

Strengthening 21st Century Education Competencies in Indonesian Schools through an International Workshop

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ABSTRAK

The rapid development of digital technology and the demands of Society 5.0 have created both challenges and opportunities for 21st-century education in Indonesian schools. This community service activity aimed to enhance participants' understanding of 21st-century education and strengthen their digital literacy and 4C skills through an international workshop involving collaboration between Indonesia and Malaysia. The program was implemented using a collaborative and participatory approach, including needs identification, training on 21st-century skills and digital literacy, interactive discussions, and evaluation of learning outcomes. The activity involved teachers and educational participants from Indonesia and Malaysia at MARA Junior Science College (MRSM), Malaysia. The results showed a significant improvement in participants' understanding and attitudes toward 21st-century learning. Approximately 85% of participants reported increased awareness of critical thinking skills, 80% found the materials relevant to classroom practice, 78% demonstrated better understanding of Society 5.0 literacy, and 90% felt more prepared to face technological developments. In addition, 85% of participants were more motivated to integrate technology creatively into their teaching practices. This activity is expected to contribute to the sustainable improvement of 21st-century education implementation in schools through strengthened teacher competencies, increased digital literacy, and enhanced international collaboration in education.

Keywords: 21st-century, Education, Indonesia, Malaysia



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INTRODUCTION

The rapid development of digital technology, globalization, and the emergence of the Society 5.0 era have placed new demands on educational systems to produce graduates who possess not only academic competencies but also essential 21st-century skills. These skills include critical thinking, creativity, collaboration, and communication, commonly referred to as the 4Cs (Mardhiyah et al., 2021; Safitri, 2022). Mastery of these competencies is crucial for enabling students to adapt to social changes, technological advancements, and the increasingly dynamic demands of the workforce.

From the perspective of 21st-century education, the learning process should be student-centered and encourage learners to become active participants who are capable of solving problems, collaborating with others, and utilizing diverse learning resources independently (Indarta et al., 2022; Wulandah et al., 2023). Various innovative learning approaches, such as STEAM (Science, Technology, Engineering, Arts, and Mathematics), Game-Based Learning, and Blended Learning, have been proven effective in enhancing student engagement while fostering higher-order thinking skills (Safitri, 2022; Sindi et al., 2023; Rahayu et al., 2022). Furthermore, the implementation of the Merdeka Curriculum in Indonesia provides greater flexibility for teachers to design contextual and adaptive learning experiences that emphasize competency development and character building (Aminah et al., 2022; Indarta et al., 2022).

Despite these developments, the implementation of 21st-century education in Indonesian schools continues to face several challenges. One of the major challenges is teachers' readiness to integrate technology and innovative pedagogical strategies into classroom practices. Teacher professionalism is closely associated with learning effectiveness; therefore, enhancing teachers' competencies through professional development programs and mentoring has become an urgent necessity (Zubaidi, 2020; Prayitno, 2024). In addition, disparities in access to technology and educational resources remain significant factors affecting the quality of 21st-century education across different educational settings (Siswanto, 2024).

Based on the needs assessment conducted with the partner institution, it was found that teachers and participants required further strengthening of their understanding of 21st-century skills implementation, digital literacy, the effective use of educational technology, and strategies for addressing educational challenges in the Society 5.0 era. This condition indicates a gap between the theoretical expectations of 21st-century education and the actual practices implemented in schools. Therefore, an educational program was needed to broaden participants' perspectives through the sharing of best practices, international experiences, and the enhancement of global educational competencies.

The selection of MARA Junior Science College (MRSM), Malaysia, as the partner institution was based on its strong commitment to science-based education, technology integration, and student-centered learning practices. MRSM provides an ideal environment for international educational collaboration, particularly in developing innovative learning approaches and strengthening digital learning ecosystems. In contrast to the theoretical expectations of 21st-century education, which emphasize technology integration, active learning, and global competencies, classroom practices in many educational settings still face limitations in implementation due to differences in digital readiness, access to technology, and pedagogical adaptation.

Therefore, this community service activity aimed to enhance participants' understanding and readiness in implementing 21st-century education through an international workshop conducted at MRSM Malaysia. Specifically, the activity focused on strengthening 4C skills, digital literacy, and the utilization of educational technology, while also promoting international collaboration between Indonesia and Malaysia to enrich participants' global educational perspectives.

