The Urgency of Technology Integration Skills for Lecturers in the Teacher Professional Program at Universitas Negeri Medan

Tiur Malasari Siregar[1], Abil Mansyur[2], Fajar Apollo Sinaga[3], Muliawan Firdaus[4], Karmila Machmud[5], Suci Frisnoiry[6]

{tiurmalasarisiregar@unimed.ac.id[1], abil@unime.ac.id[2], sinaga_fajar@yahoo.com[3], muliawanfirdaus@unimed.ac.id[4], karmila.machmud@ung.ac.id[5], sucifrisnoiry@unimed.ac.id[6]}

Mathematics Education Study Program, Universitas Negeri Medan[1,4,6], Mathematics Study Program, Universitas Negeri Medan[2], Sports Science Study Program, Universitas Negeri Medan[3] , English Department, Faculty of Letters and Culture, Univeritas Negeri Gorontalo[5]

Abstract. The primary objective of this research on the Urgency of Technology Integration Skills for Teacher Professional Program Lecturers is to gain a deep understanding of the importance of technology integration skills for PPG lecturers, specifically those at Universitas Negeri Medan, in carrying out their duties and responsibilities as educators of future teachers. The dynamic evolution of education brings about significant changes, with technology becoming an inseparable part of the learning process. This undoubtedly creates opportunities to enhance the quality of education and prepare the younger generation to face the challenges of the 21st century. In this regard, the mastery of technology integration skills by Teacher Professional Program lecturers is both crucial and urgent. This study employs a library research approach. The results highlight the urgency of technology integration skills in Teacher Professional Program lecturers' teaching practices, including the demand for 21st-century skills, making learning more effective, broadening access to learning resources, keeping pace with technology-based learning models, preparing future teachers to face the challenges of educational digitization, and addressing the learning needs of Millennial and Generation Z students.

Keywords: Skills, Technology Integration, Lecturers, Teacher Professional Program.

1 Introduction

Learning processes in the Industrial Revolution 4.0 era are marked by the massive utilization of digital technology. Technology not only improves the quality and efficiency of learning but also prepares students for the challenges of the 21st century [1]. This makes it essential for educators, including PPG lecturers, to have the ability to integrate technology into learning effectively [2].

The PPG program, aimed at producing professional teacher candidates, bears the responsibility of equipping students with the ability to utilize technology in their teaching processes. Technology in education helps students achieve learning objectives and boosts their motivation to learn [3]. This also fosters the acquisition of 21st-century skills such as creativity, collaboration, critical thinking, and communication [4] [5]. However, many PPG lecturers

ICONSEIR 2024, November 28, Medan, Indonesia

DOI 10.4108/eai.28-11-2024.2355369

struggle to incorporate technology effectively due to limited training, insufficient resources, or resistance to adopting new technologies [6].

Previous research has identified several strategies to improve technology integration skills, such as conducting training workshops, building communities of practice, and providing adequate technical support [7]–[9]. However, these strategies must be tailored to the specific context and needs of PPG programs to overcome barriers effectively.

The primary objective of this study is to improve the integration of technology in learning to create innovative and quality education by enhancing PPG lecturers' understanding and skills in technology integration [10]. By understanding appropriate strategies, the PPG program can design professional development programs that meet lecturers' needs, enabling optimal technology integration into teaching and learning processes.

Thus, research on comprehensive strategies to enhance technology integration skills in learning for lecturers of the Teacher Professional Education (PPG) program will make a significant contribution to improving the quality of learning processes within the PPG program. Through the implementation of strategies that include training and sustainable professional development, facilitating collaboration and sharing of best practices, and ensuring the provision of adequate technological infrastructure and digital resources, the ability of PPG lecturers to design and implement learning that effectively integrates technology will experience a significant improvement. This, in turn, will prepare future PPG graduates with the competence and skills to utilize technology in supporting high-quality teaching and learning processes in today's and tomorrow's digital era. Furthermore, the findings from this research could also serve as a valuable reference or model for other professional education programs in designing strategies to enhance technology integration skills in learning for their professional educators.

