Jurnal Pengabdian UNDIKMA:
Jurnal Hasil Pengabdian & Pemberdayaan kepada Masyarakat
https://e-journal.undikma.ac.id/index.php/jpu/index
Email: pengabdian@undikma.ac.id

Vol. 6, No. 2 (May 2025)
E-ISSN : 2722-5097
Pg : 320-328

21st Century Critical Thinking Skills Training for Early Childhood Education Teachers Using Computational Thinking Principles

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Abstract: This community service program aims to guide early childhood education teachers in integrating Computational Thinking (CT) principles into classroom learning using English as the language of instruction. The implementation method of this community service activity consisted of workshops and mentoring sessions. The target participants of this program were PAUD teachers at PPT Mutiara Bunda Ondomohen Surabaya. The data collected through observation sheets and documentation was analyzed to know teachers' ability to incorporate CT principles into teaching and implement them in the classroom. The results of this community service program indicated an improvement in teachers' teaching skills through their efforts to integrate critical thinking skills and CT principles into the learning process.

Article History:
Received: 24-03-2025
Reviewed: 28-04-2025
Accepted: 07-05-2025
Published: 25-05-2025

Key Words:
Critical Thinking Skills; Early Childhood Education Teachers; Computational Thinking.

How to Cite: Haryanto, J. (2025). 21st Century Critical Thinking Skills Training for Early Childhood Education Teachers Using Computational Thinking Principles. *Jurnal Pengabdian UNDIKMA, 6*(2), 320-328. doi:https://doi.org/10.33394/jpu.v6i2.15358

https://doi.org/10.33394/jpu.v6i2.15358

Introduction

In this 21st century, where the rapid advancement of time is evident, the use of technology has been increasing in human life. Technology has developed rapidly to help humans accomplish various tasks in their daily lives. Therefore, in the future, humans are expected not only to be able to use technology but also to manage and create technology (Kumala et al., 2023). As a result, individuals are required to possess various skills, including communication, collaboration, critical thinking, and creativity (Jufriadi et al., 2022). One of the efforts to develop 21st-century skills is by implementing the concept of Computational Thinking (CT).

CT is a fundamental part of analytical skills and can be equated with the ability to read, write, and count. CT helps individuals solve problems in a different way—by using computational concepts, which means thinking like a computer (Bers et al., 2019). Thus, the implementation of CT develops the ability to break down problems, analyze data, develop solutions, and evaluate results using programming and technology principles (Harjanto et al., 2024). These CT skills should be developed from an early age so that as children grow, they will be able to face increasingly complex challenges in the future.

In line with the needs of CT implementation, the Ministry of Education and Culture has integrated CT as a new competency in the nationally implemented education curriculum named Freedom Curriculum or *Kurikulum Merdeka* (Kepmendikbudristekdikti, 2022). Although CT is not explicitly mentioned in the legislation, the government has established policies regarding technology education starting from Early Childhood Education or *Pendidikan Anak Usia Dini* (PAUD) (Kemendikbudristek, 2022). The policy states that one of the subject areas in PAUD learning under Freedom Curriculum is the gradual and

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enjoyable introduction to the use and development of technology in daily life. The integration of technology in PAUD learning is reflected in one of the learning outcomes which focuses on literacy and STEAM (Science, Technology, Engineering, Arts, and Mathematics).

The use of technology is inevitably linked to the use of foreign languages, especially to enhance literacy. One of the most commonly encountered foreign languages as the primary medium in technology is English (Anggraini et al., 2022), as it is an international language. Therefore, children are expected to develop proficiency in English in their daily lives, especially during classroom activities. In this regard, teachers play a crucial role in guiding children to familiarize themselves with and apply technology while also mastering English as the language of instruction.

In its implementation, the use of English as the language of instruction in PAUD requires engaging learning methods that make the experience enjoyable for students while also fostering their confidence, motivation, and creativity (Amelia, 2021). Similar to the introduction of CT, the introduction of English language should begin at an early age. Being exposed to English from an early stage, children can develop their language skills more easily as they grow older, especially when they get into elementary school, junior and senior high school, or higher education levels. Students who have been taught English early tend to be able to acquire English better than those who do not get any exposure (Jazuly & Ahmad, 2016). Furthermore, Sukmawati & Sabillah (2020) states that children who master a foreign language have an advantage in terms of intellectual flexibility, academic skills, language proficiency, and social abilities.

