



## Upskilling automotive engineering teacher competence: Learning innovation through QR Codes

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### Abstract

This community service activity aims to enhance the quality and accessibility of learning materials in automotive engineering through digitalizing teaching materials based on Quick Response (QR) codes. The training covered introducing digitalization concepts, QR code creation, and their implementation in teaching materials through lectures, demonstrations, practice, and evaluation. The results of this activity indicate an increased understanding among participants regarding digital technology and its benefits in the learning process. Teacher's competence in developing technology-based teaching modules, including integrating QR codes and the potential of TTS AI-based videos, has significantly improved. The teachers demonstrated high enthusiasm for implementing the learned materials.

**Keywords:** Training; Digitalization; QR Code; Teacher competence; Learning innovation

## Peningkatan kompetensi guru teknik otomotif: Inovasi pembelajaran melalui kode QR

### Abstrak

Pengabdian masyarakat ini bertujuan meningkatkan kualitas dan aksesibilitas materi ajar teknik otomotif melalui digitalisasi berbasis kode Quick Response (QR). Pelatihan ini meliputi pengenalan digitalisasi, pembuatan kode QR, dan implementasinya dalam materi ajar melalui ceramah, demonstrasi, praktik, dan evaluasi. Hasil kegiatan menunjukkan peningkatan pemahaman peserta tentang teknologi digital dan manfaatnya dalam pembelajaran. Kompetensi guru dalam mengembangkan modul ajar berbasis teknologi, termasuk integrasi kode QR dan potensi video berbasis TTS AI, meningkat signifikan. Para guru menunjukkan antusiasme tinggi untuk mengimplementasikan materi yang dipelajari.

**Kata Kunci:** Pelatihan; Digitalisasi; Kode QR; Kompetensi guru; Inovasi pembelajaran

## 1. Introduction

Established in 1985, SMK Negeri 1 Koto Baru significantly contributes skilled automotive technicians to the Dharmasraya and Sawahlunto Sijunjung regions. However, the institution faces challenges in optimizing infrastructure and pedagogical innovation. Outdated facilities and the underutilization of simulators, resulting from a lack of integrated practical and theoretical learning in instructional materials, hinder effective education and complicate students' ability to connect theory with real-world applications.

Contributions to  
SDGs



### Article History

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Current pedagogical practices are predominantly conventional and teacher-centered (Wirawan et al., 2017). Integrating digital technologies is difficult due to limited professional development for educators, especially senior faculty who often rely on traditional communication like WhatsApp. This is further complicated by the scarcity of blended learning modules aligned with the national Independent Curriculum (Kurikulum Merdeka) (Herayani et al., 2017). While SMK Negeri 1 Koto Baru has considerable potential, its progress is constrained by insufficient modern educational media and the suboptimal use of existing simulation tools. Automotive instructors have expressed concerns about the lack of blended learning modules, unidirectional classroom interaction, and reliance on WhatsApp for instruction, highlighting an urgent need for pedagogical transformation. Low participation in technology training and a lack of teacher confidence in using digital tools exacerbate these issues.

The Independent Curriculum empowers educators to develop engaging and accessible blended learning environments (Hidayat et al., 2024; Purnomo et al., 2024). It mandates active learning, both online and offline, incorporating digital assessments that evaluate affective and psychomotor domains (Yahya et al., 2020). This ultimately enhances student learning preferences, creativity, and engagement (Wulandari et al., 2023). Automotive engineering education inherently requires integrating cognitive and psychomotor abilities (Situmorang, 2021; Sulastris et al., 2023).

In the context of the Independent Curriculum, teachers are ideally positioned as role models, facilitators, and mentors (Milana et al., 2023). However, students at SMK Negeri 1 Koto Baru have limited access to supplementary learning resources (Purwanto, 2020), and potentially beneficial technologies like QR codes for additional materials (Ayu et al., 2016) are largely untapped. Effective technology integration is crucial for creating engaging and industry-relevant learning experiences (Saripudin & Robbani, 2024), underscoring the necessity for innovative interventions to improve educational quality and graduate outcomes (Kibar & Ayas, 2010).