2 Research Method

The research approach employed is a qualitative approach using a case study method. A qualitative approach was chosen to gain an in-depth understanding of effective strategies for enhancing technology integration skills among PPG lecturers [11]. The research participants consisted of lecturers teaching in the Teacher Professional Education (PPG) program from various universities. Participants were selected using purposive sampling based on the criteria of being permanent lecturers in the PPG program, having at least two years of teaching experience in PPG, and possessing experience in integrating technology into learning. Data collection techniques were carried out through three methods: interviews, observations, and document studies. The data obtained from interviews, observations, and document studies were analyzed using qualitative data analysis techniques, which included data reduction, data presentation, and drawing conclusions and verification.

3 Results and Discussion

The integration of technology in the Teacher Professional Education (PPG) program is a crucial aspect in preparing future educators who are competent and adaptive. By utilizing various tools and digital platforms, PPG can enhance the effectiveness of material delivery, expand access to learning resources, and create more interactive learning experiences that are relevant to the demands of the digital era [12]. Technology enables flexibility in learning

processes, facilitates collaboration between teachers and students or between lecturers and their students, and provides realistic teaching simulations through virtual reality [13]. Furthermore, technology integration equips future teachers with essential digital skills to teach the digital-native generation while introducing them to more efficient evaluation and feedback methods [14]. Thus, the utilization of technology in PPG not only enhances the quality of the program but also ensures that its graduates are well-prepared to face the challenges of education in an ever-evolving technological era.

Concrete Strategies for Enhancing Technology Integration Skills To improve technology integration skills in the PPG learning process, a series of training sessions, workshops, and mentoring programs have been conducted. PPG lecturers were equipped with both knowledge and practical skills to use various educational technologies, ranging from online learning platforms to interactive learning applications. They were also trained on how to integrate technology into lesson design effectively.

PPG lecturers participated in intensive training and workshops focusing on the use of technology in education. These training sessions covered introductions to various learning tools and applications, as well as the development of teaching content tailored to students' needs. Several interactive applications were identified as useful for facilitating technology-integrated teaching, including: (1) Curipod: Assists in creating engaging and interactive teaching materials and presentations; (2) Magic School AI: Provides virtual learning resources for independent learning and real-time feedback; (3) Perplexity AI: Helps simplify complex concepts through visualizations and interactive simulations; (4) ED-TED: Offers a platform for creating and sharing educational videos; (5) Liveworksheet: Enables the creation and management of digital worksheets; (6) Diffit: Supports the creation and sharing of interactive digital quizzes and assessments.

Table 1. List of Interactive Learning Applications

Application	Benefits	Website
Curipod	Prepares engaging and interactive lesson materials and presentations.	curipod.com
Magic School AI	Offers real-time feedback and facilitates learning progress monitoring.	magicschoolai.com
Perplexity AI	Simplifies complex concepts with interactive simulations and enhances problem-solving skills.	perplexity.ai
ED-TED	Facilitates collaboration in creating educational videos and increases access to quality content.	ed.ted.com
Liveworksheet	Simplifies the management of digital worksheets and provides instant feedback.	liveworksheets.com
Diffit	Enables real-time automated assessments and quiz management.	diffit.com

Curipod is a web-based platform designed for creating online presentations using Artificial Intelligence (AI). The AI tools in Curipod are specifically developed to support educators in teaching activities rather than replacing them. To access Curipod, users can visit curipod.com using a web browser, then click "Sign Up" to create an account. For quicker registration, Gmail accounts can be used. After creating an account, users will be prompted to input the topic title and learning objectives, select the appropriate grade level from 1st to 13th grade, and click the "do magic" button. The AI will then generate an interactive learning presentation within moments. Users can review, edit, and customize the presentation to suit their teaching needs.

When ready to present, educators can click the "Present" button and actively engage students by directing them to open a browser, visit curi.live, and enter the PIN displayed on the presentation. Through this platform, students can participate interactively by sharing opinions, answering questions, collaborating in groups, voting, or even sketching. Curipod makes learning more dynamic and engaging, fostering greater interaction and motivation during lessons.