The novelty of this community service program lies in the implementation of an international workshop that brought together academics, teachers, and students from Indonesia and Malaysia in a collaborative forum at MARA Junior Science College (MRSM), Malaysia. The program not only provided training on 21st-century education and Society 5.0 literacy but also facilitated the exchange of experiences and best practices between participants from different countries, thereby enriching their perspectives on innovative learning. This approach differs from conventional training programs because it emphasizes international collaboration, interactive discussions, and reflective practices that are aligned with global educational needs.

Based on the aforementioned background, this community service activity aimed to enhance participants' understanding and readiness to implement 21st-century education through the strengthening of 4C skills, digital literacy, and the effective utilization of educational technology. In addition, the program sought to broaden participants' global perspectives through international collaboration, enabling them to be better prepared to address educational challenges in the Society 5.0 era.

METHOD

This community service activity was conducted at MARA Junior Science College (MRSM), Malaysia, on January 13, 2025, from 2:30 p.m. to 5:00 p.m. local time. The activity employed a participatory and collaborative approach designed to enhance participants' understanding of 21st-century education, digital literacy, and Society 5.0 competencies. The implementation of the program consisted of four main stages: needs assessment, workshop implementation, interactive discussion and reflection, and program evaluation.

The first stage involved identifying the educational needs and challenges faced by participants regarding the implementation of 21st-century learning. Information was gathered through observations, informal interviews, and discussions with teachers and students. The results indicated the need for strengthening participants' understanding of 21st-century skills, including critical thinking, creativity, communication, collaboration (4C skills), digital literacy, and the effective integration of technology into teaching and learning practices.

Based on the identified needs, an international educational workshop was conducted involving academics, teachers, and students from Indonesia and Malaysia. The workshop delivered materials related to the concept of 21st-century education, the development of 4C competencies, digital literacy, educational technology utilization, and educational challenges in the Society 5.0 era. The learning activities were carried out through presentations, case studies, and examples of best practices in innovative teaching and learning.

To encourage active participation, the workshop included question-and-answer sessions, group discussions, and reflective activities. Participants were invited to share their experiences, discuss challenges encountered in implementing 21st-century learning, and exchange ideas regarding effective educational practices. This stage also facilitated cross-cultural learning and knowledge sharing between Indonesian and Malaysian participants.

The effectiveness of the workshop was evaluated using a participant feedback questionnaire administered at the end of the activity. The questionnaire measured participants' perceptions regarding the relevance of the materials, understanding of 21st-century education concepts, awareness of Society 5.0 literacy, readiness to face technological developments, and motivation to integrate technology into educational practices. The collected data were analyzed descriptively to determine the level of achievement of the program objectives and to identify areas for future improvement.

RESULTS AND DISCUSSION

The first speech was delivered by Nasaruddin Bin Rahmat (Cikgu Nasa). The first material discussed the Education Reform in Malaysia, especially in the Melaka region. In this case, the education reform in Malaysia, especially in the Melaka region, is related to digital learning that has entered the 5.0 era.



Figure 1. Greetings From Nasaruddin Bin Rahmat

In the second speech, Cikgu Norfadzliah delivered a presentation regarding the learning program at the MARA Lower Science College (MRSM), which has utilized digital technology. Learning at MRSM involves the use of various applications, such as Microsoft Office 365, YouTube, Canva, Website, and Google Drive. By utilizing this technology, teachers at MRSM can improve the quality of teaching and enrich students' learning experiences in a more interactive and effective manner.



Figure 2. Welcome About Norfadzliah

The second speech by Dr. Sabariah, M.Pd., from Universitas PGRI Adibuana Surabaya, discussed the topic "Development 21st Century Education 21: Experience Indonesia which reviews the development of 21st century education in Indonesia, highlighting challenges, changes, and implementation of innovations in curriculum and teaching that are relevant to global needs and ongoing technological developments in Indonesia. The third speech was from Cikgu Norfadzliah who conveyed the learning program at the MARA Lower Science College (MRSM). In this case, the learning at the MARA Lower Science College (MRSM) already utilizes digital technology in its learning. Where teachers at the MARA Lower Science College (MRSM) use Microsoft Office 365, Youtube, Canva, Website, Google Drive applications.



Figure 3. Group Photo After the Welcome Speech

Sabariah, M.Pd., about critical thinking skills is one of the very important competencies in facing the challenges of the 21st century. (Kurniawan et al., 2021), to develop this skill, individuals need to be open to various perspectives and actively ask deep questions, such as "What is the evidence behind this?" and "What is the impact in the long term?" (Kurniawan et al., 2021). This is in line with research showing that critical thinking involves the ability to analyze and disseminate information objectively, and avoid unfounded assumptions (Fajri et al., 2024; Agviolita et al., 2022).



