Attempt to Train Computational Thinking Skills Among Students of SMP Negeri 5 Indralaya Utara, Tanjung Baru Village: Introduction and Training on the Using of Basic Coding Through the Pictoblox 4.0 Application

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Abstract: Current technological developments require the education sector to engage in continuous innovation to advance the quality of future generations. Coding and artificial intelligence are forms of innovation that can be integrated into learning activities. To equip students with these skills, this community service program aims to introduce and train students in the use of simple block coding through the use of 4.0 applications. The training and community service activities were carried out over a period of 3 months with a target of 25 junior high school students in Tanjung Baru Village. The training was carried out through a series of activities, namely (a) conducting a preliminary test; (2) delivering material on the use of block coding for learning, the use of the Pictoblox 4.0 application, and the creation of simple games and chatbots; and (3) conducting a final test. The N-gain percentage result was 89.5%. This percentage is high, indicating that there is a significant effect on improving students' computational thinking skills. The implementation of this activity had a positive impact on the training participants. This is demonstrated by the evaluation results, which indicate that this community service activity will continue with other innovative activities. The implication of this community service activity is to provide innovative coding and artificial intelligence learning activities that are integrated into the curriculum.

Keywords: Basic Coding, Computational Thinking Skills, Training, Pictoblox 4.0 Application.

Introduction

Indonesia has focused on developing superior and competitive human resources to face global challenges, including in the digital field, through Law No. 59 of 2024 concerning the National Long-Term Development Plan (RPJPN). Digital capabilities are crucial in the era of the Fourth Industrial Revolution and Society 5.0, with technologies such as Artificial Intelligence (AI), big data, and the Internet of Things (IoT) increasingly being used in various sectors, including education. The use of technology in learning has a different impact on the quality of the teaching and learning process and the digital skills possessed by students(Aziza Syaila Amilyana et al., 2021; Patriot et al., 2023)

One way to improve digital skills is to strengthen digital literacy, coding, and artificial intelligence (AI) in primary and secondary education curricula (Guechair, 2024). This program aims to improve the competitiveness of Indonesian human resources at the global level and supports the acceleration of an inclusive and sustainable digital economy ecosystem.

21st century education requires students to face global challenges with critical thinking, creativity, communication, and collaboration skills. One sub-skill that can be taught to students is computational thinking. Computational thinking is a problem-solving skill that involves modeling and simulation to produce effective, efficient, and optimal solutions that can be implemented by humans or machines(Grover & Pea, 2013; Henderson et al., 2007). It includes logical, critical, and creative reasoning based on data, either independently or it includes logical, critical, and creative reasoning based on data, either independently or collaboratively (Marcelino et al., 2018).

Coding can be taught through various methods, including plugged coding, which utilizes computers and software; unplugged coding, which teaches programming concepts without using computers through physical activities, simulations, or games; and Internet-based coding, which enables learning through interactive online platforms with an Internet connection (Maqoqa, 2024). Based on these concepts, coding can be understood as the practice of programming computing devices that involves computational thinking and algorithms in the form of Internet-based, plugged, and unplugged coding (Mills et al., 2025).

Ogan Ilir Regency is one of the regencies in South Sumatra Province, Indonesia. SMP Negeri 5 Indralaya Utara is one of the schools in Ogan Ilir Regency that has an excellent school profile in the field of education, located in Tanjung Baru Village, Indralaya Utara District, Ogan Ilir Regency. This location was chosen by the proposing team because it is one of the villages supported by Sriwijaya University and the school is located approximately 5 km from Sriwijaya University, enabling the community service team to carry out activities intensively and continuously.

An analysis of the situation and issues faced by partners was conducted through field observations and interviews with the principal, teachers, and students at SMP Negeri 5 Indralaya Utara. Based on the results of observations based on student input regarding the admission system using the nearest domicile, most of the students attending this school come from the local area, namely, Tanjung Baru, Permata Baru, Tanjung Pering, and Timbangan Villages.

The fundamental problem faced by partners is the lack of coding and artificial intelligence learning in the curriculum or extracurricular school activities. In addition, learning minimally uses technology-based interactive media, making it less attractive to students. This has a direct impact on students' low creativity, learning motivation, and computational thinking skills. Another weakness identified is the lack of capacity to develop technology-based programs to improve students' critical thinking and independence skills.

