

# Outreach Program 'Physics Fun for All' Through Simple Experiments for High School Students as a Community Service Initiative

Siti Nurdianti Muahjir<sup>1\*</sup>, Asep Irvan Irvani<sup>1</sup>, Resti Warliani<sup>1</sup>, Rahmadhani Mulvia<sup>1</sup>, Andini Febya Alfiansyah<sup>1</sup>, Rani Putri Septiani<sup>1</sup>, Wilda Nurul Qolbi<sup>1</sup>, Shifa Mutia Rahmah<sup>1</sup>

<sup>1</sup>Department of Physics Education, Universitas Garut, Garut, Indonesia.

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Corresponding Author:

Author Name\*: Siti Nurdianti

Muahjir

Email\*:

[sitinurdiantimuhajir@uniga.ac.id](mailto:sitinurdiantimuhajir@uniga.ac.id)

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**Abstract:** The current challenge for physics teachers is not only to enhance students' understanding of physics but also to help them realize the significant contributions of physics to everyday life in society. The purpose of this community service program is to assist students and teachers in developing problem-solving skills and to transform the image of physics learning from drill-based teaching into problem-solving and project-based learning. In addition, this activity aims to promote a more engaging and enjoyable image of physics. The method employed in this program was a workshop in which partner school students created simple projects under the guidance of university students as facilitators. After the activity, participants were asked to complete a satisfaction survey regarding the implementation of this community service program. The results indicated that almost all participants expressed satisfaction with the program's execution.

**Keywords:** Physics, Robotics, Workshop

## Introduction

The current challenge for physics teachers lies not only in enhancing students' understanding of physics content but also in making physics more relevant and contributive to students' lives beyond the classroom. This can be achieved by implementing engaging physics learning activities that are not burdened with abstract and highly theoretical materials, one of which is through simple experiments (Amarulloh et al., 2023; Haetami et al., 2023; Petersen et al., 2023; Stadermann & Goedhart, 2021). Physics Fun for All is a program designed by the Physics Education Study Program at FPIK UNIGA as a form of community service with multiple objectives, one of which is to introduce physics to high school students in Garut Regency through simple experiments. This program aims to foster students' interest in and understanding of physics, a subject often perceived as difficult and intimidating.

Although Garut Regency has many high schools, a considerable number of them still lack adequate physics laboratory facilities. This condition often becomes a barrier for students to study physics in a comprehensive and practical manner. Laboratories are a crucial component in science education, particularly in physics (Ali et al., 2022; Kerekes, 2024; Safaryan, 2023). Without access to laboratories, students are unable to conduct experiments that can help them better understand physics

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concepts. In physics education, laboratories are not limited to physical spaces; they also encompass broader forms such as virtual laboratories or simulations (El Kharki et al., 2021; Poo et al., 2023; Reeves & Crippen, 2021; Sadidah & Irvani, 2021). Furthermore, the lack of equipment also prevents teachers from effectively demonstrating physics principles, which may result in lessons becoming dry and difficult to comprehend. Therefore, it is crucial to explore alternative solutions that enable students to learn physics even without access to fully equipped laboratories.

Through physics experiments, high school students can experience substantial benefits (Banda & Nzabahimana, 2021; Bogador et al., 2024; Schneider et al., 2022). First, physics experiments help students understand theoretical concepts in a practical way by engaging in direct observation (Banda & Nzabahimana, 2021; Girwidz et al., 2022; Kade et al., 2024). Such a learning process provides real-world experiences that deepen their understanding of physics principles, support problem-solving, and enhance analytical and problem-solving skills (Irvani et al., 2024; Nilimaa, 2023).

Physics experiments also help students develop essential laboratory skills (Hamid et al., 2023; Holmes & Smith, 2023). They learn how to properly use physics tools such as rulers, balances, multimeters, and other measuring instruments, thereby sharpening their essential technical competencies. This not only supports students in the context of formal education but also equips them with skills that can be beneficial for future scientific careers.