Developing effective blended learning resources demands teacher creativity and technological proficiency (Milana et al., 2023). Observations and discussions with the Teacher Working Group (MGMP) and the school principal have identified key challenges in implementing the Independent Curriculum, particularly within phases E and F (Hidayat et al., 2023), specifically concerning the creation of interactive online learning modules. Educators, especially senior staff, report difficulties in developing instructional materials that effectively integrate information and communication technologies, a challenge amplified in the post-pandemic educational landscape (Rahman, 2021).

To address these challenges, this study proposes training and ongoing mentorship in creating QR code-based digital learning materials. QR codes are selected for their accessibility, interactive potential, and support for autonomous learning (LP2M UNP, 2016). The proposed intervention includes workshops on developing blended learning modules incorporating QR codes and AI text-to-speech (TTS) video resources, complemented by sustained mentoring support. Existing research supports the positive impact of digital technologies in vocational education, with QR codes enhancing student engagement and motivation. Blended learning methodologies, especially with technologies fostering independent study, have been shown to improve educational quality. Mentorship in developing blended learning materials has also been linked to

increased teacher creativity (Hidayat et al., 2023), and integrating QR codes promises a more cohesive alignment of practical and theoretical instruction.

The overarching aim of this training and mentoring initiative for developing QR code-based online modules and AI TTS videos is to equip teachers with enhanced technological and informational literacy, enabling them to design innovative instructional modules and anticipate effective pedagogical strategies (Nam et al., 2025). A deeper understanding of blended learning principles is anticipated to encourage broader technology integration. Crucially, ongoing mentoring support, including potential follow-up training (Muslim et al., 2024), is essential for successful and sustainable implementation.

## 2. Method

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This study, conducted between August and September 2024, employed a blended learning approach, combining online sessions via Zoom with in-person workshops at SMKN 1 Koto Baru, Dharmasraya Regency. The Teacher Working Group (MGMP) and the school provided essential resources, including equipment, suitable meeting rooms, and a computer laboratory with supporting infrastructure.

The instructional methods comprised three key components: (1) online lectures to introduce the principles of the independent curriculum (Marley et al., 2024); (2) face-to-face guided demonstrations, enabling participants to practice material creation under direct supervision (Härmävaara & Schümchen-schram, 2025); and (3) practical exercises to evaluate participants' comprehension and their ability to develop teaching modules tailored to their specific needs (Bhide et al., 2023).

The program's evaluation involved a two-stage process. A pre-test, utilizing a questionnaire, assessed teachers' baseline knowledge of QR code-integrated and TTS AI narrative video-based learning and their initial skills in developing online modules (Wagino et al., 2024). Subsequently, a post-test was administered to gather observational data on the enhancement of teachers' competencies following the training.

## 3. Results and Discussion

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### 3.1. Initial assessment via pre-test

The pre-test results, collected through a Google Form survey of 15 participants, indicated that the members of the Subject Teacher Forum (MGMP) generally lacked in-depth understanding regarding the digital transformation of learning material development, particularly concerning supporting applications. The survey inquired about using several applications, including Canva, TTS Maker (text-to-speech conversion), Gom Mix Max (video editing), Y2meta.app (YouTube downloader), Chat GPT, and applications for converting links or text into QR codes.

As shown in Table 1, the knowledge and understanding of the 15 respondents were generally low. The most familiar application was Chat GPT, with a usage percentage of 57.33%, likely due to its current high popularity. Canva followed this at 47.33%, potentially attributed to the premium belajar.id account facility provided by the Ministry of Education and Culture (Kemendikbud). The usage of other applications such

as Gom Mix Max, TTS Maker, Y2Mate App, and QR codes showed low comprehension percentages. This finding aligns with the research of [Lohr et al. \(2024\)](#), which emphasizes the importance of teachers' technological pedagogical content knowledge (TPACK) for various forms of active student learning, while the availability of digital technology equipment in schools has a smaller impact. Furthermore, school support positively correlates with the success of digital teaching and learning ([Livas et al., 2019](#); [Sun & Gao, 2019](#)). Their research also highlighted that the success of Bring-Your-Own-Device (BYOD) implementation depends on device ownership, whether by teachers or students. The low pre-test scores ([Table 1](#)) indicated a need for comprehensive training, leading to the development of the following activity modules ([Table 2](#)).

