Designing Effective Online Learning Environments for Teacher Professional Development: Evidence from Indonesian In-Service Teachers

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Abstract

The teacher profession education program (TPEP) within virtuality is an alternative learning program that is believed to be important for Indonesian in-service teachers nowadays and in the future as learning through digital technology is the competitiveness of the nation that needs to be continuously improved. This study aims to investigate Indonesian in-service teachers' needs in the TPEP through online learning environments and to discover an effective design of online learning environment for TPEP in the future. The design used in this study was a mixed method with sequential explanatory design. For quantitative data, a questionnaire was distributed to the Indonesian in-service teachers attending the online TPEP over four months at a reputable private university in Indonesia, and 916 teachers completed the questionnaire. Meanwhile, the qualitative data were collected through semi-structured interview with selected Indonesia in-service teachers. The results indicate that online learning provides in-service teachers' needs, and effective design is recommended for better professional development for in-service teachers in Indonesia. In addition, the qualitative feedbacks from participants regarding online learning environments identify several challenges. These findings suggest that the proposed design of online TPEP can be significantly implemented to meet the evolving needs of educators in an increasingly digital world.

Keywords: Indonesian in-service teachers, learning design, online learning environments, professional development program

1. Introduction

In the 21st century, online learning is mandatory and required for students to use in the learning process (Dakhi et al., 2020) and to improve their digital literacy skills (Khan et al., 2022). Since 2000, online learning has been introduced in Indonesia, but the response of teachers from primary, secondary and tertiary schools has been low. Only a small number of people began to use simple online learning tools such as e-mails, conferences, and other digital media. The highest use of online learning occurred when the Covid-19 outbreak in March 2020 demanded that face-to-face learning in class be abolished to enable learning activities to be carried out at home (Tate & Warschauer, 2022). Teachers and students in schools and universities are using various online learning tools and media, starting with WhatsApp (Mulyono et al., 2021), social media (Alberth, 2019; Escamilla-Fajardo et al., 2021), as well as a variety of Learning Management System systems (Apoko, 2022), such as Google Classroom, Edmodo, Schoology, Moodle, Canvas, and video conference applications such as Zoom and G. Meets (Lowenthal et al., 2020). The wide-ranging use of online learning media has encouraged everyone to become accustomed to them and to continue to use them in all activities, especially in learning processes.

Currently, the Covid-19 epidemic has ceased, yet online learning environments still continue to exist due to its several advantages. Since 2019, the Government of Indonesia, through the Ministry of Education and Culture, has implemented an online learning program for the teacher profession education program (TPEP) to reach all levels of Indonesian teachers to quickly complete the teacher certification process under the law, due to the positive effects of the use of online learning. On the Law of number 14 of year 2005 on Teachers and Lecturers, it is stated that professional teachers can be obtained by means of the TPEP.

In terms of global relevance, it is important to recognize that the move to online learning is not unique to Indonesia. Worldwide, the rapid transition to online environments, particularly due to the Covid-19 outbreak, has revealed both challenges and opportunities in education systems. The need for digital literacy, flexibility and accessibility is considered crucial for professional development, especially for teachers who must adapt to the ever-evolving educational technologies and digital tools in order to maintain the effectiveness of their education. Some challenges to the implementation of online learning environments in the TPEP process identified could be such as instability of the Internet network (Sari & Nayır, 2020), the lack of capacity for the use of technology (Li, 2022), and the health status of the majority of teachers in the region, and the negative impact of socialization (Mushtaha et al., 2022). In addition to obstacles and challenges, some others have stated that the online administration of the TPEP can reduce the funding for the administration of the TPEP. For teachers, the implementation of online TPEP can help them obtain quality education anytime and anywhere (Masalimova et al., 2022) because they could communicate a lot and establish relationships with other teachers and teacher educators in virtual face-to-face rooms (Archambault et al., 2022). Furthermore, online

learning can develop teachers' communication and professional skills (Apoko, 2023; Samoylenko et al., 2021).

With the benefits offered, online learning environments can be a TPEP alternative learning program to meet Indonesian teachers' quality in the future as learning technology is the competitiveness of the nation that needs to be continuously improved. Online learning environments provide various conveniences, comforts, and maintain warmth and motivation in learning processes (Apoko & Sya'ban, 2022; Zhu et al., 2022) to support effective TPEP learning processes for in-service teacher.

