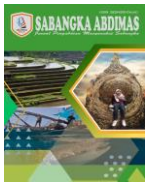

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ENHANCING DIGITAL COMPETENCIES OF STUDENTS AT MUHAMMADIYAH AL MUJAHIDEEN ISLAMIC JUNIOR HIGH SCHOOL THROUGH PYTHON-BASED CODING INSTRUCTION

Ridho Haikal Pratama[1], Siti Hazar[2], Rajunaidi Rajunaidi[3], Aqid Fahri Hafin[4], Muhammad Ridwan[5], Muhammad Kunta Bidinnika[6], Murinto Murinto[7], Herman Yuliansyah[8], Darmanto Darmanto*[9]

[1,2,3,4,5,6,7,8,]Ahmad Dahlan University, Indonesia
[9]Sehan University, South Korea
[*]Corresponding Author: darma3388@sehan.ac.kr

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Abstract: *In the digital era, programming has become an essential skill for students. This community service activity aimed to introduce Python-based coding instruction to students at Muhammadiyah Al Mujahideen Islamic Junior High School, combining digital literacy with Islamic character development. The activity followed a three-stage model: planning, implementation, and evaluation. During the two-day training, students were taught basic Python concepts such as syntax, variables, and data types using the W3Schools platform. Tasks were designed to evaluate their understanding, including coding exercises to calculate the area of basic geometric shapes. Results showed high enthusiasm and full task completion by all 20 participants, indicating that junior high school students can grasp foundational programming concepts when supported by clear instruction and engaging materials. This program demonstrates the potential of integrating Python into early education to support national education goals and foster future-ready, ethically grounded digital citizens.*

Abstrak: Di era digital, penguasaan pemrograman menjadi keterampilan penting bagi siswa. Kegiatan pengabdian masyarakat ini bertujuan memperkenalkan pemrograman berbasis Python kepada siswa SMP Islam Muhammadiyah Al Mujahideen dengan mengintegrasikan literasi digital dan pengembangan karakter Islami. Metode pelaksanaan terdiri atas tiga tahap: perencanaan, pelaksanaan, dan evaluasi. Pelatihan dilaksanakan selama dua hari, peserta diajarkan konsep dasar Python seperti sintaks, variabel, dan tipe data menggunakan platform W3Schools. Pemahaman siswa diukur melalui latihan membuat program penghitung luas bangun datar. Hasil evaluasi menunjukkan tingkat antusiasme yang signifikan dari seluruh peserta (20 siswa), sekaligus membuktikan efektivitas pendekatan pembelajaran terstruktur berbasis materi interaktif dalam pengenalan konsep pemrograman dasar di jenjang SMP. Kegiatan ini memperlihatkan potensi Python sebagai alat pembelajaran untuk mendukung pendidikan digital yang beretika dan relevan dengan tujuan pendidikan nasional.

INTRODUCTION

Digital competencies have evolved in the twenty-first century into foundational abilities that every student must acquire to thrive in an increasingly technology-driven world. From basic digital literacy to advanced computational thinking, the ability to navigate and create within digital environments is no longer optional (Ferrari, 2013; OECD, 2019). Educational institutions are adapting their teaching strategies to meet these evolving demands by integrating programming and digital tools into their curricula. Among the various programming languages used in education, Python has emerged as one of the most accessible, flexible, and widely adopted for teaching coding to beginners (Lye & Koh, 2014; Sentance et al., 2019).

Muhammadiyah Al Mujahideen Islamic Junior High School is among the progressive Islamic educational institutions in Indonesia that are embracing the challenge of equipping students for the digital age while maintaining a strong foundation in moral and religious values. By integrating Python-based coding instruction, the school creates a unique opportunity to bridge technical proficiency with Islamic character-building. This initiative aligns with Indonesia's national education goals (Ministry of Education and Culture, 2020) and the Muhammadiyah vision of producing ethical, creative, and capable contributors to society.

Digital competency encompasses more than just the ability to operate digital devices. It includes a broad range of knowledge, skills, and attitudes required to use digital technologies effectively and responsibly. The European Commission's Digital Competence Framework (DigComp) outlines five key areas: information and data literacy, communication and collaboration, digital content creation, safety, and problem-solving (Carretero et al., 2017). These competencies are vital for students to engage in critical thinking, solve real-world problems, collaborate in digital spaces, and generate meaningful content.