**Table 1. Pre-test results**

No	Understanding of digitalization applications	Mean (%)
1	Canva	47.33
2	Gom Mix Max	36.33
3	TTS Maker	34.67
4	Y2 Mate App	31.67
5	Chat GPT	57.33
6	QR Code	34.00

**Table 2. Training activity module outline**

Module	Program
Module 1	<ul style="list-style-type: none"> <li>▪ Introduction to the Independent Curriculum and the concept of digitalizing learning materials</li> <li>▪ Understanding the philosophy and objectives of the Independent Curriculum</li> <li>▪ Why digitalizing learning materials is important in the context of the Independent Curriculum</li> <li>▪ Benefits of using QR Codes in automotive engineering learning</li> </ul>
Module 2	<ul style="list-style-type: none"> <li>▪ Creating interactive digital learning materials with QR Codes</li> <li>▪ Introduction to various platforms or applications for creating digital learning materials</li> <li>▪ Practical exercise in creating simple digital learning materials (Canva)</li> </ul>
Module 3	<ul style="list-style-type: none"> <li>▪ Implementation of digital learning materials in automotive engineering learning</li> <li>▪ Innovative learning strategies with QR Code-based learning materials</li> <li>▪ Integrating digital learning materials into lesson plans (RPP)</li> <li>▪ Creating QR Codes for teaching modules</li> </ul>
Module 4	<ul style="list-style-type: none"> <li>▪ Developing the automotive engineering MGMP as a learning community</li> <li>▪ Forming working groups to develop digital learning materials</li> <li>▪ Sharing knowledge and experiences among teachers</li> <li>▪ Developing a follow-up plan for continuous development</li> </ul>

### **3.2. Education on the Independent Curriculum and digitalization of learning materials**

This educational activity on the Independent Curriculum and the digitalization of learning materials involved several expert instructors in media and web usage from the electronics department, aiming to maximize the effectiveness of material delivery ([Saa,](#)



2024). Additionally, this activity was supported by the P3UPT implementation team, which possesses good capacity and competence.

As illustrated in Figure 1, the education on the Independent Curriculum and digitalization of learning materials was conducted online via Zoom over two 8-hour sessions to ensure broad and flexible accessibility. Throughout the activity, participants received intensive guidance from instructors with in-depth expertise in video editing and the development of digital teaching materials aligned with the needs of the Independent Curriculum. The material presented covered the fundamental principles of the Independent Curriculum, strategies for integrating digital technology in learning, the utilization of various platforms and applications for creating interactive learning materials, and basic video editing techniques to produce engaging and easily understandable learning materials for students. Interactive discussions and Q&A sessions were also integral parts of this activity, allowing participants to share experiences and address challenges they might face in the implementation of the Independent Curriculum and the digitalization of learning materials.

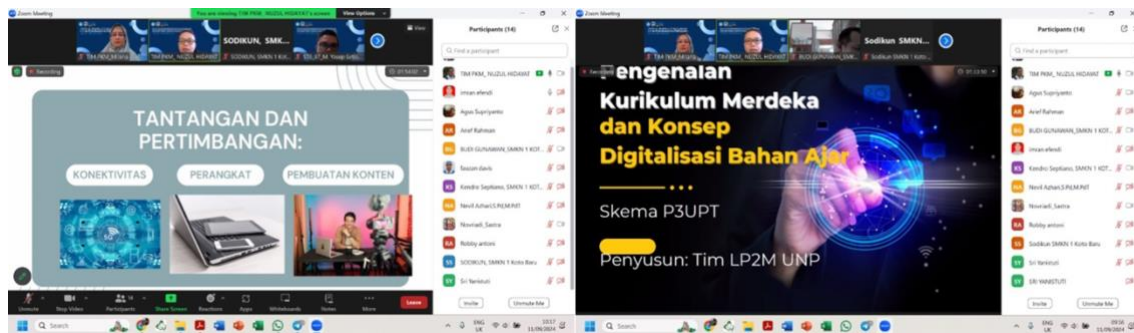


Figure 1. Education on the Independent Curriculum and digitalization of learning materials