To teach the young learners both technology and English, teachers must be aware of the variations of the learning methods that encompass all aspects of development. For example, PAUD teachers can incorporate various media engage children and spark their interest in learning English as media plays a crucial role in determining the success of teaching and learning (Resmini et al., 2021). There are three integrated functions of learning media, such as providing stimulation to spark children's interest in learning, acting as a bridge between teachers and students, and serving as a source of information that enhances the teacher's explanation (Aji, 2018). One of the most essential and effective learning media for child development is the use of Educative Game Tools or *Alat Permainan Edukatif* (APE) found in the child's surroundings. The use of APE serves as an effective medium for improving children's language and communication skills, including speaking, writing, and listening to the teacher's instructions. Additionally, APE plays a significant role in stimulating children's creativity, introducing syllables, and expanding their vocabulary (Apsari et al., 2020).

Based on the explanation above, this program aims to improve PAUD teachers' knowledge and skills in implementing the principles of CT in classroom learning while simultaneously using English as the language of instruction. The partners in this community service activity are four PAUD teachers at PPT Mutiara Bunda Ondomohen Surabaya who manage 14 PAUD students in the school. Initial interview conducted before the training sessions highlighted how the teachers acknowledge the importance of CT skills for today's students. They also admitted to having a limited understanding of CT concepts and skills, as well as insufficient English proficiency. They expressed a strong need for guidance to equip their students with the necessary knowledge and skills. This community service program is expected to address the needs and high enthusiasm of the four PAUD teachers PPT Mutiara Bunda Ondomohen Surabaya in developing their CT and English language skills.

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Method

This community service program adopts a descriptive qualitative approach, aiming to gain a comprehensive understanding of events experienced by the subjects involved in the program, including actions, motivations, perceptions, and behaviors. These aspects are described in words and sentences based on natural contexts using various reasonable methods (Sugiyono in Anggraini & Sriemulyaningsih, 2024). The method implemented in this community service program is training, following a structured and systematically organized series of activities (Figure 1).

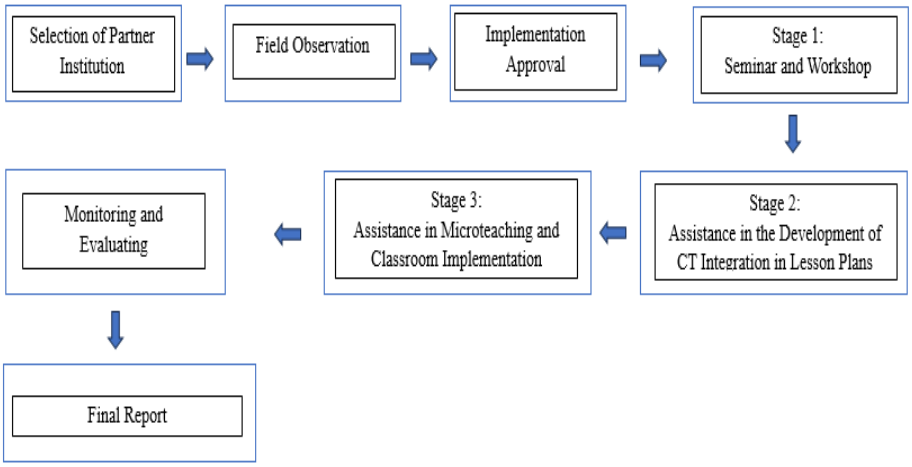

Figure 1. Stages of the Community Service Program

The stages mentioned above are described as follows:

1) Selection of Partner Institution:
   The partner school was initially selected based on a database of nearby early childhood education (PAUD) institutions identified as requiring support.
2) Field Observation:
   Once the partner school was selected, the writer and team conducted an initial visit to PPT Mutiara Bunda Ondomohen Surabaya to establish communication and carry out preliminary interviews with the teachers. During the interviews, the teachers were asked about their background knowledge of Computational Thinking (CT) principles which are considered essential and advantageous for PAUD students. The writer also began observing the school environment, including the available teaching and learning media supporting the classroom activities.
3) Implementation Approval:
   In the same meeting with the school principal and the area coordinator, the writer explained the overall program plan and obtained formal permission to carry out all 3-stage activities according to the agreed schedule.
4) Stage 1 (Meeting 1): The writer and team conducted the workshops and mentoring sessions.
5) Stage 2 (Meeting 2-7): The writer and team monitored and assisted the development of CT integration in lesson plans.
6) Stage 3 (Meeting 8): The writer and team evaluated the micro teaching (teaching demonstration) and classroom implementation.
7) Monitoring and Evaluating:

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Throughout the program, the writer was monitoring and assisting the teachers' progress in implementing CT principles into the teaching and learning activities, while simultaneously using English as a language of instruction. The writer also conducted interviews with the teachers. At the end of the training session, the teacher also evaluated the teachers' teaching demonstration based on the constructed lesson plans.