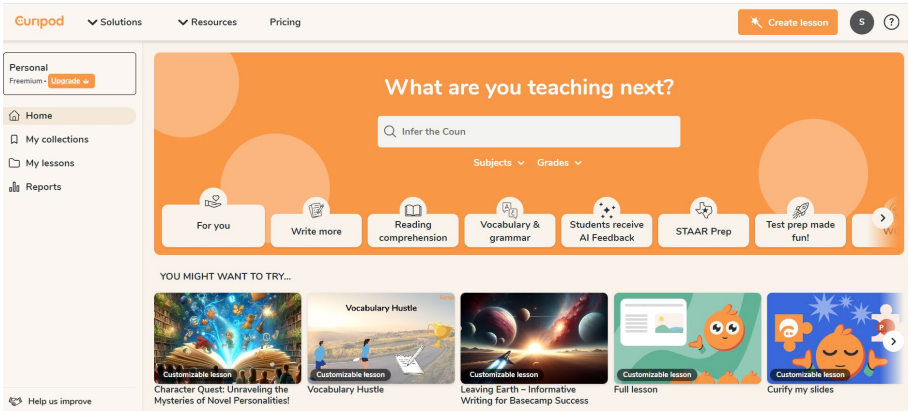

Fig. 1. *Curipod*

Magic School AI is an innovative and engaging platform that introduces a new approach to learning magic through artificial intelligence (AI). By focusing on the development of magical abilities and mastery of technology, Magic School AI offers students a unique learning experience. Leveraging advanced AI technology, students have the opportunity to explore various magical disciplines in depth and interactively. With expert instructors in the field, Magic School AI helps students grasp modern magic concepts and refine their magical skills innovatively. This approach enables students to prepare themselves as highly competitive magic practitioners in today's digital era.

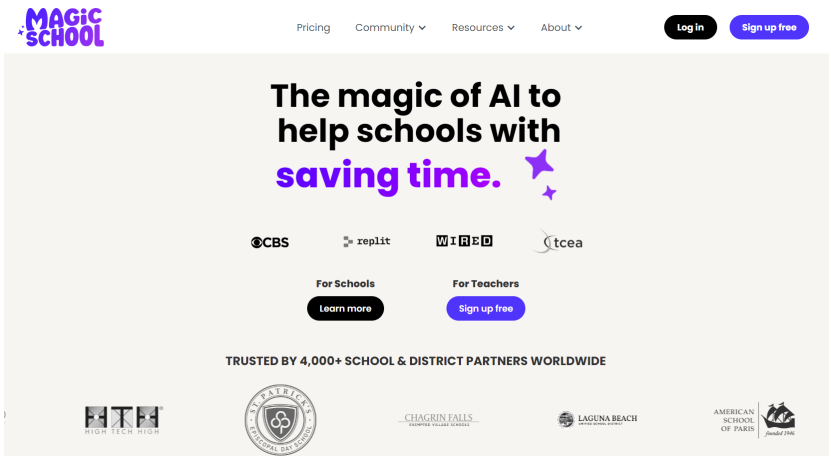

Fig. 2. *Magic School AI*

Perplexity AI is an AI-based technology that functions similarly to an internet search engine but operates as a chatbot powered by artificial intelligence. Users can search for information on

various topics with a single click. After entering a question, Perplexity AI provides answers based on the given instructions. In terms of functionality and system, Perplexity closely resembles the already popular ChatGPT, as both utilize the Generative Pre-Training Transformer (GPT) language model.

