



Fitra Fauziah *et al*, International Journal of Pharmaceutical Sciences and Medicine (IJPSM),
Vol.10 Issue. 1, January- 2025, pg. 42-49

ISSN: 2519-9889

Impact Factor: 5.958

Strategic Pathways to Global Standards in Pharmacy Education: An Indonesian Perspective

Fitra Fauziah¹; Silvy Aldila²; Henni Rosaini¹;
Muthia Fadhilla¹; Sinta Wahyuni¹; Sanezea Effendy¹

¹School of Pharmaceutical Science Padang (STIFARM Padang), Padang, West Sumatera, Indonesia, 25147

²Department of Pharmacy, STIKES Telogorejo Semarang, Central Java, Indonesia, 50144

DOI: 10.47760/ijpsm.2025.v10i01.004

Abstract:

Pharmacy education in Indonesia faces significant challenges in aligning with the dynamic needs of the pharmaceutical industry. This review highlights six key strategies to enhance the quality and relevance of pharmacy education: curriculum flexibility, faculty training, technological infrastructure, interactive learning methods, stakeholder collaboration, and sustainability and evaluation. A flexible curriculum, integrating digital platforms and virtual simulations, improves critical thinking, collaboration, and problem-solving skills while preparing students for the Pharmacy 4.0 era. Faculty training programs enhance teaching competencies and support the adoption of advanced teaching methods. Technological tools such as Virtual Reality (VR) and Augmented Reality (AR) provide immersive learning experiences but face challenges like limited infrastructure and access. Interactive learning methods, such as Project-Based Learning (PjBL) and case-based simulations, effectively increase student engagement and competency but require adequate resources and faculty support. Collaboration among stakeholders, including government, educational institutions, and industry, is crucial for resource sharing and aligning education with industry standards. Sustainability is equally important, requiring continuous evaluation and feedback to maintain program relevance and quality. This review emphasizes the need for innovative, collaborative, and sustainable strategies to transform pharmacy education in Indonesia; ensuring graduates are equipped to meet the evolving demands of the modern pharmaceutical landscape.

Keywords: Curriculum flexibility; faculty training; technology integration; interactive learning; stakeholder collaboration.

1. Introduction

Pharmacy education in Indonesia is at a critical juncture as it adapts to the rapidly evolving needs of the pharmaceutical industry and the technological advancements shaping healthcare systems worldwide. The current educational structure, comprising a four-year undergraduate program and a one-year professional pharmacy program, adheres to the standards set by the Association of Indonesian Pharmacy Higher Education (APTFI) and aligns with the World Health Organization's Seven Star Pharmacist concept. While undergraduate programs emphasize foundational knowledge, including pharmaceutical sciences and clinical pharmacy, the professional programs focus on pharmacy practice, preparing graduates for more diverse roles and responsibilities within the healthcare sector.

Despite notable progress, persistent challenges such as misaligned policies, limited stakeholder collaboration, and gaps in competency-based training continue to hinder the full potential of pharmacy education in Indonesia. Addressing these barriers is essential to strengthening pharmacists' roles in delivering effective healthcare services across the country (Cokro *et al.*, 2021).

The rapid evolution of technology and the increasing complexity of the pharmaceutical industry demand significant transformations in pharmacy education. Digitalization, automation, and data-driven practices, as part of the Pharmacy 4.0 framework, require graduates to be not only well-versed in theoretical knowledge but also proficient in technological and practical skills. This underscores the urgent need for reforms in key areas, including curriculum design, faculty development, technological infrastructure, and teaching methodologies, to equip students with the competencies needed to thrive in a modern pharmaceutical landscape (Arief *et al.*, 2022).



An adaptive and flexible curriculum plays a pivotal role in bridging the gap between academic learning and industry requirements. Integrating digital tools, such as virtual simulations and online learning platforms, not only enhances accessibility but also increases the relevance of pharmacy education, particularly in underserved or remote regions. Blended learning models and Project-Based Learning (PjBL) have been shown to foster critical thinking, teamwork, and problem-solving skills, enabling students to address real-world challenges effectively (Meilianti *et al.*, 2021; Kurniawan *et al.*, 2024).

