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# Adaptation of midwifery education curriculum in the fourth industrial revolution

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**ABSTRACT**

The evolution of technology in the Fourth Industrial Revolution age requires the world of education to undergo digital metamorphosis, including midwifery education. In producing graduates who are not only clinically competent but also able to adapt to technological advances, the midwifery curriculum needs to be improved. This study aims to examine the adaptation strategy for the midwifery education curriculum in response to the challenges and opportunities presented by the Fourth Industrial Revolution. The limited literature examining digital technology collaboration in midwifery education provides the background and driving force behind this research. The approach employed is a literature review using a qualitative descriptive method, examining eight relevant scientific articles published between 2020-2025. The results of the study show that integration has been proven to improve the quality of learning and student competence. Challenges such as limited infrastructure, educators' digital literacy, and institutional readiness remain the primary obstacles. Curriculum reform based on Outcome-Based Education and cross-sector collaboration are the keys to adapting midwifery education to remain relevant, professional, and humanistic in the digital age.

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***ABSTRAK***

*Evolusi teknologi di era Revolusi Industri Keempat menuntut dunia pendidikan untuk bertransformasi secara digital, termasuk dalam pendidikan kebidanan sehingga menghasilkan lulusan yang kompeten secara klinis, mampu beradaptasi dengan kemajuan teknologi. Maka dari itu, perlu adanya pembenahan dalam kurikulum kebidanan. Penelitian ini bertujuan untuk mengkaji strategi adaptasi kurikulum pendidikan kebidanan dalam menghadapi tantangan dan peluang yang muncul akibat perkembangan teknologi. Keterbatasan literatur yang membahas kolaborasi teknologi digital dalam pendidikan kebidanan menjadi latar belakang penting bagi penelitian ini. Pendekatan yang digunakan adalah tinjauan literatur dengan metode deskriptif kualitatif, yang menganalisis delapan artikel ilmiah terbitan tahun 2020-2025. Hasil penelitian menunjukkan bahwa integrasi teknologi dalam pendidikan kebidanan terbukti meningkatkan kualitas pembelajaran, kompetensi mahasiswa, dan kesiapan mereka menghadapi tantangan profesi. Namun, tantangan seperti keterbatasan infrastruktur, rendahnya literasi digital pendidik, dan kesiapan institusi masih menjadi hambatan utama. Reformasi kurikulum berbasis Outcome-Based Education dan kerja sama lintas sektor sangat diperlukan untuk memastikan pendidikan kebidanan tetap relevan, profesional, dan humanistik di era digital.*

***Kata Kunci:*** *adaptasi pendidikan; kurikulum kebidanan; perubahan digital; revolusi industri keempat*

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## INTRODUCTION

Midwives are healthcare professionals who play a direct role in providing services to mothers and babies in various healthcare facilities. As the frontline in maternal and neonatal services, midwives have the primary responsibility for identifying early pregnancy, assessing the risk of abnormal delivery, and handling emergency conditions in pregnant women to ensure the safety of the mother and fetus (Katebi & Bazrafkan, 2020). Midwives must acquire knowledge and skills following midwifery competency standards and complete the entire series of learning outlined in the curriculum. The curriculum encompasses the mastery of knowledge, technical skills, and professional attitudes that students need to possess, both in formal and non-formal learning environments (Jabeen et al., 2024).

Human civilization has undergone four phases of the industrial revolution, which have brought about significant changes in the social and professional order. The First Industrial Revolution was characterized by the widespread use of steam power, followed by the Second Industrial Revolution, which employed electricity and industrial machines, and the Third Industrial Revolution, which introduced automation and computer technology. We are currently in the Fourth Industrial Revolution, characterized by comprehensive digital penetration, the use of the Internet of Things (IoT), artificial intelligence, and big data-based technologies that significantly transform the way work is done in various sectors, including education and healthcare (Arianesya & Wibawa, 2022).

Digital transformation in the education sector has driven substantial changes in learning methods. Approaches such as online learning, hybrid learning, and virtual reality-enhanced education have been demonstrated to enhance student engagement and improve learning outcomes (Thoriq et al., 2024). Additionally, mastery of digital literacy is a crucial skill for students to understand the dynamics of the digital age. Yusuf mentioned in his book titled "*Inovasi Pendidikan Abad-21: Perspektif, tantangan, dan praktik terkini*" that this challenge encourages the world of education, including midwifery education, to adopt digital technology strategically in order to produce adaptive and innovative graduates.