On the other hand, the school showed openness and enthusiasm for collaboration by providing supporting facilities such as rooms, presentation equipment, and accompanying teachers for the implementation of activities. This strength can be utilized in the implementation of technology-based solutions. Based on the analysis results, partners have an urgent need for easy-to-use interactive learning media, simple coding training for students, and guidelines for teachers on the use of learning technology. The potential of partners will be further optimized if supported by training in the use of applications such as Pictoblox 4.0 and Blockly Games, which have been proven to train computational thinking skills through a fun, visual, and structured approach (Rosadi et al., n.d.; Suryawijaya et al., 2025).

The first problem is the low computational thinking skills of students, especially those in grade 8. With two sub-problems, namely declining motivation and cognitive abilities that are not maximally honed through effective strategies, the community service team offers a solution by implementing simple coding introduction and training through the Pictoblox 4.0 and Blockly Games applications, which are taken and adapted from the results of research and community service by the proposing team (Prahani et al., 2022; Wang et al., 2023)

The service team will use the Pictoblox 4.0 and Blockly Games applications, equipped with usage procedures in the teaching and learning process in the classroom to produce an enjoyable experience for students and have an impact on increasing student learning motivation and computational thinking (Yuana et al., 2025). Through the use of the Pictoblox 4.0 and Blockly Games applications, it is hoped that students can learn in a deep and enjoyable manner (Computational Thinking Training Using Pictoblox, 2021). Thus, the habit of using simple coding can have a positive impact on students' computational and critical thinking skills as a whole.

The second issue, the use of technology and the untapped potential of students and teachers in using updated learning support technology, can be overcome by transferring knowledge through the provision of guidelines for using Pictoblox 4.0 and Blockly Games (Paristiowati, n.d.). The application of training with a variety of updated technologies in teaching allows teachers to develop their skills according to the needs of

the class and the students (Akhsan & Ariska, 2025; Marcelino et al., 2018).

This community service activity directly supports efforts to improve the quality of human resources and strengthen the capacity of partner schools through technology integration in learning. The focus of the activity, which is on training in the use of simple coding using the Pictoblox 4.0 application, is in line with the strategic direction of producing a young generation that is adaptive to technological developments, creative, and has critical and computational thinking skills. This training aims to introduce and utilize simple block coding through the Pictoblox 4.0 application to train students in computational thinking.

Method

The introduction and training in this series of community service activities used a participatory empowerment method with knowledge transfer involving the community service team and students. The method used in this community service activity is Participatory Action Research (PAR). This method is a learning approach to overcoming problems that arise in the community and producing knowledge, as well as encouraging social change (Suhendar et al., 2021). The stages or steps in implementing community service activities are as follows: (1) socialization, (2) training and mentoring, (3) technology application, (4) evaluation, and (5) sustainability of the community service program (Yuana et al., 2025).

The community service activity was attended by 25 students who are eighth graders at SMP Negeri 5 Indralaya Utara, Tanjung Baru Village. The community service activity was conducted face-to-face three times in the computer laboratory of SMP Negeri 5 Indralaya Utara from September to November 2025. The community service activity aimed to train students' computational thinking through the introduction and use of simple block coding in Pictoblox 4.0. The detailed series of training activities is presented below.

Needs Analysis and Initial Preparation

The series of community service activities began with observations and interviews with partners, in this case, SMP Negeri 5 Indralaya Utara. Observations and interviews were conducted to determine the initial conditions of learning at SMP Negeri 5 Indralaya Utara, especially the use of learning media. Based on the results of interviews conducted with the principal, teachers, and students, several problems were identified, namely the lack of coding and artificial intelligence learning and the low level of computational thinking among students. The results of this initial identification and observation

will be used to provide interventions tailored to the needs of partners in the introduction and use of simple block coding through the Pictoblox 4.0 app.

Development and Implementation of Simple Block Coding Through Pictoblox 4.0

The series of training activities continued with the design and development of simple block coding to be implemented in learning activities (Vico et al., 2019). In developing the use of block coding, several prototypes were produced, including character movement animations, simple chatbots, and interactive games. The utilization of simple coding blocks was developed through the Pictoblox 4.0 application, which is a block-based visual programming platform designed to help children and beginners learn coding, robotics, and artificial intelligence (AI) in a fun manner. The development of simple block coding involved a community service team consisting of lecturers as the implementing team, students, and ICT teachers (Kakavas & Ugolini, 2019; Paristiowati, n.d.). This was done to ensure that the block coding to be used was indeed needed and was in line with the material contained in the Merdeka curriculum.

