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Integrating Theory and Practice: Contribution of the Teaching Practitioner Program in Achieving the Vision of the Physics Education Study Program

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Abstract: The Teaching Practitioner Program is part of the Independent Learning-Independent Campus which is designed to bridge the gap between theory and practice in higher education. This article aims to analyze the contribution of the program in achieving the vision of Physics Education Study Program, University of Mataram, namely to develop physics education based on engineering of modern learning devices and media. This research was conducted in the even semester of 2023/2024 involving four collaborative courses with practitioners, namely School Administration and Management, Introduction to Core Physics, Thermodynamics, and Physics Learning Strategies. The research method used qualitative descriptive analysis based on final activity reports and interviews with students and lecturers. The results showed that the involvement of practitioners in teaching contributed significantly to students' understanding of the application of theory in the world of work, as well as the development of critical and adaptive thinking competencies. In addition, this program supports the mission of the Study Program in producing superior graduates who are able to develop modern learning media. It is hoped that the Teaching Practitioner Program will continue to be implemented as a strategic effort to improve the quality of physics education that is adaptive to the needs of the world of work.

Keywords: Practitioner Teaching; Physics education; Student competencies.

Introduction

In the era of technological disruption and the development of the Industrial Revolution 4.0, universities around the world, including Indonesia, are facing the demand to produce graduates who not only have strong academic mastery but also practical skills that are relevant to the dynamics of the world of work. The gap between the theory taught in class and practice in the field is one of the challenges that must be answered by the higher education system (Halimah & Zulfitria, 2024). In response to this, the Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia launched the Merdeka Belajar-Kampus Merdeka (MBKM) program, which aims to provide flexibility and freedom for students to develop their potential through learning paths that are in accordance with the interests and needs of the industry (Ainun et al., 2023; Mus & Arismunandar, 2024; Nurjannah et al., 2024).

One of the core components of MBKM is the "Teaching Practitioners" program, which aims to bring the world of industry into the classroom by involving professionals from various sectors as lecturers in universities. Through this program, students can gain direct insight from practitioners who already have experience in the field, so that they can relate academic theory to real practice. This program not only enriches students' knowledge but also increases their readiness to enter the increasingly complex and competitive world of work (Mark et al., 2021; Nurhaida et al., 2023; Pendriana et al., 2024).

For the Physics Education Study Program at the University of Mataram, the Teaching Practitioner program plays an important role in realizing its vision to "Develop Physics Education based on engineering of modern learning devices and media." The mission of this

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study program includes providing quality education, conducting research that is recognized nationally and internationally, and serving the community through the application of learning and research results. The Teaching Practitioner Program supports the achievement of this mission by providing a platform for students to learn from experts who have a deep understanding of the application of physics in a broader context, both in education and industry (Kurniawan et al., 2023; Popova et al., 2021).

In the implementation of Teaching Practitioner Batch 4 of the Even Semester of the 2023/2024 Academic Year, the Physics Education Study Program at the University of Mataram has involved practitioners in four courses: School Administration and Management, Introduction to Core Physics, Thermodynamics, and Physics Learning Strategies. Through collaboration between lecturers and practitioners, students have the opportunity to dig deeper into their understanding of the theories they have learned, as well as learn how to apply them in the context of the world of work. This hands-on experience strengthens students' competence in integrating theory with practice, which will ultimately produce graduates who are better prepared to face the challenges of the working world (Mamayoqubova & Begmatova, 2023; Retnowati et al., 2023).

Thus, the Teaching Practitioner program is not only a tool to fill the gap between the academic world and industry, but also an important instrument in shaping the graduate profile desired by the Physics Education Study Program. The graduates produced are expected to be able not only to think critically and analytically in understanding physics theories, but also to be creative in applying this knowledge in the real world (Vhalery et al., 2022). In addition, this program also encourages students to have the social skills needed to collaborate with various parties in the work environment. The synergy between the world of education and industry built through the Teaching Practitioner program is in line with the spirit of MBKM to produce an adaptive, innovative, and competitive generation, both nationally and globally (Intan et al., 2023; Wulandari et al., 2021).

This program, therefore, plays a central role in realizing the vision of the Physics Education Study Program to produce superior graduates who are able to develop contemporary physics media and learning and contribute to improving the quality of education in Indonesia. The integration of theory and practice carried out in this program not only strengthens students' readiness to enter the working world, but also increases the relevance of higher education to the needs of society and industry (Ismail & Syukron, 2023; Perdana et al., 2024).

