

Introducing Coding and Artificial Intelligence to Enhance Teacher Readiness at SDN Cibuntu 01

Dea Andini Andriati^{1*}, Tri Nur Arifin², Uus Rusmawan³

^{1,2,3}Universitas Dian Nusantara

Email: dea.andini.andriati@dosen.undira.ac.id

Received : 19-06-2026 Revised : 16-09-2026 Accepted : 01-10-2026 Published : 16-06-2026

Abstract

Rapid technological advances associated with the Fourth Industrial Revolution have heightened the need to cultivate digital literacy from the earliest stages of formal education. Coding and artificial intelligence (AI) are increasingly recognised as essential twenty-first-century competencies, making teachers' capacity to incorporate these technologies into instruction particularly important. At SDN Cibuntu 01 in Bekasi Regency, an initial assessment identified substantial readiness gaps: approximately 80% of participating teachers lacked a sufficient grasp of fundamental coding and AI concepts, while 90% had no prior experience using visual coding platforms or AI-supported educational tools. This community engagement programme sought to strengthen teachers' conceptual understanding, confidence, and pedagogical readiness to integrate coding and AI into classroom learning. It combined interactive training and workshops featuring unplugged activities with guided demonstrations of accessible AI tools. Post-test scores exceeded pre-test scores across all assessed dimensions. Participants also prepared draft lesson plans incorporating computational thinking, while the programme produced a practical guide entitled "Introduction to Coding and Artificial Intelligence for Elementary School Teachers" to support continued implementation. These findings indicate that combining unplugged learning with accessible AI tools can strengthen teachers' initial readiness for technology-enhanced instruction and generate practical resources that may be adapted by elementary schools facing similar circumstances.

Keywords: coding, artificial intelligence, unplugged activities, digital literacy, elementary school teachers

Introduction

The exponential development of technology in the era of Industry 4.0 and Society 5.0 has fundamentally reshaped global skills requirements. Digital literacy, computational thinking, and a foundational understanding of artificial intelligence (AI) are no longer optional advantages; they are increasingly essential competencies for individuals, including children in primary education. As integral components of twenty-first-century learning, these capabilities need to be cultivated early to prepare an adaptable and innovative generation (Grover & Touretzky, 2023).

Indonesia's educational policy, particularly the implementation of the Merdeka Curriculum, also recognises informatics and computational thinking as competencies to be introduced in primary education. Their practical integration into school-based learning, however, continues to depend on teachers' readiness to understand and apply relevant technologies. Technical proficiency alone is insufficient without the pedagogical expertise

required to align technology integration with learners' needs and intended learning outcomes (Tsortanidou et al., 2024). Consequently, teacher professional development must strengthen pedagogical capabilities alongside an informed understanding of the technologies employed in instruction (Yadav et al., 2023).

These challenges were evident at SDN Cibuntu 01, Bekasi Regency, the partner school involved in this community engagement programme. A preliminary assessment of 30 participating teachers indicated that approximately 80% had an inadequate understanding of fundamental coding and AI concepts, while 90% had never used visual coding platforms or AI tools to support classroom learning. These findings suggest that the school's needs extend beyond technological knowledge to encompass hands-on experience and pedagogical readiness for meaningful integration. The challenge is particularly pertinent where the availability and effective utilisation of technological facilities remain insufficient to support fully device-based learning. Under such circumstances, viable alternatives that do not rely entirely on computers are needed (Lodi et al., 2021; Putra et al., 2024).

Conventional technology training for teachers has often concentrated on proficiency with particular applications or digital devices. Such provision does not invariably create adequate opportunities to examine the underlying concepts or translate them into instructional planning. This points to the need for a professional development model that connects conceptual understanding with classroom practice. Unplugged activities offer a suitable approach because they enable coding and computational thinking concepts to be explored through accessible, hands-on tasks without direct reliance on computers. They are therefore also applicable in schools with limited technological infrastructure (Bell & Bunt, 2022; Lodi et al., 2021).

In response, the community engagement programme was designed to reinforce foundational coding and AI concepts through unplugged activities, introduce accessible AI tools, and support the preparation of lesson plans (Rencana Pelaksanaan Pembelajaran, RPP) incorporating computational thinking. Its contribution lies in enabling teachers not only to experience digital technologies but also to comprehend the concepts informing their use and translate these into instructional designs suited to primary education. To sustain the programme's benefits, a practical guide entitled "Introduction to Coding and AI for Elementary School Teachers" was developed and provided to the partner school for subsequent use. On this basis, the programme aimed to deepen teachers' understanding of coding and AI, strengthen their readiness and confidence to integrate these competencies into teaching, and provide practical experience through unplugged learning and accessible AI tools. It was anticipated that participants would be able both to recognise technologies relevant to teaching and to develop feasible, sustainable lesson plans aligned with their school's circumstances.