Equally important is the development of faculty capacity to implement modern pedagogical approaches. Faculty training initiatives, focusing on Problem-Based Learning (PBL), computer-based simulations, and blended teaching methods, are critical for ensuring effective student engagement and better learning outcomes. Successful programs, such as those implemented by Universitas Indonesia, highlight the impact of innovative teaching strategies on adapting education to technological advancements (Almulla *et al.*, 2020; Universitas Indonesia, 2023).

Technological infrastructure further underpins the transformation of pharmacy education, with Virtual Reality (VR), Augmented Reality (AR), and advanced e-learning platforms offering students immersive and interactive learning experiences. These tools are particularly valuable for understanding complex pharmaceutical processes and preparing students for Pharmacy 4.0, where digital skills are indispensable (Zhao *et al.*, 2023). However, challenges related to infrastructure limitations, particularly in remote areas, require targeted investments and collaborative solutions.

Finally, the adoption of interactive learning methods, such as PjBL and case-based learning, has proven highly effective in preparing students for professional challenges. These methods emphasize active engagement, teamwork, and practical applications of knowledge, equipping students with skills that align with the evolving needs of the pharmaceutical industry. Evidence from studies in institutions like Universitas Muhammadiyah Malang underscores the positive impact of these methods on student engagement and competency development (Kexin & Buang, 2024; Ingale *et al.*, 2024).

By addressing these critical components—curriculum reform, faculty training, technological infrastructure, and interactive methodologies—pharmacy education in Indonesia can achieve global standards and ensure that its graduates are prepared for the complexities of the modern pharmaceutical industry. Collaboration among academic institutions, government entities, and industry stakeholders will be crucial to realizing this transformative vision and elevating pharmacy education to meet both national and international healthcare demands.

2. Pharmacy Education in Indonesia

Pharmacy education in Indonesia stands at a critical juncture in its history, facing modernization challenges amidst the increasingly dynamic pharmaceutical industry. In response to these challenges, several approaches have been identified to enhance the quality and relevance of pharmacy education. This review focuses on four key areas: the development of a flexible curriculum, faculty training, strengthening technological infrastructure, and the implementation of interactive learning methods.

2.1 Development of a Flexible Curriculum

The development of a flexible and adaptive curriculum is essential in pharmacy education to meet the rapidly evolving demands of the pharmaceutical industry. The dynamic nature of this sector requires educational programs that are not only responsive to technological advancements but also aligned with global trends and local needs. A flexible curriculum facilitates the integration of innovative technologies such as digital learning platforms, virtual simulations, and other interactive tools, which significantly improve the quality and accessibility of education. These technologies provide students with immersive and engaging learning experiences, enabling them to develop critical thinking, collaboration, and problem-solving skills that are crucial in modern pharmacy practice (Meilianti *et al.*, 2021).

Moreover, such a curriculum is indispensable in preparing students for the emerging era of Pharmacy 4.0, which emphasizes digitalization, automation, and the use of big data in pharmaceutical processes. Pharmacy 4.0 necessitates a workforce equipped with digital literacy and the ability to operate within automated systems, making the integration of these elements into the curriculum an urgent priority. Studies have demonstrated that approaches like Problem-Based Learning (PBL) and Project-Based Learning (PjBL) effectively bridge the gap



between theoretical knowledge and practical application, fostering competencies required in technologically driven environments (Rhoney *et al.*, 2020; Bottacin *et al.*, 2024).

However, despite these advantages, the implementation of a flexible curriculum is not without challenges. Resistance to change among educators and administrators, coupled with limited financial and technological resources, often hinders its widespread adoption. Many institutions, particularly in developing countries, face difficulties in acquiring the necessary infrastructure and training faculty to effectively utilize advanced teaching methods and technologies. Additionally, aligning the curriculum with industry expectations and regulatory requirements requires ongoing collaboration between academic institutions, government bodies, and industry stakeholders (Filho *et al.*, 2018).