Method

This study uses a case study approach to describe the implementation of the Practitioner Teaching Program Batch 4 in the Even Semester of the 2023/2024 Academic Year in the Physics Education Study Program, University of Mataram. The case study method was chosen because it allows for in-depth exploration of the implementation process and impact of the program in a specific context. This study aims to understand the contribution of the program in the integration of theory and practice, and how it supports the achievement of the study program's vision (Creswell, 2012).

The subjects of the study consisted of lecturers, practitioners, and students who participated in four courses included in the Practitioner Teaching Program Batch 4. Each course has different participants, namely:

1. School Administration and Management: Involving 27 students, 1 lecturer, and 1 practitioner from the field of school management.
2. Introduction to Core Physics: Involving 35 students, 1 lecturer, and 1 practitioner who is experienced in core physics research.
3. Thermodynamics: Involving 26 students, 1 lecturer, and 1 practitioner from the industry who applies thermodynamic principles.
4. Physics Learning Strategy: Involving 18 students, 1 lecturer, and 1 practitioner who is experienced in curriculum development and learning strategies.

Thus, the total participants in this study consisted of 106 students, 4 lecturers, and 4 practitioners. All participants were actively involved in the learning process involving practitioners as part of the teaching collaboration.

This study lasted for one semester, namely from January to July 2024, in line with the implementation of the Practitioner Teaching Program Batch 4. Data collection was carried out throughout this period to obtain a comprehensive picture of the implementation of the program in each course.

The data in this study were collected through several methods to obtain a holistic understanding:

1. Observation: Researchers conducted direct observations during the implementation of learning activities in the classroom, especially when practitioners were involved in teaching. This observation aims to record the interactions between students, lecturers, and practitioners, as well as how the integration process between theory and practice took place.
2. Interviews: In-depth interviews were conducted with lecturers, practitioners, and students. This interview was designed to explore their experiences, views, and

evaluations of the effectiveness of the Practitioner Teaching program in supporting physics learning.
3. Questionnaire: An open questionnaire was distributed to students to obtain data on their perceptions of the contribution of practitioners in enriching learning. This questionnaire was used to complement data from interviews and observations.
4. Documentation: Researchers collected relevant documents such as logbooks, attendance, meeting notes, and materials or evaluations used during the Teaching Practitioner program.

The collected data were analyzed descriptively qualitatively. The analysis process was carried out by:
1. Data Reduction: Simplifying and organizing raw data obtained from interviews, observations, and questionnaires. Irrelevant data was filtered to maintain the focus of the study.
2. Categorization: Grouping data into themes related to the research objectives, such as the contribution of practitioners in the integration of theory-practice, implementation challenges, and their impact on student competencies.
3. Interpretation: Looking for meaning and patterns from the categorization results to draw conclusions about the impact of the Teaching Practitioner program on learning and achieving the vision of the study program.

To ensure the credibility of the data, method and source triangulation was carried out. Method triangulation was carried out by comparing the results of interviews, questionnaires, and observations. Meanwhile, source triangulation was conducted by comparing perspectives from students, lecturers, and practitioners. Data validity was also strengthened through member checking, where interview results were reconfirmed with participants to ensure that the data interpretation was in accordance with what they intended.

With this method, the study is expected to be able to provide a detailed picture of the implementation of the Teaching Practitioner program in the Physics Education Study Program, University of Mataram, and the extent to which this program supports the achievement of the study program's vision and mission.

Result and Discussion

The results of this study reflect the implementation of the Teaching Practitioner Program Batch 4 of the Even Semester of 2023/2024 in the Physics Education Study Program, University of Mataram. With four courses that collaborate with practitioners, namely School Administration and Management, Introduction to Core Physics, Thermodynamics, and Physics Learning Strategies, this study illustrates the effectiveness of the program in supporting the vision of the Physics Education Study Program. This vision is "Developing Physics Education based on engineering of contemporary learning devices and media" which is directed at producing superior and adaptive prospective physics teachers in high schools. Through these results, it can be seen how the involvement of practitioners can help achieve the competencies needed by prospective physics teachers in the modern era (Bitzenbauer & Meyn, 2021; Kulgemeyer et al., 2020). Student grade data for each course is shown in Figure 1.

