

Enhancing Vocational High School Students' Technological Competence through Python and Artificial Intelligence

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Abstract

Purpose: This study aims to enhance the technological competence of vocational high school students through the introduction of Python programming and Artificial Intelligence (AI) to improve their digital literacy and computational thinking skills.

Methodology: This study was conducted at *Sekolah Menengah Kejuruan (SMK) Sultan Iskandar Muda*, involving 44 tenth-grade vocational high school students. The program applied a quasi-experimental approach with a pretest–posttest design to measure students' understanding before and after training. The training activities included lectures, demonstrations, and hands-on coding practice using Python 3.10, Google Colab, and Microsoft PowerPoint as learning tools. Data were collected through questionnaires, observations, and evaluation tests to measure the students' knowledge of programming concepts and AI applications.

Results: The results showed a significant improvement in students' understanding after they participated in the training program. The average pretest score of 53.5 increased to 82.8 in the post-test. Students demonstrated better comprehension of Python programming concepts, including syntax, variables, data types, and input–output commands, as well as greater awareness of Artificial Intelligence applications in everyday life.

Conclusions: The training program effectively improved students' technological competence and increased their interest in learning programming and in emerging technologies.

Limitations: The study was limited by the short training duration and differences in students' initial knowledge levels.

Contributions: This study contributes to vocational and technology education by providing a practical training model that can support the development of students' digital literacy and readiness to face the challenges of the digital transformation era.

Keywords: *Artificial Intelligence, Community Service, Python Programming, Technological Competence, Vocational Students*

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1. Introduction

The rapid advancement of information and communication technology has accelerated digital transformation across various sectors, including education, industry, and society ([Darmanto et al., 2025](#);

[Santati, Saftiana, Mavillinda, & Ghasarma, 2022](#); [Yoraeni & Abdillah, 2024](#)). Technological developments such as cloud computing, artificial intelligence, big data, and the Internet of Things have significantly changed the way people work, learn, and interact ([Hu, Luo, & Wang, 2025](#); [Macar et al., 2023](#); [Mafrukhah & Lisana, 2026](#)). Consequently, the ability to understand and utilize digital technologies has become an essential competency in the 21st century. Therefore, educational institutions are expected to prepare students with the knowledge and skills needed to adapt to the rapidly evolving digital environment ([Masnia, Saputri, Kamsurya, & Tuhu, 2025](#); [Poerna Wardhanie & Lebdaningrum, 2022](#)).

In the educational sector, computers have become one of the most important tools for supporting teaching and learning activities ([Suhendah, Jennifer, Goh, & Heni, 2025](#); [Wijaya et al., 2024](#)). The use of computers in senior high schools and vocational high schools has increased significantly in recent years, especially for accessing learning resources, completing assignments, conducting online assessments, and supporting digital learning platforms ([Juliani & Rahman, 2025](#); [Masnia et al., 2025](#)). Many schools have integrated computer laboratories and Internet access into their learning environments to facilitate technology-based education ([Annuš, 2025](#); [Yoraeni & Abdillah, 2024](#)). The availability of these technologies provides opportunities for students to develop digital literacy skills and gain practical experience in using technological tools ([Askar & Suhardiman, 2025](#)).

Digital literacy is increasingly recognized as a fundamental skill for students in the contemporary era. Digital literacy involves not only the ability to use computers and digital devices but also the capacity to understand, evaluate, and create digital information effectively and responsibly ([Masnia et al., 2025](#); [Matlubah, Herowati, & Punggeti, 2025](#); [Santati et al., 2022](#)). Students with strong digital literacy skills are better prepared to navigate information-rich environments, solve problems using technology, and participate in the digital economy. Therefore, strengthening digital literacy among high school and vocational school students has become an important priority in educational systems worldwide ([González, López, & Castro, 2018](#); [Halim, Gohzali, Pardosi, Wong, & Megawan, 2025](#)).