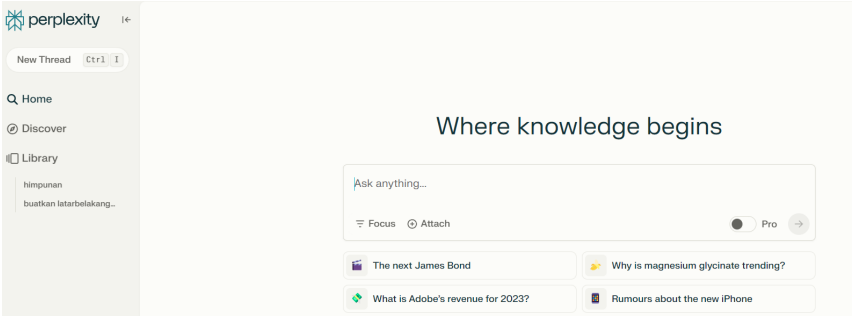

Fig. 3. *Perplexity AI*

ED-TED is an online learning platform offering short animated videos that educate viewers on a wide range of topics, including science, history, mathematics, arts, and more. "ED" in ED-TED stands for "Education," while "TED" represents "Technology, Entertainment, Design," the initials of the renowned TED conference. TED is a nonprofit organization established in 1984, famous for hosting conferences and providing a platform to share valuable ideas. ED-TED is one of TED's initiatives to disseminate knowledge through visually appealing and easy-to-understand videos.

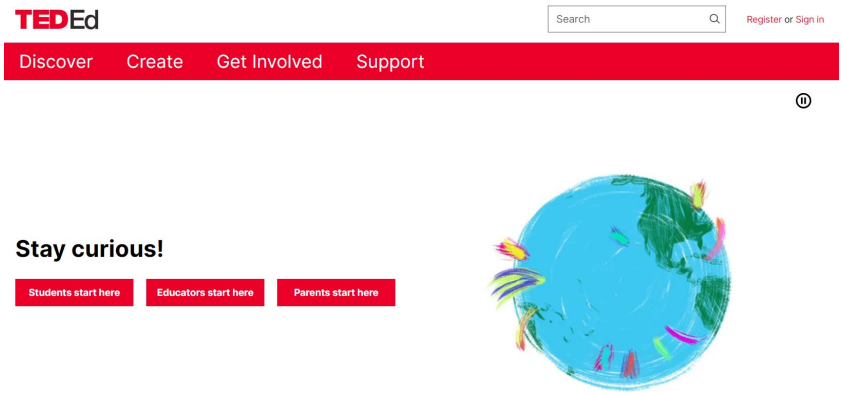

Fig. 4. *ED-TED*

Liveworksheet is an online learning platform that allows teachers to create and share interactive worksheets with their students. These worksheets can include various exercises, questions, and activities that students can complete directly online. Liveworksheet features tools for creating engaging and interactive worksheets, incorporating images, audio, video, and other interactive elements. Teachers can design worksheets tailored to their curriculum and share them via a unique link or code. Students can then access the worksheets from their devices and complete the tasks according to the teacher's instructions. This platform enhances student

engagement in online learning and provides a more appealing alternative to traditional printed worksheets.

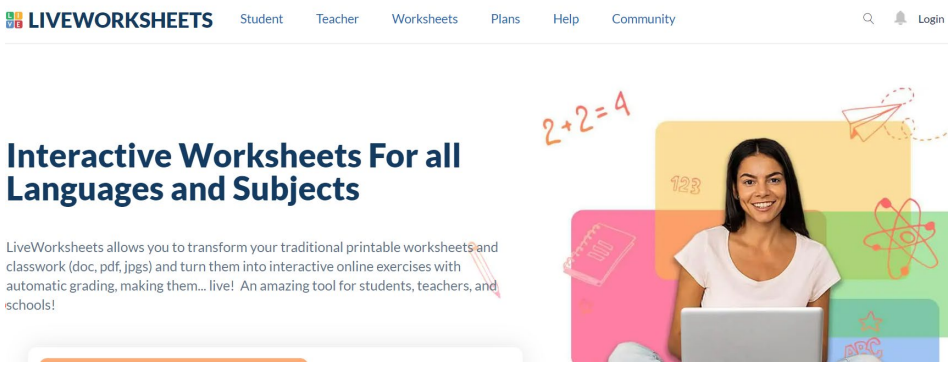

Fig. 5. *Liveworksheet*

Following the training sessions, mentoring or guidance provided by experienced educational technology experts greatly assisted PPG lecturers in applying the concepts and skills they learned to their teaching contexts. Mentoring was conducted face-to-face, during which participants were encouraged to develop teaching tools by integrating technology into their lesson plans. Collaborative discussions with peers facilitated the completion of tasks, making it easier and more efficient to incorporate the applications learned during the training into their teaching strategies.