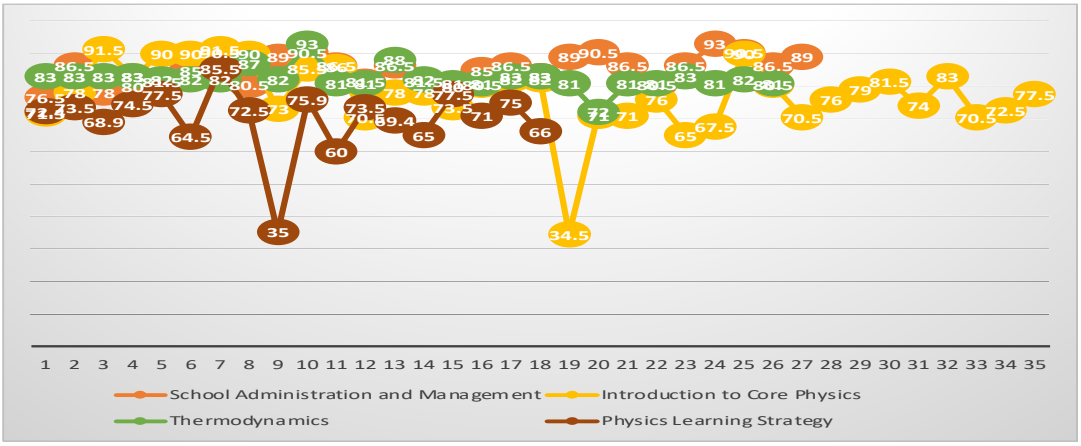

Figure 1. Student grade data for each course.

The discussion can be described into four aspects.

1. *Student Involvement and Collaboration with Practitioners*

The number of students involved in this study varies according to the courses being collaborated. For School Administration and Management, there were 27 students, while Introduction to Core Physics was attended by 35 students, Thermodynamics by 26 students, and Physics Learning Strategies involved 18 students. Through this collaboration, students gain direct insight from practitioners who have real-world experience in the field, so that they not only understand

the theory but also its application in practical contexts (Ilyas, 2023; Moreira et al., 2023).

Students, especially prospective physics teachers, benefit directly from the practical experience provided by practitioners through discussions, presentations, and practice questions. For example, in the "Thermodynamics" course, practitioners explain the first and second laws of thermodynamics, and students are given the opportunity to discuss the application of these laws in real life, such as in energy systems and engine cycles. This real-world case-based approach hones students' analytical skills and conceptual understanding of physics (Hasbiyallah et al., 2023).

Vygotsky's constructivism theory emphasizes the importance of learning through social interaction and active involvement in the learning process. This is evident in the Practitioner Teaching program, where students are directly involved in discussion activities and projects that require them to collaborate with colleagues and practitioners. This approach is very relevant to preparing prospective physics teachers who will later face the challenge of integrating theory with real-world applications in secondary schools (Herayanti et al., 2023; Siahaan & Simamora, 2023).

2. Evaluation of Program Implementation Based on Courses

Each course has its own characteristics in terms of topics and teaching approaches, but in general, all of them support the achievement of the Physics Education Study Program's vision which focuses on the development of contemporary media and learning tools. For example, in the Introduction to Core Physics course, students not only learn the basics of nuclear reactions, but also utilize particle detectors in practicums. Practitioners provide guidance on how to operate the tool and instill the importance of mastering technology in physics education (Sinensis & Firdaus, 2023). This approach supports the Study Program's mission in producing graduates who are able to utilize the latest technology in learning (Misbah et al., 2021).

In "School Administration and Management", students learn about managing facilities and infrastructure and technology in school management. Collaboration with practitioners who have experience in educational administration strengthens students' insights into how technology can be integrated into 21st-century school management. This is relevant to the study program's mission of producing prospective teachers who not only master physics material, but also understand important managerial aspects in the school context (Lahme et al., 2023).

Students in the "Physics Learning Strategy" course also benefit from this collaboration, especially in developing project-based and problem-based learning strategies. Practitioners provided insights into how these strategies are implemented in the field, as well as the constraints and challenges that teachers in secondary schools may face. One of the key findings from discussions with practitioners was that students still needed further adjustment to the newly implemented Merdeka Curriculum, indicating the need for a deeper understanding of curriculum change (Nurtanto et al., 2021).

3. Challenges Faced in the Teaching Practitioner Program

Although the Teaching Practitioner Program provides significant benefits, there are several obstacles that need to be considered. First, the difference between the teaching methods of practitioners and lecturers can still cause inconsistencies in the delivery of material. For example, some practitioners emphasize more on practical and implementative approaches, while lecturers tend to focus more on theory (Saptono & Matondang, 2023; Schubatzky et al., 2023). This can be seen in the "Physics Learning Strategy" course, where students find it difficult to understand practitioners' presentations related to the direct implementation of learning strategies, because their theoretical background is not yet strong enough (Hikmawati et al., 2023; Sudaryanto & Zainudin, 2023).