Vocational education, particularly Vocational High Schools, plays a strategic role in preparing students with practical skills aligned with the workforce's needs ([Juliani & Rahman, 2025](#); [Mafrukhah & Lisana, 2026](#)). SMK students are expected to develop competencies that enable them to directly contribute to the industry after graduation. In the era of digital transformation, technological competence has become essential for many occupations. Consequently, vocational education institutions must integrate technology-based learning activities that can strengthen students' digital skills and technological understanding.

An important aspect of technological competence is programming knowledge. Learning programming helps students develop computational thinking, logical reasoning, and problem-solving abilities ([Elnaffar, Rashidi, & Abualkishik, 2025](#); [Hou & Yu, 2025](#)). Programming also allows students to understand how software and digital systems are created and operated in the real world. Among the various programming languages available today, Python has become one of the most widely used languages in both education and industry because of its simplicity, readability, and extensive library support ([Hu et al., 2025](#); [Liu et al., 2024](#)).

Python is commonly used in software development, data analysis, automation, and Artificial Intelligence (AI) applications ([Tribethran et al., 2023](#); [Zhu, Liu, Wang, & Wu, 2023](#)). Its simple syntax makes it suitable for beginners learning programming for the first time ([Khairudin, 2024](#); [Putri & Nur, 2023](#)). Because of these advantages, Python is increasingly being introduced in educational environments to help students understand fundamental programming concepts and develop computational thinking skills ([Hidayatullah & Berliana, 2023](#); [Jamil, Saputra, Fawait, Rahmah, & Rosmasari, 2025](#); [Junaidi, Devegi, & Kurniawan, 2023](#)).

In addition to programming knowledge, understanding emerging technologies such as Artificial Intelligence (AI) is becoming increasingly important ([Wilyani, Arif, & Aslimar, 2024](#)). AI has become a transformative technology that influences many sectors, including healthcare, transportation, finance,

manufacturing, and education ([Alanazi, Li, Samra, & Soh, 2025](#); [Elnaffar et al., 2025](#); [Ramadhani et al., 2025](#)). AI technologies enable computers to perform tasks that typically require human intelligence, such as pattern recognition, data analysis, and prediction. Introducing AI concepts to students at an early stage can help them understand the technological changes occurring in society and prepare them for future careers in technology-related fields ([Hou & Yu, 2025](#); [Suharsono, Gunawan, Sukmana, Ath-Thariq, & Ahmad, 2023](#)).

However, despite the increasing availability of digital technology in schools, the implementation of programming and AI learning at the vocational high school level remains limited in many cases. Several factors contribute to this situation, including limited curriculum integration, insufficient learning resources, and lack of opportunities for hands-on programming practice. Consequently, many students have limited exposure to programming and emerging technologies, which may hinder the development of their technological competence. To address these challenges, educational initiatives and community service programs can play an important role in introducing programming and AI concepts to students in the lower grades. Such programs provide practical learning experiences that complement formal classroom instruction and help students gain hands-on experience with digital technology.

Therefore, this community service program, entitled “*Enhancing Vocational High School Students’ Technological Competence through the Introduction of Python Programming and Artificial Intelligence*” was designed to improve students’ technological competence by introducing fundamental programming concepts and AI applications. Through interactive learning activities and practical coding exercises, the program aims to enhance students’ digital literacy, computational thinking, and technological awareness, thereby preparing them to face the challenges of the digital transformation era in the future.

2. Methodology

2.1 Research Design

This study employed a community service-based educational intervention with a quasi-experimental approach using a pretest and post-test design. This program aimed to evaluate the effectiveness of introducing Python programming and Artificial Intelligence (AI) concepts to improve the technological competence of vocational high school students. This study focused on measuring students’ understanding of basic programming concepts, AI awareness, and computational thinking skills before and after participating in the training program. The activity was conducted as part of a Community Service Program designed to provide practical learning experiences through hands-on coding activities and interactive explanations of AI concepts.

2.2 Participants

The participants of this community service were 10th grade students from a Vocational High School who took part in the training program. A total of 44 students participated in this study. The participants were selected based on their enrolment in the targeted class and willingness to participate in the training activities. Most participants had limited prior experience with programming and artificial intelligence, making them suitable for introductory training on Python programming and AI concepts.

