Jurnal Pemberdayaan Masyarakat Madani, Vol 9 (1) 2025, 71-83
JURNAL PEMBERDAYAAN MASYARAKAT MADANI
http://journal.unj.ac.id/unj/index.php/jpm/index

BASIC PYTHON PROGRAMMING TRAINING TO ENHANCE DIGITAL LITERACY AMONG STUDENTS AT SMA WACHID HASYIM 2 SIDOARJO

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ARTICLE INFO

Article history:
Received: 12th March 2025
Accepted: 7th May 2025
Published: 16st July 2025

Keywords:
Digital Literacy, Python Programming, ABCD, Technology, Student Empowerment

ABSTRACT

Improving digital literacy among students has become one of the main focuses of the era of the Fourth Industrial Revolution. Programming skills must be mastered to prepare young generations to face global challenges. This community service aims to enhance the digital literacy of students at SMA Wachid Hasyim 2 Sidoarjo by introducing and applying basic Python programming. The method used is Asset-Based Community Development (ABCD), which leverages existing school assets and involves active student participation in the learning process. This training was attended by twelfth-grade students interested in technology and digital skill development. Evaluation results indicate a significant improvement in students' understanding of programming, with the average pretest score increasing from 64.86 to 96.22 after the training. To ensure the continuity of learning, the service team established a coding community as a platform for students who wish to explore programming further. This community aims to develop collaboration and communication skills among students. The program successfully empowered students created a positive learning environment, and demonstrated promising potential for their skill development in programming.

How to cite: Yuliati, D., Ulinnuha, N. Basic Python Programming Training To Enhance Digital Literacy Among Students At Sma Wachid Hasyim 2 Sidoarjo. *Jurnal Pemberdayaan Masyarakat Madani* (JPMM), 9(1), 71-83. https://doi.org/10.21009/JPMM.009.1.06

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ISSN
2580-4332 (online)
DOI: doi.org/10.21009.1.06

INTRODUCTION

The Industrial Revolution 4.0 has had a significant impact on various aspects of human life, particularly in the fields of education and the skills needed to compete in the global market (Fajriyani et al., 2023). In this digital era, programming skills have become one of the most essential competencies. Research shows that programming is not just a technical skill, but also a tool for enhancing critical thinking, creativity, and problem-solving abilities (Hehanussa et al., 2023). Therefore, mastering programming skills among students is crucial to prepare them for the challenges and opportunities present in the modern workforce. However, despite the urgent need to enhance digital literacy among students, many of them still struggle to understand the fundamental concepts of programming. Data from Badan Pusat Statistik shows that less than 40% of high school students possess adequate digital skills. (Badan Pusat Statistik Indonesia, 2022). At SMA Wachid Hasyim 2 Sidoarjo, initial observations indicate that twelfth-grade students, despite having a strong interest in technology, still have limited knowledge and programming skills. They often do not know how to start learning programming, and many feel intimidated by the complexity of existing programming languages.

Previous studies have shown that innovative and practice-based learning approaches can enhance students' motivation and understanding of programming. For example, Maukar et al. found that collaborative learning methods effectively increase student engagement and learning outcomes (Maukar et al., 2022). However, most training programs available in schools have not leveraged local asset potential and active student engagement, which could enhance learning effectiveness and promote sustainable skills. This gap highlights the need for a new approach to community service that can provide concrete solutions to enhance digital literacy. Therefore, this community service aims to provide Python programming training for students at SMA Wachid Hasyim 2 Sidoarjo, focusing on the introduction and application of the fundamentals of programming. The method used in this community service is Asset-Based Community Development (ABCD), which prioritizes student empowerment and the utilization of local assets in the learning process. With this approach, it is hoped that students will not only learn technical skills but also contribute to optimizing their potential in developing programming skills. This training activity is designed to create an interactive and collaborative learning environment, where students are the main actors in the learning process. By providing hands-on training in Python programming, this program is designed to develop students' technical skills in using technology to solve real-life problems. The training not only enhances their practical abilities but also aims to cultivate their interest and motivation in technology and innovation.