This community service activity was conducted for eight sessions with four PAUD teachers working in PPT Mutiara Bunda Ondomohen Surabaya. Through the interviews, the writer collected the teachers' perspectives and experiences in understanding and implementing CT principles into the classroom. The interview questions focused on how the teachers comprehend, practice, and reflect on the new teaching method with CT principles. Furthermore, observation sheets were used to document the teachers' practices and engagement throughout the workshops and mentoring sessions. Relevant documentations such as lesson plans, teaching materials, photos, and videos from the activities were also gathered to support data triangulation. All qualitative data were analyzed using a descriptive approach, where the information was categorized based on recurring patterns and themes related to the integration of CT principles, the development of critical thinking skills, and the use of English as a language of instruction. The findings were then interpreted to reflect the teachers' processes, including good practices and challenges in applying CT principles within the early childhood education context.

Result and Discussion

This community service activity was conducted for one month, from July 7 to July 31, 2024, and was held twice a week, on Mondays and Thursdays. The program took place at the Community Unit (RW) Hall of Kampung Ondomohen, Surabaya, which also serves as the learning center for PPT Mutiara Bunda. The activity was attended by four Early Childhood Education (PAUD) teachers. The training consisted of three important key stages administered for the participants. The first stage was to introduce the principles of Computational Thinking (CT) in learning through a seminar and workshop in the first session. The second stage involved mentoring teachers in integrating CT principles into lesson plans from the second to the seventh sessions. The third stage focused on guiding teachers through microteaching sessions and classroom implementation in the eighth session.

The preliminary interview showed the lack of understanding of CT concepts and skills, as well as limited English proficiency among teachers. These facts led to students' inability to master English. Additionally, this issue was also caused by the minimal use of learning media and the lack of teacher creativity in delivering lessons in the classroom. The available teaching and learning media was not regularly renewed and has been repeatedly used for the last few years. This aligns with the opinion of Suwartono & Purwokerto (2019) who stated that teacher creativity is a crucial factor in the success of English language learning. The three key stages of the activities are described in the following paragraphs.

In the first stage, the activity focused on introducing CT in PAUD teaching and learning. In the form of a seminar and workshop in the first meeting, the community service team explained the definition of CT, the four CT principles (Abstraction, Decomposition, Pattern Recognition, and Algorithms), and the importance of integrating CT into learning (Barr & Stephenson, 2011; Grover, 2020; Grover & Pea, 2013; Wing, 2006). While listening to the explanation, the participants showed great enthusiasm by actively taking notes and asking many questions related to CT skills as it was still a new concept to them.

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Figure 2. First Meeting (Seminar and Workshop on CT)

The second stage took place from the second to the seventh sessions, focusing on assisting the participants in developing lesson plans. During these sessions, the training did not only cover CT integration but also included guidance on creating Educative Game Tools or *Alat Permainan Edukatif* (APE) and delivering lessons using English as the language of instruction, all of which were interconnected and constructed in the lesson plans or *Rencana Pelaksanaan Pembelajaran* (RPP). In this training, the team designed seven APE based on themes from PAUD curriculum, ensuring that the created tools could be directly implemented in the classroom throughout one academic year.

During this activity, the participants remained enthusiastic, especially after creating the APE. The session was continued with guidance on delivering lessons in English in the classroom. Although some participants struggled at times to imitate the delivery of materials in English, they still smiled with satisfaction, showing their enjoyment of the training. In fact, some even brought their children along to the training sessions, hoping that their children would also benefit by learning new English vocabulary.

Figure 3. Second Meeting (Assistance in Developing CT Integration into Lesson Plans)

From the second to the seventh session, the teachers were guided in creating various APE, including *Style Imitation, Knowing Shape and Color, Brushing Teeth, Transport, Fruitful Tree, Animal Puzzle,* and *Magic Maze*. The materials and tools for making these APE were provided by the team, such as colorful heart foam sheets, cardboard, scissors, paper glue, double-sided tape, etc. The teachers showed great enthusiasm while creating different APE based on specific themes. In each session, they were guided to create one APE. For example, *Style Imitation* was made using digitally designed images that were printed and laminated.