Method

The community engagement programme was conducted at SDN Cibuntu 01, Jl. Raya Setu No. 9, Cibuntu, Cibitung District, Bekasi Regency, West Java. It involved 30 teachers, including classroom and subject teachers, most of whom had backgrounds in primary teacher education (PGSD) or disciplines outside information technology. The programme was delivered in partnership with PT Linkdataku Solusi Indonesia under Universitas Dian Nusantara's Early-Career Community Engagement Scheme.

The programme adopted a collaborative, participatory approach. Facilitators guided the activities, while teachers actively engaged in learning, practical exercises, discussions, and

evaluation. Its guiding structure was the Pedagogical Framework for Introducing Coding and AI through Unplugged Activities and Accessible Tools. This framework was intended to contextualise foundational coding and AI concepts while reducing dependence on computer-based resources.

Activities took place over four consecutive days, from 19 to 22 August 2025. Sessions ran from 08:00 to 17:00 on the first three days and from 08:00 to 15:30 on the fourth. Individual learning sessions lasted 45–180 minutes, equivalent to one to three instructional periods (JP), depending on the material and activity format. The programme comprised an initial assessment; foundational coding and computational thinking instruction; AI literacy and ethics; exploration of AI tools; pedagogical development for coding and AI; evaluation; and preparation of a follow-up action plan.

Table 1. Stages of Community Engagement Programme Implementation

No.	Programme Stage	Date and Duration	Main Activities	Outputs
1	Programme Orientation and Initial Assessment	19 August 2025; 90-minute pre-test	Coordination, programme orientation, and administration of the pre-test	Baseline assessment data and pre-test scores
2	Foundational Coding and AI Training	19–20 August 2025; 45–180 minutes/session	Introduction to computational thinking, algorithms, sequences, loops, AI concepts, AI literacy and ethics; unplugged exercises	Understanding of coding and AI concepts and experience of unplugged activities
3	Technology Application and Exploration	21 August 2025; 90 minutes/session	Demonstrations and guided exercises using AI tools, chatbots, illustration generators, and ScratchJr	Experience exploring and using AI-related tools
4	Mentoring and Evaluation	21–22 August 2025	Mentoring, post-test, participant satisfaction questionnaire, and participatory observation	Post-test scores, satisfaction data, and observational findings
5	Programme Sustainability	22 August 2025	Preparation of follow-up actions, handover of the practical guide, and establishment of an online communication group	Practical guide, communication group, and follow-up action plan

Source: Community engagement programme implementation records, 2025.

Programme Orientation and Initial Assessment

The first stage took place on 19 August 2025. Following programme coordination and an orientation for participants, a 90-minute pre-test was administered from 11:15 to 12:45. The test comprised 100 multiple-choice questions designed to establish teachers' baseline

understanding of coding and AI. Before administration, the instrument had undergone review and validation by a team from the Ministry of Primary and Secondary Education (Kemendikdasmen). The principal output was a set of initial assessment scores documenting participants' knowledge before training.

Foundational Training in Coding and Artificial Intelligence

The second stage was conducted on 19–20 August 2025 through a series of sessions lasting 45–180 minutes each, or one to three instructional periods (JP). Topics included computational thinking as the foundation of coding, algorithms, sequences, loops, introductory AI concepts, and AI literacy and ethics.

Instruction was delivered interactively through presentations, discussion, simulations, and group work. Participants also undertook unplugged coding and AI exercises involving simulations and collaborative games, allowing them to practise algorithmic reasoning and computational thinking without computers. This stage was intended to develop conceptual familiarity with coding, computational thinking, and AI, together with practical experience of unplugged learning.

Technology Application and Exploration

The third stage was held on 21 August 2025. AI-tool exploration ran from 08:00 to 11:15, comprising 90-minute practice sessions with a coffee break. Further instruction on the pedagogy of coding and AI continued until 17:00.

Teachers were given opportunities to experiment directly with accessible digital tools relevant to primary education. Activities included using chatbots to generate story ideas, image-generation tools to create illustrations, and the visual coding platform ScratchJr. These hands-on exercises were facilitated by the community engagement team. The principal outcomes were direct experience with AI-related tools and an understanding of their potential as supplementary instructional resources.

Mentoring and Evaluation

The fourth stage comprised mentoring throughout the training programme and a final evaluation. Evaluation activities included a post-test, a participant satisfaction questionnaire, and participatory observation.