Introduction and Utilization of Pictoblox 4.0 for Students

The core of the training and community service activities was carried out through the introduction and utilization of Pictoblox 4.0 for eighth-grade students at SMP Negeri 5 Indralaya Utara. This training was conducted in several sessions covering (1) presentation of material on the use of block coding for learning; (2) use of the Pictoblox 4.0 application; (3) creation of simple games and chatbots. All materials were delivered by respective resource persons from the community service team. Following the presentation of materials, the next step involved guiding students to create coding and artificial intelligence projects in the form of animated products that could be simulated by other students.

Assistance and Application of Simple Block Coding Through Pictoblox 4.0

Guidance on coding usage was provided over a period of two weeks, both offline and online. The purpose of this guidance was to assist students in developing simple block coding according to their creativity. The service team and students also provided space for students to consult on the block coding products they developed if they encountered problems and were unable to run them on their own. Students who revised their block coding prototypes were directed to give individual presentations.

Mentoring activities are expected to foster creativity, innovation, computational thinking, critical

thinking, and a high level of curiosity. This step received a positive response from the training participants because they were given convenience through the mentoring activity. Block coding products can also be maximized so that they can be utilized by students and ICT teachers at school. The output of this activity is the documentation of the implementation and a video of the PKM activity.

Implementation of Service Activity Evaluation

The evaluation activity was conducted after mentoring and implementing simple block coding using Pictoblox. This series of activities was carried out to obtain feedback from students as training participants on the implementation of service activities. Students were also given a final test as a form of evaluation of their computational thinking skills after receiving three months of training at SMP Negeri 5 Indralaya Utara. The final test, administered via Google Forms, consisted of 15 questions covering coding materials, technical usage, and the benefits of implementing simple coding. An evaluation questionnaire was also administered to the students to determine the impact, sustainability, and depth of the simple block coding training program at SMP Negeri 5 Indralaya Utara. The questionnaire consisted of 15 statements presented through Google Forms and accessed by the students as training participants.

Continuity of Community Service Programs at SMP Negeri 5 Indralaya Utara

The continuity of the training program is realized through communication with partners so that the use of simple coding through the Pictoblox 4.0 and Blockly Games applications in learning can be developed in line with the advancement of science and technology in the digital era. It is hoped that the use of simple coding will not stop when the program ends. This program can be continued by the school as a strategy to train students in computational thinking for other levels, namely grades 7 and 9. When SMP Negeri 5 Indralaya Utara is ready to share with other teachers outside the school, holding training sessions in KKG or MGMP forums can also be a means of continuing the program so that it can continue to be beneficial.

Result and Discussion

Technological developments have created opportunities for educational innovation, whether in the form of content, learning media, evaluation tools, or other devices (Saqjuddin et al., 2025). Based on SDG 4, which is quality education, it is clear that the current urgency is to improve learning at every level of schooling in every region that can be reached to have a direct impact. Based on current issues, Sriwijaya University, as one of the institutions that plays a role in providing a direct impact on educators and students in schools, especially at the secondary level, is committed to this cause.

SMP Negeri 5 Indralaya Utara is one of the schools in Ogan Ilir Regency with an excellent school profile in the field of education, located in Tanjung Baru Village, Indralaya Utara District, Ogan Ilir Regency. This location was chosen by the proposing team because it is one of the villages supported by Sriwijaya University, and the school is located approximately 5 km from Sriwijaya University, enabling the community service team to carry out activities intensively and continuously.

Community service activities will be held from September 9 to October 31, 2025, at SMP Negeri 5 Indralaya Utara, Tanjung Baru Village. The participants in this training activity were 25 eighth-grade students. Community service activities begin with an opening ceremony attended by the community service team, school officials, the local education office, students, and teachers.

Pre-Test Administration by Training Participants After

The opening ceremony, the students filled out a pre-test provided via Google Forms, which they accessed independently. The test consisted of 15 multiple-choice questions. This pre-test was conducted to assess the students' computational thinking skills before they received training on the use of simple block coding through the Pictoblox 4.0 application. The activity is showed from this figure below.

Figure 1. Participants taking the pre-test in the computer lab.

Presentation of Material by the Community Service Team

The material was presented by each member of the community service team. The material presented included an introduction to coding and artificial intelligence for Level D, the use of coding to create chatbots and simple games through Pictoblox 4.0, and hands-on practice using Pictoblox 4.0 to produce prototypes. One of the materials is shown in Figure 2.