Another obstacle is the limited availability of practitioners' time. Practitioners who participate in this program often have main jobs outside of campus, so their time allocation for teaching is sometimes limited. This can have an impact on the continuity of learning and interaction with students. However, good coordination between practitioners and lecturers can minimize this impact, as seen in the "Introduction to Core Physics" course, where all meeting plans can be implemented according to schedule with satisfactory results (Alicea-muñoz et al., 2021; Jung et al., 2021).

4. Competency Achievement of Prospective Physics Teachers

One of the main objectives of the Teaching Practitioner Program is to prepare students to become competent and professional prospective physics teachers. Based on observations and interviews with students, the majority of participants felt that the program helped them improve their understanding of physics concepts and how they are applied in the real world (Klein et al., 2021; Ulfah et al., 2024). The average student scores in each course also reflected this improvement: 85.2 for School Administration and Management, 77.6 for Introduction to Core Physics, 82.4 for Thermodynamics, and 69.9 for Physics Learning Strategies.

In addition, the program also contributed to the development of students' social competence. Their involvement in discussions and projects with practitioners helped hone communication and

collaboration skills, which are important parts of a teacher's social competence. This competence is very important for prospective physics teachers in high school, because they must not only master the teaching materials, but also be able to interact and manage the class effectively (Abdin et al., 2023; Abdurrahman & Ji, 2023; Hazin et al., 2023). Topics and activities in the Course: School Administration and Management are shown in Table 1.

Table 1. Topics and activities in the Course: School Administration and Management

Meeting	Topic	Activity
2024-04-23	Describes school facilities and infrastructure management	Discussion, Assignment Work
2024-05-18	Projecting learning curriculum management and internal quality assurance	Presentation, Discussion
2024-05-28	Contrasting Technology-based Learning Management Systems	Presentation, Tutorial
2024-04-30	Reviewing the management of development of teaching and educational staff	Presentation, Discussion
2024-05-07	Detailing school guidance and counseling management	Presentation, Discussion
2024-05-21	Detailing the 21st century school management system based on information technology	Presentation, Discussion

Topics and activities in the Course: Introduction to Core Physics are shown in Table 2.

Table 2. Topics and activities in the Course: Introduction to Core Physics

Meeting	Topic	Activity
2024-04-20	Introduction to Nuclear Reactions and Types of Nuclear Reactions	Lecture, Discussion
2024-05-11	Special nuclear reactions, combined nuclei, formation of radioisotopes in nuclear reactions	Lecture, Discussion
2024-05-25	The interaction of charged particles with matter, and the working principles of Particle Detectors.	Presentation, Discussion
2024-04-27	Elastic scattering and inelastic scattering	Lecture, Discussion
2024-05-04	Photonuclear scattering and radioactive capture	Lecture, Discussion
2024-05-18	Kinematics of low energy reactions, threshold energy of nuclear reactions, nuclear fission and fusion	Lecture, Discussion

Topics and activities in the course: Thermodynamics are shown in Table 3.

Table 3. Topics and activities in the course: Thermodynamics

Meeting	Topic	Activity
2024-05-11	Explaining the meaning of dakhil power	Presentation, Practice Questions
2024-05-27	Carnot Cycle and Carnot Cycle Equation	Lecture, Discussion
2024-05-03	Some consequences of the first law of thermodynamics	Practice Questions
2024-06-08	Second Law of Thermodynamics	Lecture, Discussion
2024-06-29	Combination of the First and Second Laws of Thermodynamics	Presentation, Lecture

Topics and activities in the Course: Physics Learning Strategies are shown in Table 4.

Table 4. Topics and activities in the Course: Physics Learning Strategies

Meeting	Topic	Activity
2024-05-14	Project-based learning model	Presentation, Assignment Work
2024-05-07	Project-based learning model	Presentation, Practice Questions
2024-05-29	Learning approach	Presentation, Assignment Work
2024-04-30	Problem-based learning model	Presentation, Discussion
2024-05-22	Direct learning model	Presentation, Assignment Work

In the framework of educational theory, the Practitioner Teaching program can be associated with the "experiential learning" approach developed by Kolb (1984). Kolb emphasized that learning is most effective when individuals participate directly in the learning process through experience. In this case, physics students have the opportunity to learn from real experiences shared by practitioners, so that they are able to relate the physics theory learned in class to real-world applications (Ahmad et al., 2020; Ardini et al., 2021; H. Hikmawati et al., 2017; Ronfeldt, 2021).