The training yielded positive impacts on the ability of PPG lecturers to integrate technology into learning. This was evidenced by data collected through pre-tests and post-tests, surveys, observations, and technology-based project analysis. A significant improvement of 30.8% in technology integration skills was recorded. Ninety percent of participants showed increased scores, with 60% achieving scores above 80 on the post-test. Details of the average pre-test and post-test scores for the 50 training participants are illustrated in the graph provided.

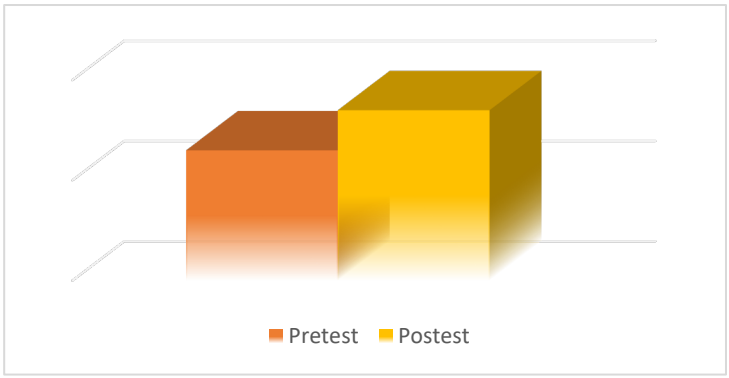

Fig. 6. Test Result Graph

Survey results from questionnaires distributed to participants also indicated favorable outcomes. Analysis of the responses, conducted using NVIVO-12 software, revealed that the dominant feelings expressed by participants after the training and mentoring sessions were

"motivating" and "informative." The Word Frequency analysis visualization further supports these findings.

Fig. 7. Survey Analysis Results Using NVIVO-12

There are numerous effective strategies for enhancing technology integration skills in learning [15]. Relevant studies highlight three primary strategies that can serve as alternatives for improving the skills of lecturers, particularly in integrating technology into learning. These strategies include:

a. Training and Workshops
   Research shows that training programs and workshops are effective in improving the technology integration skills of PPG lecturers. Practical and contextual training that provides examples of technological applications in real-life teaching scenarios greatly helps lecturers understand the benefits and proper use of technology [16], [17]. Moreover, training programs that are continuous and accompanied by mentoring and evaluations ensure that the acquired skills are fully implemented in teaching practices [18].
b. Establishing Communities of Practice
   Another proven strategy is the formation of communities of practice among PPG lecturers. These communities facilitate experience-sharing, collaborative learning, and support for integrating technology into learning. Through communities of practice, lecturers can share strategies, tips, and useful resources, as well as discuss challenges and solutions to overcome obstacles [19].
c. Providing Facilities and Technical Support
   Adequate technological facilities, such as hardware, software, and reliable internet access, are essential in supporting the integration of technology in learning. Additionally, responsive technical support is crucial to help lecturers resolve technical issues that may arise during technology-based learning processes [20], [21].

Based on the findings and analysis of recent literature, it can be concluded that improving technology integration skills among PPG lecturers can be achieved through several key

strategies. First, practical, contextual, and sustainable training and workshops effectively enhance lecturers' understanding and ability to apply technology in real teaching scenarios. Second, communities of practice provide a platform for lecturers to share experiences, collaborate, and support each other in facing the challenges of technology integration. Third, adequate technological facilities and responsive technical support are crucial factors in ensuring the effective implementation of technology in learning. Training provides foundational knowledge and skills, communities of practice encourage collaborative learning and experience-sharing, and facilities and technical support ensure that lecturers have the necessary resources to implement their knowledge.