### 3.3. Mentoring on the development of digital learning materials

The mentoring activity on developing digital learning materials was a follow-up stage focused on strengthening the participants' practical abilities in applying the knowledge gained in the previous education sessions. The P3UPT team actively provided technical guidance and individual consultation to participants in developing specific digital learning materials tailored to the subjects and needs of students at SMK Negeri 1 Koto Baru (Figure 2).



Figure 2. Mentoring process on digital learning materials development

The results of this mentoring activity demonstrated a significant improvement in participants' abilities related to using various applications and web platforms for digital

learning material development. Participants were able to produce prototypes of digital teaching modules integrated with interactive features, including the use of QR codes to access additional learning resources and text-to-speech (TTS) AI-based learning videos. This improvement was reflected in the quality of the learning materials produced, which showed a better understanding of the principles of digital learning design and technical skills in operating relevant software and platforms. Furthermore, this mentoring session also fostered collaboration among participants in sharing ideas and best practices in digital learning material development, creating a sustainable learning community.

### 3.4. Simulation of digital learning material development

This activity created a simulator unit for motorcycles' Electronic Fuel Injection (EFI) system (Rahayu et al., 2024). The development process involved a combination of various digital tools, including video editing software, Canva for graphic design, text-to-speech (TTS) makers (Gom Mix Max and TTS Marker), a video downloader application (Y2Mate App), and a QR code generator. The simulation stage began with creating a YouTube video thumbnail using Canva, as illustrated in Figure 3.

The activity continued with the conversion of textual material into audio format (.mp3) and various other media digitalization activities. All resulting media were then edited using Gom Mix Max video editing software, resulting in a final video product. This video was uploaded to the YouTube platform to obtain a website link, which was subsequently converted into a QR code.



Figure 3. YouTube thumbnail created using Canva

After all supporting components for creating digital teaching materials were complete, the next step was integrating or collaborating media according to needs (Huang & Macgilchrist, 2024). A single QR code can contain various media types, such as videos, audio, and documents (files). The media uploading process was adjusted based on its characteristics; for example, videos and audio were uploaded to YouTube due to ease of access and their free nature. Documents, images, and other formats were uploaded to Google Drive, and then the links from these files were copied and converted into QR codes using a QR code generator application.

Figure 4 illustrates the transformation of the conventional simulator. Each component or part of the simulator requiring additional information underwent a series of adjustments, including the addition of video, audio, and other media requirements. This stage's outcome was acquiring QR codes that would then be affixed to the motorcycle EFI system simulator. Research by Masih (2022) indicates that the utilization of QR codes significantly enhances student response and overall learning efficiency, particularly in improving the quality of learning implementation.



