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ENHANCING STUDENTS' DIGITAL COMPETENCIES THROUGH BASIC WEB TRAINING AT SMKS INDONESIA MEMBANGUN 1

Gilbert Fernando Situmorang[1]*, Sunaryo Winardi[1], Rivaldi Lubis[1], Nadya Sikana[1], Ronsen Purba[1]
[1]Universitas Mikroskil, Medan, Indonesia
*gilbert.situmorang@mikroskil.ac.id

Abstrak: Keterbatasan siswa SMKS Indonesia Membangun 1, khususnya program keahlian Teknik Komputer dan Jaringan (TKJ), dalam mengonversi pengetahuan pemrograman dasar menjadi artefak digital yang aplikatif menjadi latar belakang kegiatan ini. Pembelajaran yang berfokus pada sistem jaringan menyebabkan penerapan konsep pemrograman belum terintegrasi dengan kebutuhan pengembangan digital. Kegiatan pengabdian masyarakat ini bertujuan untuk menjembatani kesenjangan tersebut melalui pelatihan pengembangan antarmuka web berbasis HTML dan CSS. Program dirancang dengan pendekatan Participatory Action Research (PAR) yang mencakup analisis kebutuhan, perancangan pembelajaran, pelaksanaan pelatihan tatap muka, dan evaluasi. Sebanyak 55 siswa berpartisipasi dalam program. Evaluasi kuantitatif dilakukan melalui pre-test dan post-test menggunakan 10 soal objektif pada platform Kahoot!, dengan analisis data secara deskriptif berdasarkan skor total dan jumlah jawaban yang benar. Skor Kahoot! merepresentasikan akurasi dan kecepatan jawaban. Capaian praktik dievaluasi melalui produk antarmuka web sederhana yang dikembangkan oleh siswa dalam siklus PAR. Hasil menunjukkan peningkatan kompetensi yang signifikan. Rerata skor peserta meningkat dari 2.041,91 menjadi 4.828,78, dan rerata jawaban benar meningkat dari 2,91 menjadi 5,98 dari 10 soal. Meski efektif, evaluasi berbasis daring menghadapi kendala teknis seperti ketergantungan pada koneksi internet. Oleh karena itu, disarankan agar kegiatan serupa di masa depan mengembangkan instrumen penilaian yang kompatibel dengan pembelajaran luring serta mempertimbangkan pendekatan low-code/no-code sebagai strategi pedagogis inklusif untuk memfasilitasi beragam tingkat kesiapan siswa dalam menghasilkan artefak digital.

Kata Kunci: desain web, keterampilan digital, kurikulum independen, teknologi

Abstract: The limitations of SMKS Indonesia Membangun 1 students, particularly those in the Computer and Network Engineering (TKJ) program, in converting basic programming knowledge into applicable digital artifacts served as the background for this activity. Learning focused on network systems has resulted in the application of programming concepts not being integrated with digital development needs. This community service activity aims to bridge this gap by providing training in developing HTML- and CSS-based web interfaces. The program was designed using a Participatory Action Research (PAR) approach that included needs analysis, learning design, face-to-face training implementation, and evaluation. A total of 55 students participated in the program. Quantitative evaluation was conducted through pre-tests and post-tests using 10 objective questions on the Kahoot! platform, with descriptive data analysis based on the total score and the number of correct answers. The Kahoot! score represents the accuracy and speed of answers. Practical achievements were evaluated through a simple web interface product developed by students in the PAR cycle. The results showed a significant increase in competency. The average score of participants increased from 2,041.91 to 4,828.78, and the average correct answer rate increased from 2.91 to 5.98 out of 10 questions. Although effective, online-based evaluations face technical challenges such as dependence on an internet connection. Therefore, it is recommended that similar activities in the future develop assessment instruments that are compatible with offline learning and consider low-code/no-code approaches as inclusive pedagogical strategies to facilitate diverse levels of student readiness in producing digital artifacts.

Keywords: web design, digital skills, independent curriculum, technology

Introduction

Established in 1996, SMKS Indonesia Membangun 1, located in Medan, North Sumatra, is a highly regarded vocational institution, as evidenced by its "A" accreditation. The school has embraced the Kurikulum Merdeka, a flexible learning framework, and currently serves 327 students across 13 study groups (Dapodik, 2025). The Computer and Network Engineering (TKJ) program stands out as a key specialization. Supported by 22 dedicated educators and a robust infrastructure including 23 classrooms, a library, and specialized laboratories, the school is well-equipped for technology-driven instruction (Dapodik, 2025).