This research-based community service aims to provide a better understanding of programming and digital literacy to students and create a learning environment that supports active student engagement. Thus, this community service is expected to make a significant contribution to enhancing the digital skills of the younger generation, preparing them to face future challenges, and fostering their interest in

ISSN 2580-4332 (online)
DOI: doi.org/10.21009/JPMM.009.1.06

technology and innovation. In the era of the Fourth Industrial Revolution, the development of information and communication technology (ICT) has transformed the ways we live, work, and learn (Alimuddin et al., 2023). One of the biggest challenges faced by today's youth is digital literacy, which encompasses the ability to use technology effectively and critically (Setiani & Barokah, 2021). Most teenagers believe that programming skills are essential for their future; however, research shows that many students in Indonesia, particularly at the high school level, lack an adequate understanding of the fundamentals of programming (Hardianto et al., 2024).

Based on initial observations at SMA Wachid Hasyim 2 Sidoarjo, it was found that twelfth-grade students have a strong interest in technology but still struggle to understand programming concepts. This indicates a gap between the skill requirements expected in the digital era and the current abilities of students. On the other hand, formal education programs in schools still pay insufficient attention to the development of these essential programming skills (Multidisiplin, 2024).

Several previous studies have discussed the importance of introducing programming skills at the secondary school level. For example, Febby et al. demonstrated that Python programming, known for its simple syntax, can be an effective choice for teaching programming to students (Febby Wilyani et al., 2024). However, despite its simplicity, Python can still pose challenges for beginners who lack prior exposure to logical thinking or algorithmic structures. Some students may find it difficult to understand abstract concepts such as loops, conditionals, and functions without continuous guidance or contextual examples.

Additionally, the Asset-Based Community Development (ABCD) approach, which emphasizes strengthening local capacity, has proven successful in increasing student participation in the learning process (Sarip et al., 2023). Research by Walid et al. also highlighted the effectiveness of the ABCD approach in enhancing digital literacy skills among students in various regions of Indonesia (Walid et al., 2020). Nevertheless, one of the limitations of the ABCD approach is its reliance on community assets that may not be evenly distributed. In contexts where community support or digital infrastructure is limited, the implementation of ABCD may face practical challenges, such as limited access to mentors or technology tools.

Despite some efforts to improve digital literacy through training (Kurnianingsih et al., 2017), there is still little research specifically applying the ABCD method in the context of teaching programming at the secondary school level. This creates a gap in the literature that needs to be filled, making it essential to undertake research-based solution actions. Based on this background, this community service aims to enhance students' digital literacy at SMA Wachid Hasyim 2 Sidoarjo through the introduction and application of the fundamentals of Python programming. By using the ABCD approach, it is hoped that students will not only acquire technical skills but also be empowered to maximize their potential in an increasingly evolving technological world.

ISSN 2580-4332 (online)
DOI: doi.org/10.21009/JPMM.009.1.06

LITERATURE REVIEW

1. Python Programming

Python programming is a language developed by Guido van Rossum in 1991. Known for its simplicity and human-readable syntax, Python is considered an easy language to learn (Pramudya et al., 2023). Python supports various programming paradigms, including object-oriented programming, procedural programming, and functional programming (Fauziah et al., 2024). Python offers a wide range of libraries to meet diverse needs, such as data analysis (e.g., NumPy and Pandas), web development (e.g., Flask and Django), and artificial intelligence (e.g., TensorFlow and PyTorch). These advantages make Python highly relevant for teaching digital literacy at the school level.

2. Digital Literacy

Digital literacy refers to an individual's ability to understand, use, and effectively leverage information technology. According to Gilster (1997), as cited in Aveny et al. (Aveny et al., 2023), digital literacy is not merely about technical proficiency in using digital devices but also involves critical understanding of the information obtained through these technologies. In the educational context, digital literacy has become one of the essential 21st-century skills that students must acquire to face the challenges of the digital era (Cynthia & Sihotang, 2023).

3. Programming Education in School

Teaching programming at the school level aims to develop computational thinking skills, which involve a logical approach to problem-solving (Juldial & Haryadi, 2024). This education also enhances students' analytical skills and creativity. Python, with its simplicity and flexibility, is an ideal programming language for beginners. Common methods used in teaching programming in schools include: Project-Based Learning: Students learn programming concepts by developing specific project. Collaborative Learning: Students work in groups to complete programming tasks (Situmorang, 2024). Interactive Learning: Using tools such as simulations or interactive software to understand programming concepts (Handayani et al., 2024).

4. The Relationship Between Digital Literacy and Python Programming

Learning Python programming can serve as a means to enhance students' digital literacy. Python not only helps students understand logic and algorithms but also sharpens their critical thinking, problem-solving skills, and ability to create technology-based solutions (Hidayat et al., 2024). Previous research indicates that students who learn programming demonstrate a better understanding of technology and are more creative in utilizing digital tools (Febriani et al., 2024). Integrating Python into the learning process, students can gain deeper insights into how technology works and how they can leverage it for academic purposes and everyday life.