The post-test contained 100 multiple-choice questions intended to examine changes in teachers' understanding following the programme. The pre-test and post-test covered four domains: (1) understanding coding concepts, (2) understanding AI concepts, (3) skills relating to unplugged activities, and (4) the ability to use AI tools. Both instruments had undergone review and validation by the Kemendikdasmen team before use.

Correct responses were scored, and results were converted to a 0–100 scale. The satisfaction questionnaire elicited participants' views of programme delivery, while participatory observation documented teachers' engagement and performance during practical activities. Outputs included post-test scores, participant satisfaction data, and observational evidence of engagement and practical skills.

Programme Sustainability

The fifth stage was conducted on 22 August 2025 and focused on the final evaluation and preparation of a follow-up action plan. To support continuity, the facilitators provided the school with the practical guide “Introduction to Coding and AI for Elementary School Teachers”. A WhatsApp discussion group was also established to facilitate communication between the teachers and the community engagement team after the formal programme ended. Outputs comprised the guide, the online communication group, and a follow-up plan intended to support sustained application of the training within the school. The guide was also documented as a tangible programme deliverable.

Programme data were collected through pre-tests, post-tests, participant satisfaction questionnaires, and participatory observation sheets. The pre-test and post-test each comprised 100 multiple-choice questions addressing coding concepts, AI concepts, unplugged activities, and the use of AI tools. Both instruments underwent review and validation by the Kemendikdasmen team before administration. Scores were converted to a scale of 0–100.

Programme outcomes were evaluated by comparing mean pre-test and post-test scores to describe changes in participants’ understanding before and after training. These results were supplemented by participatory observation and satisfaction questionnaire data to provide further information on programme implementation.

Results

The community engagement programme, entitled “Introducing Coding and Artificial Intelligence to Teachers at SDN Cibuntu 01, Bekasi Regency”, was delivered over four days, from 19 to 22 August 2025, at SDN Cibuntu 01. Thirty teachers participated. Activities progressed from an initial assessment to foundational coding and computational thinking instruction, AI concepts and literacy, ethical considerations surrounding AI, unplugged learning exercises, exploration of AI tools, evaluation, and preparation of a follow-up action plan.

Programme delivery combined conceptual instruction, discussion, practical exercises, and technology exploration. This combination was designed to offer learning experiences that extended beyond conceptual understanding and enabled teachers to practise applying coding and AI within instructional settings. The integration of knowledge development with pedagogical practice is also consistent with the emphasis placed on teacher professional development for educational technology and AI integration by Yadav et al. (2023).

Attendance was not uniform across the four-day programme. Although 30 teachers were registered, some were unable to attend particular days or sessions. This variation matters when interpreting outcomes because participants did not receive identical exposure to instructional content and practical activities. Programme achievement was consequently considered in relation not only to attendance but also to assessment changes, engagement during training, and the deliverables produced.

An evaluation was undertaken to describe changes in participants’ understanding after training. A pre-test was administered before instruction, followed by a post-test at the end of the programme. The 100-item multiple-choice assessment addressed four domains: coding concepts, AI concepts, unplugged activity skills, and the ability to use AI tools. Scores were converted to a 0–100 scale.

Mean scores increased across all assessed domains. Table 2 presents the pre-test and post-test results.

Table 2. Participants' Pre-test and Post-test Results

Assessment Domain	Mean Pre-test Score (%)	Mean Post-test Score (%)
Understanding of Coding Concepts	24.3	82.7
Understanding of AI Concepts	21.5	79.8
Unplugged Activity Skills	18.7	80.3
Ability to Use AI Tools	15.2	76.5
Overall Mean	19.9	79.8

Source: Primary data, 2025.

As shown in Table 2, the overall mean score rose from 19.9 to 79.8, an increase of 59.9 points. Improvements were observed across all four domains. Higher scores for coding and AI concepts suggest gains in participants' understanding following training. These findings accord with Suryani et al. (2023) and Tsortanidou et al. (2024), who emphasise the importance of strengthening teacher competencies and embedding computational thinking in primary education.

The greatest improvement occurred in unplugged activity skills, with an increase of 61.6 points. This result supports the use of computer-free activities to introduce coding and computational thinking in an accessible and contextually meaningful manner (Alim et al., 2021; Syamsiah et al., 2024). The ability to use AI tools also improved by 61.3 points. Tool familiarisation extended beyond technical operation to address AI literacy and its appropriate use in educational settings, as emphasised by Grover and Touretzky (2023).

