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Digital Technology Integration Training for Vocational Teachers in the Industry 4.0 Era: Evidence from Indonesia

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ABSTRACT

The rapid development of digital technology requires teachers, especially in vocational schools, to have competencies in integrating technology in the learning process. This community service activity aimed to enhance digital literacy and technology integration skills for teachers at SMKN 1 Kertajati, Majalengka Regency. The training was conducted on June 10-11, 2025, involving 45 teachers from various departments, including automotive engineering, computer network engineering, motorcycle engineering, textile engineering, and refrigeration engineering. The method used was participatory training with hands-on practice covering Learning Management System (LMS), digital content creation, interactive learning tools, and blended learning strategies. Pre-test and post-test results showed significant improvement in participants' digital competencies, with average scores increasing from 45.2 to 78.6 ($p<0.001$). All participants completed practical assignments and committed to implementing digital technology in learning. This activity demonstrates the effectiveness of comprehensive training in enhancing teachers' digital competencies in vocational education settings.

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INTRODUCTION

The era of the industrial revolution 4.0 has fundamentally changed the education paradigm, particularly in the context of vocational education, which is required to produce graduates ready to face the challenges of modern industry. Vocational High Schools (SMK) as educational institutions preparing skilled workers, face significant challenges in integrating digital technology into the learning process to meet the demands of the digital era (Rusli et al., 2020).

Research conducted by UNESCO (2022) shows that digital transformation in education has become an urgent need, yet 70% of teachers in developing countries still have limitations in using digital technology for learning. In Indonesia, a survey by the Ministry of Education, Culture, Research, and Technology (2022) revealed that only 35% of vocational school teachers have adequate digital competencies to integrate technology in learning, while the remaining 65% still require comprehensive digital capacity strengthening.

Current conditions show a significant digital gap between technological development and teachers' ability to utilize it. Cattaneo et al. (2022) in their research found that the majority of vocational school teachers still use conventional learning approaches even though adequate technological infrastructure is available at schools. This is caused by the lack of specific and practical training in integrating digital technology into the learning process.

SMKN 1 Kertajati, Majalengka Regency, is one of the vocational education institutions facing similar challenges. Based on initial observations conducted by the service team, this school has adequate technological facilities, but their utilization is not optimal due to teachers' limited digital competencies. Needs analysis shows that 78% of teachers at this school have never attended comprehensive and practical digital technology training.

The Technological Pedagogical Content Knowledge (TPACK) framework developed by Mishra and Koehler (2006) and updated by Valtonen et al. (2020) serves as the theoretical foundation for developing teachers' competencies in integrating digital technology. This model emphasizes the importance of balance between mastery of content, pedagogy, and technology to create effective learning. In the context of vocational schools, digital technology integration includes not only the use of learning tools but also understanding how technology can enhance practical learning in various fields.

Previous research shows the effectiveness of participatory training in enhancing teachers' digital competencies. Asghar et al. (2022) reported that training with a hands-on practice approach could increase vocational school teachers' digital competencies by up to 65%, while digital facilitator profiles are essential in managing digital transformation in vocational schools (Cattaneo et al., 2021). Furthermore, Rahmawati et al. (2022) found that training involving direct practice in creating digital content provided a positive impact on teachers' motivation in using technology.

The expected condition after this community service activity is the creation of enhanced digital competencies of SMKN 1 Kertajati teachers who are able to effectively integrate digital technology in learning across various vocational departments. The main target is for teachers to master the use of Learning Management System (LMS), be able to create digital learning content, implement blended learning strategies, and conduct digital assessments that are appropriate to the characteristics of their respective vocational subjects.

Based on the situation and needs analysis, the Study Program of Technology and Vocational Education, Graduate School, Universitas Pendidikan Indonesia, conducted a community service activity

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in the form of digital technology integration training in learning. The selection of participatory training strategies with a hands-on practice approach is based on its effectiveness in providing direct and practical experience to participants, so it is expected to enhance teachers' digital competencies and ultimately improve the quality of learning at SMKN 1 Kertajati.