ISSN 2580-4332 (online)
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5. The ABCD Method (Asset-Based Community Development)

Asset-Based Community Development (ABCD) is a community empowerment approach that focuses on utilizing the existing assets or potentials within a community, such as individual, social, and material resources. This method emphasizes building community capacity by involving residents as the main actors in decision-making and problem-solving. The approach aims to mobilize the assets owned by the community to create sustainable solutions (Ibrahima, 2018). This approach not only identifies existing assets but also strengthens social relationships within the community to foster sustainable collaboration. The ABCD approach can enhance residents' confidence as they are directly involved in the planning and implementation processes. This involvement allows for solutions that are more relevant to the community's needs and reduces dependency on external parties (Salahudin et al., 2015).

MATERIAL AND METHOD

This research employs the Asset-Based Community Development (ABCD) approach, which focuses on empowering students through the utilization of existing assets in the school environment (Pada et al., 2018). This approach was chosen because it emphasizes the potential possessed by the community, in this case, students, teachers, and school facilities, to enhance digital literacy skills through Python programming training. In the ABCD method, students are not viewed in terms of their shortcomings but are empowered based on the strengths and assets they already possess (Irawan et al., 2024). The research was conducted at SMA Wachid Hasyim 2 Sidoarjo, with the subjects being twelfth-grade students participating in the Python programming training program. The research process consists of four main stages: asset identification, asset mapping and empowerment, training implementation, and the establishment of a coding community as a sustainability effort in learning (Lewu, 2024).

In the asset identification stage, observations and interviews were conducted with students, teachers, and school staff to discover assets that could be utilized in the training. The identified assets included students' basic technology skills, computer laboratory facilities, and support from teachers and school staff. Next, in the asset mapping stage, an analysis of these assets was conducted to determine how they could be optimized in the training activities. The training implementation consisted of introducing the basics of Python programming, followed by collaborative practical exercises, where students were encouraged to assist each other in completing programming tasks. The training was conducted in an interactive and project-based atmosphere, focusing on the active involvement of each student. Evaluation was carried out through pre-tests and post-tests to measure the students' skill development, as well as questionnaires and group discussions to gather feedback on the training's effectiveness. After the training, the subsequent step was the formation of a coding community in the school. This community was established to maintain the continuity of learning and provide a space for students to continue

ISSN 2580-4332 (online)
DOI: doi.org/10.21009/JPMM.009.1.06

developing their programming skills. The coding community serves as a platform for students to share knowledge, hold regular discussions, and work on programming projects together. With this community in place, students can support each other in enhancing digital literacy while also strengthening their collaboration and problem-solving skills in the context of programming.

RESULT AND DISCUSSION

This community service program aims to enhance the digital literacy skills of students at SMA Wachid Hasyim 2 Sidoarjo, focusing on Python programming. The implementation process of this program is carried out in several stages: asset identification, training implementation, coding community formation and evaluation of results. Each stage plays a crucial role in achieving the established objectives.

1. Student and Learning Environment Asset Identification

In the initial stage, the community service team conducts observations to understand the context and conditions of the students, as well as the digital literacy needs at SMA Wachid Hasyim 2 Sidoarjo. This observation includes interviews with teachers and direct observation of the teaching and learning activities taking place at the school.

Figure 1. Interview with teachers and students

During the observation process, the community service team noted that the majority of students had access to technological devices, such as smartphones and computers; however, only 20% of them had previously participated in programming training. This indicates a gap in programming skills among the students, despite their high interest in technology.

To support the learning process, the team also conducted interviews with several teachers who taught technology-related subjects. They expressed that students had difficulties understanding basic programming concepts and often lacked confidence when encouraged to practice. However, the teachers showed strong commitment and enthusiasm in supporting student development, and they expressed openness to collaborate in integrating programming into classroom activities.

ISSN 2580-4332 (online)
DOI: doi.org/10.21009/JPMM.009.1.06

In addition to student-related assets, the observations revealed several environmental learning assets. These include the availability of a computer laboratory, which, although modest in number of devices, provides a structured space for programming practice, teachers with a background or interest in technology, who can act as local facilitators or mentors during and after the training, school support for extracurricular activities and external programs, indicating institutional openness to innovation, a generally positive school climate, where students are motivated and cooperative in learning new skills.