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The process of making and playing APE *Style Imitation* involved teachers creating images of human body movements. Once the images were printed, children were asked to imitate the movements as in the pictures. The teachers worked together, discussing and supporting each other in creating these APE. The community service team did not only teach the teachers on how to create APE but also trained them on how to deliver lessons and use the APE in English. For instance, while using APE *Style Imitation*, teachers would show a picture of a person in motion and say phrases like *"Where's your left hand?"* or *"Raise your hands, both of your hands."*, etc.

Figure 4. Example of an Image in APE *Style Imitation*

At the third meeting, the team guided the teachers in creating the APE *Knowing Shape and Color*, which was made of colorful heart foam formed into various geometric shapes and equipped with dice made of cardboard then covered with heart foam and also covered with geometric shapes. The APE *Knowing Shape and Color* was played by placing the heart foam sheets with geometric shapes on the floor, then throwing the dice until it landed and showed the geometric shape. The teacher would then ask the children, *"What shape is this? What's the name of this shape?"* and encourage them to jump onto the matching geometric shape on the heart foam sheet. The same enthusiasm continued from the fourth to the seventh meeting. The teachers were highly engaged in the training sessions. In addition to learning how to deliver lessons in English, the team also introduced the CT principles embedded in each APE. For example, the APE *Style Imitation* incorporated several CT principles, including pattern recognition, abstraction, and algorithms.

Figure 5. Third Meeting (Assistance in using APE *Knowing Shape and Color*)

At the eighth meeting, the third stage was carried out involving assistance in microteaching and classroom implementation. The teachers were asked to select and use the APE they had created and implement them in the classroom using English as the language of instruction. In this stage, the team provided feedback on the results of the microteaching and classroom implementation.

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Figure 6. Eighth Meeting (PAUD Teachers implementing the CT and English Skills)

Overall, the results showed that the teachers were very creative in delivering lessons and understood the CT principles in the teaching and learning process. The one-month community service program achieved several key outcomes, including:

1) Teachers gained a better understanding of CT principles, which are useful for teaching children to think critically in solving everyday problems.
2) Teachers were enhanced in developing their creativity and skills in designing engaging APE for various themes.
3) Teachers' English proficiency was improved, particularly in delivering lessons, as a requirement of the 21st century.

At the end of the program, all the APE demonstrated by the writer and team were given to the PAUD teachers to be used by the school continuously. As the teachers were also given online teaching resources, they are able to continue exploring the implementation of CT principles to the teaching and learning activities as well as the use of English as a language of instruction and teaching media.

Conclusion

Based on the results presented above, it can be concluded that the community service activity in the form of 21st Century Critical Thinking Skills Training for Early Childhood Education Teachers using Computational Thinking Principles, which was conducted for a month with four participants from PPT Mutiara Bunda Ondomohen Surabaya, was successfully organized. The teachers responded positively to the program and appreciated the organizing team. Through the interviews, the teachers also show better understanding on the implementation of Computational Thinking (CT) principles through the use of APE and English as a language of instruction. The teaching demonstration evaluated at the end of the program also displayed the teachers' efforts in individually trying to conduct CT integrated teaching activities for the PAUD students. However, some challenges encountered during the training were particularly about the teachers' limited vocabulary in English which hindered the delivery of materials in English using the Educative Game Tools (APE) they had created. In line with the training objectives, it is hoped that teachers can enhance their creativity in developing APE, become familiar with CT, and deliver lessons in English as the language of instruction. This will help gain students' attention and improve their critical thinking skills.

Recommendation

With the program's success, future researchers and educators are suggested to provide more specialized advanced training, supporting collaboration between educators and relevant

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experts, and expanding access to resources and supporting materials to enhance the teachers' competencies. These include:

1) Organizing regular workshops: It is essential to hold training sessions regularly to update teachers' knowledge and skills while providing opportunities for experience-sharing.
2) Collaboration with experts: The involvement of experts and practitioners in Computational Thinking (CT) training programs is very useful to provide deeper insights and more effective strategies to support children in developing critical and innovative thinking skills to face 21st-century challenges.
3) Developing relevant materials: Training materials need to be up-to-date and relevant to the latest developments in the Early Childhood Education curriculum.

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