuan pemecahan masalah Dan hasil belajar kognitif siswa SMA Negeri 10 Kota Bengkulu. *Edukatif: Jurnal Ilmu Pendidikan*, *3*(3), pp.717-727., 2021, doi : 10.1080/10508422.2021.1910826.

Asuri, A.R., Suherman, A. and Darman, D.R., 2021. Penerapan model problem based learning (PBL) berbantu mind mapping dalam pembelajaran fisika untuk meningkatkan kemampuan pemecahan masalah pada materi usaha dan energi. *Jurnal Penelitian Pembelajaran Fisika*, *12*(1), pp.22-28.

Aswal, A., Hunaidah, H. and Erniwati, E., 2019. Development of Lesson Plan (LP) with Software Lectora Inspire Assisted Problem-Based Learning in Improving Learning Outcomes for Senior High School. *Indonesian Review of Physics*, *2*(2), pp.40-52.

Aulia, I.M., 2022. Pengaruh Model Pembelajaran Berbasis Masalah Terhadap Kemampuan Pemecahan Masalah Fisika Peserta Didik Pada Materi Usaha dan Energi. *Jurnal Pendidikan Fisika dan Teknologi*, *8*(SpecialIssue), pp.52-57.

Ayudha, C.F.H. and Setyarsih, W., 2021. Studi literatur: Analisis praktik pembelajaran fisika di sma untuk melatih keterampilan pemecahan masalah. *Jurnal Pendidikan Fisika Undiksha*, *11*(1), pp.16-28.

Bahri, S., 2021 Penerapan Model Problem Based Learning terhadap Kemampuan Kognitif pada Materi Fisika Siswa Kelas VII SMP. *Jurnal Sains dan Pendidikan Fisika*, *17*(3), pp.178-184.

Departemen Pendidikan Nasional, 2014. No, U.U., 20. Tahun 2003 tentang sistem pendidikan

nasional.

Desnita, D., 2021. Meta Analisis Pengaruh Model Pembelajaran Problem Based Learning (Pbl) Terhadap Hasil Belajar Fisika. *Jurnal Pendidikan Fisika Undiksha*, *11*(2), pp.11-18.

Gay, S., Sahjat, S. and Hamid, F., 2022. Efektivitas Pembelajaran Fisika Menggunakan Model Pembelajaran PDEODE dan Model PBL Terhadap Hasil Belajar Siswa Kelas VII di SMP Negeri 5 Kota Ternate Pada Materi Kalor. *EDUKASI*, *20*(1), pp.112-125.

Hakim, A., 2021. Pengaruh model Problem Based Learning Berbantuan Software Tracker Terhadap Kemampuan Pemecahan Masalah Siswa Pada Materi Gerak Lurus Di SMA Negeri 1 Belimbing. *COMPTON: Jurnal Ilmiah Pendidikan Fisika*, *8*(1), pp.17-20.

Hamdayama, J., 2014. Model dan metode pembelajaran kreatif dan berkarakter. *Bogor: Ghalia Indonesia*, *2*(3).

Holifah, N., 2022. *Penerapan Model Problem Based Learning Untuk Meningkatkan Hasil Belajar Fisika Siswa Kelas Xi Mipa 4 Sma Negeri 2 Singaraja Tahun Pelajaran 2019/2020* (Doctoral dissertation, Universitas Pendidikan Ganesha).

Jayadiningrat, M.G. and Ati, E.K., 2018. Peningkatan Keterampilan Memecahkan Masalah Melalui Model Pembelajaran Problem Based Learning (PBL) Pada Mata Pelajaran Kimia. *Jurnal Pendidikan Kimia Indonesia*, *2*(1), pp.1-7.

Jemarus, W., 2022. Penerapan Model PBL (Problem Based Learning) dalam Meningkatkan Hasil Belajar Fisika Kelas XI SMA Negeri 1 Langke Rembong. *EDUNET-The Journal of Humanities and Applied Education*, *1*(2), pp.238-248.

Juliani, H., Setiawan, I. and Putri, D.H., 2021. Pengaruh model pembelajaran problem based learning berbantuan media crocodile physic terhadap penguasaan konsep fisika materi Usaha dan Energi di SMAN 1 Bengkulu Tengah. *Jurnal Kumparan Fisika*, *4*(2), pp.85-92.