Figure 2. Condition of the Computer Laboratory at SMA Wachid Hasyim 2 Sidoarjo

From these findings, the community service team was able to identify both student and environmental learning assets. This comprehensive asset mapping informed the design of a training program that is not only relevant and targeted to students' needs but also builds on the strengths of the existing school environment to ensure program sustainability.

2. Asset Mapping

After the asset identification process, the next step is to map the assets of students and the school to support the Python programming training. This mapping aims to determine how these assets can be optimized in the implementation of the training program. From the identification results, several key assets were found, including students' access to technological devices like smartphones and computers, as well as the school's computer lab facilities, which were previously described. These lab facilities play a crucial role in the mapping, as they will be maximally utilized for hands-on training, allowing students to apply Python programming skills with teacher guidance.

Most students have access to personal technological devices, such as smartphones, which, although limited in advanced programming capabilities, can still be used for basic coding introductions and light simulations. Students with personal computers will be encouraged to continue practicing outside of school training hours. Through this asset mapping, study groups will be adjusted according to the type of technology each student possesses, making the program more efficient and tailored to individual

ISSN 2580-4332 (online)
DOI: doi.org/10.21009/JPMM.009.1.06

needs. In addition to technological assets, the mapping also includes support from the school's information technology teachers, who actively help students grasp programming concepts. These teachers are not only involved in teaching but also assist in troubleshooting problems students may encounter during training. The involvement of these teachers is a significant asset in ensuring the success of the training and the sustainability of the coding community within the school. The asset mapping also includes organizing optimal use of the computer lab for students participating in the training. With this arrangement, all participants have equal opportunities to access the school's available computer resources. By maximizing existing assets, such as the lab and teacher support, the training can be conducted effectively, providing meaningful learning experiences for all students.

3. Implementation of Python Programming Training

After the asset identification stage, the team proceeded to the implementation of the Python programming training. The training consisted of five sessions, each lasting two hours. In every session, the team focused on fundamental programming concepts with an interactive approach.

- Session 1: Introduction to Programming. In the first session, the team introduced the basics of programming using Python. They explained variables, data types, and control structures. To assess students' prior knowledge, the team conducted a pretest. The pretest results showed an average score of 64.86, indicating a relatively low understanding of programming concepts.

- Session 2: Basic Programming Practice. The second session focused on practicing creating simple programs. Students were taught how to write a program that prints "Hello, World!" and performs basic mathematical operations. The team divided students into small groups to foster collaborative learning.

- Session 3: Control Structures and Functions. In the third session, the team covered control structures, such as conditionals and loops. Students were tasked with creating a program that calculates the average value of a series of numbers entered by the user. This exercise was highly beneficial in helping students understand programming logic.

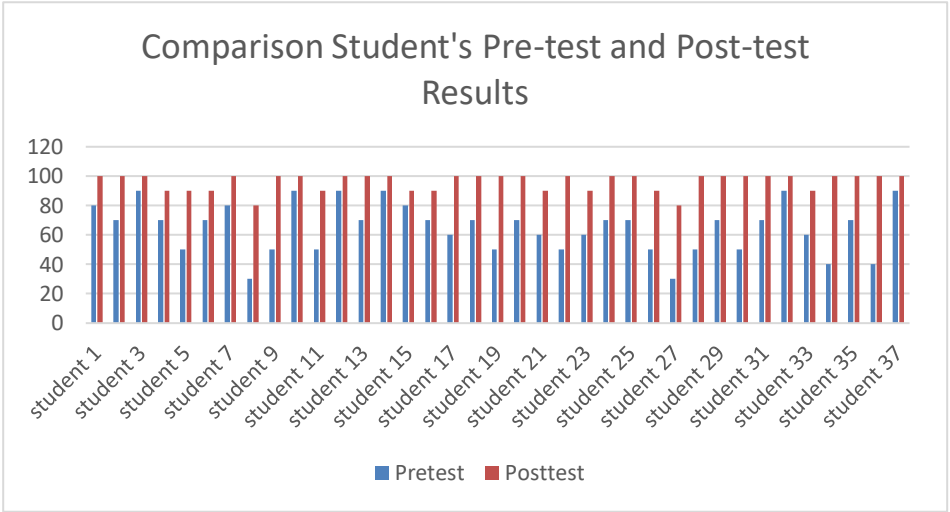
- Session 4: Introduction to a Mini Project. In the fourth session, students were encouraged to work on a mini project where they had to create a simple calculator. This project aimed to enhance students' critical thinking and creativity. The team guided throughout the project development process to ensure successful completion.