2.3 Materials and Learning Content

The learning materials used in this program focused on basic Python programming and introductory Artificial Intelligence concepts, including:

1. Introduction to programming and coding concepts
2. Basic Python syntax and structure
3. Variables and data types in Python
4. Input and output operations using Python
5. Simple conditional statements and logic
6. Introduction to Artificial Intelligence concepts
7. Examples of AI applications in everyday life and industry

The materials were designed to be simple, practical, and suitable for beginner-level learners.

2.4 Training Procedure

The program implementation consisted of several stages.

2.4.1 Preparation Stage

At this stage, the research team prepared learning materials, training modules, presentation slides, and practical exercises related to Python programming and AI. The necessary hardware and software environments were prepared prior to the training session.

2.4.2 Pretest

Before the training began, the participants completed a pretest questionnaire designed to measure their initial knowledge and understanding of programming concepts, Python programming, and Artificial Intelligence.

2.4.3 Training Implementation

The training session was conducted using a combination of lectures, demonstrations, and hands-on practice. Students were introduced to the fundamentals of Python programming and guided through simple coding exercises. In addition, AI concepts were explained using real-world examples to help students understand how AI technologies are applied in their daily lives and industries. During the practical sessions, students were encouraged to experiment with Python commands and develop simple programs under the guidance of the instructors.

2.4.4 Post-test

After completing the training session, the students were asked to complete a post-test questionnaire to evaluate their understanding of the materials presented. The post-test aimed to measure improvements in students' technological competence and conceptual understanding after they participated in the program.

2.4.5 Evaluation and Reflection

The final stage involved analysing the results of the pre- and post-tests to determine the effectiveness of the training program in improving students' knowledge and technological competencies.

2.5 Data Collection Instruments

The data in this study were collected using the following instruments:

1. Pretest and post-test questionnaires were used to measure students' knowledge and understanding of Python programming and AI concepts.
2. Observation sheets to evaluate students' engagement and participation during the training sessions.
3. Feedback questionnaires were used to collect students' responses and perceptions regarding the training program.

The questionnaire consisted of multiple-choice and short-answer questions designed to evaluate students' knowledge of basic programming concepts and AI applications.

2.6 Hardware and Software Used

The training implementation utilized several hardware and software tools, including:

1. Hardware
 - Personal Computers used by participants
 - LCD Projector for presentation and demonstrations
 - Internet connection for accessing learning resources
2. Software
 - Python 3.10 programming language
 - Google Colab as the code editor
 - Google Chrome (Google LLC) web browser for accessing online resources and demonstrations
 - Microsoft PowerPoint (Microsoft Corporation) for training presentations

These tools were selected because they are widely available and suitable for beginner-level programming education.

2.7 Data Analysis

The collected data were analyzed using descriptive statistical methods. The results of the pre- and post-tests were compared to determine the improvement in students' technological competence after the training program. The analysis focused on measuring changes in students' knowledge levels and their understanding of Python programming and Artificial Intelligence concepts. The effectiveness of the program was evaluated based on the difference between pre- and post-test scores, as well as observations of student participation during the training activities.

Present the materials, methods, survey, questionnaire, used in the study. Authors should explain whether this study is experimental, a review study, or simulation- or survey-based. The software and hardware used during the study are discussed with their brand names. Mention all research conditions, assumptions, and theories that were followed. This section should be easy for any reader to repeat the study under similar conditions.

3. Results and Discussions

3.1 Results

The community service program aimed to introduce Python programming and Artificial Intelligence (AI) concepts to vocational high school students to improve their technological competence. The effectiveness of the program was evaluated through pre- and post-test assessments, classroom observations, and participant feedback. A total of 44 tenth-grade vocational high school students participated in the training program. Before the training session began, the participants completed a pretest designed to measure their initial knowledge of programming concepts, Python programming, and Artificial Intelligence. After the training activities were completed, the students were asked to complete a post-test to measure their level of understanding after receiving the training.