Another advantage of conducting physics experiments is that they encourage students' willingness to explore and nurture their curiosity (Looi et al., 2023; Solanes et al., 2023; Tripon et al., 2023). Through hands-on experimentation and investigation, students are encouraged to ask questions, observe, and test their own hypotheses. This not only creates a dynamic and interactive learning environment but also trains students to become critical and independent thinkers. Thus, physics experiments not only support students' understanding of physics but also strengthen their intellectual and metacognitive abilities.

Through the Physics Fun for All program, we aim to help address these issues. We will conduct outreach activities and demonstrate simple physics experiments that can be performed by students at home or at school without requiring expensive or complex laboratory equipment. These experiments are designed by considering the availability of materials and tools around the students, enabling them to easily replicate the experiments at home or school. We will also provide clear and easy-to-follow guidelines for each experiment, allowing students to learn independently. This independent learning is closely related to students' learning motivation (Eriyanto et al., 2021; Sveshnikova et al., 2022; Wulanningtyas & Fauzan, 2022). In this way, we hope to bring physics closer to students' daily lives and show them that physics is not a frightening subject, but something that can be learned and enjoyed by everyone.

This program also aims to provide support for physics teachers in partner schools. We will provide teaching materials and experiment guidelines that they can use to deliver physics lessons in a more engaging and interactive way.

We believe that through the Physics Fun for All program, high school students in Garut Regency will gain a more enjoyable and meaningful experience in learning physics. We hope that this program will help them develop their interest and understanding of physics and ultimately encourage them to pursue careers in science and technology.

## Method

The methods employed in this program included outreach, demonstrations, and workshops, which concluded with the administration of a survey (Amarulloh et al., 2023; Irvani et al., 2020, 2023). Prior to implementation, the authors conducted a literature review as well as discussions and surveys with the team to design a simple physics-robotics module relevant to the students' abilities and conditions. Once the module was finalized, the faculty team provided training to university students who served as facilitators during the community service activities. The program was carried out on February 13, 2024, involving 12th-grade students at SMA Ciledug Al Musadadiyyah, Garut Regency.

During the implementation, students were divided into several groups, with each group assisted by a university student facilitator to create a simple robot project using commonly available materials.

These simple robots were built without using Arduino; instead, they employed basic motors connected to batteries or utilized balloons as a means of movement. For the frame, the robots were constructed using ice cream sticks, chopsticks, and toothbrushes.

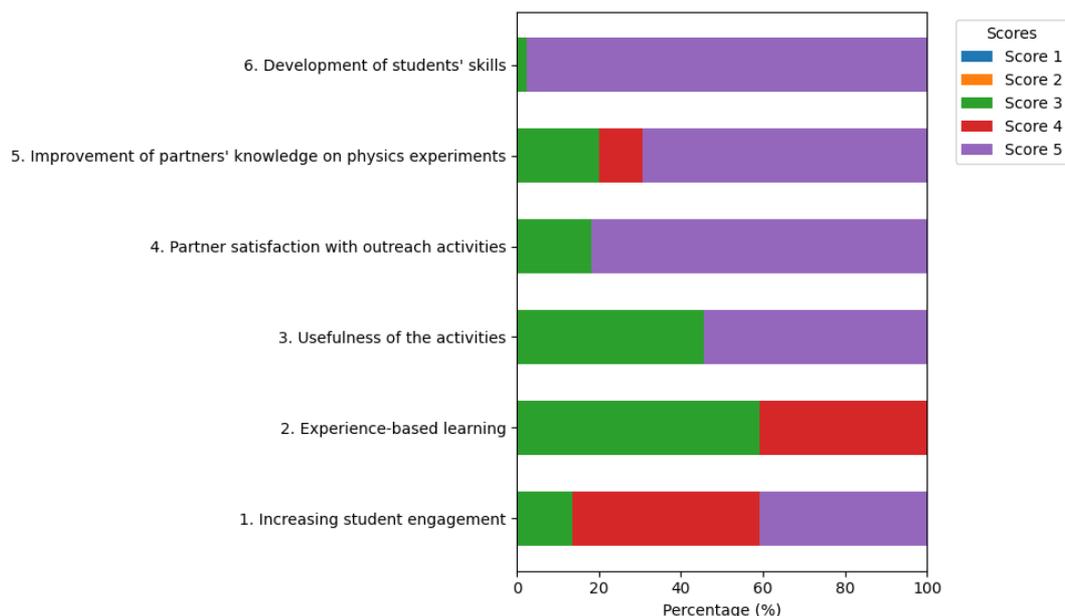
In the process of designing their robot projects, students experimented with various designs and determined the tools needed to construct them. The completed robots were then raced to determine which design was the fastest. This activity was intended to motivate students to create the best possible design. After completing the robot project, students were given a survey to evaluate their satisfaction with the community service program. The survey included several satisfaction indicators, as presented in Table 1.