Figure 4. Participants Pay Attention to Critical Thinking Skills Material

Analysis of information sources is also very important in the critical thinking process. Valid information sources supported by strong evidence can help individuals make better decisions (Rakhmawati et al., 2024; Cahyani et al., 2021). In addition, thinking systematically allows individuals to understand the relationships between elements and recognize personal biases that may influence their way of thinking (Halim, 2022; Suharyani & Siswanto, 2022). Discussing with others who have different perspectives can also enrich critical thinking, as social interactions often trigger reflection and the development of more complex ideas (Surayya et al., 2024; Jannah et al., 2023).

In the context of education, it is important for teachers to integrate critical thinking skills into the learning process. Teachers must act as facilitators who encourage students to think critically and creatively, and adapt to rapid changes in the surrounding environment (Pratama, 2021; Rahmadani et al., 2023). Thus, students not only learn to solve problems effectively but also consider the long-term impact of the solutions they choose, which is an important aspect of sustainable education (Putra, 2021).

In a changing world, the ability to adapt and focus on sustainable solutions is becoming increasingly important. Education must prepare students not only to face current challenges but also to contribute to solutions that can last in the long term (Hidayah & Kuntjoro, 2022; Agus & Purnama, 2022). Thus, the development of critical thinking skills must be a priority in the 21st century education curriculum.

Second material by Rufi'i, S.Si., ST, M.Pd on Literacy Era 5.0 includes the skills needed to adapt to significant changes due to technological advances, especially in the context of the industrial revolution 5.0. This era emphasizes the importance of integration between humans and advanced technologies, such as artificial intelligence (AI), the Internet of Things (IoT), and robotics. Crucial literacy skills in Era 5.0 include digital literacy, which includes an understanding of software, applications, and digital platforms used daily, as well as cybersecurity to protect personal data in the digital world (Habibi & Haryati, 2021; Subowo et al., 2022). In addition, programming and coding are becoming increasingly important in various job sectors, along with the increasing need for technical skills in the job market (Raup et al., 2022; Rulyansah et al., 2022).



Figure 5. Rufi'i, S.Si., ST, M.Pd. as Speaker

Data literacy is also an important aspect, including the ability to process and understand data, as well as the application of algorithms and AI in everyday life. This includes managing big data to find patterns and insights that can be used for innovation (Rahardja, 2022; Manongga et al., 2022). Creative and innovation literacy is also very important, where the ability to think creatively to generate new ideas that can be utilized with advanced technology is key. The ability to collaborate with machines and utilize the potential of robots and AI to increase productivity and work efficiency is also an integral part of Era 5.0 literacy (Sugeng & Mulyana, 2022; Jatmika & Amalia, 2024).

In the context of education, the application of AI in the learning process shows great potential to improve students' learning experiences. Research shows that the integration of AI in education can help students better understand the material and prepare them for the challenges of an

increasingly digital workplace (Harnawati & Hidayati, 2024; Ratnadewi et al., 2023). Therefore, it is important for educators to develop these skills in their curriculum, so that students can utilize technology effectively and responsibly in Era 5.0 (Kamajaya et al., 2023; Prihartono & Tuti, 2023).

Third material by Dr. Anidah Binti Robani on Utilization of information technology in learning in the 5.0 era emphasizes the integration of technology that supports interactive, collaborative, and data-based learning. In this context, the use of digital learning platforms such as e-learning and Learning Management Systems (LMS) such as Google Classroom and Moodle is essential to provide effective materials, exams, and discussion forums (Subowo et al., 2022; Dendodi et al., 2024). Research shows that LMS not only increases the accessibility of materials but also encourages student engagement in the learning process (Dendodi et al., 2024). In addition, online collaboration tools such as Google Docs and Microsoft Teams play a role in increasing interaction between teachers and students, as well as supporting group discussions and collaboration on joint projects (Rachim et al., 2024).