The training activities were implemented in several stages. The first stage was the preparation stage, which included coordination with the school, preparation of training materials, and development of evaluation instruments such as pre- and post-test questions. The materials were designed to introduce the basic concepts of Python programming and Artificial Intelligence in a simple and understandable manner for beginner-level students. The second stage was the implementation stage, where training activities were conducted in the form of lectures, demonstrations, and hands-on coding practice. During the lecture session, students were introduced to the importance of programming skills and the role of Artificial Intelligence in modern technology. The instructors explained the basic Python concepts, such as variables, data types, operators, and input-output commands. Students were also introduced to the basic concept of Artificial Intelligence and its applications in everyday life and various industries.



Figure 1. Training session on python programming

The second stage was the implementation stage, where training activities were conducted in the form of lectures, demonstrations, and hands-on coding practice. During the lecture session, students were

introduced to the importance of programming skills and the role of Artificial Intelligence in modern technology. The instructors explained the basic Python concepts, such as variables, data types, operators, and input–output commands. Students were also introduced to the basic concept of Artificial Intelligence and its applications in everyday life and various industries.

In the demonstration and practice sessions, the students were guided to write simple Python programs using a code editor. They practiced creating basic programs, performing simple calculations, and displaying the outputs. The instructors also demonstrated simple examples of how AI systems work, such as pattern recognition and data-processing. This practical approach allowed students to directly experience the process of writing code and understand how programming works.



Figure 2. Students practicing python coding

The final stage was the evaluation stage, which aimed to measure students’ understanding after participating in the training programmed. Students were given a post-test to assess their comprehension of the materials that had been delivered. The pretest and posttest results were analyzed to evaluate the effectiveness of the training program. The evaluation results indicate that the training program successfully improved students’ understanding of Python programming and Artificial Intelligence concepts. Before the training began, the students were given a pretest to measure their initial knowledge. The results showed that most students had limited knowledge of programming and AI.

After participating in the training activities, the students were given a post-test to measure their learning outcomes. A comparison between the pre- and post-test scores showed a clear improvement in students’ understanding. A comparison of students’ understanding before and after the training program is presented in Table 1.

Table 1. Students’ understanding before and after the training (n = 44)

No	Assessment Indicators	Pretest Mean Score	Posttest Mean Score	Improvement
1	Understanding of basic programming concepts	54	79	+25
2	Knowledge of Python programming syntax	50	82	+32
3	Understanding variables and data types in Python	52	83	+31
4	Understanding input and output commands in Python	49	81	+32
5	Understanding basic Artificial Intelligence concepts	56	85	+29
6	Awareness of AI applications in daily life	60	87	+27

Based on Table 1, it can be observed that all indicators of students' understanding increased after the training program. The highest improvement occurred in the indicators related to Python programming syntax and input-output commands, each showing an increase of 32. This indicates that hands-on coding exercises helped students understand programming structures and commands more effectively. To further analyze the improvement in students' performance, descriptive statistics of the pre- and post-test scores are presented in Table 2.

Table 2. Distribution of students' pretest and posttest scores (n = 44)

Test Type	Minimum Score	Maximum Score	Mean Score	Standard Deviation
Pretest	40	68	53.5	7.2
Posttest	72	92	82.8	5.6

Table 2 show that the average pretest score was 53.5, indicating that most students had limited prior knowledge of programming and AI concepts prior to the course. After the training program, the average post-test score increased significantly to 82.8. The improvement in the average score demonstrates that the training activities successfully enhanced the students' understanding of the learning materials. In addition, the standard deviation decreased from 7.2 to 5.6, indicating that students' understanding became more consistent after training. This suggests that the program not only improved students' knowledge but also helped reduce the variation in their understanding. The improvement in students' scores can also be seen visually in Figure 1, which shows a comparison between the average pre- and post-test scores.