This program is also in accordance with the "social learning" theory proposed by Bandura (1977), which emphasizes that learning occurs through observation and social interaction. Students learn not only through formal instruction, but also through direct interaction with practitioners, who serve as models in the world of work. This is very relevant to the vision of the Physics Education Study Program at the University of Mataram, which is committed to preparing prospective teachers

who are able to integrate modern technology and learning media in physics education in high schools. This program successfully connects educational theory with real-world practice, thus creating opportunities for students to develop skills that are relevant and needed in high school (Ginting et al., 2023; Hikmawati Hikmawati et al., 2022; Hutauruk et al., 2024; Watin et al., 2023; Wicagsono et al., 2023).

Conclusion

The Teaching Practitioner Program Batch 4 in the Physics Education Study Program, University of Mataram has had a positive impact on students in preparing them as professional physics teacher candidates. Collaboration with practitioners from various fields not only helps students integrate theory and practice, but also improves their technical, analytical, and social competencies. This program is in line with the vision of the study program to develop contemporary media and learning tools, and supports the mission of producing graduates who are competent and adaptive to technological developments and modern educational challenges.

In the future, the Teaching Practitioner program can be further improved by extending the duration of interaction between students and practitioners, and involving practitioners with more varied backgrounds, such as from the industrial and research sectors. In addition, better coordination is needed between lecturers and practitioners to align teaching approaches, so that students can receive a more holistic and structured understanding. The implementation of this program should also be accompanied by a more comprehensive evaluation to identify areas that require further development in order to improve the quality of education for physics teacher candidates.

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Author Contributions
Conceptualization, H. and S.; methodology, A. D. and A. H.; formal analysis, H. and N. N.; investigation, H. and S.; resources, H. and S.; data curation, H. and N. N.: writing—original draft preparation, H and S.; writing—review and editing, H. and A. D.; visualization, A. H. and N. N. All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest
No conflicts of interest.

References

Abdin, A., Safiuddin, A., & Rusman, L. O. (2023). Utilization of Microsoft Power Point Applications as Physics Learning Media Interactive on Diode Material. *Prisma Sains : Jurnal Pengkajian Ilmu Dan Pembelajaran Matematika Dan IPA IKIP Mataram*, *11*(1), 63–75.

Abdurrahman, A. K., & Ji, R. (2023). Teacher Strategies in Realizing Teacher Pedagogical Competence in High. *Indonesian Journal of Education Research (IJoER)*, *4*(6), 140–146. https://doi.org/10.37251/ijoer.v4i6.770

Ahmad, C., Hsiu, J., Wong, D., Kuo, L., A, M. S. N., Huri, D., Min, N., Pallath, V., Phoay, C., Tan, L., & Hong, C. (2020). Physica Medica Teaching and learning of postgraduate medical physics using Internet-based e-learning during the COVID-19 pandemic – A case study from Malaysia. *Physica Medica*, *80*(July), 10–16. https://doi.org/10.1016/j.ejmp.2020.10.002

Ainun, N., Jalaluddin, J., Asri, K., Agustina, Y., Fahmi, C. N., Suryawati, I., Irwan, I., Ismulyati, S., Azwar, E., Sufriadi, D., Azzarkasyi, M., Nurliza, E., Irnanda, S., Mukhtasar, M., & Zakaria, Z. (2023). Meningkatkan Literasi dan Kualitas Pembelajaran yang Kreatif Berorientasi Kurikulum Merdeka Belajar Kampus Merdeka. *Jurnal AMPOEN*, *1*(2), 27–31.

Alicea-muñoz, E., Sullivan, C. S., & Schatz, M. F. (2021). Transforming the preparation of physics graduate teaching assistants : Curriculum development. *Physical Review Physics Education Research*, *17*(2), 20125. https://doi.org/10.1103/PhysRevPhysEducRes.17.020125

Ardini, S. N., Dwijayanti, I., Ulfah, M., & Saputo, B. A. (2021). Implementasi Program Merdeka Belajar Kampus Merdeka di Universitas PGRI Semarang Tahun 2020-2021: Permasalahan dan Solusi. *Jurnal Pendidikan Dan Profesi Pendidik*, *7*(2), 163–179.