METHOD

This community service activity used a participatory training method with a service learning approach that emphasized active participant involvement in the learning process and hands-on practice. The selected strategy referred to the Community-Based Research (CBR) model with a focus on empowering the teacher community through digital capacity building.

Involved Parties and Partnership Forms

This activity involved various parties in strategic partnerships: Universitas Pendidikan Indonesia as the expertise provider and training facilitator; SMKN 1 Kertajati as the main partner and provider of participants and facilities; the Education Office of Majalengka Regency as the party providing policy support; and the Vocational School Teacher Community as a peer support system. The partnership form built was collaborative with the principle of mutual benefit, where each party contributed according to capacity and benefited from this activity.

Place and Time of Activity

The community service activity was conducted on June 10-11, 2025, at SMKN 1 Kertajati, Majalengka Regency, West Java, with a duration of 16 intensive learning hours. The location selection was based on coordination results with the Education Office of Majalengka Regency and needs analysis that had been identified through preliminary surveys.

Participants and Selection Criteria

Training participants consisted of 45 teachers selected through purposive sampling based on the following criteria: civil servants or permanent teachers at SMKN 1 Kertajati; having high motivation to develop digital competencies; representing various departments in the school; and willing to attend training for 2 full days. The distribution of participants included: Light Vehicle Engineering (12 teachers), Computer and Network Engineering (10 teachers), Motorcycle Engineering (8 teachers), Textile Engineering (7 teachers), Refrigeration and Air Conditioning Engineering (5 teachers), and general subject teachers (3 teachers).

The sample size of 45 participants was determined based on maximum capacity considerations for effective hands-on training with a trainer-to-participant ratio of 1:15, ensuring each participant received adequate individual attention during practical sessions. This sample size also ensured representation from all major vocational departments at the school.

Training Design and Stages

Training was designed using the ADDIE model (Analysis, Design, Development, Implementation, Evaluation) with the following stages:

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Stage 1: Needs Analysis (Pre-Training). An online survey using Google Forms was conducted to identify initial digital competency levels; a Focus Group Discussion (FGD) with teacher representatives and the school principal; and an analysis of available technological infrastructure at the school.

Stage 2: Training Implementation. Day one focused on mastering digital technology basics with sessions on: (1) Introduction to digital technology in education and the TPACK framework, (2) Learning Management System using Google Classroom, (3) Digital tools for learning (Google Workspace, Canva, Flipgrid, Padlet), and (4) Creating learning videos with screen recording and simple editing. Day two emphasized advanced applications with sessions on: (1) Interactive learning and gamification (Kahoot, Quizizz, Mentimeter), (2) Blended learning and flipped classroom, (3) Digital assessment using Google Forms and digital rubrics, and (4) Preparation of implementation action plans.

Stage 3: Evaluation and Follow-up. Comprehensive evaluation used a mixed methods approach combining quantitative and qualitative data.

Data Collection Techniques and Analysis Tools

Data were collected through several instruments: Pre-test and Post-test using instruments adapted from the DigComp framework with 25 question items ($\alpha = 0.89$; CVR = 0.78); Practice assessment rubric with 6 assessment aspects using a 1-4 scale ($\alpha = 0.85$); Participant satisfaction questionnaire with 15 Likert scale items 1-5 ($\alpha = 0.92$); Action plan assessment using 8 evaluation criteria ($\alpha = 0.81$); Photo documentation of activities to support learning process analysis.

Quantitative data were analyzed using a paired sample t-test to test the significance of competency improvement, while qualitative data were analyzed descriptively to provide a comprehensive picture of training effectiveness. SPSS version 28 software was used for statistical analysis, while Atlas.ti was used for qualitative data analysis. Instrument validity was tested through expert judgment by 3 educational technology experts, while reliability was tested using Cronbach's Alpha. All instruments had good validity and reliability levels for use in this research.

Ethical Considerations

This community service activity followed ethical principles of educational research. Written informed consent was obtained from all participants, and confidentiality of personal data was maintained throughout the study. Participation was voluntary, and participants were free to withdraw at any time without consequences. The activity received approval from the school principal and the Education Office of Majalengka Regency. All data collected were used solely for training evaluation and academic publication purposes, with participant anonymity preserved.