Programme Deliverables

Beyond the improvements in assessment scores, the programme produced the practical guide "Introduction to Coding and AI for Elementary School Teachers", a WhatsApp communication group, and a follow-up action plan. The guide provides a supporting resource for participating teachers, while the communication group and action plan are intended to facilitate continued implementation after training. Post-programme support is important for further developing acquired competencies and applying them in classroom settings (Yadav et al., 2023).

Overall, participants' assessment performance improved in coding concepts, AI concepts, unplugged activities, and AI-tool use. These outcomes should nevertheless be interpreted as improvements in post-training assessment scores, not as evidence that all participants attained full proficiency, particularly because attendance varied across sessions.

Discussion

The evaluation identified improvements across all assessed domains, with the overall mean increasing from 19.9% to 79.8%. These gains suggest that training combining conceptual instruction, practice, and technology exploration can strengthen teachers' foundational understanding of coding and AI. Nevertheless, the magnitude and implications of improvement differed across assessment domains.

Understanding of coding concepts increased from 24.3% to 82.7%, a gain of 58.4 percentage points. This improvement suggests that introducing algorithms, sequences, and loops through analogies and practical activities enabled teachers to understand coding as the

logical organisation of instructions, extending beyond the act of writing computer programmes. Such an approach is consistent with Lodi et al. (2021) and Tsortanidou et al. (2024), who emphasise concrete, contextual activities in developing computational thinking.

Understanding of AI concepts increased from 21.5% to 79.8%, representing a gain of 58.3 percentage points. Introducing basic AI concepts and examples from everyday life appears to have supported teachers' foundational understanding. However, conceptual familiarity must be accompanied by critical AI literacy so that teachers do not regard AI merely as a system that automatically generates information. Such literacy also requires awareness of AI's limitations, possible inaccuracies, and the ethical implications of its use (Grover & Touretzky, 2023; Sugiono, 2024).

Scores for unplugged activity skills increased from 18.7% to 80.3%, a gain of 61.6 percentage points and the largest improvement among the measured domains. This pattern suggests that computer-free activities can help teachers develop an experiential understanding of coding concepts before progressing to digital tools. It supports the use of unplugged learning as an accessible, context-sensitive introduction to computational thinking (Bell & Bunt, 2022; Lodi et al., 2021; Setiawan & Ringo, 2024; Syamsiah et al., 2024).

The ability to use AI tools increased from 15.2% to 76.5%, a gain of 61.3 percentage points. Despite this substantial increase, AI-tool use recorded the lowest post-test score among the four domains. This suggests that operational proficiency cannot be developed fully through short-term technical familiarisation alone; continued practice and mentoring are needed. Accordingly, AI use in primary schools should remain aligned with clearly defined learning objectives and guided by teachers.

This consideration is important because AI use in primary education entails more than operational competence: it also raises questions of ethics, data security, and appropriate boundaries of use. Teachers must ensure that pupils' personal information is not entered indiscriminately into AI services, that AI-generated material is checked before use, and that these systems do not displace teachers' own reasoning or pedagogical judgement. Teachers therefore retain responsibility for guiding, filtering, and validating AI-generated outputs. This perspective reflects the need for professional development that integrates technological proficiency with pedagogical judgement (Yadav et al., 2023), and accords with discussions of output evaluation, potential risks, and practical challenges associated with educational AI (Mukhlis, 2024; Sugiono, 2024; Supriyono et al., 2024).

Taken together, the outcomes point not only to improvements in technology-related competencies but also to the importance of preparing teachers to use coding and AI contextually, critically, safely, and responsibly. The practical guide and provision for continued mentoring offer mechanisms through which these competencies may be further developed and sustained (Yadav et al., 2023).

Conclusion

The community engagement programme at SDN Cibuntu 01, Bekasi Regency, was associated with improved participant assessment performance following training in coding and AI. The overall mean score increased from 19.9% at pre-test to 79.8% at post-test. Coding concept scores rose from 24.3% to 82.7%, AI concept scores from 21.5% to 79.8%, unplugged activity skills from 18.7% to 80.3%, and AI-tool use from 15.2% to 76.5%. These results indicate gains in the teachers' foundational knowledge and practical skills after the programme.

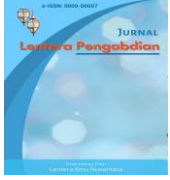
The programme's implications underscore the need to extend introductory coding and AI training through classroom-based mentoring in lesson-plan implementation, allowing acquired knowledge to be translated into practice. Teachers' AI-tool capabilities should also be developed progressively, with sustained attention to ethical use, data protection, information verification, and awareness of AI limitations. The practical guide and communication group established through the programme can serve as resources for continued professional development and post-training support.