However, there is still a gap in the literature that highlights how the midwifery education curriculum is specifically adapted to overcome the Fourth Industrial Revolution, especially within the framework of technology integration. Approaches such as artificial intelligence, digital simulations, and data-driven learning have been demonstrated to enhance student engagement and improve learning outcomes (Dai & Ke, 2022). Additionally, several studies have discussed effective implementation strategies and institutional challenges in the adaptation process (Owen, 2020). This literature review aims to evaluate the literature related to midwifery education curriculum adaptation strategies in response to the challenges of the Fourth Industrial Revolution, and to identify creative approaches and practices that can be applied to produce midwives who are professional and relevant to the demands of the times.


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## LITERATURE REVIEW

### Midwife Profession and Adaptation in the Fourth Industrial Revolution

According to the International Confederation of Midwives (ICM), a midwife is a woman who has graduated from midwifery school and is then declared as having passed and recognized by her country so that she has the requirements to be registered and has a legal license to perform midwifery services (Adnani et al., 2022). Amalia mentioned in her book titled "*Konsep Kebidanan*" that in Indonesia, midwives have an official professional organization under the umbrella of the Ikatan Bidan Indonesia (IBI). IBI is defined as a woman who has finished midwifery education that is approved by the government and professional associations within Negara Kesatuan Republik Indonesia (NKRI) and who possesses the skills and credentials necessary to be registered, certified, and/or lawfully obtain a license to practice midwifery is considered a midwife.

Based on the definitions of the two organizations, there is a similarity in their views on the qualifications of a midwife as a professional healthcare worker. It shows that the same validation of the competence and legality of the midwife profession is available. Midwifery is a profession that can be implemented throughout the productive age range. This profession requires midwives to have comprehensive knowledge and competence in handling various pregnancy and childbirth conditions. Amalia also added in her book titled "*Konsep Kebidanan*" that this ability is crucial in ensuring that the delivery process takes place safely and healthily. Midwives are also responsible for providing health services to pregnant women, fetuses, newborns, and children, as well as playing a role in education and counselling regarding sexual and reproductive health (Moridi et al., 2020).

Midwives are entitled to obtain a license to open an independent practice with a formal educational background and a diploma. Midwives can also work in various health facilities, both under the auspices of the government and the private sector, thus allowing for dual practice in the midwifery profession (Adnani et al., 2023). In providing holistic midwifery services, a midwife must continually update and upgrade their knowledge and skills, in line with the needs of the digital age and the Fourth Industrial Revolution. Midwives face new challenges in adopting technology and improving their digital competence to meet the demands of more adaptive and responsive midwifery services (Arianesya & Wibawa, 2022). Therefore, midwives, as pioneers in maternal and child health services, must continue to adapt to technological developments and the changing times in order to maintain excellent service and meet the demands of the profession in the era of the Fourth Industrial Revolution.

### The Fourth Industrial Revolution in Education

Kumar mentioned in his book titled "Industry 4.0 Developments towards the Fourth Industrial Revolution" that one significant technological shift that led to advances in other sectors was the Industrial Revolution. The steam engine was created around 1750, marking the start of the Industrial Revolution, which is sometimes referred to as the first Industrial Revolution. When electrically powered devices replaced steam engines, the Second Industrial Revolution got underway. The employment of machines that could move and be controlled, beginning with basic robots and progressing to computers, marked the beginning of the Third Industrial


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Revolution. During the Fourth Industrial Revolution, the system evolved into a digital form with the aid of networks. The education sector must adapt to the rapid technological advancements by utilizing information and communication technology as an advanced tool to expedite the learning process (Dzakaaul, 2024).