Despite the school's strong infrastructure and well-structured curriculum, preliminary discussions with the institution revealed a gap between students' exposure to foundational programming concepts and their ability to produce practical digital artifacts, particularly simple web interfaces. Instructional activities tend to emphasize conceptual understanding of hardware and networking systems, while structured opportunities for applied web development remain limited. This condition reflects a broader challenge in vocational education (Somantri & Pramudita, 2024), where the transition from theoretical knowledge to industry-relevant practical competence is not always fully realized. Without targeted intervention, students may develop conceptual familiarity without achieving the applied skills necessary for authentic digital production contexts.

The curriculum at SMKS Indonesia Membangun 1 is designed to provide students with essential competencies in information technology and computer networking. While Grades X and XI follow the Kurikulum Merdeka, Grade XII still uses the 2013 Curriculum. Grade X focuses on foundational subjects such as network engineering, basic computer and networking concepts, and basic programming. Grade XI builds on this with more complex technical skills such as wired and wireless network technology, network planning, and administration. For Grade XII, the curriculum delves into advanced topics, including network infrastructure and system administration. The school's excellent facilities, particularly its computer laboratory and stable internet, position it to integrate technology effectively and support innovative digital programs.

SMKS Indonesia Membangun 1 aims to enhance its professionalism and accountability, becoming an internationally recognized center for competency development. Technological proficiency is crucial for this goal, as it's vital for students' academic and professional success (Rahmatika et al., 2021; Rodrigues et al., 2021). The Kurikulum Merdeka emphasizes integrating information and communication technology to boost digital literacy (Paidi et al., 2020; Voutama et al., 2022). In line with this, the Indonesian government has implemented policies to ensure equitable access to the internet and educational resources, thereby strengthening digital skills and contributing to economic, educational, and social progress (Mali et al., 2023).

Among digital skills, web development is highly relevant to global industry standards (Bhattacharya & Rakshit, 2024; Golchevskiy & Yermolenko, 2023). To achieve its mission, the school must strengthen technology skills that align with industry needs. A basic understanding of HTML and CSS is fundamental for web application development (Gor, 2023). These languages are

relatively easy for students to learn, serving as an ideal entry point into web development. This not only fosters logical thinking and creativity but also provides a base for further development in both front-end and back-end programming (Kushwaha & Gupta, 2024; Widjaja et al., 2023).

Previous digital literacy and introductory web training initiatives in vocational education have largely focused on tool exposure or creativity-oriented workshops (Rahmawati, et al. 2025). While such programs contribute to awareness and engagement, many lack a structured participatory framework combined with measurable evaluation mechanisms to assess competency development. Training activities are often demonstration-based, with limited alignment to contextual institutional needs. In contrast, the present program adopts a Participatory Action Research (PAR) framework that grounds instructional design in stakeholder-identified needs, integrates professional development tools, and employs pre– and post–assessments to evaluate learning gains systematically. This approach enables a more rigorous measurement of competency improvement while ensuring contextual relevance to vocational learning environments.

Given the identified gap between conceptual programming exposure and applied web development competence, a targeted instructional intervention is needed to strengthen students' practical digital skills. This community engagement program was therefore designed as a structured response to bridge that gap through foundational HTML and CSS training. Beyond enhancing general digital literacy, the program specifically aims to develop students' ability to design and implement simple web interfaces as tangible demonstrations of industry-relevant competence. Through practice-oriented, face-to-face instruction supported by measurable evaluation, the intervention seeks to transform foundational knowledge into applied skills that better prepare students to participate in digital work environments.

Method

This community engagement study employed a Participatory Action Research (PAR) framework to enhance vocational students' digital competencies through foundational training in HTML and CSS. PAR was selected to ensure that the intervention was context-driven, collaborative, and systematically evaluated through measurable learning outcomes. The methodological structure followed four PAR cycles: Initial Reflection/Diagnosis, Planning, Action, and Observation/Reflection (see Figure 1).

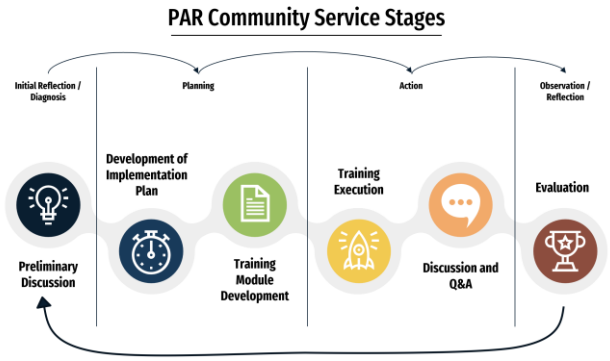

Figure 1. Community service implementation stages

Initial Reflection / Diagnosis

The diagnostic phase involved a structured consultation between the Universitas Mikroskil PKM team and the principal of SMKS Indonesia Membangun 1 to identify instructional needs and contextual constraints. The discussion focused on evaluating alignment between the existing Computer and Network Engineering curriculum and students' applied digital competencies. This participatory assessment revealed limited exposure to practical web development tasks despite their relevance to vocational digital literacy. The findings from this phase established the instructional focus and ensured that the intervention addressed authentic institutional needs.