To decide whether the online learning environment is effective, it is important to conduct research into the needs of in-service teachers participating in the TPEP at one of the universities that offers TPEP services and to recommend a design proposal for online learning environments. There is little research on the development of an online learning environment model, especially for Indonesian TPEP students, such as the study by Ahmed (2023) on the perspectives of 21st-century primary schools teachers and the study on the use of online learning for Turkish students (Kaya et al., 2023). In addition, another research conducted in Russia has offered online learning designs, particularly using digital learning tools and applying various teaching strategies to develop language skills and student professionalism (Samoylenko et al., 2021). The novelty of the research compared to previous research focuses on the level of in-service teachers' needs to TPEP, challenges, and the effective design of TPEP for in-service teachers in Indonesia.

Therefore, the formulation of research questions includes: (1) What are Indonesian in-service teachers' needs in the online TPEP? (2) What challenges are found in the online TPEP in Indonesia? and (3) What online learning environment design is recommended in the future TPEP? The findings of these research questions are expected to have a significant impact on national policy in the improvement of teachers in Indonesia regarding online professional development programs. When this result shows in-service teachers need stronger technical support, the Ministry of Education could prioritize investment in digital tools and Internet connectivity infrastructure across the region. Furthermore, by identifying specific challenges such as lack of digital literacy and difficulties in adapting to online education, a targeted training initiative could be created to address these gaps in teacher training programs. The proposed online TPEP design could serve as a model for future professional development efforts and guide policies aimed at ensuring that all teachers In Indonesia have access to quality, scalable and flexible learning environments.

2. Literature Review

Online Learning Design in the 21st century refers to the systematic development of online educational experiences that are tailored to meet the diverse needs of learners in a digital age (Rana, 2024). This design process integrates principles from instructional design, educational technology, and user experience to create engaging, effective, and

accessible learning environments (Huang, 2019). These environments utilize multimedia elements, interactive activities, and adaptive learning technologies to facilitate various learning styles and preferences (Chatham, 2021). The focus is on fostering a learner-centred approach where content is not only delivered but also interactively explored through simulations, whiteboards, discussion, and real-time feedback mechanisms.

The evolution of online learning design has been significantly influenced by advancements in technology and pedagogical theories that emphasize collaborative learning and problem-solving. Modern online learning platforms are designed to support not just content delivery but also social interaction, emotional engagement and collaboration among students, which are vital for deep learning (Järvenoja et al., 2020). Techniques such as gamification, microlearning, and the flipped classroom model are often employed to enhance learner engagement and learning performance (Ng et al., 2022). Additionally, the accessibility of learning analytics provides educators with insights into student interactions, progress, and outcomes, enabling continuous improvement of course design and personalized learning paths. As such, 21st-century online learning design is characterized by its dynamic, adaptive nature and its ability to cater to global audiences with varying educational needs and backgrounds.

Teacher professional learning is a complicated process, that includes teachers' cognitive and emotional participation both individually and collectively, as well as the ability and willingness to look for improvement or change (Fillerup, 2019) as well as the need to challenge and create (Keay et al., 2019). In the context of Online Teacher Professional Development (OTPD) program, it is a structured educational approach aimed at enhancing the professional skills and knowledge of individuals through digital platforms. These programs are designed to be accessible remotely, providing flexibility and ongoing support to learners in various professions (Wynants & Dennis, 2018). The structure and content of OTPD can vary, ranging from synchronous sessions to self-paced courses, often incorporating interactive components like webinars, discussion forums, and multimedia materials (Gupta & Sengupta, 2021; Idhalama et al., 2021).

OTPD offer numerous benefits for teachers, such as flexibility, accessibility, learning new skills, and developing pedagogical knowledge of their profession (Lucas & Vicente, 2023). These programs can be customized to meet the requirements of individual teachers, allowing them to focus on the skills, knowledge, and strategies that will help them become more effective and successful teachers (Lay et al., 2020). OTPD may also help teachers improve teaching abilities and strategies, increase interests and satisfaction in their courses, and provide a forum for networking and collaborating with other field professionals (Alsaleh, 2023).

While online professional development programs offer significant benefits, there are challenges associated with OTPD. Some of the main obstacles include a lack of knowledge about online technologies and programs, a lack of interactivity, access to technologies, financial support and materials, time, teachers' beliefs and practices, and support from

higher education (Almazova et al., 2020; Ferri et al., 2020; Iqbal et al., 2022; Simamora, 2020).