One of the most effective ways to develop these competencies is through coding instruction, which fosters logical reasoning, perseverance, creativity, and innovation. Coding transforms students from passive users of technology into active creators (Grover & Pea, 2013). Learning programming languages like Python enables students to engage directly with the technologies that power modern systems—from websites and apps to artificial intelligence and data analytics (Wilson et al., 2010). Python is particularly well-suited for educational settings due to its simple and readable syntax. Unlike more complex programming languages, Python helps students to focus on problem-solving

and algorithmic thinking without being overwhelmed by technical details (Tioh et al., 2018). It also supports multiple programming paradigms—procedural, object-oriented, and functional—making it a versatile tool that grows with the learner's skill level. Its practical applications in areas such as machine learning, automation, and data science further enhance its value for students' future careers (Shah et al., 2021).

At Muhammadiyah Al Mujahideen Islamic Junior High School, the integration of Python-based coding is not merely a technical upgrade but a strategic educational innovation. As students engage more deeply with digital tools, schools must equip them not only with usage skills but also with the ability to use technology ethically, creatively, and purposefully. Coding classes provide a platform to nurture 21st-century skills—the 4Cs: communication, collaboration, critical thinking, and creativity—while reinforcing Islamic values such as discipline, patience, problem-solving, and perseverance (Trilling & Fadel, 2009).

Additionally, incorporating coding into the curriculum supports student-centered learning. Python projects can be tailored to reflect students' interests and real-life contexts, from developing educational apps and interactive quizzes to simple games. This project-based learning approach enhances engagement, makes learning more meaningful, and builds confidence through tangible achievements (Thomas, 2000). Moreover, it encourages collaboration and communication among students, which are essential skills in both academic and professional environments (Bell et al., 2010).

Numerous studies show that early exposure to programming positively impacts students' academic outcomes and career aspirations. Students introduced to coding at a young age demonstrate greater confidence in STEM subjects and are more inclined to pursue technology-related careers (Code.org, 2020; Sentance & Csizmadia, 2017). For Muhammadiyah Al Mujahideen students, this exposure offers both a competitive advantage in the job market and a foundation for responsible digital citizenship. It also helps foster a growth mindset, encouraging students to embrace challenges, persist through difficulties, and continuously improve their problem-solving abilities (Dweck, 2006).

Furthermore, Python instruction enables interdisciplinary learning. Students can apply programming skills to various subjects—building programs that analyze Quranic text patterns, simulate scientific experiments, or solve mathematical equations. This cross-curricular integration not only demonstrates Python's versatility but also reinforces its relevance across academic disciplines (Henderson et al., 2021). It fosters

computational thinking, a problem-solving process that can be applied beyond computer science and is essential for success in science, mathematics, and even the humanities (Grover & Pea, 2013). Moreover, integrating programming into diverse subjects enhances student engagement, encourages creative exploration, and supports the development of 21st-century skills such as critical thinking and adaptability (Trilling & Fadel, 2009).

Despite its advantages, implementing a Python coding program at the junior high school level does present challenges. These include curriculum development, teacher training, infrastructure readiness, and diverse student backgrounds. Teachers must possess both programming knowledge and effective pedagogical techniques to engage young learners (Barr & Stephenson, 2011). Schools need to ensure access to computers and internet connectivity while creating an inclusive and supportive learning environment. Curriculum designers must align content with national education standards and make it accessible and engaging for students at varying levels of tech literacy. Considering the importance and challenges of learning Python, we decided to take action by conducting a Python coding training program for students at Muhammadiyah Al Mujahideen Junior High School to support their understanding of Python programming.

METHOD

The method used to carry out this community service activity followed the model proposed by Romantica et al. (2025) and Dja'wa et al. (2024), which consists of three stages: planning, implementation, and evaluation. According to UNESCO (2002), planning stage is the initial and most crucial stage in community service. It involves identifying the target community, understanding their needs, and defining clear objectives. The planning phase also includes selecting appropriate methods, designing the materials or tools needed (e.g., training modules, presentations), and coordinating logistics such as time, place, and participants.

Bringle and Hatcher (1996) state that the implementation stage involves carrying out the planned activities. In the context of educational community service, this could include delivering workshops, providing training sessions, or facilitating group discussions. The team engages directly with participants, applying the planned content and strategies. After the service is delivered, evaluation is conducted to assess the effectiveness and impact of the activity. This can be done through participant feedback, reflections, surveys, or performance assessments. Evaluation also helps the service

providers identify areas for improvement and gather insights for future programs (Furco, 1996).

RESULTS AND DISCUSSION

Planning Stage

In the planning stage, the community service team visited Muhammadiyah Al Mujahideen Junior High School on 9 November 2024 and met the principal, Agus Suroyo, S.Pd.I., M.Pd.I. The purpose of this visit was to hold discussions with the principal and teachers to identify students' needs related to technology. After the meeting with the principal, a follow-up discussion was held with eighth-grade students. Based on these discussions, it was agreed to conduct coding instruction training using Python.