Figure 4. End-to-end simulation scheme

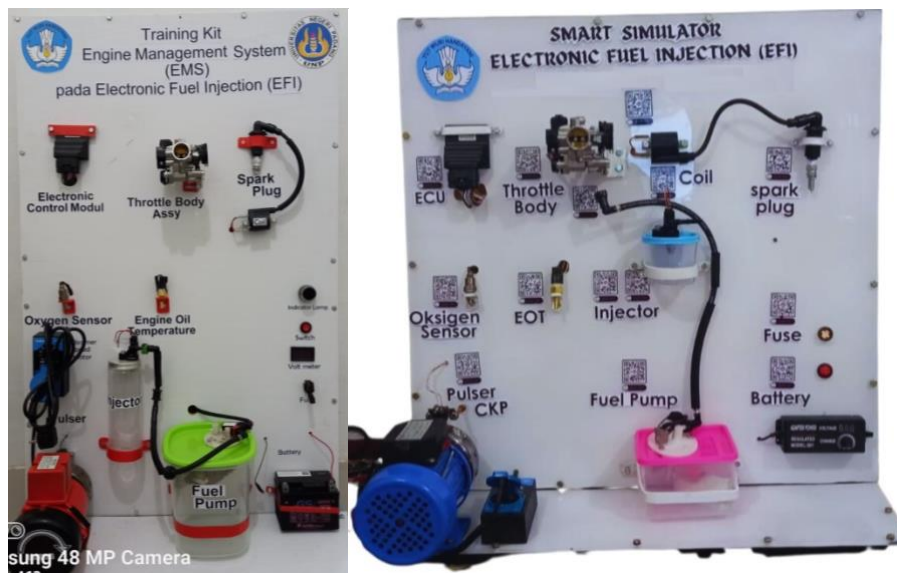


Figure 5. Development of a conventional simulator into a simulator equipped with a QR Code

Furthermore, Figure 5 shows the result of the simulator development, from a conventional model to a simulator equipped with a QR code. All outputs of the community service mentoring activities, in the form of videos, audio, images, and documents, were integrated into links. Thus, users can interact with the simulator more informatively by scanning the QR code using a smartphone, making access to additional information related to the simulator components easier (Firmansyah, 2019).

## 4. Conclusion

A community service initiative at SMKN 1 Koto Baru highlighted significant challenges for teachers in adopting blended learning within the Independent Curriculum, particularly in utilizing digital tools like Canva, Gom Mix Max, TTS Maker, and QR codes. Initial comprehension of these technologies was generally under 50%, with ChatGPT showing a slightly higher understanding at 57.33%. A training intervention involving lectures, demonstrations, practical exercises, and evaluations successfully

improved teachers' abilities to create technology-integrated learning modules and fostered an appreciation for innovative practices like QR code integration and TTS AI-generated video to connect theory and practice.

To optimize technology integration, ongoing support is essential. We recommend regular professional development focused on digital tools such as Canva, Gom Mix Max, and TTS Maker. The school should also explicitly integrate technology into its curriculum and strengthen its infrastructure, including hardware and internet connectivity. Furthermore, collaborative partnerships with external organizations like training providers or technology firms are crucial for sustained mentorship. Future technology-enhanced pedagogical strategies should prioritize interactivity to enhance student engagement. Finally, continuous evaluation and monitoring are necessary to ensure the effective application of technology in fully supporting the Independent Curriculum.

## Author Contributions

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Program implementers: WP, NH, ML; Preparation the manuscript: ML, NH; Lecturer: MYS, FR; Revised the manuscript: ML, NH, WP.

## Conflict of Interest

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The authors declare no financial or non-financial competing interests related to this article.

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## References

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- Ayu, I., Indrasari, W., & Siswoyo. (2016). Pengembangan Media Pembelajaran Fisika Menggunakan Lectora Inspire pada Materi Usaha dan Energi SMA. *Jurnal Penelitian & Pengembangan Pendidikan Fisika*, 2(2), 71–78. <https://doi.org/10.21009/1.02210>
- Bhide, P., Mohan, G., Holley, T., & Kramer, V. E. (2023). A Quality Improvement Exercise Using the “Rapid Cycle Deliberate Practice” Method of Simulation Training for Critical Event Leadership Training. *CHEST*, 164(4), A3900. <https://doi.org/10.1016/j.chest.2023.07.2545>
- Firmansyah, G. (2019). *Penggunaan QR code pada dunia pendidikan : penelitian pengembangan bahan ajar*. 5.
- Härmävaara, H., & Schümchen-schram, N. (2025). Language & Communication How to teach know-how ? Corrective manual demonstrations in teaching construction work. *Language Sciences*, 100, 224–242. <https://doi.org/10.1016/j.langcom.2024.12.008>