In this study, efforts to improve technology integration skills were implemented through training and mentoring sessions. The results show that lecturers significantly improved their ability to integrate technology into their teaching. Additionally, participants responded positively to these activities. However, continuous evaluation is needed to keep up with the rapid evolution of educational technology. By applying these strategies comprehensively and sustainably, the quality of learning in the PPG program is expected to improve, ultimately having a positive impact on the competencies of future teachers in integrating technology into their teaching practices.

Along with the observed positive changes and responses, this study also identified factors that can support or hinder the implementation of technology integration in learning. Supporting factors include institutional leadership support and commitment, lecturers' motivation and positive attitudes toward technology use, sufficient budgets for procuring and maintaining technological facilities, and collaborations with external experts in educational technology [22]. On the other hand, hindering factors include the lack of continuous training and mentoring, limited time and high workloads for lecturers, inadequate technological infrastructure, resistance to change, and low motivation to adopt new technologies [23].

4 Conclusion

This study offers valuable insights for designing strategies to enhance technology integration skills among PPG lecturers. By addressing supporting and inhibiting factors, PPG programs can optimize strategy implementation, ultimately improving the quality of teacher education and preparing educators for modern pedagogical challenges.

Refences

[1] T. Wrahatnolo, "21St Centuries Skill Implication on Educational System," *IOP Conf. Ser. Mater. Sci. Eng.*, vol. 296, no. 1, pp. 0–7, 2018, doi: 10.1088/1757-899X/296/1/012036.

[2] S. Frisnoiry, T. M. Siregar, and Elfitra, "Digital Literacy Analysis in the Online Learning Process," *Proc. 6th Annu. Int. Semin. Transform. Educ. Educ. Leadersh. (AISTEEL 2021)*, vol. 591, no. Aisteel, pp. 898–901, 2022, doi: 10.2991/assehr.k.211110.201.

[3] A. Burik, "Using Technology to Help Students Set, Achieve, and Publicize Goals," *Adult Lit. Educ. Int. J. Literacy, Lang. Numer.*, vol. 3, no. 1, pp. 83–89, 2021, doi: 10.35847/aburik.3.1.83.

[4] N. Nurwataniah, S. H. Hasan, and ..., "Investigating the Effectiveness of the Teacher Professional Training Program (PPG) in Improving Teacher Competences," *... Online J. ...*, vol. 11, no. 4, pp. 1390–1400, 2022.

[5] A. Wiradimadja, N. Ratnawati, B. Kurniawan, R. P. Yaniafari, and J. S. Alivi, "Screen Recorder for