To overcome these barriers, a strategic and phased approach is needed. This includes investing in faculty development programs, securing funding for technological upgrades, and establishing partnerships with industry players to ensure the curriculum remains relevant and aligned with real-world demands. Furthermore, continuous evaluation and feedback mechanisms should be integrated to monitor the effectiveness of the curriculum and make necessary adjustments. By addressing these challenges, pharmacy education can produce graduates who are not only knowledgeable but also adaptable and capable of thriving in the rapidly advancing field of pharmacy.

Ultimately, a flexible and adaptive curriculum is more than an educational necessity; it is a strategic tool for empowering the next generation of pharmacists to meet the challenges and opportunities of the modern pharmaceutical landscape. Through its successful implementation, pharmacy education can achieve its dual goals of academic excellence and industry relevance, ensuring a workforce that is well-prepared to contribute to global healthcare advancements.

2.2 Faculty Training

Faculty members are pivotal in driving the success of modern teaching methodologies in pharmacy education. Their role extends beyond delivering lectures to shaping the educational environment and equipping students with skills needed in the evolving pharmaceutical industry. To fulfill this role effectively, continuous professional development is indispensable. Faculty training programs play a critical role in improving pedagogical skills and enabling the integration of advanced educational technologies into teaching practices.

Research from Universitas Indonesia, in collaboration with the Association of Indonesian Pharmacy Higher Education (APTFI), underscores the impact of such training programs in enhancing teaching quality, particularly in clinical pharmacy. These programs focus on innovative teaching strategies, experiential learning, and digital integration, fostering a more interactive and engaging learning environment. By leveraging these approaches, educators are better equipped to address the dynamic needs of pharmacy education and ensure that students acquire relevant and practical skills (Universitas Indonesia, 2023; Phiri *et al.*, 2023).

The training programs enable faculty members to adopt modern teaching tools such as computer-based simulations, case-based learning, and Virtual Reality (VR) technology. These tools create immersive learning experiences, allowing students to engage in realistic scenarios that enhance their critical thinking and problem-solving abilities. However, despite these advancements, several challenges hinder the widespread implementation of such training programs. Time constraints, limited funding, and restricted access to high-quality training resources remain significant barriers, particularly in underfunded institutions or those in remote areas.

To overcome these challenges, collaboration among educational institutions, government bodies, and training organizations is essential. Partnerships can provide financial support, facilitate resource sharing, and create standardized training programs that ensure equitable access for educators across the country. Furthermore, integrating training opportunities into national educational policies can help institutionalize faculty development as a core component of pharmacy education.

By addressing these barriers and prioritizing faculty development, pharmacy education in Indonesia can achieve higher standards of teaching quality and better prepare students for the demands of the modern pharmaceutical landscape. Sustainable and impactful faculty training programs are not only a necessity but also an investment in the future of healthcare education.



2.3 Enhancement of Technological Infrastructure

Technology plays a transformative role in pharmacy education, enabling more dynamic, digital, and interactive learning environments. Tools such as Virtual Reality (VR), Augmented Reality (AR), and e-learning platforms provide students with immersive experiences that bridge the gap between theoretical knowledge and practical application. These technologies are especially beneficial in areas like clinical pharmacy education and drug manufacturing, where students can safely practice complex scenarios in virtual environments before transitioning to real-world settings. For instance, VR allows students to simulate patient interactions or drug preparation processes, enhancing both their technical skills and confidence (Zhao *et al.*, 2023).

Despite these advancements, technological infrastructure limitations continue to pose challenges, particularly in remote institutions. Issues such as unstable internet connections, outdated hardware, and insufficient access to high-quality learning software hinder the full integration of these technologies into pharmacy education. These barriers disproportionately affect institutions in less urbanized areas, limiting equal access to modern learning tools.