- Herayani, L., Fuaddunnazmi, M., & Habibi. (2017). Pengembangan Media Pembelajaran Berbasis Moodle Pada Matakuliah Fisika Dasar. *Jurnal Pendidikan Fisika Dan Teknologi*, 1(3), 205. <https://doi.org/10.29303/jpft.v1i3.260>
- Hidayat, N., Purwanto, W., Ambiyar, Muslim, & Simatupan, W. (2023). Design of air conditioner (AC) system simulator on cars to improve student competence. *Jurnal Inovasi Teknologi Pendidikan*, 10(1), 33–42. <https://doi.org/10.21831/jitp.v10i1.55758>
- Hidayat, N., Wakhinuddin, Lapisa, R., Milana, Muslim, Sardi, J., & Wirdianto, E. (2024). Development of Smart Simulator for Electronic Fuel Injection (EFI) Fuel System Based on Quick Response Code (QR Code) for Learning Media. *JOIV: International Journal on Informatics Visualization*, 8(3), 1319–1324. <https://doi.org/10.62527/joiv.8.3.2209>
- Huang, X., & Macgilchrist, F. (2024). Computers & Education : X Reality A virtual classroom map-based immersive VR learning approach to fostering collaborative learning. *Computers & Education: X Reality*, 5(8), 100088. <https://doi.org/10.1016/j.cexr.2024.100088>
- Kibar, Z. B., & Ayas, A. (2010). Developing a worksheet about physical and chemical event. *Procedia - Social and Behavioral Sciences*, 2(2), 739–743. <https://doi.org/10.1016/j.sbspro.2010.03.094>
- Livas, C., Katsanakis, I., & Vayia, E. (2019). Perceived impact of BYOD initiatives on post-secondary students' learning, behaviour and wellbeing: the perspective of educators in Greece. *Education and Information Technologies*, 24(1), 489–508. <https://doi.org/10.1007/s10639-018-9791-6>
- Lohr, A., Sailer, M., Stadler, M., & Fischer, F. (2024). Digital learning in schools : Which skills do teachers need , and who should bring their own devices ? *Teaching and Teacher Education*, 152(4), 104788. <https://doi.org/10.1016/j.tate.2024.104788>
- LP2M UNP. (2016). *Rencana Induk Penelitian (RIP)* (Issue 031).
- Marley, G., Lavigne, J. E., Cross, W., Gamble, A., Zhang, Z., & Carpenter, D. M. (2024). Comparing three methods to assess learning outcomes for a suicide prevention training program for pharmacy staff. *PEC Innovation*, 5(October), 100348. <https://doi.org/10.1016/j.pecinn.2024.100348>
- Masih, E. A. (2022). Nurse Education Today Feasibility of using QR code for registration & evaluation of training and its ability to increase response rate – The learners' perception. *Nurse Education Today*, 111, 105305. <https://doi.org/10.1016/j.nedt.2022.105305>
- Milana, Hidayat, N., Sugiarto, T., Wagino, & Purwanto, W. (2023). Pelatihan Penggunaan Smart Simulator Elecronic Fuel Injection (EFI) Pada Motor Dalam Meningkatkan Aktifitas Pembelajaran. *J-CoSE: Journal of Community Service & Empowerment*, 1(2), 81–91.
- Muslim, Ambiyar, Karudin, A., Ruslan, M. S. H., Kuo, H. C., Hidayat, N., & Putra, R. (2024). Augmented Clutch Reality Mobile: Innovative Educational Media for Modern Engineering. *Journal of Theoritical and Applied Information Technology*, 102(23), 8603–8616.
- Nam, H. W., Lee, S. J., Kim, J. J., Lee, J. Y., & Cho, M. (2025). Development and Training Operation Analysis Results of Virtual Reality/Augmented Reality Training Simulator for Radiation Emergency Medicine Hyung. *Nuclear Engineering and Technology*, 103477. <https://doi.org/10.1016/j.net.2025.103477>
- Purnomo, S., Arkhan, S. A. F., Sholah, A., & R.P, A. B. N. (2024). Pengembangan Media Pembelajaran Interaktif QR Code Berbasis Website Untuk Meningkatkan