**Table 1.** Satisfaction Survey Indicators

No	Indicator Statements in the Satisfaction Survey	Item Numbers
1	Increasing student engagement	1, 2
2	Experience-based learning	3, 4
3	Usefulness of the activities	5, 6, 7
4	Partner satisfaction with outreach activities	8, 9, 10
5	Improvement of partners' knowledge on physics experiments	11, 12
6	Development of students' skills	13, 14, 15

## Result and Discussion

Following the implementation of the community service program at SMA Ciledug Al Musadadiyyah, the authors administered a satisfaction survey to the partners, consisting of high school students and teachers. The survey contained statements with responses on a 1–5 scale, where 1 represented the lowest score and 5 represented the highest. The statements in the survey were based on previously formulated satisfaction indicators. The survey was distributed digitally using Google Forms. The collected survey data were then interpreted based on the survey criteria by Sugiyono (Sugiono, 2016). This interpretation was essential for gaining a deeper understanding of the survey results and for identifying how these results could be used for improving or developing the program in the future. By applying Sugiyono's survey criteria, the results could be analyzed more systematically and objectively, providing a deeper understanding of the program's effectiveness. According to Sugiyono's questionnaire criteria, a percentage score between 76%–99% falls into the 'almost all' category, 51%–75% into 'most,' 50% into 'half,' 26%–49% into 'almost half,' and below 25% into 'a small portion.' The survey results were then quantitatively processed into percentages and are presented in Figure 1.



**Figure 1.** Distribution of Satisfaction Survey Scores by Indicator

From the survey results presented in Figure 1, it can be observed that none of the indicators received scores below 3. This indicates that, overall, respondents provided relatively positive assessments of the indicators evaluated in this survey. Even for a score of 3, it only appeared in two indicators, namely the first indicator, 'increasing student engagement,' and the fifth indicator, 'improvement of partners' knowledge on physics experiments,' with percentages not exceeding 20%. This shows that although a few respondents gave moderate ratings (score 3) for these two indicators, the majority of respondents provided higher ratings. Student engagement in learning activities is closely related to student motivation, both internal and external, as well as creativity (Masripah et al., 2024; Qolbi et al., 2024; Rahmat et al., 2023; Suhirman & Prayogi, 2023)

In addition, the indicator with the highest satisfaction percentage was the sixth indicator, namely 'development of students' skills.' This shows that respondents were highly satisfied with the improvement of students' skills and the partners' knowledge of physics experiments as measured in this community service program survey. The high satisfaction percentages for these two indicators indicate that the program successfully achieved its main objectives of enhancing students' skills and increasing partners' knowledge. Moreover, knowledge improvement was not only obtained from the workshop activities but also from various sources such as the internet, social media, and even games (Dahalan et al., 2024; Hartanto et al., 2022; Zamiri & Esmaeili, 2024). Based on these interpretations, it can be stated that the majority of partners were satisfied with the implemented community service program. Furthermore, they perceived this program as highly beneficial for teaching and learning activities, particularly in transforming the image of physics into a more enjoyable subject in line with the theme Physics Fun for All. It can almost be concluded that most student and teacher partners were very satisfied with the community service program.