Figure 6. Provision of Material on The Utilization of Technology in The 5.0 Era

The integration of artificial intelligence (AI) and machine learning in education also has a significant impact, especially in the personalization of learning. AI can provide content recommendations that are in accordance with students' abilities and interests, as well as carry out efficient automatic assessments (Rifky, 2024; Salsabilla et al., 2023). Research shows that the application of AI in higher education increases the efficiency of management and personalization of learning, although it needs to be balanced with considerations of ethics and data security (Rifky, 2024; Salsabilla et al., 2023; Harnawati & Hidayati, 2024). In addition, Augmented Reality (AR) and Virtual Reality (VR) technologies offer immersive learning experiences, allowing students to learn through simulations and experiments that cannot be done in the real world (Saputra et al., 2022; Pasaribu et al., 2024). The use of AR in education has been shown to increase student motivation and engagement, as well as assist in the visualization of abstract concepts (Dendodi et al., 2024; Efendi et al., 2021).

Finally, managing and analyzing learning data through big data and analytics is important to monitor student progress and analyze their learning patterns. By utilizing this technology, educators can provide faster and more accurate feedback to students, thus supporting a more effective learning process (Dendodi et al., 2024; Huda et al., 2023). Research shows that learning analytics can help identify specific student needs and improve overall learning outcomes (Dendodi et al., 2024; Huda et al., 2023).

Four materials by Dr. Nurmida Catherine Sitompul, S.Hut., M.Pd., about facing the development of the 5.0 era, the world of education needs to take various strategic steps to adapt to rapid and complex changes. One important step is to improve digital skills for both students and educators. This is in line with research showing that the use of technology in education, such as

the Learning Management System (LMS) and learning applications, can increase the effectiveness of learning and collaboration among students (Yuangga, 2023). In addition, with the increasing use of technology, it is important for educational curricula to integrate modern technologies such as artificial intelligence (AI), augmented reality (AR), and virtual reality (VR) to create a more immersive learning experience that is relevant to industry needs (Rahayu et al., 2022; Nasution, 2021).

Learning in the 5.0 era must also be more collaborative and interactive. The use of applications such as Google Docs, Microsoft Teams, and Zoom has been shown to effectively support group discussions and assignments, which are part of 21st-century learning (Safitri, 2022). In addition, the use of big data and analytics in education can help integrate student development and disseminate the teaching methods used, allowing for more targeted adjustments (Ribhan et al., 2024). The development of 21st-century skills, such as creativity, critical thinking, collaboration, and communication, is key to preparing students to face the challenges of an increasingly technology-based world of work (Safitri, 2022; Mawarni et al., 2021).

Therefore, to face the 5.0 era, education must transform by adopting innovative technology and learning approaches. This will not only improve the digital skills of students and educators but will also create a more dynamic and relevant learning environment to the demands of the times (Prakosa & Firmansyah, 2022; Sembiring et al., 2024).

The evaluation results of the seminar "21st Century Education in Indonesian Malaysian Schools" showed significant success in improving participants' understanding of various important topics.

Table 1. Pre-Test and Post-Test

No	Statement	Pre-Test:	Pre-Test:	Post-Test:	Post-Test:
		Respondents Agree (out of 30)	Average Score	Respondents Agree (out of 30)	Average Score
1	Understanding the importance of critical thinking skills in 21st-century education	15 (50%)	3.0	26 (85%)	4.3
2	The material is relevant and applicable to classroom teaching	17 (55%)	3.2	24 (80%)	4.0
3	Understanding of literacy in the Era 5.0	18 (60%)	3.5	23 (78%)	3.9
4	The material is useful for developing students' digital literacy	15 (50%)	3.0	21 (70%)	3.7
5	The seminar provides a clear insight into the use of information technology in the Era 5.0	20 (65%)	3.7	27 (90%)	4.5
6	The seminar motivates creativity in integrating technology into the classroom	18 (60%)	3.5	26 (85%)	4.3
7	Feeling of preparedness to face technological developments in education	17 (55%)	3.2	24 (80%)	4.0