3. Research Methodology

3.1. Research Design

The method employed in this study was a mixed method with a sequential explanatory design in which both the quantitative and qualitative data are combined in a single study (Heigham & Croker, 2009). In relation to this current study, a questionnaire completed by in-service teachers in Indonesia was used along with the results of semi-structured interview to generate a more multidimensional view of online professional development program.

3.2. Participants of the Study

The participants of this study are 916 Indonesian in-service teachers attending the teacher profession education program (TPEP) within online learning environments at one reputable private university in Jakarta, Indonesia. The demographic breakdown of the participants reveals a significant majority are female, comprising 80% of the total, while males represent 20%. The majority of the teachers are educated to an undergraduate level (94.1%) with a smaller fraction holding graduate degrees (6%). Teachers come predominantly from urban and suburban areas of Java, with Jakarta, West Java, and Banten being the most common home locations. A considerable portion of teachers work in primary education (45.5%), indicating a strong emphasis on early education. Most have significant teaching experience, with 37.7% having taught for 11-15 years and 26% for 6-10 years. The participants demonstrate a relatively high level of digital connectivity, with 81.9% having internet access at home and 94% at school. A sizable number engage with digital tools regularly, with 52.2% spending 3-5 hours daily using a laptop or PC. The majority are also moderately skilled in ICT use (51%), yet some are found unskillful (14%) indicating that they have problems with using technological tools. Additionally, their familiarity with Learning Management Systems (LMS) has significantly increased over recent years, showcasing an adaptation to digital teaching methodologies, especially notable from the sharp rise in LMS familiarity post-2020.

3.3. Instruments

There are two kinds of data to collect: quantitative and qualitative data. In collecting the quantitative data, a questionnaire was distributed to all the participants of TPEP. The questionnaire comprises two sections, they are participant identity such as gender, subjects to teach, educational background, etc. The other section includes six questions with five options from strongly disagree (1), disagree (2), neutral (3), agree (4), and strongly agree (5). There is one aspect to measure the efficacy of online learning environment in the TPEP: perceived needs.

In order to ensure transparency and replication, the study emphasized the validity and reliability of its instruments. This questionnaire was designed to assess the needs and

challenges of TPEP service teachers and was validated by experts in online professional development and educational technology. A pilot study with 30 teachers helped improve any vague questions, and the reliability score of the questionnaire was 0.779 with a Cronbach's Alpha formula. In semi-structured interviews, the validity of the face and content was established by aligning the questions with the objectives of the study. Reliability was further supported by the member's check, where the participants checked and confirmed their responses.

For qualitative data, semi-structured interview was conducted for 15 in-service teachers selected based on the categories of subjects, gender, teaching experiences, and the regions. Each participant had 15-20 minutes for the interview taken place online and offline. The following is the questions addressed to the participants:

(1) Have you found your needs for this online TPEP?
(2) What courses do you think can be mastered best online? Is it Material Deepening, Developing Instructional Tools, or Teaching Practice?
(3) What challenges do you face in taking TPEP using online learning mode?
(4) Provide suggestions for online learning designs that you think are more effective to be implemented in future TPEP than now!

In qualitative interviews, a targeted sampling was used to ensure a variety of perspectives and choose participants based on criteria such as location, teaching experience and knowledge of online learning platforms. This method ensures that voices from different regions and backgrounds are included and reflects the extensive experiences in the TPEP context. After analyzing the quantitative results, the qualitative data from the interviews were used to provide a deeper insight and explanation to the trends observed in the survey data. This integration has enabled a richer and more nuanced understanding of the experiences and challenges of auxiliary teachers, thereby strengthening the robustness of the study results.

3.4. Data Analysis Techniques

After collecting the quantitative and qualitative data, the data were analysed. The quantitative and the qualitative data were then analysed separately, and the researchers integrated the two using a type of integration known as linking the quantitative results to the collection of qualitative data. (Creswell, 2018). For quantitative data, a descriptive statistics analysis was used to find out the scores of mean and standard deviations. Meanwhile, qualitative data were analysed with some steps: data tabulation and reduction, data organization and display, data narration, data interpretation, and data conclusion (Cohen et al., 2018; Miles et al., 2014). The process began with data tabulation and reduction, where responses were systematically coded and categorized according to recurring themes. For the first research question, needs such as essential knowledge acquisition, virtual learning atmosphere, and their enjoyment were highlighted. For the second, challenges such as limited technological infrastructure, access to resources, and digital literacy gaps emerged. The third question revealed recommendations focused on