ISSN 2580-4332 (online)
DOI: doi.org/10.21009/JPMM.009.1.06

- Session 5: Evaluation and Feedback. The final session was dedicated to evaluation, where the team administered a post-test to measure the improvement in students' understanding after the training. The post-test results showed an average score of 96.22, reflecting a significant increase in students' programming comprehension. Additionally, the team collected feedback from students regarding the training. Student feedback indicated that they enjoyed the interactive and engaging teaching methods. They expressed that the hands-on practice greatly helped in understanding the concepts taught

Figure 3. Training Process

During the training, the students actively participated in Q&A sessions, group discussions, and programming exercis29es. A significant improvement was observed in the post-test results, with the average score increasing from 64.86 to 96.22. This improvement in skills is also reflected in the following graph:



Graph 1. Comparison of Students' Pretest and Posttest Results

ISSN 2580-4332 (online)
DOI: doi.org/10.21009/JPMM.009.1.06

4. Formation of the Coding Community

After completing the training, the service team formed a coding community at SMA Wachid Hasyim 2 Sidoarjo as a follow-up to the training program. The purpose of establishing this community is to maintain the continuity of learning and provide a platform for students who want to further explore programming. The first meeting of the coding community was held one week after the training ended. In this meeting, students were encouraged to discuss the topics they wanted to learn more about and the challenges they faced in programming. This helped students feel more engaged and take ownership of the community. Most of the students who participated in the training actively joined the coding community. During the meetings, the service team provided opportunities for students to share experiences and help each other learn. They also organized sharing sessions where students could present the projects they had worked on.

Figure 4. Coding Community Meeting

In the coding community activities, students practiced independently and worked on more complex projects, such as creating simple applications. This community not only serves as a place for learning but also helps develop collaboration and communication skills among students. The application of the ABCD approach in this training demonstrated that leveraging existing assets within the school significantly enhanced students' programming skills. Evaluation results indicated that the majority of students experienced an increase in their programming abilities, as seen in Table 1, which shows a comparison of pretest and posttest results. The implementation of this community service program illustrates that an asset-based approach can empower students and create a positive learning environment. By utilizing the resources available at the school, the service team was able to significantly improve students' programming skills. This success is evident not only from the pretest and posttest results but also from the enthusiasm of students in forming the coding community. This community provides students with opportunities to apply the skills they have learned and fosters a culture of continuous learning. Overall, the results of this program indicate that innovative, student-centered teaching methods can create more meaningful learning experiences. With the right support, students can sustainably develop their digital literacy skills, which will help them face challenges in the digital era.

ISSN 2580-4332 (online)
DOI: doi.org/10.21009/JPMM.009.1.06

Conclusion

The community service program conducted at SMA Wachid Hasyim 2 Sidoarjo successfully achieved its primary objective of enhancing students' digital literacy skills through Python programming training. Through a series of activities, including initial observations, training implementation, and the establishment of a coding community, the service team was able to identify student needs and design a program that aligned with the educational context of the school. Evaluation results showed a significant improvement in students' programming understanding, with the average pretest score rising from 64.86 to 96.22 after the training. Furthermore, students' enthusiasm for forming a coding class as a platform for continued learning serves as a positive indicator of the program's sustainability. However, while the program achieved positive results, some challenges were identified. The varying levels of prior knowledge among students presented difficulties in delivering a uniform learning experience for all participants. Some students, particularly those with limited prior exposure to programming, required more support, which could not be fully addressed within the time constraints of the training. Despite these challenges, the program demonstrated the effectiveness of an asset-based approach in empowering students and fostering a positive learning environment. To ensure the continued development of students' digital literacy skills, the service team recommends the continuation of coding class activities and the design of follow-up programs that provide ongoing support. Optimizing the use of community assets, such as teacher training and enhanced access to resources, will be essential for sustaining the students' growth in programming. With continuous support and adaptation, it is hoped that students will further develop their skills and be better prepared for the digital challenges of the future.

Acknowledgments

The service team expresses its sincere gratitude to the Institute for Research and Community Service (LPPM) of UIN Sunan Ampel Surabaya (UINSA) for the support provided during the implementation of this community service program. This support played a crucial role in the smooth execution and success of our activities at SMA Wachid Hasyim 2 Sidoarjo. We hope this collaboration can continue in the future to enhance education in the community.

ISSN 2580-4332 (online)
DOI: doi.org/10.21009/JPMM.009.1.06

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ISSN
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