# The Feasibility of Blended Learning TPD TPACK Program for Indonesia's Teacher Education

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## ABSTRACT

As the organizers of teacher education programs, universities in Indonesia face challenges in providing a decent Technological Pedagogical Content Knowledge (TPACK) professional program for pre-service teachers. This study aims to assess the feasibility of the Teacher Professional Development (TPD) program, combining the blended learning model and the TPACK framework for teacher education programs in Indonesia. Six experts assessed the nine stages of the blended learning TPD TPACK program as feasible and piloted on 38 pre-service teachers. Krippendorff's Alpha measures the expert's agreement level, and the paired sample t-test measures the program's significance level. Krippendorff's Alpha ($\alpha$) value on the TPD effectiveness component is ($\alpha$) 0.8203 with the conclusion that the agreement level is very high among the raters, as well as the TPACK framework component with an alpha ($\alpha$) value of 0.7833 with the conclusion of a high agreement level among raters. The results of the t-test of paired samples have a value of sig. (2-tailed) $0.001 < 0.05$, indicating a significant difference between pre-service teachers' pretest and posttest TPACK knowledge. The results concluded that the blended learning TPD TPACK program is feasible to implement by the university, which provides the teacher education program as one of the curriculum designs of the TPACK professional development program for pre-service teachers.

**Keywords—**TPD, TPACK, Feasibility, Preservice Teacher, Indonesia, University.

## INTRODUCTION

As the organizers of teacher education programs, universities face challenges in providing professional development programs for prospective teachers that suit their needs, along with the development of technology in all aspects of education. The main challenge of education in Indonesia is to improve the quality of teacher education. The results of the study show that about 65% of the total 2.7 million teachers in Indonesia do not meet the requirements of professional teachers; this happens because the weak national teacher training system results in the low quality of prospective teachers [1]. Therefore, universities that provide teacher professional development programs must make fundamental changes to improve the quality of teacher teaching in Indonesia [1]. The results of this study are also in line with the results of a study related to the evaluation of the implementation of teacher professional development two years afterward, which stated that teachers in Indonesia need not only more and more continuous professional development activities but also more variations in structure, processes, and content to accommodate they're and the specific circumstances of the school [2].

Therefore, the curriculum can be changed by innovating learning models that utilize information technology and combining them with traditional learning methods. One is the blended learning model, which combines the advantages of online learning with face-to-face training programs. Blended learning has emerged as a new trend and has proven promising for TPD innovation in Indonesia [3]. Blended learning is integrated into curriculum design to be more relevant and adaptable to various local and global characteristics [4], [5], [6]. Blended learning tries to integrate the usefulness of e-learning and face-to-face training programs.

One of the Teacher Professional Development (TPD) frameworks that utilize information technology that is a reference for many studies is the Technological Pedagogical Content Knowledge (TPACK) framework; this framework is considered adequate for TPD programs that focus on developing understanding and competencies

related to pedagogy and technology. TPACK is considered a promising theoretical framework for understanding the knowledge teachers need for effective technology integration [7]. The TPD program with the TPACK framework is still very much needed for teachers in Indonesia, in line with previous research that stated that effective professional development is significant to improve teacher TPACK; the strategy includes technology modeling, pedagogical alignment, and practice deepening [8]. These results align with the results of interviews conducted by researchers with lecturers at one of the universities providing teacher education, namely the State University of Malang (UM); this university occupies the first position at the national level as the best campus in the field of educational science in Indonesia [9]. The results of interviews at one of the teacher education departments at UM, namely the Early Childhood Education teacher education Department, showed that a total of 12 lecturers out of 15 lecturers in the department expressed their agreement with the curriculum changes in the TPD program with the TPACK framework to complete course materials related to knowledge and technology pedagogy practices.

Thus, this study assesses the feasibility of the TPD program, which combines the blended learning model and the TPACK framework. It is called the Blended Learning TPD TPACK Program. The feasibility assessment included a feasibility assessment from expert raters and the results of the program trial on 38 pre-service teachers.

# LITHERATURE REVIEW

## Blended Learning

Blended learning combines face-to-face learning methods with technology-mediated activities [10]. This model combines traditional classroom methods with online educational resources and activities [10], [11], [12]. In addition, blended learning involves the use of technology to enhance the learning experience, giving students control over aspects such as time, place, path, or learning pace [4], [10], [12]. Blended learning also integrates innovative technologies and multimedia with the best aspects of traditional pedagogical approaches, thus creating a richer learning experience for students [12].

In the context of TPD, blended learning is a model or method in a website-based training program (e-learning) that combines face-to-face meetings, accessing materials online through websites, online meetings through access to information technology at the same time (synchronous) or at different times (asynchronous) [13], [14], [15] Therefore, blended learning in this study is defined as a TPD learning model that combines face-to-face methods and e-learning methods to improve the involvement, competence, and learning outcomes of training program participants, namely teachers.

However, a quality blended learning model needs good structure and collaboration to ensure effective implementation and meet students' diverse needs [10], [16]. Blended learning is due to challenges related to the quality and quantity of teaching or instructor resources and the need for effective assessment methods[17]. For this reason, knowing the main components of the blended learning model is expected to be able to produce quality blended learning. The main components of the blended learning model are described as follows.