Kalele, E.C., Taunaumang, H. and Rende, J.C., 2022. Pengaruh Penggunaan Model Pembelajaran Problem Based Learning (PBL) Terhadap Proses dan Hasil Belajar Siswa pada materi Gaya di SMA Negeri 2 Tondano Kelas X. *Charm Sains: Jurnal Pendidikan Fisika*, *3*(2), pp.115-118.

Khusaeri, A., 2022. Peningkatan Keaktifan dan Hasil Belajar Peserta Didik Dalam Proses Pembelajaran Fisika Materi Fluida Dinamis Dengan Model Pembelajaran Berbasis Masalah (Problem Based Learning). *Global Journal Science IPA*, *1*(1), pp.31-37.

Maelani, G., Yanti, R.A.E. and Sutendy, U.A., 2021. Pengaruh Penerapan Model Pembelajaran Project Based Learning (Pbl) Melalui Penggunaan Media Unit Kegiatan Belajar Mandiri (Ukbm) Terhadap Hasil Belajar Siswa. *J-KIP (Jurnal Keguruan dan Ilmu Pendidikan)*, *2*(2), pp.71-80.

Marnita, M., Taufiq, M., Iskandar, I. and Rahmi, R., 2020. The Effect of Blended Learning Problem-Based Instruction Model on Students' Critical Thinking Ability in Thermodynamic Course. *Jurnal Pendidikan IPA Indonesia*, *9*(3), pp.430-438.

Maysyaroh, S. and Dwikoranto, D., 2021. Kajian pengaruh model project based learning terhadap keterampilan berpikir kreatif peserta didik pada pembelajaran fisika. *ORBITA: Jurnal Kajian, Inovasi dan Aplikasi Pendidikan Fisika*, *7*(1), pp.44-53.

Nasution, S.W.R., Siregar, L.H. and Nasution, U.S.Z., 2022. Pengaruh Model Problem Based Learning (Pbl) Terhadap Hasil Belajar Fisika Materi Hukum Newton. *Jurnal Physedu (Physics Education)*, *4*(1), pp.20-20.

Nurazmi, N. and Bancong, H., 2021. Integrated stem-problem based learning model: its effect on students' critical thinking. *Kasuari: Physics Education Journal (KPEJ)*, *4*(2), pp.70-77.

Nurhayati, D.I., Yulianti, D. and Mindyarto, B.N., 2019. Bahan ajar berbasis problem based learning pada materi gerak lurus untuk meningkatkan kemampuan komunikasi dan kolaborasi siswa. *UPEJ Unnes Physics Education Journal*, *8*(2), pp.208-218.

Patabang, I., Yusuf, I., Allo, A.Y. and Widyaningsih, S.W., 2020. The Application of Problem Based Learning Models with E-Learning during the Covid-19 Pandemic to Students' Science Process Skills of Class XI IPA Students at SMA Santo Paulus Manokwari. *Kasuari: Physics Education Journal (KPEJ)*, *3*(2), pp.118-127.

Pawlak, A., Irving, P.W. and Caballero, M.D., 2020. Learning assistant approaches to teaching computational physics problems in a problem-based learning course. *Physical Review Physics Education Research*, *16*(1), p.010139.

Permata, M.D., Koto, I. and Sakti, I., 2018. Pengaruh model Project Based Learning terhadap minat belajar fisika dan kemampuan berpikir kritis siswa SMA Negeri 1 Kota Bengkulu. *Jurnal Kumparan Fisika*, *1*(1 April), pp.30-39.

Prahani, B.K., Rizki, I.A., Nisa, K., Citra, N.F., Alhusni, H.Z. and Wibowo, F.C., 2022. Implementation of online problem-based learning assisted by digital book with 3D animations to improve student's physics problem-solving skills in magnetic field subject. *JOTSE*, *12*(2), pp.379-396.

Pujiyanti, A., Ellianawati, E. and Hardyanto, W., 2021. Penerapan Model Problem Based Learning (PBL) Berbantuan Alat Peraga untuk Meningkatkan Minat dan Hasil Belajar Fisika Siswa MA. *Physics Education Research Journal*, *3*(1), pp.41-52.

Putranta, H. and Kuswanto, H., 2018. Improving students' critical thinking ability using problem based learning (PBL) learning model based on PhET simulation. *SAR Journal*, *1*(3), pp.77-87.