- Cognitive Skill Alat Ukur Siswa TKR di SMKN 11 Malang. *Jurnal Teknik Otomotif: Kajian Keilmuan Dan Pengajaran*, 8(1), 47–54.
- Purwanto. (2020). Penggunaan QR Barcode dalam Pembelajaran Daring. *Social, Humanities, and Educational Series (SHES): Conference Series*, 3(3), 1951–1957.
- Rahayu, H. M., Kurniasih, D., Sunandar, A., & Nengsih. (2024). Training on creating augmented reality-based flash card for SMAIT Al-Fityan teachers. *Community Empowerment*, 9(11), 1585–1590. <https://doi.org/10.31603/ce.11174>
- Rahman, S. (2021). Pentingnya Motivasi Belajar dalam Meningkatkan Hasil Belajar. *Prosiding Seminar Nasional Pendidikan Dasar" Merdeka Belajar Dalam Menyambut Era Masyarakat 5.0"*.
- Saa, S. (2024). Merdeka Curriculum: Adaptation of Indonesian Education Policy in the Digital Era and Global Challenges. *Revista de Gestao Social e Ambiental*, 18(3). <https://doi.org/10.24857/rgsa.v18n3-168>
- Saripudin, & Robbani, M. D. F. (2024). Integrasi Teknologi Dalam Pendidikan. *Jurnal Teknologi Pendidikan*, 23(3), 336–346.
- Situmorang, R. P. (2021). Pelatihan Perancangan Pembelajaran Inovatif dan Asesmen Berbasis Dalam Jaringan ( Daring ) terhadap Guru Lingkup Yayasan PPKS Surakarta. *JMS Magistrorum et Scholarium: Jurnal Pengabdian Masyarakat*, 02(1), 1–15. <https://doi.org/10.24246/jms.v2i12021p1-15>
- Sulastri, A., Milana, Fernandez, D., Hidayat, N., Erawati, S., & Afriza, W. L. (2023). Evaluasi Kurikulum Merdeka dalam Meningkatkan Kualitas Pendidikan di SMKN 1 Dua Koto MSI Transaction on Education. *MSI Transaction on Education*, 4(4), 201–212.
- Sun, Y., & Gao, F. (2019). Exploring the roles of school leaders and teachers in a school-wide adoption of flipped classroom: School dynamics and institutional cultures. *British Journal of Educational Technology*, 50(3), 1241–1259. <https://doi.org/10.1111/bjet.12769>
- Wagino, Hidayat, N., Saputra, H. D., Baharudin, A., Koto, R. D., Akmal, M. S. F., & Herwin. (2024). Enhancing heavy equipment engineering students' skills through hydraulic and pneumatic systems training at SMKN 1 Sungai Limau. *Community Empowerment*, 9(10), 1453–1462. <https://doi.org/10.31603/ce.12125>
- Wirawan, A. W., Rahmanto, A. N., & Indrawati, C. D. S. (2017). The Development Of Learning Media Archives To Improve Student Learning Outcomes SMK Negeri 3 Surakarta. *Jurnal Pendidikan Vokasi*, 7(1), 78–86. <https://doi.org/10.21831/jpv.v7i1.12879>
- Wulandari, G. A. P. T., Putrayasa, I. B., & Martha, I. N. (2023). Efektivitas Asesmen Diagnostik dalam Pembelajaran Berdiferensiasi pada Pelajaran Bahasa Indonesia. *Nusantara: Jurnal Pendidikan Dan Ilmu Sosial*, 3(3), 433–448. <https://doi.org/10.14421/njpi.2023.v3i3-5>
- Yahya, F., Ratu, T., Hermansyah, Sentaya, I. M., & Sulindra, I. G. M. (2020). Pelatihan Pelaksanaan Asesmen Formatif Berbantuan Tik Untuk Optimalisasi Kegiatan Pembelajaran. *IJECS: International Journal of Education and Community Service*, 1(1), 9–13.



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