Acknowledgements

The authors gratefully acknowledge the Research and Community Engagement Institute (LRPM) of Universitas Dian Nusantara for funding this programme through the Early-Career Community Engagement Scheme for the 2025/2026 fiscal year. Appreciation is also extended to the principal and all teachers of SDN Cibuntu 01, Bekasi Regency, for their active participation and valuable cooperation, and to PT Linkdataku Solusi Indonesia, the programme's institutional partner, for its support in implementing the activities.

References

- Alim, S., Purnomo, H., & Wardani, K. (2021). Pengembangan modul ajar koding berbasis unplugged activities untuk guru sekolah dasar. *Prosiding Seminar Nasional Pendidikan*, 2(1), 45–56.
- Bell, T., & Bunt, A. (2022). The role of unplugged activities in introducing computational thinking concepts to young children. *Proceedings of the 2022 ACM Conference on International Computing Education Research (ICER 2022)*, 423–432.
- Grover, S., & Touretzky, D. (2023). AI literacy in K-12: A review of competencies. *Proceedings of the 54th ACM Technical Symposium on Computer Science Education (SIGCSE 2023)*, 488–494.
- Lodi, M., Malchiodi, D., & Brinda, T. (2021). Unplugged activities: A literature review. *Informatics in Education*, 20(2), 291–316.
- Mukhlis, M. (2024). Persepsi guru terhadap pemanfaatan ChatGPT dalam mengembangkan soal literasi membaca: Studi kasus pada sekolah menengah di Provinsi Riau. *Jurnal Pendidikan dan Kebudayaan*, 9(1), 1–19. <https://doi.org/10.24832/jpnk.v9i1.4873>
- Putra, I. N., Santosa, R. H., & Yuliani, T. (2024). Efektivitas pengenalan konsep koding melalui aktivitas non-komputer pada siswa sekolah dasar di Indonesia. *Jurnal Pendidikan Informatika*, 8(1), 112–123.
- Setiawan, Y. A., & Ringo, S. S. (2024). Pengaruh kegiatan plugged dan unplugged terhadap berpikir komputasional murid SMP. *Jurnal Didaktika Pendidikan Dasar*, 8(3), 993–1014. <https://doi.org/10.26811/didaktika.v8i3.1680>
- Sugiono, S. (2024). Proses adopsi teknologi generative artificial intelligence dalam dunia pendidikan: Perspektif teori difusi inovasi. *Jurnal Pendidikan dan Kebudayaan*, 9(1), 110–133. <https://doi.org/10.24832/jpnk.v9i1.4859>
- Supriyono, A., Lesmono, A. D., & Prihandono, T. (2024). Dampak dan tantangan pemanfaatan ChatGPT dalam pembelajaran pada Kurikulum Merdeka: Tinjauan literatur sistematis. *Jurnal Pendidikan dan Kebudayaan*, 9(2), 134–152. <https://doi.org/10.24832/jpnk.v9i2.5214>

	<p align="center">JLP : Jurnal Lentera Pengabdian Volume 04 No 04 Oktober 2026 E ISSN:2985-6140</p> <p align="center">https://lenteranusa.id/</p>	
---	--	---

- Suryani, N., Widodo, S., & Sumarni. (2023). Kesiapan guru sekolah dasar dalam mengadopsi kecerdasan buatan untuk pembelajaran di era digital. *Jurnal Teknologi Pendidikan*, 11(2), 156–169.
- Syamsiah, N. O., Firmansyah, Y., Mustika, Y., Burhanudin, B., Gani, A., & Fitriani, N. (2024). Pengaruh edukasi unplugged coding terhadap kemampuan computational thinking anak usia sekolah dasar. *VOX EDUKASI: Jurnal Ilmiah Ilmu Pendidikan*, 15(2), 365–373. <https://doi.org/10.31932/ve.v15i2.4048>
- Tsortanidou, X., Karkaletsis, E., Fesakis, G., & Tsolis, D. (2024). Integrating computational thinking in primary education: A systematic literature review. *Education Sciences*, 14(1), 89.
- Wahyuni, S., Pratiwi, D. A., & Hidayat, R. (2022). Analisis persepsi dan kebutuhan guru sekolah dasar terhadap pelatihan koding dan kecerdasan artifisial. *Jurnal Pendidikan Dasar*, 13(2), 101–115.
- Yadav, A., Lindeman, D. A., Good, J., Voogt, J., & Fisser, P. (2023). Teacher professional development for AI in K-12 education: A systematic review. *Journal of Educational Computing Research*, 40(2), 299–325.