Participants and Context

The intervention involved 55 vocational students enrolled in the Computer and Network Engineering track. Participants were selected through purposive sampling based on their relevance to the training objectives and prior exposure to foundational computing subjects. The training was conducted face-to-face in the computer laboratory of Universitas Mikroskil on May 23, 2025, using a structured one-day schedule that integrated instruction, guided practice, and evaluation.

Planning

The planning phase translated diagnostic findings into a structured instructional design. Training objectives, learning sequence, and evaluation procedures were defined to support measurable competency development. Instructional materials were curated from established beginner-oriented web development resources, specifically W3Schools and GeeksforGeeks, chosen for their clarity and suitability for introductory HTML and CSS learning. Coding activities were implemented in Visual Studio Code, a lightweight development environment well-suited to instructional settings for its efficiency and accessibility (Tan, Chen, & Jiao, 2023; Uzayr, 2022). The instructional sequence followed a scaffolded structure consisting of conceptual explanation, demonstration, guided coding practice, and independent task completion. Training modules emphasized practical implementation of page structure, text formatting, image embedding, hyperlinking, button creation, and basic styling.

Action

The action phase consisted of instructor-led training sessions emphasizing experiential learning. Students engaged in demonstrations followed by collaborative coding exercises designed to reinforce conceptual understanding and procedural fluency. Interactive discussion supported clarification and peer learning. Following guided activities, students completed independent web interface tasks that required the use of HTML and CSS elements. These tasks functioned as behavioral demonstrations of applied competence and prepared participants for formal evaluation.

Observation/Reflection

The observation phase emphasized systematic measurement of learning outcomes through quantitative assessment. Pre-test and post-test scores were compared descriptively to

identify changes in participant performance following the intervention. The analysis focused on summarized differences in scores and correct responses. The session concluded with an informal reflective discussion intended to reinforce key concepts and address student questions. This phase completed the PAR cycle by linking measured outcomes with participant reflection.

Instruments

The study employed a quantitative assessment instrument consisting of a structured pre-test and post-test administered via Kahoot! platform. Each assessment included ten objective questions designed to measure conceptual understanding of HTML and CSS elements introduced during training. Performance metrics included response correctness and response performance, as recorded by the platform.

Kahoot! uses a weighted scoring system that combines response accuracy and response speed. Correct answers are awarded points scaled according to how quickly participants respond relative to the question timer, with up to 1000 points available per correctly answered item. As a result, total participant scores exceed the range of a conventional percentage-based scale and represent a composite measure of correctness and response efficiency rather than a 0–100 grading system. The platform provides detailed scoring documentation (Kahoot: How Points Work, 2025).

The pre-test established baseline knowledge, while the post-test measured immediate learning gains following instruction. Comparative analysis focused on differences in total scores and correct responses to evaluate instructional effectiveness.

Results and Discussion

The training intervention was delivered in a structured, face-to-face format designed to support progressive learning and measurable evaluation (see Figure 2). The session began with an initial diagnostic pre-test to establish participants' baseline understanding of web development concepts. This was followed by an instructor-led instructional segment introducing foundational HTML and CSS elements, including page structure, text formatting, image embedding, and basic styling. Demonstrations were integrated with guided practice to reinforce conceptual understanding and procedural application.

Figure 2. Lecture and hands-on training sessions on HTML and CSS

After the instructional phase, participants completed an independent practical exercise in which they applied the concepts presented to create a simple web interface. A post-test was

then administered to measure learning gains relative to the initial assessment. The session concluded with an informal reflective discussion to reinforce key concepts and clarify student questions.