This is how education is interconnected with the Fourth Industrial Revolution. The learning mentality can shift from being teacher-centred to student-centred, depending on the suitability of knowledge and correspondence. During the Fourth Industrial Revolution, learning can take many forms, including skills like critical thinking and problem-solving, teamwork and communication, creativity and innovation, information and communication technology literacy, contextual learning, and media and information literacy (Chaka, 2020). Kumar also mentioned in his book titled "Industry 4.0 Developments towards the Fourth Industrial Revolution" that the Fourth Industrial Revolution requires education to produce a generation that can think creatively, innovatively, and competitively. This can be accomplished by maximizing the role of technology in education to produce a generation capable of shaping the future. Education is also needed at this time to balance the harmony between humans and technology.

## Transformation of Midwifery Curriculum and Learning in the Fourth Industrial Revolution

Midwifery education in Indonesia has advanced rapidly during the last two centuries, with 856 institutions producing 749.866 registered midwives by 2023. The levels of midwifery education include Associate Degree (Diploma 3 in Indonesia), Applied Bachelor, Undergraduate, and Midwife Professional Education. The Associate Degree (Diploma 3 in Indonesia) program focuses on vocational training and clinical practice. At the same time, the Applied Bachelor Program, developed in 2008, integrates academic and vocational skills, including management and leadership (Adnani et al., 2023). The diploma curriculum is designed with a composition of 60% practice and 40% theory according to the Confederation of Midwives (ICM) standards (Adnani et al., 2022). The undergraduate midwifery program and midwife professional education were officially introduced in Indonesia in 2019 to enhance midwifery professionalism. The undergraduate midwifery program curriculum includes scientific research, leadership, ethics, and evidence-based midwifery practice. The midwifery professional education program emphasizes intensive clinical training, comparable to clinical internship programs in medical education (Adnani et al., 2023).

Kemendikbud states in "Peraturan Menteri Pendidikan, Kebudayaan, Riset, dan Teknologi Republik Indonesia Nomor 53 Tahun 2023 tentang Penjaminan Mutu Pendidikan Tinggi" that the current midwifery curriculum is designed to adopt the Outcome-Based Education (OBE) approach, ensuring that graduates meet competency standards aligned with contemporary needs. All elements of the learning system, including teaching methods, curriculum, and assessment, are designed to ensure that midwifery students achieve the predetermined competencies by the end of the learning process. This approach also facilitates adjustment to international standards such as those set by the International Confederation of Midwives (ICM), which emphasizes clinical practice-based education, interdisciplinary such as interpersonal communication skills, utilization of technology, and cultural context in providing



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holistic and comprehensive maternal and child care as learning outcomes (Goshomi et al., 2022).

Midwifery learning is a process designed to develop the competency of midwife students through the integration of theory and practice affected by digitalization. In its development, midwifery education now utilizes innovative approaches relevant to modern learning, based on the Fourth Industrial Revolution, including E-learning, Blended Learning, and Problem-Based Learning (PBL). These three approaches not only boost learning flexibility but also promote the achievement of the desired skills in the era of the Fourth Industrial Revolution, which are required in modern midwifery practice (Susanti et al., 2024; Susanti & Mandiri, 2024). E-learning is a knowledge acquisition system that leverages electronic or computer technology to facilitate the teaching and learning process without the need for direct in-person interactions. Depending on the demands of the human resources (teachers, lecturers, instructors, and students) who conduct the learning activities, e-learning can take place at any time and from any location (Milićević et al., 2021).

E-learning system still applies the principles of effective learning, for example, the Learning Management System (LMS). The Learning Management System (LMS) as an online learning media platform provides various facilities for learning needs, such as learning materials, learning outcome scores, discussion forums (asynchronous), and video conferences or direct learning (synchronous), indicating that learning happens immediately and that students and teachers complete the learning process simultaneously (in real-time) but occur in a different location with learning methods through chatting, virtual classrooms, video conferences, and audio conferences (Murad et al., 2022). The combination of digital and traditional learning methods is referred to as blended learning, which shifts the learning paradigm from being teacher-centered to student-centered (Sharma et al., 2022). Blended learning can create a flexible and high-quality learning experience. Blended learning's effectiveness in the education of health students, including midwifery students, can enhance motivation, skills, knowledge, learning satisfaction, self-confidence, and, most importantly, competencies relevant to health fields. There are six main approaches to online learning in midwifery, including 1) mobile learning; 2) virtual reality; 3) learning videos; 4) blended learning; 5) ePortfolios; and 6) mobile applications for collaboration and discussion (Rahimah et al., 2024).