In the community service program, students were assigned to create a simple robot project that could move effectively, with guidance provided by facilitators. The robots were built following designs formulated by student groups, which were then communicated to the facilitators, who provided full support during the process. The activity of developing ideas and designs significantly influences students' thinking skills. The robot-making process began with the planning and problem-identification stage. Afterward, students were required to formulate ideas and design robots according to the project's needs and objectives. In this stage, students were encouraged to think critically and creatively in seeking innovative and effective solutions (Echavarría et al., 2023; Fennell et al., 2019; Hernandi et al., 2024; Listiana et al., 2023; Muhajir et al., 2024; Sulaiman & Azizah, 2020).

After formulating their ideas and designs, students proceeded to the construction phase, where they assembled the robot components according to the designs they had created. In this stage, students learned about various electronic and mechanical components used in building the robots, as well as how to integrate these components to ensure that the robots functioned properly. Facilitators provided guidance and technical support throughout this process to ensure that students could successfully complete their projects. The ability to generate ideas and designs fosters higher-order skills such as student creativity (Cojorn, 2024; Kwangmuang et al., 2021; Sopakitiboon et al., 2023).

After completing their robots, students were asked to present their projects to their peers and facilitators. In these presentations, they had to explain their robot's concept and design, the construction process, as well as the challenges they encountered and how they overcame them. This presentation activity not only enhanced students' communication skills but also provided them with opportunities to receive constructive feedback from facilitators and fellow students (Liao et al., 2022; Sirisrimangkorn, 2021; Sjølie et al., 2021). Following the presentations, students displayed their projects on tables, after which the products were tested through a robot race competition. This robot racing activity greatly increased student enthusiasm, as they could witness the precision of their designs and components based on their original ideas developed through discussion and collaboration. Documentation of these activities is presented in Figures 2 and 3 below.



**Figure 2.** Photos of Community Service Activities

Figure 3 shows the documentation of students' project activities. The photo on the left depicts students enthusiastically preparing their simple robots for a racing competition, demonstrating teamwork and collaboration during the activity. The photo on the right presents one of the completed robot projects, constructed using readily available materials such as ice cream sticks, toothbrush heads, a small motor, and batteries. These images illustrate students' creativity and practical application of physics concepts through hands-on



experimentation.

**Figure 3.** Student Project Photos

## Conclusion

Based on the survey results from this community service program, it can be concluded that the majority of students and partner teachers were satisfied with the 'Physics Fun for All' activity. This program not only successfully improved students' knowledge and skills related to physics concepts but also created an enjoyable and interactive learning atmosphere. The students demonstrated high enthusiasm throughout the activities, and the partner teachers found the simple robotics experiment method to be innovative and engaging. Furthermore, this program positively impacted students' learning motivation and strengthened collaboration between students and teachers. Overall, the 'Physics Fun for All' program can be considered successful in achieving its goal of making physics learning more engaging and enjoyable for all participants.

### Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this article. This community service program was carried out solely for educational and community development purposes, without any financial or personal interests that could influence the outcomes or interpretation of the activities.