Ramadani, E.M. and Nana, N., 2020. Penerapan problem based learning berbantuan virtual lab phet pada pembelajaran fisika guna meningkatkan pemahaman konsep siswa sma: Literature review. *JPFT (Jurnal Pendidikan Fisika Tadulako Online)*, *8*(1).

Safitri, F. and Edie, S.S., 2020. Penerapan Model Pembelajaran Problem Based Learning Menggunakan Strategi Pair Checks untuk Meningkatkan Hasil Belajar Siswa di MAN 2 Boyolali. *UPEJ Unnes Physics Education Journal*, *9*(1), pp.96-109.

Sari, I.P., Nanto, D. and Putri, A.A., 2022. Pengaruh Hasil Belajar Pendidikan Fisika Siswa menggunakan Teknik Meta-analisis dengan Model PBL (Problem Based Learning). *Jurnal MENTARI: Manajemen, Pendidikan dan Teknologi Informasi*, *1*(1), pp.20-28.

Sari, I.D.P., 2021. Respon Siswa Terhadap Pembelajaran Fisika Menggunakan Model Pembelajaran Pbl (Problem Based Learning) Di Sman 2 Tanjung Jabung Timur. *Prosiding Snitt Poltekba*, *5*, Pp.320-325.

Siagan, M.V., Saragih, S. and Sinaga, B., 2019. Development of Learning Materials Oriented on Problem-Based Learning Model to Improve Students' Mathematical Problem Solving Ability and Metacognition Ability. *International electronic journal of mathematics education*, *14*(2), pp.331-340.

Sitinjak, L. And Banurea, J.S., 2022. Analisis Interaksi Model Pembelajaran Problem Based Learning Dan Berpikir Kritis Terhadap Pemecahan Masalah. *Jurnal Pendidikan Fisika*, *11*(1), Pp.61-66.

Sitompul, S.A., 2022. Penerapan Model Pembelajaran Problem Based Learning Untuk Meningkatkan Keterampilan Berfikir Kritis Peserta Didik Pada Materi Getaran Dan Gelombang Di Kelas Viii Smp Negeri 1 Tukka.

Suastra, I.W., Suarni, N.K. and Dharma, K.S., 2019, October. The effect of Problem Based Learning (PBL) model on elementary school students' science higher order thinking skill and learning autonomy. In *Journal of Physics: Conference Series* (Vol. 1318, No. 1, p. 012084). IOP Publishing.

Suyidno, S., 2021. Pembelajaran Kreatif Berbasis Otonomi.

Tanti, T., 2020. Konstruksi dan Validasi Bahan Ajar Fisika Berbasis Problem-Based Learning (PBL) untuk Meningkatkan Keterampilan Generik Siswa. *Journal of Teaching and Learning Physics*, *5*(1), pp.28-34.

Trianto, I.B. and Ibnu, B., 2014. Mendesain model pembelajaran inovatif, progresif, dan kontekstual. *Jakarta: Prenadamedia Group*.

UU Nomor 0 Tahun 2003 Tentang Sistem Pendidikan Nasional.

Wahyuni, A. and Hamid, A., 2017. Upaya peningkatan hasil belajar fisika siswa melalui penerapan model pembelajaran problem based learning (pbl). *Jurnal ilmiah mahasiswa*

pendidikan fisika, *2*(1), pp.42-49.

Wijayanti, N. and Jatmiko, B., 2022. Pembelajaran Virtual Fisika dengan Model Problem Based Learning untuk Meningkatkan Higher Order Thinking Skills Siswa SMA. *Briliant: Jurnal Riset dan Konseptual*, *7*(1), pp.145-156.

Yuliana, W., Dwi, F.S., Pd, M., Si, M. And Eka, T., 2018. *Pengembangan Lembar Kerja Siswa (Lks) Fisika Berbasis Problem Based Learning (Pbl) Pada Materi Getaran Dan Gelombang Untukmeningkatkan Keterampilan Proses Sains Siswa Kelas Viii Smp Negeri 16 Pontianak* (Doctoral Dissertation, Ikip Pgri Pontianak).

Yullya, Lesmono, A.D. and Nuraini, L., 2021. Pengaruh model problem based learning dengan pendekatan STEM terhadap hasil belajar kognitif pada pembelajaran fisika di SMA. *Jurnal Pembelajaran Fisika*, *10*(2), pp.62-69.

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