Bitzenbauer, P., & Meyn, J. (2021). Fostering experimental competences of prospective physics. *Physics Education*, *56*(045020), 1–19.

Creswell, J. W. (2012). *Educational Research: Palnning, Conducting and Evaluating Quantitative and Qualitative Research. Fourth Edition.* (4th ed.).

Pearson.

Ginting, F. W., Sakdiah, H., & Unaida, R. (2023). Analysis of the Need for Development of Virtual Reality-Based Learning Media to Build Technological Pedagogical and Content Knowledge (TPACK) Competencies for Prospective Physics Teachers. *Jurnal Penelitian Pendidikan IPA*, *9*(12), 12098–12103. https://doi.org/10.29303/jppipa.v9i12.6163

Halimah, S., & Zulfitria. (2024). Implementasi Program Merdeka Belajar Kampus Merdeka pada Mahasiswa Terbuka dan Jarak Jauh sebagai Upaya dalam Menciptakan Mahasiswa Berkarakter dan Profesional. *Jurnal Pendidikan Indonesia: Teori, Penelitian, Dan Inovasi*, *4*(1), 1–5. https://doi.org/10.59818/jpi.v4i1.757

Hasbiyallah, Munadi, M., & Nurulhaq, D. (2023). Character Education Model for High School Students during the Pandemic in terms of Pedagogic Competence and Teacher Personality. *International Journal of Instruction*, *16*(2), 1077–1094.

Hazin, M., Wedia, N., & Rahmawati, D. (2023). Implementation of Policy " Praktisi Mengajar " in Higher Education. *Journal of Education and Teaching Learning*, *5*(1), 1–13.

Herayanti, L., Habibi, H., & Sukroyanti, B. A. (2023). Development of Inquiry-Based Teaching Materials to Improve the Creativity of Prospective Physics Teachers. *Jurnal Penelitian Pendidikan IPA*, *9*(2), 971–976. https://doi.org/10.29303/jppipa.v9i2.3007

Hikmawati, Ayub, S., & Verawati, N. N. S. P. (2023). Blended Learning : Upaya Menuntaskan Hasil Belajar Mahasiswa Calon Guru. *Jurnal Ilmiah Profesi Pendidikan*, *8*(1), 734 – 741.

Hikmawati, H., Rokhmat, J., & Sutrio, S. (2017). The Implementation of Learning Devices With Scientific Approach To Improve Student Life Skills. *Jurnal Pendidikan Fisika Indonesia*, *13*(1), 1–8. https://doi.org/10.15294/jpfi.v13i1.10152

Hikmawati, Hikmawati, Sutrio, Wahyudi, & Syahidi, K. (2022). Effects of Learning with Ethnoscience Context on Learning Outcomes in Cognitive Aspects of Prospective Physics Teacher Students. *Jurnal Penelitian Pendidikan IPA*, *8*(6), 2793–2801. https://doi.org/10.29303/jppipa.v8i6.2388

Hutauruk, A. J., Gultom, S. P., Serep, R., Sihite, V., Royani, I., & Gaol, L. (2024). Pengaruh kegiatan praktisi mengajar terhadap capaian mata kuliah kpmi di prodi pendidikan matematika. *Jurnal Pembelajaran Matematika Inovatif (JPMI)*, *7*(1), 35–48. https://doi.org/10.22460/jpmi.v7i1.21157

Ilyas, Z. (2023). Development of TPACK-Based Physics Magazine as Teaching Material for High Schools : A Study on Rotational Dynamics and Rigid Body Equilibrium. *IMPULSE Journal of Research and Innovation in Physics Education*, *3*(1), 19–30. https://doi.org/10.14421/impulse.2023.31-03

Intan, N., Wijaya, S., Siahaan, A., & Nasution, I. (2023). Implementasi Manajemen Kurikulum Merdeka Belajar Kampus Merdeka pada Fakultas Ilmu Tarbiyah dan Keguruan Universitas Islam Negeri Sumatera Utara. *Edukasi Islami: Jurnal Pendidikan Islam*, *12*(2), 1697–1712. https://doi.org/10.30868/ei.v12i02.3761

Ismail, M., & Syukron, N. (2023). Implementasi Kebijakan Kampus Mengajar Sebagai Manifestasi Atas Program Kebijakan Merdeka Belajar. *Jurnal Administrasi Karya Dharma*, *2*(1), 85–94.