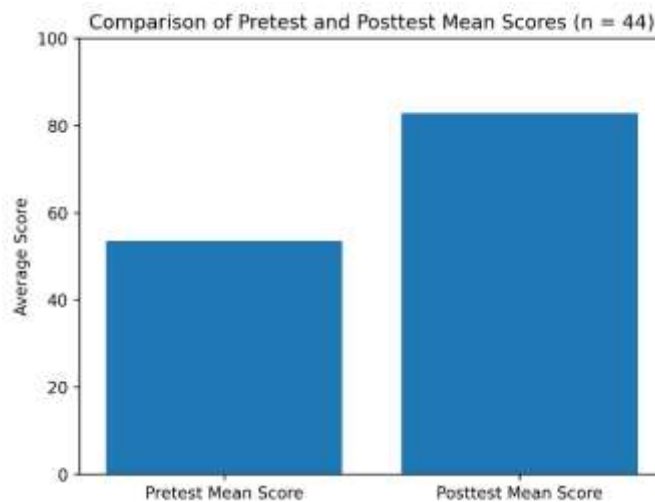


Figure 3. Comparison of pretest and posttest mean scores

Figure 3 illustrates a clear increase in students' learning outcomes after they participated in the training program. The results confirm that introducing Python programming and AI concepts through structured training activities significantly improves students' technological competence. In addition to the quantitative results, classroom observations showed that the students demonstrated high enthusiasm and actively participated during the practical coding sessions. Many students experimented with simple Python programs and showed curiosity about how programming could be used to solve real-world problems. Participant feedback also indicated that the students found the training activities interesting and beneficial. Several students expressed interest in learning more advanced programming topics after the training sessions.

3.2 Discussion

The findings of this study indicate that introducing Python programming and Artificial Intelligence concepts through practical learning activities can significantly improve the technological competence of vocational high school students. The substantial increase in post-test scores suggests that students gained a better understanding of programming logic and AI concepts after participating in the training

program. This finding is consistent with previous research, which states that programming education plays an important role in developing computational thinking skills. Learning programming encourages students to think logically, analyze problems systematically and develop algorithmic solutions. These skills are essential for preparing students to meet the demands of the digital workforce.

The results also support previous studies highlighting the advantages of Python as an introductory programming-language. Python is widely recognized for its simple syntax and readability, which make it suitable for beginner programmers. Because of its simplicity, students can focus on understanding programming concepts rather than on dealing with complicated syntax rules. Another important aspect of this program was the introduction of Artificial Intelligence concepts alongside programming education. AI has become one of the most influential technologies in modern society, with applications in healthcare, transportation, finance, and manufacturing. By learning about AI applications, students can understand how programming skills are used to develop intelligent systems.

The positive response from students during the training sessions also indicated that hands-on learning approaches are effective in teaching programming concepts. Practical activities allow students to apply theoretical knowledge directly through coding exercises, which helps them to better understand programming structures and problem-solving processes. However, several challenges were identified during the training program's implementation. Some students initially experienced difficulties in understanding programming logic because they had little prior coding experience. In addition, the limited duration of training restricts opportunities to explore more advanced programming topics or deeper AI applications. Despite these limitations, the results of this study demonstrate that community service programs focusing on technology education can play an important role in strengthening students' digital competence. Such initiatives can complement formal school curricula by providing practical learning experiences that may not always be available in regular classroom settings. Therefore, it is recommended that similar programs be implemented more frequently in vocational schools. Integrating programming education and AI literacy into vocational training can help prepare students to face the challenges of digital transformation and improve their readiness for technology-related careers.

4. Conclusions

4.1 Conclusion

This community service program aimed to enhance the technological competence of vocational high school students through the introduction of Python programming and Artificial Intelligence (AI). The training program results indicate that the activities were effective in improving students' understanding of basic programming concepts and AI applications. The significant increase in students' post-test scores compared to the pre-test results demonstrates that the training successfully strengthened students' knowledge of Python programming, including syntax, variables, data types, and input-output commands. In addition, students developed a better understanding of the basic concepts of Artificial Intelligence and its applications in everyday life. The hands-on learning approach, which combined lectures, demonstrations, and practical coding activities, encouraged active participation and increased students' interest in learning programming and digital technology. Overall, the program contributed positively to improving students' technological competence and supporting their readiness to face the challenges of the digital transformation era.