RESULT AND DISCUSSION

Training Participant Characteristics

Analysis of 45 training participants' characteristics showed a representative distribution of the SMKN 1 Kertajati teacher community. The majority of participants were in the productive age range of 31-40 years (45%), had 11-20 years of teaching experience (36%), and held a bachelor's degree (73%). The initial digital competency level of most participants was at intermediate (47%) and beginner (42%) levels, with only 11% already proficient.

Distribution of participants by department showed good representation from various expertise

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programs, with Light Vehicle Engineering (27%), Computer and Network Engineering (22%), and Motorcycle Engineering (18%) as the largest contributors. This diversity provided rich perspectives in discussions and experience sharing during training.

Training Process Dynamics

Training implementation took place in an interactive and participatory atmosphere. The first day began with an introductory session that built conceptual understanding of digital technology integration. Participants showed high enthusiasm in exploring various digital tools, especially when practicing creating virtual classes in Google Classroom.

The practical session on creating digital content with Canva received very positive responses, particularly from engineering department teachers who saw great potential for documenting practical processes such as motorcycle maintenance or textile production. Mr. Ahmad Fauzi, a motorcycle engineering teacher, stated: "This is very helpful for creating step-by-step engine repair tutorials that students can access anytime." The second day focused on more complex applications. The interactive learning session with Kahoot and Quizizz produced interesting discussions about how gamification can increase vocational school students' learning motivation. Mrs. Sari Rahayu, a textile engineering teacher, successfully created an interactive quiz about fabric types that would later be used in learning.

FIGURE 1. Participants are engaging in hands-on practice during digital content creation session using computers and digital tools

FIGURE 2. An interactive training session facilitated by the Universitas Pendidikan Indonesia team, demonstrating digital technology integration strategies

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Digital Competency Evaluation Results

Evaluation of digital competencies using the DigComp framework with 5 competency areas showed very encouraging results. Table 1 presents complete pre-test and post-test data.

TABLE 1. Pre-test and Post-test Results of Participants' Digital Competencies

Competency Area	Pre-test	Post-test	Improvement	(%)
Information and data literacy	42.3	80.5	38.2	90.2
Communication and collaboration	45.8	76.4	30.6	66.8
Digital content creation	38.5	89.0	50.5	131.3
Safety	52.3	78.2	25.9	49.5
Problem solving	47.2	78.9	31.7	67.2
Average	**45.2**	**78.6**	**33.4**	**73.2**

Results showed significant improvements in all digital competency areas ($p<0.001$). The highest improvement occurred in the "Digital content creation" area (131.3%), demonstrating the effectiveness of hands-on practice sessions in creating various digital content. The "Information and data literacy" area also experienced substantial improvement (90.2%), indicating participants' success in mastering LMS use and digital information search tools.

Effect size analysis using Cohen's d showed large effects in all competency areas ($d > 0.8$), with Digital content creation reaching $d = 3.4$ and Information and data literacy $d = 3.8$. This confirms that the training provided impact that was not only statistically significant but also practically meaningful.

Practice Evaluation Results

Evaluation of participants' practice outputs using a 4-scale rubric showed a high level of success. Table 2 presents the distribution of participants' achievements in various types of practice.

TABLE 2. Distribution of Participants' Practice Evaluation Results

Type of Practice	Excellent	Good	Fair	Average
Google Classroom	31 (69%)	12 (27%)	2 (4%)	3.64
Digital content (Canva)	28 (62%)	15 (33%)	2 (4%)	3.58
Learning videos	25 (56%)	16 (36%)	4 (9%)	3.30
Interactive quiz (Kahoot)	32 (71%)	11 (24%)	2 (4%)	3.66
Digital assessment	27 (60%)	15 (33%)	3 (7%)	3.53
Action plan	29 (64%)	14 (31%)	2 (4%)	3.60

All participants (100%) completed all assigned practical tasks. Interactive quizzes with Kahoot achieved the highest score (average 3.66), while creating learning videos had the lowest score (average 3.30), indicating the need for further deepening in educational video production aspects.