### References

- Ali, N., Ullah, S., & Khan, D. (2022). Interactive laboratories for science education: A subjective study and systematic literature review. *Multimodal Technologies and Interaction*, 6(10), 85.
- Amarulloh, R. R., Warliani, R., Irvani, A. I., Lestari, I. F., Muhajir, S. N., & Mulvia, R. (2023). TRAINING ON TRAINER KOMPETISI SAINS NASIONAL SMP/MTS BIDANG IPA FISIKA BAGI GURU DAN MAHASISWA CALON GURU FISIKA/IPA. *JCES (Journal of Character Education Society)*, 6(2), 381–389. <https://doi.org/10.31764/jces.v6i2.12783>
- Banda, H. J., & Nzabahimana, J. (2021). Effect of integrating physics education technology simulations on students' conceptual understanding in physics: A review of literature. *Physical review physics education research*, 17(2), 23108.
- Bogador, C. J., Camarao, M. K. G., Matunding, C. G., & Sombria, K. J. F. (2024). Challenges and benefits of inquiry-based learning in physics. *International Journal of Multidisciplinary: Applied Business and Education Research*, 5(7), 2716–2732.
- Cojorn, K. (2024). A collaborative professional development and its impact on teachers' ability to foster higher order thinking. *Journal of Education and Learning (EduLearn)*, 18(2), 561–569.
- Dahalan, F., Alias, N., & Shaharom, M. S. N. (2024). Gamification and game based learning for vocational education and training: A systematic literature review. *Education and information technologies*, 29(2), 1279–1317.
- Echavarría, L. G., Diaz, J. A., & Henao, P. A. O. (2023). *Study of the stiffness and lateral displacements of a confined masonry wall using linear static analysis*. <https://doi.org/10.1088/1742-6596/2515/1/012006>
- El Kharki, K., Berrada, K., & Burgos, D. (2021). Design and implementation of a virtual laboratory for physics subjects in Moroccan universities. *Sustainability*, 13(7), 3711.
- Eriyanto, M. G., Roesminingsih, M. V., & Soeherman, I. K. (2021). The effect of learning motivation on learning independence and learning outcomes of students in the package c equivalence program. *IJORER: International Journal of Recent Educational Research*, 2(4), 455–467.
- Fennell, H. W., Lyon, J. A., Magana, A. J., Rebello, S., Rebello, C. M., & Peidrahita, Y. B. (2019). *Designing hybrid physics labs: combining simulation and experiment for teaching computational thinking in first-year engineering*. <https://doi.org/10.1109/FIE43999.2019.9028390>
- Girwidz, R., Theyßen, H., & Widenhorn, R. (2022). Experiments in physics teaching. In *Physics education* (hal. 269–296). Springer.
- Haetami, A., Zulvita, N., Marhadi, M. A., & Santoso, T. (2023). Investigation of Problem-Based Learning (PBL) on Physics Education Technology (PhET) Simulation in Improving Student Learning Outcomes in Acid-Base Material. *Jurnal Penelitian Pendidikan IPA*, 9(11), 9738–9748.
- Hamid, A., Mardiah, A., Wahyuni, A., Kasli, E., Wahyuni, S., Ngadimin, N., & Zainuddin, Z. (2023). Development of a Laboratory-based Physics Module with a Science Process Skills Approach to enhance the interest of High School Students. *Asian Journal of Science Education*, 5(1), 1–10.
- Hartanto, Y., Firmansyah, M. A., & Adhrianti, L. (2022). Implementation digital marketing pesona 88 curup in to build image for the decision of visit tourist attraction. *4th social and humanities research symposium (SoRes 2021)*, 589–594.
- Hernandi, A., Warliani, R., & Irvani, A. I. (2024). Keterampilan Berpikir Kritis Siswa dalam Pembelajaran Fisika dengan Model Talking Stick. *JPF (Jurnal Pendidikan Fisika) Universitas Islam Negeri Alauddin Makassar*, 12(2), 71–90. <https://doi.org/10.24252/jpf.v12i2.50769>
- Holmes, N. G., & Smith, E. M. (2023). STRATEGIES THAT FOSTER EXPERIMENTAL PHYSICS SKILLS. *The International Handbook of Physics Education Research: Learning Physics*, 1.
- Irvani, A. I., Muhajir, S. N., Amarulloh, R. R., Warliani, R., Lestari, I. F., & Mulvia, R. (2023). Pelatihan