Jung, I., Omori, S., Dawson, W. P., Yamaguchi, T., & Lee, S. J. (2021). Faculty as reflective practitioners in emergency online teaching : an autoethnography. *International Journal of Educational Technology in Higher Education*, *18*(30), 1–17. https://doi.org/10.1186/s41239-021-00261-2

Klein, P., Ivanjek, L., Dahlkemper, M. N., Jeli, K., Geyer, M., Küchemann, S., & Susac, A. (2021). Studying physics during the COVID-19 pandemic : Student assessments of learning achievement , perceived effectiveness of online recitations , and online laboratories. *Physical Review Physics Education Research*, *010117*, 1–11. https://doi.org/10.1103/PhysRevPhysEducRes.17.010117

Kulgemeyer, C., Borowski, A., Buschhüter, D., Enkrott, P., Kempin, M., Reinhold, P., Riese, J., Schecker, H., Schröder, J., & Vogelsang, C. (2020). Professional knowledge affects action-related skills : The development of preservice physics teachers ' explaining skills during a field experience. *Journal OfResearch in Science Teaching*, *57*(October 2019), 1554–1582. https://doi.org/10.1002/tea.21632

Kurniawan, B. R., Rahmawati, I., & Fawaiz, S. (2023). E-Module Implementation by Using Feature-Lesson-Based of Moodle in Physics Learning Multimedia Practices for Students of Prospective Physics Teacher. *Jurnal Pendidikan Fisika Indonesia*, *19*(1), 76–88. https://doi.org/10.15294/jpfi.v19i1.37176

Lahme, S. Z., Klein, P., Lehtinen, A., Müller, A., Pirinen, P., Ron, L., & Su, A. (2023). Physics lab courses under digital transformation : A trinational survey among university lab instructors about the role of new digital technologies and learning objectives. *Physical Review Physics Education Research*, *020159*(19), 1–27. https://doi.org/10.1103/PhysRevPhysEducRes.19.020159

Mamayoqubova, S., & Begmatova, D. (2023). Pedagogical conditions of developing professional competence of teachers of higher educational

institutions. *BIO Web of Conferences*, *10025*, 1–8.

Mark, A., Antipolo, R., & Rogayan, D. V. (2021). Filipino prospective teachers ' experiences in teaching in K12 science curriculum : A cross-sectional research. *JPBI (Jurnal Pendidikan Biologi Indonesia)*, *7*(1), 1–10.

Misbah, M., Khairunnisa, Y., Amrita, P. D., Dewantara, D., Mahtari, S., Syahidi, K., Muhammad, N., Prahani, B. K., & Deta, U. A. (2021). The effectiveness of introduction to nuclear physics e-module as a teaching material during covid-19 pandemic The effectiveness of introduction to nuclear physics e-module as a teaching material during covid-19 pandemic. *Journal of Physics: Conference Series*, 1–5. https://doi.org/10.1088/1742-6596/1760/1/012052

Moreira, M. A., Arcas, B. R., Sanchez, T. G., Garcia, R. B., & Melero, M. J. R. (2023). Teachers ' pedagogical competences in higher education : A systematic literature review. *Journal of University Teaching & Learning Practice*, *20*(1), 90–123.

Mus, S., & Arismunandar, A. (2024). Kualitas Pengajaran Dosen Praktisi pada Program Praktisi Mengajar di Jurusan Administrasi Pendidikan FIP UNM. *Jurnal Review Pendidikan Dan Pengajaran*, *7*(1), 2662–2666.

Nurhaida, I., Windah, A., & Yudha, N. (2023). Transforming Learning Paradigms : Active Collaboration and Participation through the Teaching Practitioner Program Dissemination Transformasi Paradigma Pembelajaran : Kolaborasi dan Partisipasi Aktif Melalui Sosialisasi Program Praktisi Mengajar. *DINAMISIA: Jurnal Pengabdian Kepada Masyarakat*, *7*(5), 1315–1325.

Nurjannah, S., Alhudawi, U., & Hodriani, H. (2024). Telaah Program Merdeka Belajar Kampus Merdeka (MBKM) dalam Memperkuat Soft Skill Mahasiswa. *Pancasila and Civics Education Journal*, *3*(1), 10–18. https://doi.org/10.30596/jcositte.v1i1.xxxx

Nurtanto, M., Kholifah, N., Masek, A., Sudira, P., & Samsudin, A. (2021). Crucial problems in arranged the lesson plan of vocational teacher. *International Journal of Evaluation and Research in Education (IJERE)*, *10*(1), 345–354. https://doi.org/10.11591/ijere.v10i1.20604

Pendriana, Y., Raharjo, T. J., Pramono, S. E., & Yulianto, A. (2024). Triple Helix Collaboration : Optimising the Quality of Human Resources in the Digital Age through the Teaching Practitioner Programme. *International Conference on Science, Education and Technology*, *10*, 114–119.