Problem-based learning is a learning method that encourages students to identify problems, analyze data, and make decisions based on evidence. This process encourages active involvement and the development of deductive and analytical reasoning. PBL has shown an increase in the critical thinking skills of midwifery students and increases high learning satisfaction. PBL learning creates students who are cooperative and independent, have better teamwork, and find innovative solutions to clinical problems (Aein et al., 2020). The application of artificial intelligence (AI) in midwifery education accelerates the transformation of learning through technological innovations that are adaptive to the digital era. Technologies such as Virtual Reality (VR) enable safe and realistic clinical simulations, while AI provides real-time personalized feedback and accurate monitoring of learning progress. It allows lecturers to adjust teaching methods effectively. AI facilitates the growth of remote and online education, thereby expanding access to quality education in a more inclusive and sustainable manner (Ladjar & Susanti, 2024). Thus, the transformation of midwifery


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curriculum and learning in the era of the Fourth Industrial Revolution demands integration between technological innovation and a humanistic pedagogical approach.

## Collaborative Efforts in Adapting Midwifery Curriculum and Learning

Midwifery learning continues to evolve in response to technological advancements every decade and requires collaboration. The COVID-19 pandemic in 2020 prompted the increased use of technology, and students and lecturers were limited to online lectures. The study was conducted at the University of Grenoble-Alpes, specifically with midwifery students, utilizing the Discord tool for midwifery training. Discord is a website and program that enables simultaneous or asynchronous communication between students and instructors in a variety of media (text, audio, and video). Online gaming communities have historically utilized Discord, but the service has also been employed in various other industries. With an 88.7% satisfaction rate, Discord is a good learning tool. Discord should be incorporated into the classroom, according to 60% of respondents (Di Marco, 2021).

## Impact and Challenges of Curriculum Implementation in the Fourth Industrial Revolution

The midwifery curriculum and learning implemented in the fourth Industrial Revolution age have many dynamics, challenges, and obstacles. The primary obstacle to implementing digital innovation in midwifery education is the challenge of modifying conventional learning, as the field of midwifery heavily relies on direct skills that are difficult to teach digitally. Lecturers choose to continue implementing face-to-face learning methods with conventional methods such as teacher-centred learning. Technology is considered unable to substitute learning experiences and practices in the field (O'Connor et al., 2023). Concerns that learning through learning videos may lead to multiple interpretations for midwifery students.

The adoption of e-learning in midwifery education necessitates careful evaluation of the availability of technological resources and internet connectivity. The main factors, such as smooth internet access, are easily accessible at home, in internet cafes, or via mobile internet modems. Access in the campus area also requires free WiFi or hotspots. The ease of accessing information and technology varies by region. The provision of access to information and learning in big cities is more representative than outside the city. The implementation of e-learning must also be supported by digital infrastructure, namely laptops or personal computers (Ladjar & Susanti, 2024).

The development of digitalization in midwifery education has led to the adaptation of AI innovation. Although artificial intelligence (AI) brings numerous benefits to midwifery education, its implementation still faces challenges, including limited technological knowledge among lecturers and students, as well as inadequate infrastructure, particularly in remote areas. Concerns regarding ethics and data privacy are also important issues, considering that AI involves the collection of personal data. In addition, the lack of long-term scientific evidence limits the adoption of AI, and dependence on technology is feared to compromise the humanistic aspect of midwifery education (Ladjar & Susanti, 2024). Therefore, coordination between educational institutions, governments, and other stakeholders is needed to ensure that the transformation of the curriculum in the Fourth



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Industrial Revolution era is not only adaptive to technological developments but also maintains humanistic values and professionalism in midwifery education.

## METHODS

This study employs a literature review approach, utilizing qualitative descriptive analysis, to explore and understand various strategies for developing a midwifery education curriculum within the context of the Fourth Industrial Revolution in depth. This approach was chosen because it provides flexibility in identifying, synthesizing, and analyzing findings from various previous studies to build a comprehensive conceptual understanding of the issues studied. In this study, a semi-systematic approach was employed because it is suitable for examining developing and diverse topics, such as curriculum innovation in midwifery education.