- Perancangan Eksperimen Fisika berbasis Sensor Smartphone bagi Guru Fisika dan IPA di Kabupaten Garut. *JPM: Jurnal Pengabdian Masyarakat*, 2(3), 267–280. <https://doi.org/10.52434/jpm.v2i3.2830>
- Irvani, A. I., Sriyati, S., Nahadi, N., Sinaga, P., & ... (2024). Evaluasi Program Perkuliahan Fisika Kuantum dengan Virtual Lab Menggunakan Model CIPP. *JURNAL PENDIDIKAN ...* <https://doi.org/10.37630/jpm.v14i2.1603>
- Irvani, A. I., Warliani, R., & Amarulloh, R. R. (2020). Pelatihan Pemanfaatan Teknologi Informasi Komunikasi Sebagai Media Pembelajaran. *Jurnal PkM MIFTEK*, 1(1), 35–41. <https://doi.org/10.33364/MIFTEK/V.1-1.35>
- Kade, A., Supriyatman, S., Kamaruddin, A., Novia, N., Supriyadi, S., & Husain, S. (2024). Exploring technology-driven simulations in practical physics: Insights into mechanical measurements concept. *ASEAN Journal of Science and Engineering*, 4(3), 429–444.
- Kerekes, J. (2024). The Impact of the Lack of Chemistry and Physics Laboratories in Schools. *Educatia* 21, 28, 333–341.
- Kwangmuang, P., Jarutkamolpong, S., Sangboonraung, W., & Daungtod, S. (2021). The development of learning innovation to enhance higher order thinking skills for students in Thailand junior high schools. *Heliyon*, 7(6).
- Liao, F., Murphy, D., Wu, J.-C., Chen, C.-Y., Chang, C.-C., & Tsai, P.-F. (2022). How technology-enhanced experiential e-learning can facilitate the development of person-centred communication skills online for health-care students: a qualitative study. *BMC Medical Education*, 22(1), 60.
- Listiana, Y. R., Arfadila, A., Erlinda, E., Silvia, S., & Humaeroh, S. (2023). Pengaruh Penguasaan Keterampilan Mengajar dalam Upaya Meningkatkan Guru yang Inovatif. *Journal on Education*, 5(2), 1632–1638. <https://doi.org/10.31004/joe.v5i2.798>
- Looi, C.-K., Wong, S. L., Kong, S.-C., Chan, T.-W., Shih, J.-L., Chang, B., Wu, Y.-T., Liu, C.-C., Yeh, C. Y. C., & Chen, Z.-H. (2023). Interest-Driven Creator Theory: case study of embodiment in an experimental school in Taiwan. *Research and Practice in Technology Enhanced Learning*, 18, 23.
- Masripah, Anisah, A. S., & Irvani, A. I. (2024). Navigating Faith in the Digital Age: The Role of Technology in Shaping Gen-Z's Religious Perspectives. *Eduscape : Journal of Education Insight*, 2(4), 210–223. <https://doi.org/10.61978/EDUSCAPE.V2I4.410>
- Muhajir, S. N., Warliani, R., & Aprianti, S. (2024). Expert Validation: A Critical Phase in the Development of ARIPSA. *JIPF (Jurnal Ilmu Pendidikan Fisika)*, 9(1), 46–55.
- Nilimaa, J. (2023). New examination approach for real-world creativity and problem-solving skills in mathematics. *Trends in Higher Education*, 2(3), 477–495.
- Petersen, G. B., Stenberdt, V., Mayer, R. E., & Makransky, G. (2023). Collaborative generative learning activities in immersive virtual reality increase learning. *Computers & Education*, 207, 104931.
- Poo, M. C.-P., Lau, Y., & Chen, Q. (2023). Are virtual laboratories and remote laboratories enhancing the quality of sustainability education? *Education Sciences*, 13(11), 1110.
- Qolbi, W. N., Irvani, A. I., & Warliani, R. (2024). The Effectiveness Of The Creative Problem Solving (Cps) Model Assisted By Youme (Youtube Media) In Improving The Creative Thinking Skills Of High School Students. *Pillar Of Physics Education*, 17(4), 269–275.
- Rahmat, D., Romadhon, Mulyah, E., Rahiem, M. D., of, D., Law, C., Faeruz, R., & Futuhat, N. (2023). *Enhancing Student Engagement in Computational Physics through Project-Based Learning: An Exploration of VBA Physics Simulation*. <https://doi.org/10.1109/CITSM60085.2023.10455497>
- Reeves, S. M., & Crippen, K. J. (2021). Virtual laboratories in undergraduate science and engineering courses: A systematic review, 2009–2019. *Journal of Science Education and Technology*, 30(1), 16–30.
- Sadidah, A., & Irvani, A. I. (2021). Analisis Penggunaan Simulasi Interaktif dalam Pembelajaran pada Topik Hukum Coulomb. *JURNAL Pendidikan dan Ilmu Fisika*, 1(2), 69–74. <https://doi.org/10.52434/JPIF.V1I2.1508>
- Safaryan, N. (2023). Utilizing virtual laboratories for physics instruction in secondary education: A pedagogical inquiry. *Main Issues of Pedagogy and Psychology*, 10(2), 81–93.
- Schneider, B., Krajcik, J., Lavonen, J., Salmela-Aro, K., Klager, C., Bradford, L., Chen, I.-C., Baker, Q., Touitou, I., & Peek-Brown, D. (2022). Improving science achievement – Is it possible? Evaluating