Guiding Distance Learning: Case Study of Teacher Professional Education Program," *Int. J. Emerg. Technol. Learn.*, vol. 16, no. 7, pp. 4–15, 2021, doi: 10.3991/ijet.v16i07.21173.
[6] P. N. Munje, "The impact of the lack of ICT resources on teaching and learning in selected South African primary schools," *Int. J. Learn. Teach. Educ. Res.*, vol. 19, no. 7, pp. 263–279, 2020, doi: 10.26803/IJLTER.19.7.15.
[7] S. Fuller, "Building communities of practice in distance learning courses for higher education teacher development," *Compass J. Learn. Teach.*, vol. 15, no. 1, 2022, doi: 10.21100/compass.v15i1.1249.
[8] D. Hu, B. Yuan, J. Luo, and M. Wang, "A review of empirical research on ICT applications in teacher professional development and teaching practice," *Knowl. Manag. E-Learning*, vol. 13, no. 1, pp. 1–20, 2021, doi: 10.34105/j.kmel.2021.13.001.
[9] I. S. Milara, K. Pitkänen, J. Laru, M. Iwata, M. C. Orduña, and J. Riekki, "STEAM in Oulu: Scaffolding the development of a Community of Practice for local educators around STEAM and digital fabrication," *Int. J. Child-Computer Interact.*, vol. 26, p. 100197, 2020, doi: 10.1016/j.ijcci.2020.100197.
[10] T. M. Siregar, "Virtual Video Aid Web-Based E-Learning," *Solid State Technology*, 2020.
[11] S. İ. Kuru Gönen, "A qualitative study on a situated experience of technology integration: reflections from pre-service teachers and students," *Comput. Assist. Lang. Learn.*, vol. 32, no. 3, pp. 163–189, 2019, doi: 10.1080/09588221.2018.1552974.
[12] G. Schnitman *et al.*, "The role of digital patient education in maternal health: A systematic review," *Patient Educ. Couns.*, vol. 105, no. 3, pp. 586–593, 2022, doi: 10.1016/j.pec.2021.06.019.
[13] R. Castro, "Blended learning in higher education: Trends and capabilities," *Educ. Inf. Technol.*, vol. 24, no. 4, pp. 2523–2546, 2019, doi: 10.1007/s10639-019-09886-3.
[14] G. Falloon, "From digital literacy to digital competence: the teacher digital competency (TDC) framework," *Educ. Technol. Res. Dev.*, vol. 68, no. 5, pp. 2449–2472, 2020, doi: 10.1007/s11423-020-09767-4.
[15] N. Muhamad, M. Huda, A. Hashim, Z. A. Tabrani, and M. A. Maárif, "Managing Technology Integration for Teaching Strategy: Public School Educators' Beliefs and Practices," *Lect. Notes Networks Syst.*, vol. 908, no. June, pp. 385–400, 2024, doi: 10.1007/978-981-97-0210-7_31.
[16] J. M. Barajas, K. M. Beck, J. F. Cooper, A. Lopez, and A. Reynosa, "How effective are community pedestrian safety training workshops? Short-term findings from a program in California," *J. Transp. Heal.*, vol. 12, no. August 2018, pp. 183–194, 2019, doi: 10.1016/j.jth.2019.01.002.
[17] M. Gandhi *et al.*, "Mentoring the mentors: Implementation and evaluation of four fogarty-sponsored mentoring training workshops in low-and middle-income countries," *Am. J. Trop. Med. Hyg.*, vol. 100, no. Suppl 1, pp. 20–28, 2019, doi: 10.4269/ajtmh.18-0559.
[18] G. T. Feyissa, D. Balabanova, and M. Woldie, "How effective are mentoring programs for improving health worker competence and institutional performance in africa? A systematic review of quantitative evidence," *J. Multidiscip. Healthc.*, vol. 12, pp. 989–1005, 2019, doi: 10.2147/JMDH.S228951.
[19] M. A. de Carvalho-Filho, R. A. Tio, and Y. Steinert, "Twelve tips for implementing a community of practice for faculty development," *Med. Teach.*, vol. 42, no. 2, pp. 143–149, 2020, doi: 10.1080/0142159X.2018.1552782.
[20] S. C. Eze, V. C. A. Chinedu-Eze, C. K. Okike, and A. O. Bello, "Factors influencing the use of e-learning facilities by students in a private Higher Education Institution (HEI) in a developing economy," *Humanit. Soc. Sci. Commun.*, vol. 7, no. 1, pp. 1–15, 2020, doi: 10.1057/s41599-020-00624-6.
[21] H. Mirzajani, R. Mahmud, A. Fauzi Mohd Ayub, and S. L. Wong, "Teachers' acceptance of ICT and its integration in the classroom," *Qual. Assur. Educ.*, vol. 24, no. 1, pp. 26–40, 2016, doi: 10.1108/QAE-06-2014-0025.
[22] Johny Taroreh, Sjeddie Watung, C. L. Kewo, and Febriyani Maureen Lidya Rattu, "Factors That Influence the Succes of Application of Technology in Learning: Teacher Work Motivation and Organizational Support," *J. Educ. Technol.*, vol. 7, no. 1, pp. 146–154, 2023, doi: 10.23887/jet.v7i1.53812.

[23] S. Naidu and K. Laxman, “Factors Inhibiting Teachers’ Embracing E-Learning in Secondary Education: A Literature Review,” *Asian J. Distance Educ.*, vol. 14, no. 2, pp. 124–143, 2019.