To address these challenges, significant investments in technological infrastructure are essential. Educational institutions need to prioritize upgrading internet connectivity, acquiring modern hardware, and adopting robust e-learning software. Furthermore, collaborations with educational technology providers can help bridge gaps by offering customized solutions tailored to the unique needs of pharmacy programs. Initiatives such as public-private partnerships and government-led funding programs can further support equitable access to technology-enhanced education. By overcoming these barriers, pharmacy education can harness the full potential of digital tools, ensuring students are well-prepared for the evolving demands of the pharmaceutical industry (Hennessy *et al.*, 2022).

2.4 Implementation of Interactive Learning Methods

Interactive learning methods, such as Project-Based Learning (PjBL) and case-based simulations, play a pivotal role in enhancing student engagement and competency development. These approaches immerse students in real-world learning contexts, such as solving clinical problems or designing new drug formulations, bridging the gap between theoretical knowledge and practical application. For instance, research conducted in a Muhammadiyah junior high school in East Java highlighted the effective implementation of PjBL in intracurricular settings, where students achieved competency levels with scores ranging from 70 to 90. The study also noted that PjBL significantly improved critical thinking, teamwork, and the practical application of knowledge, with 63% of the implementation rated as effective. These results emphasize the potential of PjBL to foster essential skills needed for professional success (Chamisijatin and Zaenab, 2021).

In pharmacy education, interactive learning methods provide valuable opportunities to simulate real-life scenarios, such as patient consultations or the development of pharmaceutical formulations. Such methods encourage students to actively engage with course material and develop problem-solving abilities, which are critical for the dynamic demands of the pharmaceutical industry. However, challenges in adopting these methods persist, particularly the need for adequate faculty training to design and facilitate effective projects. Additionally, ensuring sufficient time, resources, and institutional support remains a barrier to broader implementation (Doulougeri *et al.*, 2024).

Addressing these challenges requires targeted investments in faculty development, the creation of well-structured project guidelines, and strategic allocation of resources. With these efforts, interactive learning methods can become an integral component of pharmacy education in Indonesia, equipping graduates with the skills and competencies needed to thrive in the modern pharmaceutical landscape. The successful integration of these methods will not only elevate educational standards but also ensure that pharmacy graduates are prepared to meet the industry's evolving challenges and opportunities.

2.5 Stakeholder Collaboration

Collaboration among stakeholders is a critical component in transforming pharmacy education. The success of educational reforms depends on the synergy between educational institutions, the government, and the pharmaceutical industry to align curricula with workforce demands. According to Filho *et al.* (2018), stakeholder collaboration helps bridge the gap between education and practice by providing insights into the competencies required by the industry.



Partnerships with the pharmaceutical industry enable the development of internship programs and hands-on experiences for students, providing them with practical knowledge of the workplace. Additionally, government involvement is essential in supporting educational policies and funding for infrastructure and faculty training. Public-private partnerships (PPP) are particularly effective in facilitating the adoption of modern technologies, such as Virtual Reality (VR) and Augmented Reality (AR), into teaching practices (Hennessy *et al.*, 2022).

Such collaborations not only strengthen the relationship between academia and industry but also ensure the sustainability of educational transformation. Zhao *et al.* (2023) highlight that cross-sector collaboration significantly supports innovation and prepares graduates to meet global challenges.

2.6 Sustainability and Evaluation

Sustainability and evaluation are vital to ensuring the long-term success of pharmacy education reforms. Continuous evaluation enables educational institutions to monitor the effectiveness of curricula, teaching methods, and technology integration. Southworth *et al.* (2023) emphasize that data-driven evaluation mechanisms are essential to assess whether new approaches successfully enhance student competencies and meet industry needs.

Additionally, feedback from students, faculty, and industry stakeholders should be used to address gaps and refine program implementation. Evaluation programs that incorporate surveys and in-depth interviews have been proven effective in providing valuable insights for institutions (Kurniawan *et al.*, 2024).

The sustainability of educational transformation also requires long-term planning, which includes investments in faculty training, the development of technological infrastructure, and funding for research and innovation. Rhoney *et al.* (2020) argue that integrating sustainability into pharmacy education involves iterative reforms based on principles of adaptability, efficiency, and alignment with global needs. Well-executed evaluation and sustainability strategies ensure that pharmacy education remains relevant to global standards while enabling institutions to adapt to technological advancements and evolving industry demands.