4.2 Research Limitations

Despite these positive outcomes, this study has several limitations. First, the duration of the training program was relatively short, which limited the opportunity to explore more advanced programming and Artificial Intelligence topics. Second, the participants had varying levels of prior knowledge and experience with programming, which may have influenced their learning outcomes. Additionally, the study involved a limited number of participants from a single vocational school, which may limit the generalizability of the findings to other educational contexts.

4.3 Suggestions and Directions for Future Service

Future programs should provide longer and more comprehensive training sessions that include more advanced programming topics and deeper exploration of Artificial Intelligence applications. Further studies should involve a larger number of participants from multiple vocational schools to obtain broader and more generalizable results. Future research could also investigate the long-term impact of programming and AI training on students' technological competence, learning motivation, and career readiness in the digital technology field.

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References

- Alanazi, M., Li, A., Samra, H., & Soh, B. (2025). Examining the Influence of AI on Python Programming Education: An Empirical Study and Analysis of Student Acceptance Through TAM3. *Computers*, 14(10), 411. doi:<https://doi.org/10.3390/computers14100411>
- Annuš, N. (2025). Investigation of Generative AI Adoption in IT-Focused Vocational Secondary School Programming Education. *Education Sciences*, 15(9), 1152. doi:<https://doi.org/10.3390/educsci15091152>
- Askar, M. A., & Suhardiman, S. (2025). Berkreasi dengan Canva: Pelatihan Desain Grafis untuk Kreativitas Siswa MTs Sinoa. *Yumary: Jurnal Pengabdian kepada Masyarakat*, 5(4), 751-759. doi:<https://doi.org/10.35912/yumary.v5i4.3687>
- Darmanto, D., Pratama, R. H., Hazar, S., Rajunaidi, R., Hafin, A. F., Ridwan, M., Yuliansyah, H. (2025). Enhancing digital competencies of students at muhammadiyah al mujahideen islamic junior high school through python-based coding instruction. *Jurnal Pengabdian Masyarakat Sabangka*, 4(02), 42-52. doi:<https://doi.org/10.62668/sabangka.v4i02.1425>
- Elnaffar, S., Rashidi, F., & Abualkishik, A. Z. (2025). Teaching with AI: a systematic review of chatbots, generative tools, and tutoring systems in programming education. *arXiv preprint arXiv:2510.03884*. doi:<https://doi.org/10.48550/arXiv.2510.03884>
- González, F., López, C., & Castro, C. (2018). *Development of computational thinking in high school students: A case study in Chile*. Paper presented at the 2018 37th International Conference of the Chilean Computer Science Society (SCCC).
- Halim, A., Gohzali, H., Pardosi, I. A., Wong, N. P., & Megawan, S. (2025). Pelatihan Pengenalan Pemrograman Komputer pada SMA Dharma Bakti Lubuk Pakam. *ABDIKAN: Jurnal Pengabdian Masyarakat Bidang Sains dan Teknologi*, 4(2), 55-66. doi:[10.55123/abdikan.v4i2.4963](https://doi.org/10.55123/abdikan.v4i2.4963)
- Hidayatullah, A., & Berliana, A. (2023). Workshop Pengenalan Dasar Pemrograman Python Dengan Google Colaboratory. *Prosiding Abdimas Corisindo 2023*.
- Hou, W., & Yu, X. (2025). *Exploring the Blended Teaching Mode of Python Programming Language Course Based on OBE Concepts*. Paper presented at the Proceedings of the 2nd Guangdong-Hong Kong-Macao Greater Bay Area Education Digitalization and Computer Science International Conference.
- Hu, B., Luo, Q., & Wang, Q. (2025). Exploring the application of AIGC in high school information technology programming instruction a case study of "Python Programming: Conditional Structures". *Advances in Engineering Innovation*, 16(8), 92-99. doi:[10.54254/2977-3903/2025.26530](https://doi.org/10.54254/2977-3903/2025.26530)
- Jamil, M., Saputra, Y. F., Fawait, A. B., Rahmah, S., & Rosmasari, R. (2025). Workshop pengenalan bahasa pemrograman python dan potensi python di masa mendatang di SMKN 1 Tenggarong. *Ilmu Komputer untuk Masyarakat*, 6(1), 15-21. doi:<https://doi.org/10.33096/ilkomas.v6i1.2828>