Figure 1. Meeting with the principal (Primary data, 2024)

Based on this agreement, the team prepared a PowerPoint presentation to be delivered to the students on Python-based coding instruction. Considering the time required for this community service activity, the implementation stage was scheduled over two days. This stage not only served to carry out the training but also functioned as an evaluation of the activity's outcomes and as a reflection for the team in planning future community service programs.

Implementation Stage

This stage was conducted in two days, that is on 12 and 13 November 2024. The activity with the opening speech by the principal to inform the students about the activity. After that, the material on Python-based coding instruction was delivered by Siti Hajar. Ridho Haikal assisted by operating and maintaining the PowerPoint presentation. The rest of the team supported the students when they needed help. The presentation began with an introduction to Python to provide students with general information about Python programming, including "PEP 8," the official style guide for Python code. This was followed by an introduction to the W3Schools platform, where students could access Python tutorials online. This platform was chosen because it offers simple and easy-to-understand instructions, making it suitable for beginners. The materials covered in the session included "Syntax," "Comments," and "Variables," which were presented in sequence.

Figure 2. Students listening to the introduction to Python programming (Primary data, 2024)

On the first day, the activity began at 9:00 AM and ended at 12:00 PM. After 50 minutes, there was a 10-minute break. The same schedule was applied on the second day of the activity. The presentation was delivered by Siti Hajar, and Ridho Haikal was responsible for operating and maintaining the PowerPoint presentation. The rest of the

team supported the students whenever they needed help. The presentation began with an introduction to the material that would be covered that day. The topics were “Data Types” and “Numbers.” The students were very enthusiastic while listening to the presentation.

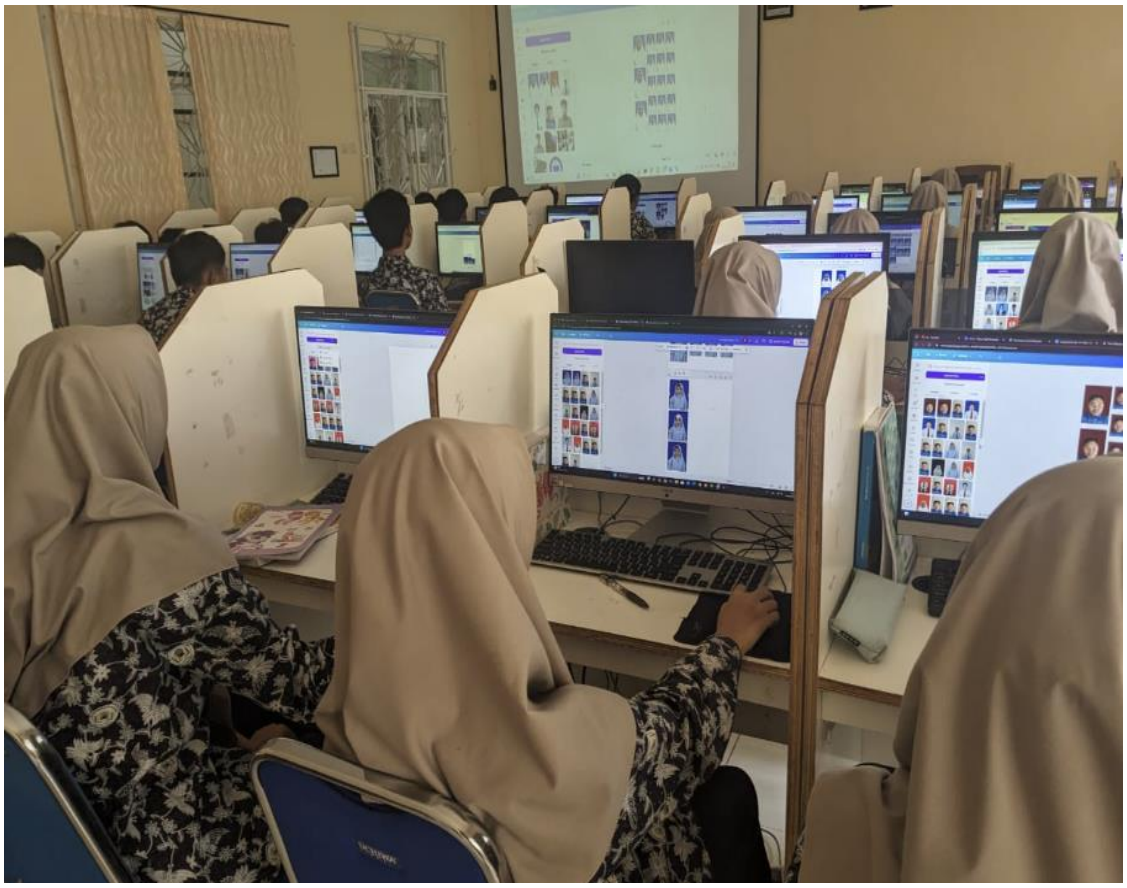

Figure 3. Students practicing python programming (Primary data, 2024)