Participant Satisfaction and Commitment Levels

Evaluation of participant satisfaction using a 5-point Likert scale questionnaire showed very high satisfaction levels. Facilitator competency received the highest score (4.8 ± 0.3), followed by training methods (4.7 ± 0.4), material quality (4.6 ± 0.5), overall satisfaction (4.6 ± 0.4), and facility amenities (4.3 ± 0.6).

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As many as 96% of participants stated they were very satisfied or satisfied with the training, and 100% of participants stated they would recommend similar training to colleagues. Qualitative feedback showed high appreciation for the practical approach and relevance of materials to learning needs in vocational schools.

Implementation commitment analysis showed a very positive distribution: 73% of participants were highly committed (score 5), 22% highly committed (score 4), 5% moderately committed (score 3), and no participants were low commitment. The average commitment score reached 4.68 ± 0.56, indicating very high commitment levels to apply digital technology in daily learning.

Action Plan and Implementation Plans

All participants successfully prepared action plans for implementing digital technology in their classes. Analysis of 45 action plans showed that 100% of participants would implement Google Classroom, 89% would use learning videos, 82% would apply interactive quizzes, 78% would conduct digital assessments, and 67% would implement blended learning models.

The diversity of implementation plans according to each department's characteristics showed a good understanding of contextualizing digital technology in vocational learning. Automotive engineering teachers planned to use video tutorials for vehicle diagnosis procedures, while textile engineering teachers would use digital platforms for production process documentation.

DISCUSSION

FIGURE 3. Teachers are collaboratively developing action plans for implementing digital technology in their respective vocational departments

The effectiveness of the participatory training model with a hands-on practice approach proved to be significant in enhancing vocational school teachers' digital competencies. The increase in digital competency scores by 73.2% showed that the 16-hour intensive training duration was effective enough to provide a strong foundation in digital technology integration. These findings align with research by Jabar et al. (2025), who found that intensive short-term training can have a significant impact if designed with the appropriate approach.

The highest improvement in the "Digital content creation" area (131.3%) confirms the importance of a direct practice approach in technology learning. However, observation results show that participants still face challenges in terms of creativity and visual design, especially in creating learning videos. This aligns with findings by Gu (2024), who identified that teachers often experience difficulties in integrating pedagogical aspects with technology in creating digital content.

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Analysis based on participant characteristics showed that teachers with master's degree backgrounds had more consistent improvements compared to bachelor's degrees, while the 31-40 years age group showed the best adaptation to digital technology. These findings support adult learning theory that emphasizes experience and intrinsic motivation in the learning process (Merriam & Bierema, 2021).

The diversity of participant departments from Light Vehicle Engineering, Motorcycle Engineering, Textile Engineering, and Refrigeration Engineering showed that digital technology integration can be universally applied across various vocational fields. Teachers from various engineering departments showed good ability in adapting digital technology for practical learning according to their respective expertise field characteristics, consistent with findings from recent vocational education research (Seeber & Seifried, 2019).

The high level of implementation commitment (average 4.68) indicates that the training successfully built participants' intrinsic motivation to apply digital technology. Supporting success factors included strong institutional support, material relevance to real needs, and a practical approach that allowed direct application.

Several identified challenges included significant variation in initial competencies, internet infrastructure limitations in some school areas, and the need for continuous mentoring to ensure implementation sustainability. These findings are consistent with research by Cattaneo et al. (2022), which emphasizes the importance of ecosystem support in educational technology integration.

CONCLUSION

The community service activity in the form of digital technology integration training in learning at SMKN 1 Kertajati was successfully implemented with a high success rate and provided a significant positive impact on improving teachers' digital competencies. Evaluation results showed highly significant digital competency improvement with average scores increasing from 45.2 to 78.6, or experiencing an increase of 73.2% ($p<0.001$), with all DigComp competency areas experiencing statistically meaningful improvements.

The participatory training model with a hands-on practice approach proved effective in facilitating learning for vocational school teachers from various engineering departments, with practical task completion rates reaching 100% and participant satisfaction levels reaching 96%. Very high implementation commitment from all participants (average score 4.68 out of 5 scale) showed that the training successfully built intrinsic motivation to apply digital technology in daily learning.