3. Results

This study highlights several key strategies to enhance pharmacy education in Indonesia, focusing on four main areas: curriculum flexibility, faculty training, technological infrastructure, and interactive learning methods. The development of a flexible and adaptive curriculum is essential to address the rapidly changing demands of the pharmaceutical industry. Approaches such as Problem-Based Learning (PBL) and Project-Based Learning (PjBL) have been shown to significantly improve critical thinking, collaboration, and problem-solving skills, while the integration of digital tools, including virtual simulations and e-learning platforms, prepares students for the Pharmacy 4.0 era (Meilianti *et al.*, 2021; Rhoney *et al.*, 2020). However, challenges such as resistance to curriculum changes and limited resources hinder widespread implementation (Filho *et al.*, 2018).

Faculty training also plays a vital role in modernizing pharmacy education. Continuous professional development programs, such as those implemented by Universitas Indonesia in collaboration with APTFI, have demonstrated success in enhancing teaching quality, particularly in clinical pharmacy. These programs emphasize innovative teaching methods, experiential learning, and digital integration (Universitas Indonesia, 2023; Phiri *et al.*, 2023). Despite their benefits, barriers like time constraints and funding limitations remain prevalent, necessitating collaboration among institutions, government bodies, and training organizations to ensure sustainable and impactful training opportunities.

In addition, technological infrastructure is a critical factor in advancing pharmacy education. Tools such as Virtual Reality (VR), Augmented Reality (AR), and e-learning platforms provide immersive learning experiences that bridge the gap between theoretical knowledge and practical application, especially in clinical pharmacy and drug manufacturing (Zhao *et al.*, 2023). However, institutions, particularly those in remote areas, face challenges such as unstable internet connections, inadequate hardware, and limited access to high-quality learning software. Addressing these issues requires targeted investments and partnerships with technology providers to enhance access and infrastructure (Hennessy *et al.*, 2022).

Lastly, interactive learning methods, such as PjBL and case-based simulations, have proven effective in enhancing student engagement and competency development. Research conducted in East Java demonstrated that PjBL improves critical thinking, teamwork, and the practical application of knowledge, with students achieving competency levels ranging from 70 to 90 (Chamisijatn and Zaenab, 2021). However, challenges such

as insufficient faculty training and limited resources for project implementation need to be addressed to maximize the potential of these methods (Doulougeri *et al.*, 2024).

Stakeholder collaboration is essential to overcoming many challenges faced by pharmacy education. Collaborative efforts among government agencies, educational institutions, and industry stakeholders can facilitate resource sharing, funding opportunities, and alignment of educational outcomes with industry needs. Public-private partnerships are particularly important for implementing innovative teaching strategies, upgrading technological infrastructure, and expanding access to modern tools and resources. Such partnerships can also drive the alignment of curricula with both national and global standards, ensuring that pharmacy graduates are equipped with the skills required in the modern pharmaceutical industry (Filho *et al.*, 2018).

Sustainability and evaluation play a critical role in ensuring the long-term success of transformation efforts in pharmacy education. Regular monitoring and evaluation mechanisms should be established to assess the effectiveness of curriculum changes, faculty training programs, and technology integration. Feedback from students, faculty, and stakeholders should inform iterative improvements to maintain the relevance and quality of educational programs. Long-term planning and investment in sustainable practices, including environmentally friendly initiatives, can further enhance the resilience and global competitiveness of pharmacy education in Indonesia.