The literature search strategy was conducted systematically across three primary databases: Google Scholar, PubMed, and ScienceDirect. The search process used structured keywords combined with Boolean operators (AND/OR) to improve the accuracy and relevance of the search results. The keywords used include: ("Midwifery curriculum" OR "Midwifery education") AND ("development" OR "innovation" OR "transformation") AND ("Digital transformation" OR "Educational technology" OR "AI in Education").

This literature review was compiled by maintaining the relevance and quality of the literature reviewed; the inclusion criteria set include articles published in the last five years (2020-2025), focus on the topic of midwifery education or curriculum innovation, using a qualitative, quantitative, or mixed-method research approach, articles available in full open access format (free full-text), and written in Indonesian or English. Articles that are opinion pieces, editorials, or non-systematic reviews are excluded from the analysis.

The literature selection process consists of four stages: identification, screening, eligibility assessment, and final inclusion. The selected literature is then analyzed based on its relevance to the issue of midwifery education transformation, the methodological approach used, and its contribution to enriching conceptual understanding of curriculum development that is adaptive to the digital age in the Fourth Industrial Revolution.

## RESULTS AND DISCUSSION

The results of the article search based on research keywords obtained eight articles, consisting of original research with quantitative (4), qualitative (2), and mixed methods (2) designs. The articles originated from several countries, including Indonesia (2), Bulgaria (2), Ghana (2), Norway (1), and Ireland (1), with the results of the analysis presented in **Table 1**.

**Table 1.** Result of Data Analysis

| Author | Tittle | Country | Destination | Methods | Results |
|---|---|---|---|---|---|
| Georgieva-Tsaneva et al. (2024) | Application of Virtual Reality, Artificial Intelligence, and Other | Bulgaria | To investigate the possibility of using artificial intelligence and virtual reality to | Two sets of participants were created for the educational | The findings demonstrated that incorporating modern interactive technologies into |


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| Author | Tittle | Country | Destination | Methods | Results |
|---|---|---|---|---|---|
| | Innovative Technologies in Healthcare Education (Nursing and Midwifery Specialties): Challenges and Strategies | | improve training efficacy. | experiment: the experimental group, which received extra training utilizing cutting-edge techniques, and the control group, which received conventional training. To evaluate their practical injection abilities, both groups completed pre- and post-tests. | the training process greatly enhanced the learning of patient care techniques. Statistical analysis was used to confirm the significance of the data. This study offers fundamental methodological guidance to scholars, educators, and curriculum developers seeking to integrate cutting-edge interactive technology. |
| Ljungblad et al. (2025) | Mixed reality for midwifery students: a qualitative study of the technology's perceived appropriateness in the classroom | Norwegia | To investigate whether and how midwifery students benefit from learning about fetal stages in birth through immersive, interactive 3D visualisations exhibited in the Magic Leap 2 mixed reality headset. | The study utilized an exploratory, qualitative method comprising four unique stages. | According to the analysis, students saw mixed reality as a practical innovation that scaffolds previously learned material while facilitating fresh ideas. Although mixed reality was thought to be intuitive or straightforward to use, flexible or customizable content should be a significant factor in immersive lesson design. It was also hypothesized that mixed reality would complement other learning modes and methodologies, such as simulation-based training. |


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| Author | Tittle | Country | Destination | Methods | Results |
|---|---|---|---|---|---|
| Miteva (2022) | Digital Media Literacy in the Training of Student Midwives | Bulgaria | To ascertain the importance and applicability of digital media literacy for midwife students as they acquire professional skills. | A survey was administered anonymously between December 2021 and January 2022 to 73 Bulgarian midwifery students. | Although midwife students have a reasonably high level of confidence in their ability to find and search for relevant information, their digital media literacy needs to be further developed to improve the effectiveness of educational activities. |
| Saab et al. (2023) | Virtual Reality Simulation in Nursing and Midwifery Education | Irlandia | This study describes how nursing and midwifery undergraduate students use virtual reality simulation. | Descriptive statistics were used to evaluate quantitative data, while deductive content analysis was used to assess qualitative data. In this study, 43 students participated. 75.87 (13.7) was the mean (SD) score on the System Usability Scale. | Virtual reality simulation was viewed as entertaining and educational, promoting safe, self-directed learning without endangering patients, and nearly all participants expressed "extreme satisfaction" or "somewhat satisfaction" with it. Participants suggested practicing clinical skills, preparing for clinical assignments, and learning about uncommon clinical scenarios through virtual reality simulation. |
| Amran & Suryani. (2021) | Effectiveness Of Online Learning Methods In Midwifery Care Courses | Indonesia | To determine the effectiveness of online learning methods in midwifery care courses. | This quantitative study, conducted from March to June 2021, involved 36 students from the S1 Midwifery Study | Online learning methods are as effective as traditional face-to-face education in midwifery care courses. They can be used as a substitute when teachers cannot meet in person, |