- Juliani, F., & Rahman, A. (2025). Pengenalan dan Pelatihan Dasar Pemrograman Python untuk SMK Negeri 8 Pekanbaru. *FLEKSIBEL: Jurnal Pengabdian Masyarakat*, 6(2), 307-310. doi:<https://doi.org/10.31849/fleksibel.v6i1.25432>
- Junaidi, S., Devegi, M., & Kurniawan, H. (2023). Pelatihan pengolahan dan visualisasi data penduduk menggunakan Python. *ADMA: Jurnal Pengabdian dan Pemberdayaan Masyarakat*, 4(1), 151-162. doi:<https://doi.org/10.30812/adma.v4i1.2963>
- Khairudin, K. (2024). Pengenalan bahasa pemrograman python untuk meningkatkan kompetensi yatim piatu rw 01 Kelurahan Panunggan Kec Pinang. *Praxis: Jurnal Pengabdian Kepada Masyarakat*, 4(3), 36-43.
- Liu, Z., Gearty, Z., Richard, E., Orrill, C. H., Kayumova, S., & Balasubramanian, R. (2024). Bringing computational thinking into classrooms: A systematic review on supporting teachers in integrating computational thinking into K-12 classrooms. *International Journal of STEM Education*, 11(1), 51. doi:<https://doi.org/10.1186/s40594-024-00510-6>
- Macar, U., Castleman, B., Mauchly, N., Jiang, M., Aouissi, A., Aouissi, S., Clark-Sevilla, A. (2023). Teenagers and Artificial Intelligence: Bootcamp Experience and Lessons Learned. *arXiv preprint arXiv:2312.10067*. doi:<https://doi.org/10.48550/arXiv.2312.10067>
- Mafrukhah, E., & Lisana, L. (2026). Adoption of Artificial Intelligence in Vocational High Schools: A Systematic Review of Teachers' Perspectives. *Sinkron: jurnal dan penelitian teknik informatika*, 10(1), 665-675. doi:<https://doi.org/10.33395/sinkron.v10i1.15701>
- Masnia, M., Saputri, V., Kamsurya, R., & Tuhu, D. M. S. (2025). Peningkatan Literasi Numerasi Siswa SMA Melalui Pembinaan AKM Untuk Mencapai Sekolah Berkualitas (Improving Numeracy Literacy of High School Students through AKM Coaching to Achieve Quality Schools). *Yumary: Jurnal Pengabdian Kepada Masyarakat (YUMARY)*, 6(2), 437-449. doi:<https://doi.org/10.35912/yumary.v6i2.3231>
- Matlubah, H., Herowati, H., & Punggeti, R. N. (2025). Upaya Menanamkan Literasi Lingkungan Siswa MDT Raudhatul Muhtadain, Sumenep. *Yumary: Jurnal Pengabdian kepada Masyarakat*, 5(4), 867-875. doi:<https://doi.org/10.35912/yumary.v5i4.3787>
- Poerna Wardhanie, A., & Lebdaningrum, K. (2022). Pengenalan Aplikasi Desain Grafis Figma pada Siswa-Siswi Multimedia SMK PGRI 2 Sidoarjo (Introduction to the Figma Graphic Design Application for Multimedia Students at SMK PGRI 2 Sidoarjo). *Jurnal Pengabdian Kepada Masyarakat*, 3(3), 165-174. doi:<https://doi.org/10.35912/yumary.v3i3.1536>
- Putri, A. K., & Nur, D. I. (2023). Penggunaan bahasa python untuk analisis dan visualisasi data penduduk di Desa Sumberjo, Nganjuk. *Karya: Jurnal Pengabdian kepada Masyarakat*, 3(3), 206-217.
- Ramadhani, I., Saputra, M. A., Salsabilla, R. N., Hakim, W. R., Al'Hadid, Y., & Fitriah, F. (2025). Pengenalan Pemrograman Python bagi Siswa SMP Negeri 04 Kota Bengkulu sebagai Upaya Meningkatkan Literasi Digital. *Mestaka: Jurnal Pengabdian Kepada Masyarakat*, 4(4), 413-421. doi:<https://doi.org/10.58184/mestaka.v4i4.733>
- Santati, P., Saftiana, Y., Mavillinda, H. F., & Ghasarma, R. (2022). Peningkatan Literasi Teknologi Informasi Bagi Perangkat Kelurahan di Lingkungan Kecamatan Ilir Barat Dua Kota Palembang. *Yumary: Jurnal Pengabdian kepada Masyarakat*, 2(4), 175-188. doi:<https://doi.org/10.35912/yumary.v2i4.1037>
- Suharsono, T. N., Gunawan, G., Sukmana, R. N., Ath-Thariq, M., & Ahmad, M. T. A. S. (2023). Penggunaan metode blok program pada pengenalan bahasa koding python untuk anak sebagai upaya menghadapi revolusi industri 4.0 pada rw 05 Kelurahan Pasirkaliki Kecamatan Cicendo Bandung. *Jurnal Abdimas Sang Buana*, 4(1), 10-18. doi:<https://doi.org/10.32897/abdimasusb.v4i1.2303>
- Suhendah, R., Jennifer, J., Goh, E., & Heni, H. (2025). Edukasi Pelatihan Sistem Penjualan Perusahaan Dagang untuk Siswa-Siswi SMA. *Yumary: Jurnal Pengabdian kepada Masyarakat*, 5(4), 877-889. doi:<https://doi.org/10.35912/yumary.v5i4.4378>
- Tribethran, S., Daniel, D., Ferdynand, R., Saputra, A., Hansen, H., & Pribadi, M. R. (2023). Pelatihan Pemrograman Dasar Python Dengan Memanfaatkan ChatGPT pada SMK Methodist 2 Palembang: Pelatihan pemrograman dasar menggunakan bahasa Python kepada para siswa kelas 10 SMK Methodist 2 Palembang. *Jumat Informatika: Jurnal Pengabdian Masyarakat*, 4(2), 71-79. doi:<https://doi.org/10.32764/abdimasif.v4i2.3709>