This activity made real contributions in preparing SMKN 1 Kertajati teachers to face digital learning challenges in the Industry 4.0 era, with each participant successfully preparing concrete action plans appropriate to their respective department characteristics. The effectiveness of this program demonstrates that investment in developing teachers' digital competencies through structured and practical training can produce sustainable positive changes in the vocational education ecosystem.

To ensure program sustainability and maximize long-term impact, continuous mentoring programs are recommended, the formation of digital teacher practice communities, and the development of structured implementation monitoring systems. Similar activities need to be expanded to other vocational schools in Majalengka Regency with adaptations according to the specific characteristics and needs of each school, including the development of special modules for vocational fields not yet represented in this activity.

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REFERENCES

Asghar, M. Z., Afzaal, M. N., Iqbal, J., et al. (2022). Evaluation of In-Service Vocational Teacher Training Program: A Blend of Face-to-Face, Online and Offline Learning Approaches. Sustainability, 14(21), 13906. https://doi.org/10.3390/su142113906

Cattaneo, A. A., Boldrini, E., & Lubinu, F. (2021). The "Digital Facilitator": An Extended Profile to Manage the Digital Transformation of Swiss Vocational Schools. Vocations and Learning, 14(2), 247-268. https://doi.org/10.1007/s12186-021-09275-0

Cattaneo, A. A., Antonietti, C., & Rauseo, M. (2022). How digitalised are vocational teachers? Assessing digital competence in vocational education and looking at its underlying factors. Computers & Education, 176, 104358. https://doi.org/10.1016/j.compedu.2021.104358

Gu, M. (2024). Empowering Vocational Education through Digital Technology: Innovating the Teaching Landscape. International Journal of New Developments in Education, 6(6), 131-136. https://doi.org/10.25236/IJNDE.2024.060621

Jabar, C. S. A., Wijayanti, W., Rahmawati, T., Utari, R., & Wijaya, W. M. (2025). Enhancing Administrative Competencies through Productivity Technology and Artificial Intelligence (AI) Integration in Muhammadiyah Elementary Schools, Bantul. ABDIMAS: Jurnal Pengabdian Masyarakat, 8(1), 29-42. https://doi.org/10.35568/abdimas.v8i1.xxxx

Kemendikbudristek. (2022). Survei kompetensi digital guru Indonesia 2022. Jakarta: Pusat Data dan Teknologi Informasi.

Merriam, S. B., & Bierema, L. L. (2021). Adult learning: Linking theory and practice. Jossey-Bass.

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. Teachers College Record, 108(6), 1017-1054.

Rahmawati, N. S., Bachtiar, F. A., & Priyambadha, B. (2022). Vocational teacher digital competence: A study from East Java, Indonesia. International Journal of Evaluation and Research in Education, 11(3), 1217-1226. http://doi.org/10.11591/ijere.v11i3.22789

Rusli, M., Rahman, A., & Abdullah, H. (2020). Student perception data on online learning using heutagogy approach in the Faculty of Mathematics and Natural Sciences of Universitas Negeri Makassar, Indonesia. Data in Brief, 29, 105152. https://doi.org/10.1016/j.dib.2020.105152

Seeber, S., & Seifried, J. (2019). Vocational and professional education and training in Germany: Developments, challenges, and modernization approaches. In S. McGrath, M. Mulder, J. Papier, & R. Suart (Eds.), Handbook of vocational education and training (pp. 1649-1667). Springer.

https://doi.org/10.35568/abdimas.v9i1.7386

UNESCO. (2022). Digital skills critical for jobs and social inclusion. UNESCO-UNEVOC International Centre for Technical and Vocational Education and Training. https://unevoc.unesco.org/

Valtonen, T., Sointu, E., Kukkonen, J., Kontkanen, S., Lambert, M. C., & Mäkitalo-Siegl, K. (2020). TPACK updated to measure pre-service teachers' twenty-first century skills. Australasian Journal of Educational Technology, 36(3), 15-31. https://doi.org/10.14742/ajet.5221.

https://doi.org/10.35568/abdimas.v9i1.7386