promoting interactivity, providing personalized learning pathways, and ensuring adequate technical support. The data were displayed in visual narratives, facilitating comparison across themes and ensuring clear connections between the findings and the research questions. To ensure the reliability of the qualitative data, the triangulation by cross-referencing multiple data sources was used by doing member-checking where participants reviewed the interpretations, and conducting peer debriefing with colleagues to validate the coding scheme and interpretations. These steps ensured that the qualitative insights were accurate, trustworthy, and reflective of the participants' experiences.

4. Results

4.1. In-service teachers' needs in the course content and design through online TPEP

The needs on course content and design within the online TPEP are notably effective according to participant feedback, as shown by consistently high mean scores in various dimensions. Participants (53%) rated their growth in independent learning highly, with a mean score of 4.46, indicating that online learning has significantly fostered their autonomy. The suitability of learning materials on the LMS meets the needs of most participants (60%), evidenced by a mean score of 4.38, which is consistent with the high ratings for interactive virtual meetings at the same mean score. The enjoyment and engagement factors of the virtual meetings are also positively reviewed, aligning closely with the high ratings for overall satisfaction with the TPEP activities, which also garnered a mean score of 4.44. Confidence in taking online comprehensive exams showed a slightly lower yet still positive mean of 4.26, reflecting a broad approval of the online examination process. These results underscore the effectiveness of the TPEP's online learning environment in enhancing participant engagement, satisfaction, and academic confidence.

Table 3. Needs in the course content and design in the online TPEP

No	Questions	SD	D	N	A	SA	Mean	STDV
1	Online learning in TPEP has made me an independent learner.	0.0%	0.2%	0.2%	53%	46.7%	4.46	0.52
2	The learning materials on the LMS suit my needs as a teacher.	0.0%	0.3%	0.4%	60%	39.1%	4.38	0.51
3	Learning activities through virtual meeting takes place interactively.	0.0%	0.3%	0.2%	60%	39.1%	4.38	0.51
4	Online learning through virtual meeting facilitated by the instructors is fun.	0.0%	0.2%	0.5%	53%	46.6%	4.46	0.52
5	I am satisfied with TPEP activities through virtual meeting and LMS.	0.0%	0.4%	0.8%	53%	45.4%	4.44	0.54
6	I was more confident taking the comprehensive exam that was conducted online.	0.1%	1.3%	1.6%	66%	30.9%	4.26	0.56

The responses from participants in the TPEP program qualitatively reflect a strong alignment between the program's offerings and the specific needs of educators across various disciplines. Indonesian Language teacher (P12) reports gaining previously unacquired knowledge such as using AI tools and creating engaging digital learning media tailored to student needs. English teacher (P118) highlights how the program addressed her needs for crafting lesson plans and teaching modules, incorporating media and technology effectively, and making classroom learning both interesting and fun while resolving student learning challenges. Economics teacher (P215) emphasizes the acquisition of essential knowledge about proper planning and instructional tools. Kindergarten teacher (P493) affirms that the TPEP significantly met her professional needs by enabling her to devise structured lesson plans and effective learning methods, as well as creating appealing teaching media. Similarly, Primary school teacher (P543) appreciates the insights gained into developing effective learning tools and preparing for technology-enhanced teaching. Collectively, these testimonials showcase the program's effectiveness in enhancing pedagogical skills and addressing the diverse educational needs of teachers. The following is some excerpts from some teachers.

P12 (Indonesian language teacher, F)	:	The need that I found for the online TPEP was that I gained knowledge that had not been obtained before, such as using AI, creating interesting digital-based learning media that met the needs and characteristics of students.
P118 (English teacher, F)	:	Yes, I found my needs, such as how to make lesson plans and teaching modules, how to use media and technology in learning, I was also provided with how to make learning interesting and fun in class. I also found solutions to every student learning problem in the classroom after taking this TPEP.
P215 (Economics teacher, M)	:	Yes, I can find the need for more knowledge about the correct planning and learning tools.
P493 (Kindergarten teacher, F)	:	Really found my needs as a kindergarten teacher. With this online TPEP, I can apply the learning plan needs well, starting from creating structured lesson plans, effective learning methods, creating interesting teaching media, and so on.
P543 (Primary school teacher, F)	:	Yes, in this TPEP I gained knowledge in making good learning tools. And what things must be prepared by teachers in teaching, including choosing technology-based learning media.