Evaluation Stage

After the implementation stage was completed, it was followed by the evaluation stage in which performance assessments was conducted by assigning three tasks to the students: calculating the area of a triangle, the area of a rectangle, and the area of a circle. This activity was conducted to evaluate the students’ understanding of basic Python programming.

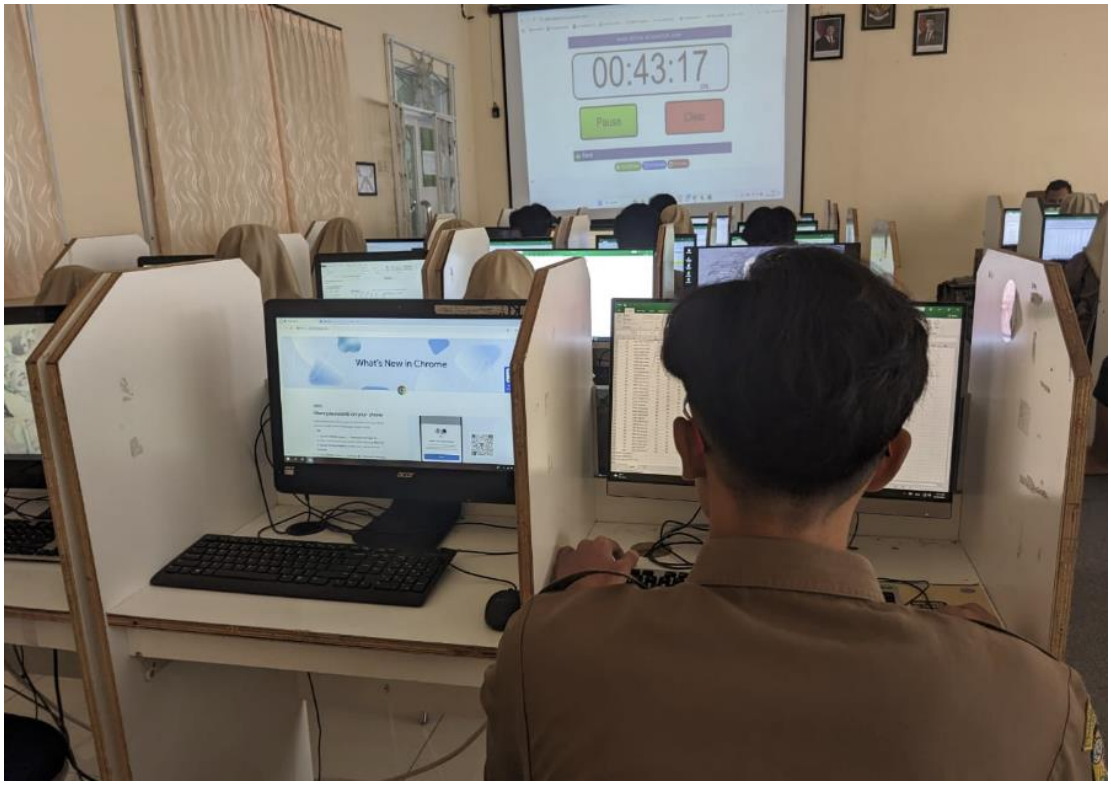

Figure 4. Students working on the tasks (Primary data, 2024)

There were 20 students who participated in this activity starting from the first day. Surprisingly, based on the task results, all students completed the assignments correctly. This indicates that introducing Python programming to junior students is possible, as long as teachers deliver the material in a way that is easy to understand.

CONCLUSION

In conclusion, this community service program showed that teaching Python coding to junior high school students is possible and practical. Using a three-step method—planning, implementation, and evaluation—the team successfully introduced basic Python programming at Muhammadiyah Al Mujahideen Islamic Junior High School. The students were very excited to learn, and all of them were able to complete the tasks correctly. The results of the activities showed that with clear materials, simple platforms like W3Schools, and helpful guidance, students could understand and enjoy learning to code.

In addition, this activity proved that digital skills could be taught while also supporting the school's Islamic values. The combination of technology and character education helps prepare students to become smart, ethical, and confident in using

technology. With more support and collaboration in the future, programs like this can reach more schools and help students prepare for the digital world.

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