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| Author | Tittle | Country | Destination | Methods | Results |
|---|---|---|---|---|---|
| | | | | Program at STIKes Payung Negeri Pekanbaru. Data were collected using a questionnaire and analyzed with univariate and bivariate analysis, including the Spearman Rank correlation test. | and their effectiveness is categorised as effective. |
| Aabaah et al. (2025) | Revolutionizing Nursing and Midwifery Informatics Curriculum Evaluation in Ghana: A Data-Driven Machine Learning Approach | Ghana | To provide medical practitioners with the skills they need to integrate new technology into their practice successfully. | According to multiple regression analysis, academic outcomes were strongly influenced by institutional differences, with Applied Sciences showing the most significant effect (β = 3.85, p = 0.021), possibly due to a better congruence between the curriculum and instructional strategies. | These findings support the use of machine learning approaches in academic assessments and provide valuable insights for curriculum development and healthcare policy planning in resource-constrained situations. The work provides a roadmap for more efficient and equitable healthcare education systems by offering a scalable prediction model that can be modified to enhance digital health education in comparable low-resource settings worldwide. |
| Susanti et al. (2022) | Midwifery Continuity of Care in Indonesia: Initiation of | Indonesia | To determine and assess midwives' service requirements | A sequential mixed technique with explanations | Midwives' skill indicators for early identification are significant in MCOC with |



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| Author | Tittle | Country | Destination | Methods | Results |
|---|---|---|---|---|---|
| | Mobile Health Development Integrating Midwives' Competency and Service Needs | | and competency in order to create mHealth in Midwifery Continuity of Care (MCOC) training and education. | was employed from August to December of 2021. The traits and range of competencies of 373 midwives in West Java were identified using a cross-sectional approach. Thirteen midwives participated in a Focus Group Discussion (FGD) as part of a qualitative design. | mHealth. Further studies are needed to evaluate midwives' competence in MCOC using mHealth. |
| Essel et al. (2020) | Digital Technologies In Nursing And Midwifery Digital Technologies In Nursing And Midwifery Education In Ghana: Educators Perspective, Practice Education In Ghana: Educators Perspective, Practice And Barriers | Ghana | To assess the attitudes, methods, and obstacles that prevent information and communication technology from being included in nursing and midwifery education. | The study employed both purposeful and convenience sampling strategies, involving 108 health tutors as participants. | The results showed that the majority of health tutors used information and communication technology to handle exam results and deliver courses to pupils. |

*Source: Research 2025*

Based on the **Table 1** shows four articles discussed the implementation and evaluation of innovative learning technology (articles 1, 2, 4, and 5), two articles discussed digital skills and literacy in midwifery education (articles 3 and 6), 1 article discussed the development and integration of specific technology in midwifery practice and education (article 7), and 1 article discussed perspectives and barriers in technology integration (article 8).


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## Discussion

Quality midwifery education is the foundation for producing clinically competent midwives, as well as developing critical thinking skills, effective communication, and a sufficient mastery of technology. This aligns with the global target to achieve Universal Health Coverage (UHC) by 2030 and supports efforts to reduce maternal and newborn mortality rates. Comprehensive curriculum design, encompassing planning, administration, and the effective utilization of adequate learning facilities and media, is a crucial prerequisite for producing superior graduates (Aprianti et al., 2024). The midwifery education curriculum must undergo systemic reform to ensure that graduates not only excel in clinical skills but also can optimize technology for midwifery services. Adaptation of the curriculum in the Fourth Industrial Revolution era is an urgent need in response to the transformation of digital-based health services. The use of digital media in midwifery students increases students' confidence in searching and obtaining enough material related to the goals and objectives of the education process that has been specified, so that the effectiveness of midwifery education activities continues to rise (Miteva, 2022).