- Wijaya, M. C., Yapinus, P. P., Loekito, J. A., Tanubrata, M., Lehman, A. S., Cheol, S. M., & Wong, K. (2024). Pengenalan Teknik Komputer bagi Siswa SMAK 4 BPK Penabur Jakarta. *Yumary: Jurnal Pengabdian kepada Masyarakat*, 4(4), 541-549. doi:<https://doi.org/10.35912/yumary.v4i4.2653>
- Wilyani, F., Arif, Q. N., & Aslimar, F. (2024). Pengenalan Dasar Pemrograman Python Dengan Google Colaboratory. *Jurnal Pelayanan Dan Pengabdian Masyarakat Indonesia*, 3(1), 08-14. doi:<https://doi.org/10.55606/jppmi.v3i1.1087>
- Yoraeni, A., & Abdillah, R. (2024). Penguatan Skill Teknologi di Kalangan Santri Tahfizh melalui Pelatihan Pemrograman Dasar dengan Python. *DCS: Jurnal Pengabdian Masyarakat*, 1(2). doi:<https://doi.org/10.62671/98bpes81>
- Zhu, Y., Liu, M., Wang, Y., & Wu, T. (2023). *Exploration on Blended Teaching Mode of Python Programming Based on PBL*. Paper presented at the 2023 11th International Conference on Information and Education Technology (ICIET).