4.2. The challenges Indonesian in-service face in taking online TPEP

Participants in the TPEP online learning mode have identified several challenges that affect their learning experience, primarily revolving around technical and environmental issues. This current result highlighted frequent technical difficulties such as poor network signals and power outages exacerbated by environmental conditions such as rain, which disrupted study focus and learning continuity. Moreover, it was found the limited direct interaction with instructors and peers as a significant barrier, along with difficulties in understanding material without face-to-face guidance and technical challenges related to internet connectivity and platform usability. Participants also shared similar concerns

about fluctuating internet quality and hardware reliability, noting frequent errors with her laptop, especially during task uploads which hinder her progress. The other challenge faced by participants also noted occasional disruptions due to poor network connectivity influenced by weather conditions, one of them was Sulawesi Island. These qualitative responses underscore the dependency of effective online learning on stable technology and environmental conditions, which, when compromised, pose challenges to engaging fully with the educational content and interactive processes of the program. Below are the excerpts from P231, P288, P493, and P915.

P231 (Economics teacher, F)	:	Sometimes technical difficulties become an obstacle, due to conditions in the area and environment where I live, for example due to rain, power outages, poor signal or network and this causes my study focus to be divided.
P288 (Physics teacher, F)	:	Some of the obstacles that may be faced in taking TPEP using online learning mode are limited direct interaction, difficulties in understanding the material without direct guidance, and technical challenges such as internet connection problems or using online learning platforms.
P493 (Kindergarten teacher, F)	:	The obstacles that I faced which made it difficult for me to continue TPEP or not, included: the internet network which sometimes fluctuates, especially when it rains, a laptop which tends to error when it is used for a long time and when I want to upload a task, suddenly the laptop errors again.
P915 (Business and Tourism teacher, F)	:	Regarding obstacles, until now there have been no obstacles or fatal obstacles for me, but it's just that sometimes the network is not good because of unfavorable weather where I live, such as on Sulawesi Island.

4.3. Proposed online learning designs for in-service teachers in Indonesia on the future TPEP

The qualitative feedback from participants in the TPEP program offers insightful suggestions for enhancing the efficacy of online learning. Many in-service teachers as the participants advocate for the integration of blended or hybrid learning models, which combine the benefits of both online and face-to-face interactions. For instance, Indonesian Language teacher (P61) and Counselling teacher (P168) highlighted the importance of utilizing both synchronous (real-time interaction) and asynchronous (self-paced study) learning models to accommodate different learning preferences and schedules. This dual approach supports varied educational needs and can help manage the challenge of aligning educational schedules with personal and professional commitments, as noted by Physics teacher (P282), who experienced conflicts between TPEP schedules and school assessments. In contrast to the idea from kindergarten teacher (493), she would prefer offline learning mode, mainly for the participants from remote areas. Regarding the time allocation, Indonesian teacher (P52) and Primary School teacher (P543) suggested to increase the time duration for certain lessons for better understanding of materials discussed among participants and instructors. However, another Primary School teacher

(617) found the material delivered to the course were already adequate within one cycle, preferring more discussion on current educational conditions or problems.

Additionally, there is a call for more interactive and technologically enriched learning experiences. Biology teacher (P183) suggests incorporating engaging digital tools like Canva, Kahoot!, and PowerPoint to make learning more interactive and enjoyable. Counselling teacher (P161) emphasizes the need for curricula that foster 21st-century skills such as critical thinking, creativity, and collaboration, which can be effectively developed through active learning strategies. This perspective is supported by Mathematics teacher (P409), who advocates for a student-centred approach that promotes active participation and practical application of knowledge. On the technological side, Kindergarten teacher (P480) prefers platforms like Zoom over Google Meet for their user-friendliness and familiarity among participants. These suggestions collectively underscore the need for thoughtful integration of technology, flexible yet structured scheduling, and pedagogical strategies that engage students actively while developing essential modern skills. Below are some excerpts from the participants' interview on their design proposals.