Perdana, A., Fitri, D., Dhea, J., Jayanti, F., & Fatmawati, D. (2024). Pengaruh Program Kurikulum Merdeka terhadap Pengembangan Kompetensi Pedagogik Guru Penggerak dalam Meningkatkan Mutu Pendidikan di Provinsi Jawa Tengah Balai Besar Guru Penggerak (BBGP) merupakan Unit Pelaksana Teknis Direktorat Jenderal Guru dan Tenaga. *DHARMA ACARIYA NUSANTARA : Jurnal Pendidikan, Bahasa Dan Budaya*, *2*(1), 109–119.

Popova, A., Evans, D. K., Breeding, M. E., & Arancibia, V. (2021). Teacher Professional Development around the World : The Gap between Evidence and Practice. *The World Bank Research Observer*, *37*, 107–136. https://doi.org/10.1093/wbro/lkab006

Retnowati, N., Suryani, D., & Nuraini. (2023). Analisis Situasi: Kurikulum Merdeka dan Pengembangan Kurikulum FKIP. *Jurnal Teknologi Pendidikan*, *8*(1), 1–12. https://doi.org/10.32832/educate.v8i1.8287

Ronfeldt, M. (2021). *Links Among Teacher Preparation, Retention, and Teaching Effectiveness*. University of Michigan.

Saptono, L., & Matondang, I. V. (2023). The Influence of Teacher Competence on Student Academic Stress. *European Journal of Education and Pedagogy*, *4*(4), 47–52.

Schubatzky, T., Burde, J., Gro, R., & Haagen-schützenh, C. (2023). Computers & Education Predicting the development of digital media PCK / TPACK : The role of PCK, motivation to use digital media , interest in and previous experience with digital media. *Computer and Education*, *206*(August), 1–19. https://doi.org/10.1016/j.compedu.2023.104900

Siahaan, F. E., & Simamora, A. B. (2023). Development Of Interactive Teaching Media to Improve the Creativity of UHKBPNP Physics Education Students. *Journal of Education and Teaching Learning*, *5*(2), 194–207.

Sinensis, A. R., & Firdaus, T. (2023). Reflective Thinking Profile of Physics Teacher Prospective Students through Nuclear Physics Learning using Virtual Laboratory. *Islamic Journal of Integrated Science Education*, *2*(2), 81–90.

Sudaryanto, M., & Zainudin, M. (2023). Measuring the perceptions of prospective teachers : Planning technology- based learning during the Covid-19 pandemic. *Jurnal Penelitian Dan Evaluasi Pendidikan*, *27*(2), 146–163.

Ulfah, L., Isnaniah, I., & Yuliani, N. D. (2024). English Students ' Perceptions in Participating the Praktisi Mengajar Program. *English Teaching and Linguistic Journal*, *5*(2), 151–159.

Vhalery, R., Setyastanto, A. M., & Leksono, A. W. (2022). Kurikulum Merdeka Belajar Kampus Merdeka: Sebuah Kajian Literatur. *Research and Development Journal Of Education*, *8*(1), 185–201.

Watin, W., Gunada, I. W., Fauzia, H., & Ayub, S. (2023). The Effectiveness of Android-Based Physics Learning Media Assisted by Smart Apps Creator to

Improve Learning Outcomes. *Jurnal Penelitian Dan Pembelajaran Fisika Indonesia*, *5*(1), 13–19. https://doi.org/10.29303/jppfi.v5i1.208

Wicagsono, M. A., Muhammad, B., & Muhammad, A. (2023). Strategies for Improving Teacher Pedagogic Competence Industrial Revolution Era 4 . 0. *Multicultural Islamic Education Review*, *1*(1), 15–25.

Wulandari, D., Febry, N., Hartatmaja, A. K. J., Mangula, I. S., & Sabrina, O. A. (2021). Evaluasi Implementasi Program Merdeka Belajar Kampus Merdeka (MBKM) di Tingkat Program Studi: Studi di Universitas Paramadina. *INQUIRY Jurnal Ilmiah Psikologi*, *13*(1), 22–40.