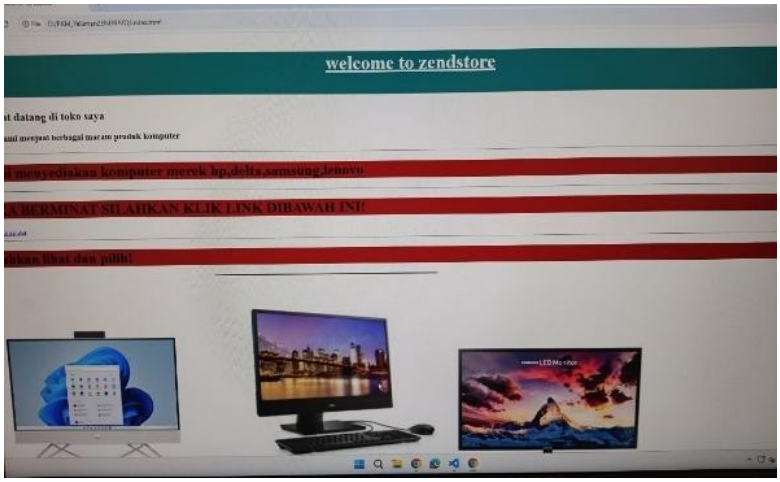

Figure 3. Exercise Results from One of the Participants Created Using HTML and CSS

Evaluation was conducted using a quantitative approach involving pre-test and post-tests, each comprising ten questions administered through Kahoot! platform. The assessment mechanism combined accuracy and response speed, with higher scores awarded to participants who answered correctly in the shortest time, fostering both engagement and comprehension.

The analysis revealed a significant improvement. Based on pre-test and post-test from 55 participants, the average score increased from 2,041.91 to 4,828.78, while the average number of correct answers rose from 2.91 to 5.98 out of 10 questions. Total cumulative scores rose from 112,305 in the pre-test to 260,754 in the post-test (Table 1), indicating the effectiveness of the instructional method. Several participants demonstrated notable performance gains, including P25 (from 1,409 to 9,264) and P27 (from 1,371 to 8,138), both of whom achieved perfect scores on the post-test (Figure 4).

Table 1. Pre-test and Post-test results of PKM Participants

Statistic	Pre-test		Post-test	
	Score	Correct Answer	Score	Correct Answer
Total	112305	160	260754	323
Average	2041,909	2,909	4828,778	5,981

The initially low pre-test performance reflects limited prior exposure to structured web development concepts, consistent with the needs assessment that identified a gap between general digital familiarity and applied HTML–CSS skills. The intervention directly addressed this gap through scaffolded instruction and guided practice, enabling participants to translate conceptual explanations into executable tasks. The use of Kahoot! as a gamified assessment tool likely contributed to engagement and attentional focus, encouraging rapid feedback cycles and reinforcing learning during the session. In a vocational context, such gamified environments can lower cognitive barriers, promote active participation, and sustain motivation, which are critical for skill acquisition.