- the efficacy of a high school chemistry and physics project-based learning intervention. *Educational Researcher*, 51(2), 109–121.
- Sirisrimangkorn, L. (2021). Improving EFL Undergraduate Learners' Speaking Skills through Project-Based Learning Using Presentation. *Advances in Language and Literary Studies*, 12(3), 65–72.
- Sjølie, E., Strømme, A., & Boks-Vlemmix, J. (2021). Team-skills training and real-time facilitation as a means for developing student teachers' learning of collaboration. *Teaching and Teacher Education*, 107, 103477.
- Solanes, J. E., Montava-Jordà, S., Golf-Laville, E., Colomer-Romero, V., Gracia, L., & Munoz, A. (2023). Enhancing STEM education through interactive metaverses: A case study and methodological framework. *Applied Sciences*, 13(19), 10785.
- Sopakitiboon, T., Tuampoemsab, S., Howimanporn, S., & Chookaew, S. (2023). Implementation of New-Product Creativity through an Engineering Design Process to Foster Engineering Students' Higher-Order Thinking Skills. *International Journal of Engineering Pedagogy*, 13(5).
- Stadermann, K., & Goedhart, M. (2021). 'Why don't you just tell us what light really is?' Easy-to-implement teaching materials that link quantum physics to nature of science. *Physics Education*, 57(2), 25014.
- Sugiono, S. (2016). Metode penelitian kuantitatif, kualitatif, dan r & d. *Bandung: alfabeta*, 288.
- Suhriman, & Prayogi, S. (2023). Problem-based learning utilizing assistive virtual simulation in mobile application to improve students' critical thinking skills. *Humanities and Social Sciences Letters*, 11(3), 351–364. <https://doi.org/10.18488/61.v11i3.3380>
- Sulaiman, A., & Azizah, S. (2020). PROBLEM-BASED LEARNING UNTUK MENINGKATKAN KEMAMPUAN BERPIKIR KRITIS DI INDONESIA: SEBUAH TINJAUAN LITERATUR SISTEMATIS. *PEDAGOGIK: Jurnal Pendidikan*, 7(1), 107–152. <https://doi.org/10.33650/pjp.v7i1.792>
- Sveshnikova, S. A., Skornyakova, E. R., Troitskaya, M. A., & Rogova, I. S. (2022). Development of engineering students' motivation and independent learning skills. *European Journal of Contemporary Education*, 11(2), 555–569.
- Tripson, C., Gonța, I., & Bulgac, A. (2023). Nurturing minds and sustainability: an exploration of educational interactions and their impact on student well-being and assessment in a sustainable university. *Sustainability*, 15(12), 9349.
- Wulanningtyas, N. D., & Fauzan, F. (2022). THE INFLUENCE OF CREATIVITY AND LEARNING MOTIVATION ON STUDENTS' LEARNING INDEPENDENCE WITH FRIEND SUPPORT AS MODERATING VARIABLES. *International Journal of Social and Management Studies*, 3(1), 196–207.
- Zamiri, M., & Esmaili, A. (2024). Methods and technologies for supporting knowledge sharing within learning communities: A systematic literature review. *Administrative Sciences*, 14(1), 17.