Figure 2. Training Materials on Artificial Intelligence and Coding

Students also received materials on how to use the Pictoblox 4.0 application, which was installed offline in the form of an apk on each computer. Pictoblox 4.0 is a block-based programming application designed for beginners, especially children, to learn coding interactively. This application allows users to easily create games, animations, and projects involving robotics, artificial intelligence (AI), machine learning (ML), and the Internet of Things (IoT) using a drag-and-drop interface. Pictoblox 4.0 is presented in Figure 3.
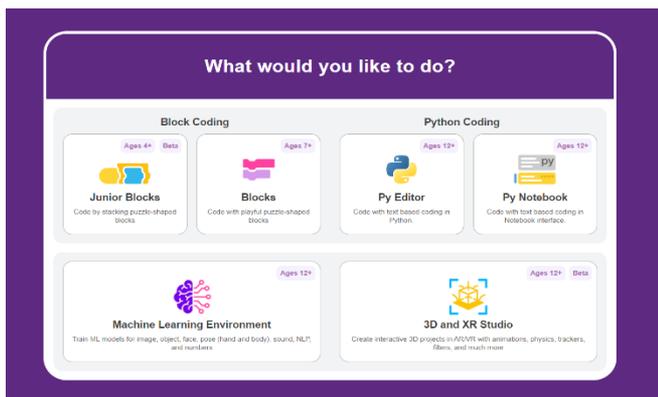

Figure 3. Opening display of the pictoblox 4.0 application for simple block coding

The delivery of the material went smoothly, and students actively asked many questions in an interactive manner, motivating them to try out the application that would be used. This is also supported by the fact that learning using media can increase student activity and curiosity and make classes more interactive (Falcão & de França, 2021).

Mentoring Training Participants in Chatbot and Simple Game Development

Individual students were given three weeks to develop training products in the form of chatbots and simple games using Pictoblox 4.0. This activity can be carried out using gadgets, laptops, or computer labs. The mentoring of training participants is intended to provide consultation to students so that they can develop prototypes to their full potential, as follows:

This mentoring and consultation are carried out alternately for students who have difficulties developing simple chatbots and games. The mentoring was conducted on October 22, 2025, at SMP Negeri 5 Indralaya Utara, Tanjung Baru Village. The students responded positively to this series of training activities because it provided convenience and space to consult the community service team. The training mentoring is shown in Figure 4.

Figure 4. Assisting Students in the Computer Laboratory

Individual students successfully created prototypes after three months of training and mentoring. These results were presented and discussed by members of the community service team. The simple games created are shown in Figure 5.

Figure 5. Simple Game Products by Students at SMP Negeri 5 Indralaya Utara

Figure 6. Chatbot Products by Students at SMP Negeri 5 Indralaya Utara

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Other products were demonstrated through the results of a simple chatbot by embedding ChatGPT as a form of artificial intelligence integration through Pictoblox 4.0. The results of the simple games are shown in Figure 6.

Post-Test Implementation by Training Participants at SMP Negeri 5 Indralaya Utara

The training participants at SMP Negeri 5 Indralaya Utara took a final test in the computer lab. This was done to determine the improvement in students' computational thinking skills through training in the introduction and use of simple block coding with the Pictoblox 4.0 application. The final test consisted of 20 multiple-choice questions and was presented via Google Forms, which could be independently accessed by the training participants.

The data obtained will be processed using the N-Gain analysis technique to determine the improvement in the computational thinking skills of the training participants in general. A pre-test was administered before the training, and a post-test was administered after the student's received treatment through training and mentoring (Siahaan et al., 2024). The results of the initial and final tests obtained from the series of community service activities are shown in Figure 7.
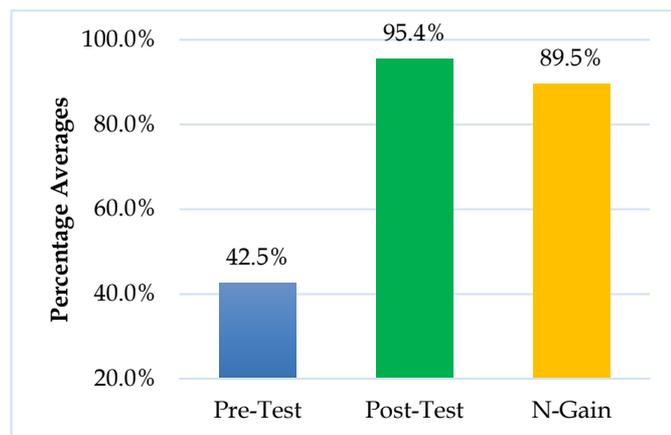