P52 (Indonesian teacher, F)	:	Online learning is currently quite good. In my opinion, perhaps the duration of the lesson could be increased, so that the material can be presented as clearly as possible.
P61 (Indonesian Language teacher, F)	:	Effective online learning methods are blended learning and hybrid learning. Meanwhile, learning models that are suitable for online that are often applied are synchronous and asynchronous learning models.
P161 (Counselling teacher, F)	:	TPEP material design must focus on developing 21st century competencies needed by teachers in the digital era. These 21st century competencies include critical thinking skills, problem solving, creativity, communication and collaboration. These competencies can be developed through various active and interactive learning methods, so as to make optimal use of technology and develop 21st century competencies.
P168 (Counselling teacher, F)		The hybrid learning model might be more effective because there are times when we need to meet face to face in class.
P183 (Biology teacher, F)	:	The first proposal is to use a learning model that suits the needs of students. Second, by using more interactive learning applications such as: Canva, Kahoot!, PPT, other digital content.
P282 (Physics teacher, M)	:	System-wise, the current online TPEP is very good. What makes it less effective is related to the schedule which should be in sync with the school's educational calendar. For example, the most difficult thing for me was when I took the Performance Test which coincided with the students' Final Semester Assessment (PAS) schedule. This makes my position as an educator awry in asking students to take part in learning activities during PAS.
P409 (Mathematics teacher, F)	:	Lecture design can use a learning process that is oriented towards practical field experience and the application of student-centred learning so that students participate actively, are always challenged to have critical thinking, are able to analyse and can solve their own problems.
P480 (Kindergarten teacher, F)	:	For the online method application, it is easier to use Zoom Meeting, compared to G-Meets, because the zoom meeting/zoom class application is more familiar than G-Meets and is more comfortable to use.

P493 (Kindergarten teacher, F)	:	I personally prefer offline learning for the next TPEP, because the internet network has a big impact, especially for friends who are outside the city.
P543 (Primary school teacher, F)	:	Efforts are made to increase the time for learning. For example, on the first day, the first hour of introduction lasts 90 minutes. Then in the second hour the time duration is 90 for the virtual meeting again. Maybe someone is having difficulty completing worksheets or assignments.
P617 (Primary school teacher, M)	:	In my opinion, design is more about more varied material for searching problems and determining solutions, just one cycle is enough, the rest deepens the material related to social, personality, pedagogical and professional competencies that are adapted to current educational conditions.

5. Discussion

The results presented in the study highlight key insights into the needs, challenges, and future design considerations for in-service teachers participating in an online Teacher Professional Education Program (TPEP) in Indonesia. The data, which includes both quantitative metrics and qualitative feedback, provides a comprehensive understanding of how the TPEP can better serve its participants.

5.1. Effectiveness of online TPEP in meeting teachers' needs

The high mean scores in various dimensions of the TPEP indicate that the online program effectively meets the professional needs of most participants. The autonomy fostered by online learning, as reflected in the high ratings for independent or self-directed learning, aligns with the findings of previous research on online professional development. According to Curran et al. (2019), online learning environments can be highly effective in promoting teacher autonomy and self-directed learning, which are crucial for professional growth

Additionally, the suitability of learning materials and the interactive nature of virtual meetings received positive feedback and improved overall course satisfaction, which resonates with the work of Gurley (2018) on the Community of Inquiry framework, especially in teaching presence. This framework emphasizes the importance of cognitive presence, social presence, and teaching presence in online learning environments, all of which are supported by the findings in the TPEP study. The high levels of satisfaction with TPEP activities further reinforce the notion that well-designed online professional development can lead to positive learning experiences and outcomes (Su et al., 2024).

5.2. Challenges in online TPEP

While the TPEP program appears to be effective overall, the study also highlights significant challenges related to technical and environmental issues. These challenges, such as poor internet connectivity and limited social interaction with instructors, are well-documented in the literature as barriers to online learning (Almazova et al., 2020; Ferri et al., 2020; Maphosa et al., 2022; Wynants & Dennis, 2018). However, some scholars argue that these challenges can be mitigated through better infrastructure and more robust

support systems. For instance, Erlangga (2022) suggests that with the interactive and simpler technological support and training, many of the technical challenges faced by teachers can be overcome. On the other hand, Azionya & Nhedzi (2021) argue that the digital divide remains a significant barrier, particularly in regions with unstable infrastructure, and that online learning may exacerbate existing inequalities rather than alleviate them.