Strategies for Transforming Pharmacy Education in Indonesia	
Flexible Curriculum	<ul style="list-style-type: none"> Integrate digital learning platforms and virtual simulations. Implement Problem-Based Learning (PBL) and Project-Based Learning (PjBL). Align curriculum with Pharmacy 4.0 (digitalization, automation, and big data). Accommodate local and global industry needs.
Faculty Training	<ul style="list-style-type: none"> Conduct continuous professional development programs. Train faculty in innovative teaching methods. Enhance skills in using advanced technologies like VR and AR. Foster collaboration with international and national training programs.
Strengthening Technological Infrastructure	<ul style="list-style-type: none"> Invest in stable internet connectivity and updated hardware. Provide access to e-learning tools, VR/AR technology, and interactive software. Establish partnerships with technology providers to tailor solutions for pharmacy education. Focus on equitable access, particularly in remote institutions.
Implementation of Interactive Learning Methods	<ul style="list-style-type: none"> Utilize PjBL and case-based simulations to foster critical thinking and collaboration. Design real-world, practice-based scenarios for student engagement. Allocate resources for project design and facilitation. Provide ongoing evaluation and feedback mechanisms.
Stakeholder Collaboration	<ul style="list-style-type: none"> Involve government, educational institutions, and industry stakeholders. Develop public-private partnerships for resource sharing and funding. Ensure alignment of educational outcomes with industry standards and expectations.
Sustainability and Evaluation	<ul style="list-style-type: none"> Monitor the effectiveness of curriculum changes and teaching methods. Adapt strategies based on feedback from students, faculty, and stakeholders. Establish long-term plans for maintaining and improving the quality of education.

Figure 1: Strategies for Transforming Pharmacy Education in Indonesia

Overall, these findings emphasize the importance of adopting innovative and collaborative educational strategies in pharmacy education. By addressing existing challenges through strategic planning, stakeholder collaboration, and sustainable investments in training and technology, Indonesia's pharmacy education system can produce graduates who are well-prepared to meet the demands of the modern pharmaceutical industry.

4. Conclusion

Pharmacy education in Indonesia requires transformative strategies to align with industry demands. Key priorities include developing a flexible curriculum with innovative methods like PBL and PjBL, enhancing faculty training, strengthening technological infrastructure, and implementing interactive learning approaches. These efforts improve critical thinking, teaching quality, and immersive learning experiences while preparing



students for the Pharmacy 4.0 era. Collaborative efforts among the government, institutions, and industry are essential to overcoming challenges and achieving global standards in pharmacy education.