Figure 7. Average percentage of initial test and final test results

The percentage results above show that there was an increase in students' computational thinking skills after participating in a series of community service activities through the use of simple block coding. The average percentage for the initial test was 42.5%, which is considered to be low. This was because the students participating in the training had never received direct knowledge and practice in the use of block coding through Pictoblox 4.0.

The average post-test score was in the high category, at 95.4%, indicating that students had learned how to use simple coding blocks, as evidenced by their

improved individual computational thinking skills. The N-Gain percentage was also high at 89.5%. This percentage indicates a significant effect on the improvement of students' Computational thinking skills.

Computational thinking skills are understood as the ability to solve problems through reasoning and analysis, as well as systematic steps that must be applied early on to improve intelligence (Muliyati et al., 2020; Zakwandi & Istiyono, 2023). Another definition considers computational thinking skills as the ability to think in terms of problem solving, system design, and structured analysis (Atmojo et al., 2024). Thus, computational thinking is not only a technical skill but also a systematic way of thinking in dealing with various problems.

The success of computational thinking in students can be seen from their ability to utilize tools such as Pictoblox 4.0 and artificial intelligence tools to solve problems, design systems, and perform systematic analyses (Peea et al., 2024). The use of these two tools develops students' critical and logical thinking skills in facing learning challenges. Students not only search for information or complete tasks, but are also trained to think analytically, design solutions, and develop ideas systematically through the features available in the app.

Evaluation and Sustainability of Community Service Activities at SMP Negeri 5 Indralaya Utara, Tanjung Baru Village

The evaluation of community service activities was reviewed through the implementation of a series of activities compiled from questionnaires submitted via Google form. The questionnaire consisted of ten statements measured using a Likert scale. The results of the questionnaire are presented in Figure 8.
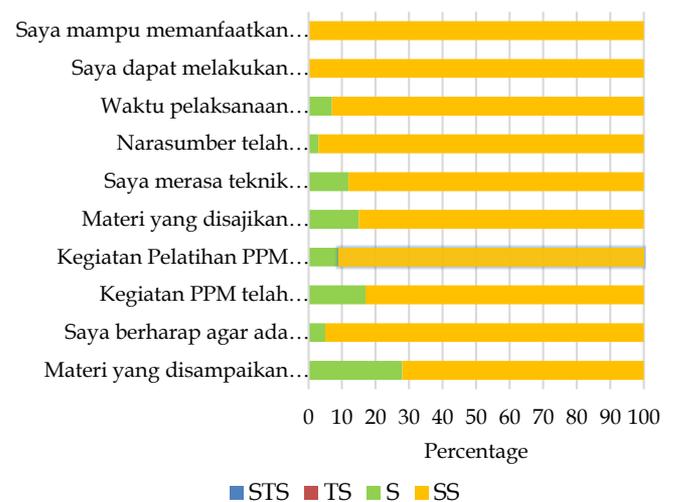

Figure 8. Students responded about training activities

Based on the graph above, the training participants felt that the material presented was very useful and relevant to the current needs of students. The participants felt that this training and service helped them use the Pictoblox 4.0 application, which is the basis for them to tackle technology and informatics subjects in grade VIII. This has become the basis for improving students' computational thinking skills through the use of simple coding. This activity is a necessity for teachers and students at SMP Negeri 5 Indralaya Utara to organize similar activities to advance the quality of education in Ogan Ilir Regency.

Conclusion

The series of activities for introducing and training the use of simple block coding through the use of the Pictoblox 4.0 application consisted of (1) conducting a preliminary test; (2) delivering material on the use of block coding for learning, the use of the Pictoblox 4.0 application, and the creation of simple games and chatbots; and (3) conducting a final test. The N-gain percentage result was 89.5%. This percentage is high, indicating that there is a significant effect on improving students' computational thinking skills. The training participants responded positively to the series of community service activities and provided a basis for the community service team to carry out sustainable community service at SMP Negeri 5 Indralaya Utara by organizing similar activities or other forms of innovation to advance the quality of education in Ogan Ilir Regency.

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