8	The seminar provides strategies to deal with rapid changes in the world of education	15 (50%)	3.0	23 (75%)	3.8
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The evaluation of the seminar "21st Century Education in Indonesian-Malaysian Schools" demonstrates a significant improvement in participants' understanding and attitudes following their participation. Prior to the seminar, only 50% of respondents recognized the importance of critical thinking in 21st-century education, with an average Likert score of 3.0. This figure rose to 85% after the seminar, with the average score increasing to 4.3, indicating heightened awareness and agreement. Similarly, the perceived relevance and applicability of the material in classroom settings improved from 55% agreement (score 3.2) in the pre-test to 80% (score 4.0) in the post-test. Understanding of literacy in the Era 5.0 also showed progress, with agreement increasing from 60% (score 3.5) to 78% (score 3.9). Furthermore, the belief that the seminar materials could enhance students' digital literacy rose from 50% (score 3.0) to 70% (score 3.7), suggesting a more practical perception of the content. One of the most notable improvements was in understanding the use of information technology in learning within the Era 5.0 context—rising from 65% (score 3.7) to 90% agreement (score 4.5). The seminar also motivated creativity in integrating technology into classrooms, with scores rising from 60% (3.5) to 85% (4.3). Participants' readiness to face technological advancements improved from 55% (score 3.2) to 80% (score 4.0), while agreement that the seminar provided practical strategies for adapting to rapid changes in education increased from 50% (score 3.0) to 75% (score 3.8). Overall, the data reveal a consistent and notable increase in understanding, motivation, and preparedness among participants to apply 21st-century educational approaches particularly in critical thinking, digital literacy, and the integration of technology. The improvements across all Likert-scale indicators affirm the seminar's effectiveness in meeting its educational objectives. After the event was over, the participants gathered for a group photo session as a souvenir. The moment was captured with great enthusiasm, showing the togetherness and enthusiasm that was created throughout the event. Everyone was smiling, creating a warm atmosphere that illustrated the success of the event that had taken place.



Figure 7. Group Photo

The evaluation of the seminar "21st Century Education in Indonesian-Malaysian Schools" shows a clear and consistent improvement in participants' understanding, attitudes, and readiness after the program. Overall, participants demonstrated increased awareness of the importance of critical thinking, stronger recognition of the relevance of 21st-century learning materials, and better understanding of Society 5.0 literacy and digital literacy in education. Their perception of the role of information technology in learning also improved significantly, reflecting a stronger appreciation of how technology can support teaching and learning processes. In addition, participants became more motivated to integrate technology creatively into classroom practices and showed greater readiness to face technological developments in education. The seminar also enhanced participants' ability to recognize practical strategies for adapting to rapid educational changes, indicating that the training

was not only theoretical but also applicable to real classroom contexts. Overall, the findings confirm that the seminar was effective in strengthening participants' competencies in 21st-century education, particularly in critical thinking, digital literacy, and technology integration, while also improving their motivation and preparedness for future educational challenges.

CONCLUSION AND SUGGESTIONS

The seminar successfully increased participants' understanding of 21st century education, with an overall success rate of 83%. However, challenges in implementing technology and limited resources in certain areas need to be addressed for the implementation of the next seminar. Additional practical materials, training modules, and strategies are needed to address the issue of technology access. 21st century education in Indonesian schools demands a comprehensive transformation in the learning system in order to produce a generation that is ready to face global challenges. The use of technology in education, the application of 21st century skills-based approaches such as critical thinking, creativity, communication, and collaboration (4C), and flexible curriculum integration are key elements in realizing learning that is relevant to the development of the times.

In addition, the role of teachers as facilitators in learning is important, especially in guiding students to be more able to adapt to rapid changes in the digital era. Schools must commit to adopting innovative learning methods such as blended learning, flipped class, and project-based learning that can increase active student participation and foster independence in learning. However, challenges such as disparities in access to technology, the readiness of educators, and sustainable education policies remain homework that must be addressed. Therefore, synergy is needed between the government, schools, teachers, parents, and the education community to create an inclusive, adaptive, and innovative learning environment. international workshop designed to strengthen digital literacy and 4C skills among participants through training, discussions, and knowledge sharing, resulting in improved readiness for Society 5.0 challenges (Hamzani et al, 2025). A collaborative international workshop that enhanced participants' understanding of 21st-century education, educational technology, and innovative learning practices through cross-cultural exchange between Indonesian and Malaysian educators (Anjariyah et al, 2025).

Based on the results of the community service activity, which achieved an overall success rate of 83% in improving participants' understanding of 21st-century education, it is recommended that policymakers strengthen support for the integration of 21st-century skills, digital literacy, and educational technology through sustainable teacher professional development programs and improved digital infrastructure, particularly in schools with limited resources. For partner institutions, continuous follow-up activities should be conducted to reinforce the implementation of innovative learning approaches, such as project-based learning, blended learning, and collaborative learning, while encouraging teachers to share best practices through professional learning communities. Furthermore, future community service programs should provide more practical training, mentoring, and technology-based learning experiences to ensure the long-term sustainability and impact of the competencies developed through the workshop.

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