Supporting these educational reforms, recent studies have explored innovative learning approaches in midwifery. Based on a review of eight scientific articles, it was found that most of the studies (Amran & Suryani, 2021; Georgieva-Tsaneva et al., 2024; Ljungblad et al., 2025; Saab et al., 2023) highlighted the implementation and evaluation of innovative learning technologies such as e-learning, blended learning, and virtual simulations that have been proven to increase midwifery students' satisfaction and learning effectiveness. Two other articles (Aabaah et al., 2025; Miteva, 2022) emphasized the importance of digital skills and literacy, which are essential competencies in responding to the challenges of technology-based educational transformation. Meanwhile, one article (Susanti et al., 2022) discusses the development and integration of specific technologies in midwifery practice and education. Various barriers to technology integration exist, including infrastructure limitations, access gaps, and the readiness of lecturers and students to adopt digital learning technologies (Essel et al., 2020).

Midwifery education curricula can integrate technology into learning, such as the use of digital simulations, online learning platforms, and artificial intelligence to evaluate students' clinical skills. The usefulness of virtual simulations among nursing and midwifery students; the results stated that students were delighted by using virtual simulations. This simulation is highly informative, trains clinical skills, and provides students with a safe and enjoyable learning experience (Saab et al., 2023). Integration of specific technologies in midwifery practice, such as the use of artificial intelligence-based clinical applications, decision-support systems in clinical decision-making, and digital platforms for practice documentation and reflection, is part of modern learning innovations. This technology not only accelerates the learning process but also prepares students to face real clinical practice that is increasingly digitalized. However, the development and implementation of this technology still face challenges in terms of infrastructure readiness, educators' digital literacy, and integration into a curriculum that is appropriate to the local context (Susanti et al., 2022).


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Learning in midwifery education typically employs a face-to-face method, involving lecturers and students. Students, as a conventional learning method, sometimes become an obstacle to smooth learning; inappropriate location and time are the main factors (Atwa et al., 2022). The application of technology in education is quite promising, as virtual learning approaches will assist lecturers in their teaching. Learning through virtual methods in community midwifery care courses is as effective as traditional face-to-face instruction. Therefore, this approach can be an alternative when lecturers cannot conduct in-person or direct teaching sessions, provided that media, teaching strategies, and learning resources are used appropriately and effectively (Amran & Suryani, 2021). Thus, the integration of technology with midwifery student learning can foster adaptive, critical thinking, and innovative competencies in preparing for the digitalized world of work. Therefore, strengthening the curriculum that not only focuses on clinical skills but also integrates information technology and evidence-based approaches (evidence-based practice) is becoming increasingly important (Aprianti et al., 2024).

## CONCLUSION

The midwife profession is required to be adaptive to technological developments in the Fourth Industrial Revolution. The transformation of midwifery education involves updating the curriculum based on Outcome-Based Education and the application of modern learning methods, including e-learning, blended learning, and problem-based learning. Technological innovations, such as artificial intelligence (AI) and virtual reality (VR), are beginning to be utilized; however, challenges like limited infrastructure and digital literacy persist. The integration of learning methods and technological innovations has proven effective in improving learning. Midwifery education needs to be reformed to produce graduates who are not only clinically competent but also able to use technology in midwifery practice. The midwifery curriculum should enhance the integration of technology and evidence-based approaches to effectively address the challenges posed by today's digital health services. Therefore, collaboration between government, higher educational institutions, midwifery professionals, midwifery associations, technology and innovation providers, the healthcare industry, students and alumni, the community, and healthcare service users is needed to ensure that midwifery education remains relevant, professional, and humanistic in the face of changing times.

## AUTHOR'S NOTE

According to the authors, the publication of this work does not include any conflicts of interest. The authors declare that all of the information and material included in this work is completely original.


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