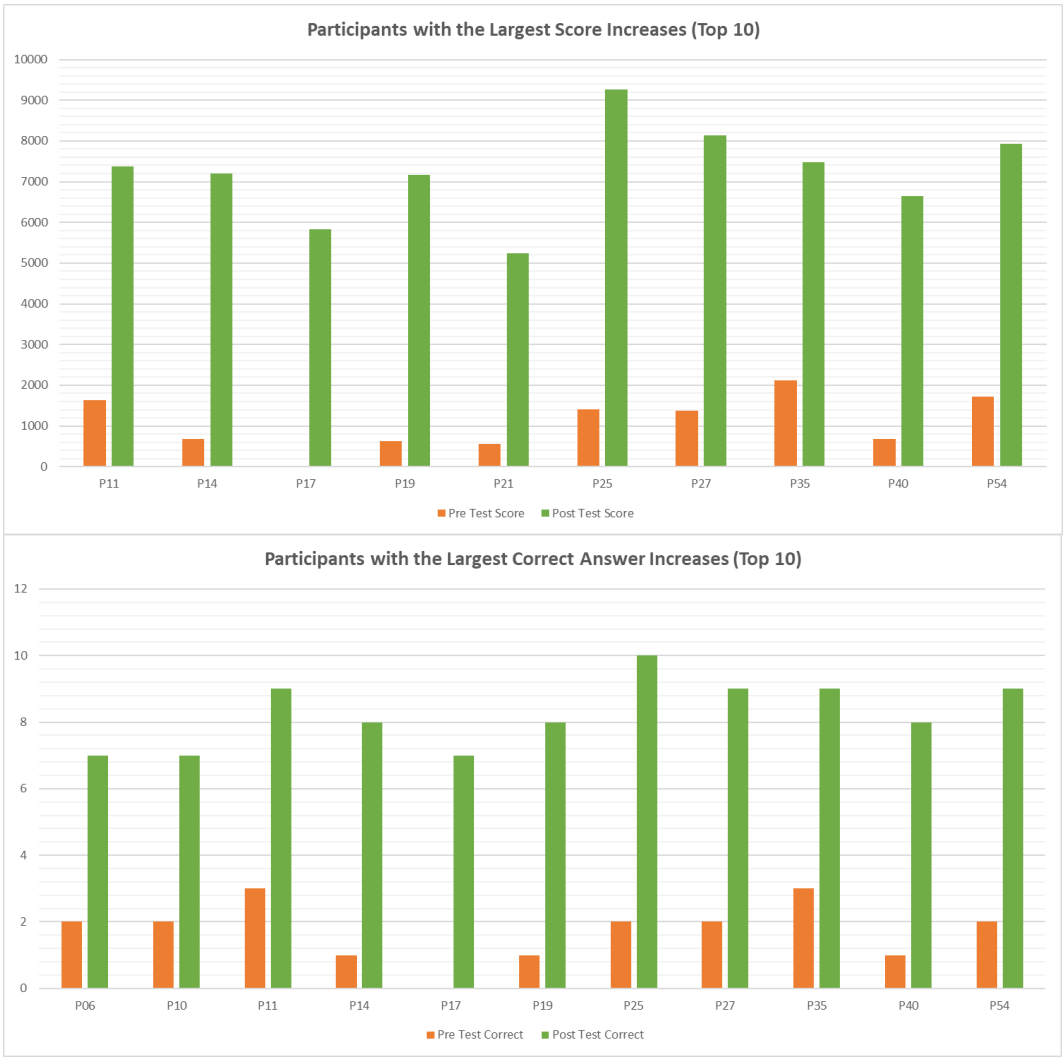

Figure 4. The increase in participants' performance based on the results of the pre- and post-test

From the partner institution's perspective, the substantial improvement in participants' test scores and practical competencies affirms the effectiveness of the training in meeting institutional objectives. The outcomes indicate that the program successfully addressed identified skill gaps in web development. Moreover, the partner expressed interest in continuing similar capacity-building initiatives to enhance students' digital proficiencies further. Such ongoing efforts are considered essential to align with the institution's strategic vision of producing graduates who are competitive in the global digital economy and responsive to evolving industry demands.

The findings of this study are consistent with recent community service programs that have introduced HTML and CSS training to novice learners at all educational levels in Indonesia. (Putra et al., 2025) trained vocational students to create landing pages using HTML, CSS, and Bootstrap, resulting in increased digital motivation and design proficiency. However, their study did not include a quantitative assessment to measure learning gains, limiting the evaluative depth of the intervention. Similarly, Alghifari et al. (2023) reported 100% improvement in competency among senior high school students following structured HTML training using a

classroom action research approach. Yet, the study primarily emphasized creativity without integrating interactive or gamified assessments. Meanwhile, Amandha et al. (2024) delivered a one-day offline workshop for university students that successfully led to the creation of responsive websites. However, the absence of pre/post testing and long-term performance tracking constrained its evaluative scope. In contrast, the present study introduced not only structured HTML and CSS training but also integrated quantitative pre-test and post-tests using Kahoot!, enabling measurable documentation of learning gains while maintaining a hands-on instructional approach.

Positive outcomes of this community service initiative underscore the importance of sustaining and expanding digital literacy programs, particularly in web development. While the current training focused on foundational coding using HTML and CSS, future programs should incorporate accessible, no-code platforms such as Canva. With its intuitive drag-and-drop interface and responsive design capabilities, Canva can serve as a powerful tool for students to design functional and visually appealing web interfaces without requiring programming expertise (Canva, 2025).

Conclusion

This community service (PKM) program provides clear evidence that a short, practice-oriented intervention in HTML and CSS can substantially elevate students' basic web development competencies. Overall, the intervention effectively doubled students' mastery of fundamental web concepts. It successfully bridged the competency gap identified during the initial needs assessment, demonstrating the effectiveness of targeted, hands-on digital skills training. Beyond individual learning gains, the program generated a meaningful transformation for the partner school. Rather than serving as a standalone training activity, the program helped establish a foundational digital literacy framework that supports supplementary skill development for TKJ students. This framework enables the school to enrich students' digital competencies through cross-disciplinary exposure to web technologies, while remaining aligned with existing curricular structures and vocational orientations. To build upon this foundational framework and further its transformative impact, future implementations should adopt a more strategic pedagogical approach that moves beyond purely technical considerations. Positioning no-code and low-code platforms, such as Canva, as a pathway to fostering inclusive digital creativity would enable students from diverse backgrounds to participate in digital content creation. This natural extension of the program, when combined with foundational coding skills, would broaden access, foster creative expression, and enhance the long-term relevance of digital literacy within vocational education.

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