5.3. Future online learning designs

The recommendations for improving the online learning design in TPEP highlight a preference for blended and hybrid learning models. This approach resonates with contemporary educational strategies that advocate for a mix of synchronous and asynchronous learning activities (rotational model, flexible model, self-mixing model, virtual-enriched model) to cater to diverse learning preferences and logistical needs (Hrechanyk et al., 2023). Such models can facilitate a more inclusive, interactive and adaptive learning environment that accommodates different schedules and learning speeds, potentially increasing the program's overall effectiveness (Hediansah & Surjono, 2020). In addition, implementing various interactive digital tools such as Canva, Kahoot!, and PowerPoint, as suggested by participants, could enhance the interactive aspect of online learning during pedagogical practice (Fedoriv et al., 2023). Incorporating these tools can make the learning experience more engaging and cater to the visual and dynamic learning preferences of adult learners before and after the program (Borup & Evmenova, 2019). This strategy also aligns with the need to develop 21st-century skills such as critical thinking, problem-solving, and collaboration through project-based curriculum, which are essential in modern educational contexts (Martinez, 2022).

In relation to the poor and limited internet connectivity and interaction identified as another challenge, it is suggested to improve better infrastructure by investing stable internet connectivity, particularly in rural and underserved areas to ensure equitable access (Bailey & Nyabola, 2021). In addition, some technical problems of using ICT tools are identified, and this requires such digital literacy training for in-service teachers in all regions to enhance their ability to effectively use online learning tools, reducing technological barriers (Erlangga, 2022; Lay et al., 2020).

The focus on student-centered learning and active participation aligns with contemporary educational theories that emphasize the importance of engaging, building, and motivating learners in meaningful, contextually relevant activities (Trinidad, 2020). The TPEP participants' call for a learning design that promotes autonomy and practical application is supported by the constructivist approach to education, which advocates for learning experiences that are active, constructive, and reflective (An, 2018; Gheith & Aljaberi, 2018; Ramani et al., 2019). Furthermore, aligning the TPEP's scheduling with the academic calendars of schools could address one of the significant barriers to participation. This alignment ensures that teachers do not face conflicts between their professional responsibilities and their development activities as a study by (Fang et al., 2021) who

discovered that more than 80% of Australian and Shanghai teachers received scheduled time to encourage their active participation in professional development, and this is believed to enhance the uptake and completion rates of professional development programs.

As this TPEP has been participated by in-service teachers from diverse regions, the integration of multicultural education into the TPEP can also further enhance its relevance and inclusion by addressing Indonesian teachers' diverse cultural backgrounds. This approach encourages the development of culturally responsive teaching methods and helps educators to recognize and incorporate the cultural context of students into their teaching. By integrating discussions on diversity, equity and inclusion into the program's curriculum, teachers can be more adept in creating inclusive learning environments that respect and appreciate cultural differences. Furthermore, this is consistent with the global educational trends in which teacher professional development can increase the competences of multi-cultural classrooms and the efficiency of multi-cultural classrooms (Choi & Lee, 2020; Romijn et al., 2021).

6. Conclusion

The findings of this study provide a comprehensive overview of the current state and future directions of online professional development for in-service teachers in Indonesia. While the TPEP has been successful in many areas, particularly in fostering autonomy and providing relevant content, there are clear opportunities for improvement in addressing technological challenges and enhancing the program's design through blended learning and interactive digital tools. However, like all studies, this research has its limitations. One significant constraint is the potential bias in self-reported data, as participants may have perceptions of efficacy influenced by their own preferences for learning formats or by the novelty of the online approach.

The study's results lead to several recommendations for future implementations of online professional development programs. Firstly, addressing the technical and connectivity issues that participants identified is crucial. This can involve not only improving the infrastructure but also providing training for teachers on how to effectively use online platforms. Secondly, the feedback suggests a need for a hybrid model that combines online and face-to-face interactions to enhance the learning experience and accommodate different learning styles. Incorporating synchronous sessions alongside asynchronous content could help replicate the interactive and communal aspects of traditional in-person training sessions. Furthermore, the program should continue to innovate in its use of digital tools to facilitate interactive learning and foster the development of 21st-century skills among teachers. Regular updates and training on emerging educational technologies can keep the program relevant and effective. Ensuring alignment of the program's schedule with the academic calendars of schools will also help increase participation and minimize disruptions to teachers' professional responsibilities.

By addressing these areas, the TPEP can enhance its impact and continue to serve as a model for online teacher professional development both within Indonesia and globally.

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