References

- [1]. Almulla MA., 2020, The Effectiveness of The Project-Based Learning (PBL) Approach as a Way to Engage Students in Learning, *SAGE Open*, 2020:2-115.
- [2]. Arief NN., Gustomo A., Roestan MR., Putri ANA., Islamiaty M., 2022, Pharma 4.0: Analysis On Core Competence and Digital Levelling Implementation in Pharmaceutical Industry in Indonesia, *Heliyon*, 8(8):e10347.
- [3]. Bottacin WE., de Souza TT., Melchioris AC., Reis WCT., 2024, Preparing Pharmacists for the Digital Age: How Pharmacy Courses are Adapting to Challenges and Opportunities, *American Journal of Pharmaceutical Education*, 88(6):100700.
- [4]. Chamisijatin L., Zaenab S., 2024, Student Competencies in Intracurricular Learning Through Project-Based Learning in Muhammadiyah Junior High School, *Research and Development in Education*, 4(1):285-303.
- [5]. Cokro F., Atmanda PFK., Sagala RJ., Arrang ST., Notario D., Rukmini E., Aparasu R., 2021, Pharmacy Education in Indonesia, *Pharmacy Education*, 21(1):432-442.
- [6]. Doulougeri K., Vermunt JD., Bombaerts G., Bots M., 2024, Challenge-Based Learning Implementation in Engineering Education: A Systematic Literature Review, *Journal of Engineering Education*, 113:1076-1106.
- [7]. Filho WL., Raath S., Lazzarini B., Vargas VR., de Souza L., Anholon R., Quelhas OLG., Haddad R., Klavins M., Orrlovic VL., 2018, The Role of Transformation in Learning and Education for Sustainability, *Journal of Cleaner Production*, 199:286-295.
- [8]. Hennessy S., D'Angelo S., McIntyre N., Koomar S., Kreimeia A., Cao L., Brugha M., Zubairi A., 2022, Technology Use for Teacher Professional Development in Low-and Middle-Income Countries: A Systematic Review, *Computers and Education Open*, 3:100080.
- [9]. Ingale S., Kulkarni V., Patil A., Vibhute S., 2024, Implementing Project-Based Learning (PBL) In Engineering Education: An Analytical Study of Student Engagement and Learning Outcomes With Statistical Insight, *Educational Administration: Theory and Practice*, 30(1):4333-4342.
- [10]. Kexin D., Buang NA., 2024, Integrating Innovative Teaching Strategies: Assessing the Effectiveness of Flipped Classrooms, Blended Learning, and Task-Oriented Methods in Enhancing Academic Performance in Vocational IT Education, *Journal of Digitainability, Realism & Mastery*, 3(5):94-108.
- [11]. Kurniawan D., Masitoh S., Bachri BS., Wahyuningsih T., Mulawarman WG., Vebibina A., 2024, Evaluation of Digital Project Based Blended Learning Model to Improve Students Critical Thinking and Problem Solving Skills, *Journal of Ecohumanism*, 3(8):1875-1895.
- [12]. Meilianti E., Smith F., Bader L., Himawan R., Bates I., 2021, Competency-Based Education: Developing an Advanced Competency Framework for Indonesian Pharmacists, *Frontier in Medicine*, 8,769326: 1-11.
- [13]. Phiri D., Haambokoma NM., Kalinde B., Phiri-Nalube P., Muleya G., 2023, Transformative Pedagogies and Practices: The Potential of the School-Based In-Service Teacher Training (SITT) Model in Transforming Teaching and Learning in Zambia, *Journal of the Educational Research Association of Zambia*, 1(1):60-85.
- [14]. Rhoney DH., Singleton S., Nelson NR., Anderson SM., Hubal R., 2020, Forces Driving Change in Pharmacy Education: Opportunities to Take Academic, Social, Technological, Economic, and Political into The Future, *Journal of the American College of Clinical Pharmacy*, 4:639-651.
- [15]. Southworth J., Migliaccio K., Glover J., Glover J., Reed D., McCarty C., Brendemuhl J., Thomas A., 2023, Developing a Model for AI Across The Curriculum: Transforming The Higher Education Landscape Via Innovation in AI Literacy, *Computers and Education: Artificial Intelligence*, 4,2023:100127.
- [16]. Universitas Indonesia, 2023, Innovative Teaching Strategies Support the Evolution of Pharmacy Education in Indonesia. Retrieved from <https://www.ui.ac.id/en/innovative-teaching-strategies-support-the-evolution-of-pharmacy-education-in-indonesia/>.
- [17]. Zhao X., Ren Y., Cheah KSL., 2023, Leading Virtual Reality (VR) and Augmented Reality (AR) in Education: Bibliometric and Content Analysis From the Web of Science (2018-2022), *SAGE Open*, 2023:1-23.



Fitra Fauziah *et al*, International Journal of Pharmaceutical Sciences and Medicine (IJPSM),
Vol.10 Issue. 1, January- 2025, pg. 42-49

ISSN: 2519-9889

Impact Factor: 5.958

A Brief Author Biography

Fitra Fauziah – A lecturer at the School of Pharmaceutical Science Padang (STIFARM Padang), specializing in pharmacology and clinical pharmacy, with interest in pharmacy education.

Silvy Aldila – A lecturer at the STIKES Telogorejo Semarang, Central Java, Indonesia, specializing in pharmaceutical technology with interest in pharmacy education.

Henni Rosaini - A lecturer at the School of Pharmaceutical Science Padang (STIFARM Padang), specializing in pharmaceutical technology with interest in pharmacy education.

Muthia Fadhilla – A lecturer at the School of Pharmaceutical Science Padang (STIFARM Padang), specializing in pharmaceutical technology with interest in pharmacy education.

Sinta Wahyuni – Sinta Wahyuni – A lecturer at the School of Pharmaceutical Science Padang (STIFARM Padang) with expertise in language and background in education.

Sanzea Effendy - A lecturer at the School of Pharmaceutical Science Padang (STIFARM Padang), specializing in pharmaceutical technology with interest in pharmacy education.