## Online interactions

Blended learning uses an online learning platform by utilizing e-learning tools such as modules, learning management systems (LMS), and other digital resources to facilitate structured and interactive learning [18], [19], [20] Blended learning also utilizes multimedia tools to support online interaction processes such as combining text, audio, video, animation, and virtual reality to create a learning experience that is engaging and interactive [21].

## Face-to-Face Interaction

Blended learning includes face-to-face meetings with training program participants, including in the form of regular seminars to cover important areas in the curriculum and ensure direct interaction between students and instructors [19], [20] This face-to-face meeting is used as an important moment of the blended learning model

to unravel complex material content. Emphasis on collaborative activities during face-to-face meetings to enhance engagement and higher-order thinking skills [22].

## Program Design and Structure

Blended learning combines theoretical and practical components to comprehensively understand the subject [19], [20]. The flexibility offered by blended learning is a program structure that provides synchronous (real-time) and asynchronous (independent) learning opportunities to meet the diverse needs and schedules of training program participants [22].

## Support System

Blended learning relies on reliable instructors and prominent supporters and complements face-to-face meetings. Therefore, training and support for instructors to effectively design and convey the concept of the blended learning model are essential to successfully implementing this model [23], [24].

## Ratings and Feedback

An important component of the blended learning model is assessment and feedback. The assessment should be an integrated assessment that includes formative and summative assessments. Implement integrated assessment methods that align with online and face-to-face components [25] and a combination of formative and summative assessments and provide timely feedback [26].

## Flexibility and Ability to Adapt

Blended learning must be flexible and changeable, so the curriculum in the design of the blended learning model must offer flexible learning options that meet different student preferences and schedules [25], [27] and ensure that the curriculum can adapt to various educational contexts and student needs [28].

## TPD TPACK Framework

The TPD method with the TPACK framework that is often used and based on the results of scientific literature reviews has a positive impact on improving teachers' TPACK ability is "Learning by Design" [29]. Learning by Design, or LBD, is one of the TPD models comprising five stages that promise to create a learning environment for technology integration, overcoming the existing nature and complex interaction between technology, pedagogy, and material content [30]. This model opens up opportunities for teachers to share knowledge with fellow teachers who have different fields of knowledge to enrich the knowledge used in pedagogical practice. This approach allows teachers to learn from fellow teachers with different areas of expertise [29].

Emphasising that a professional community supports teachers in sharing pedagogical knowledge to use technology [31]. A professional community in TPD is needed to strengthen the material from the instructor. TPD activities in this professional community collaborative discussions [29]. Offering collaborative discussion strategies in TPD, including four strategies: 1. Equipping teachers with the necessary knowledge before they engage in collaborative discussions 2. Setting common goals in collaborative discussions. 3. Involve teachers in discussing and analysing artefact/group designs. 4. Engage teachers in sharing their reflections during their collaborative discussions to develop teachers' professional knowledge individually and promote the quality of collaborative discussions.

Furthermore, [29] proposes a conceptual framework of a practical LBD approach to develop teacher TPACK as a form of improvement over the LBD strategy generated in previous studies. The existence of repeated examinations and two-way discussions involving teachers, pre-service teachers and facilitators effectively on the resulting design is an important point in reflecting on the LBD approach to improving teachers' understanding of TPACK packaged in professional development activities. Providing teachers with basic knowledge about the competencies from professional development activities is needed to provide an equalization of perception of the concept of technology integration in learning. Discussing and providing

opportunities for teachers to gain knowledge and experience strengthens teachers' trust in cooperating to realize teacher professional development goals. This method involves teachers actively engaging in the design of instruction enhanced with technology so that they can learn from peers with different areas of expertise [29].

The LBD model has proven effective in improving the TPACK competence of teachers from various levels of education. LBD is due to forming a community of teachers from various fields of science, which allows teachers to have various knowledge and complement each other. Therefore, in the context of education, a teacher, in his teaching competence, is equipped with knowledge related to the philosophy of student development, teaching strategies and teaching methods. However, knowledge of technology in detail, such as an information technology expert, is not part of it; this is an announcement (cannot be blamed) because knowledge of teaching methods is still a top priority so that the LBD model with active collaborative discussions with other teachers who have expertise in the field of technology is an important decision in choosing the LBD model as a model reference to produce the TPD TPACK program.

**Blended Learning TPD TPACK Program**

The discussion of the blended learning TPD TPACK program is divided into three parts: a step-by-step program, a device program, and an implementation program.

**Step by step Program**

The blended learning TPD TPACK program design combines e-learning activities, asynchronous methods, and face-to-face meetings. Based on Fig 1. E-learning activities with asynchronous methods in stages 2,4,5,9, namely the stages of analyzing TPACK learning videos, learning TPACK knowledge, compiling a TPACK learning design and evaluating the design and implementation of TPACK learning. Meanwhile, the synchronous learning method in stage 6, which discusses the TPACK learning design and stage 8 present or display the results of implementing TPACK learning. Furthermore, the face-to-face meeting method is in stages 1, 3, and 7, namely the stages of building commitment, collaborative discussions, and the TPACK learning design demonstration.
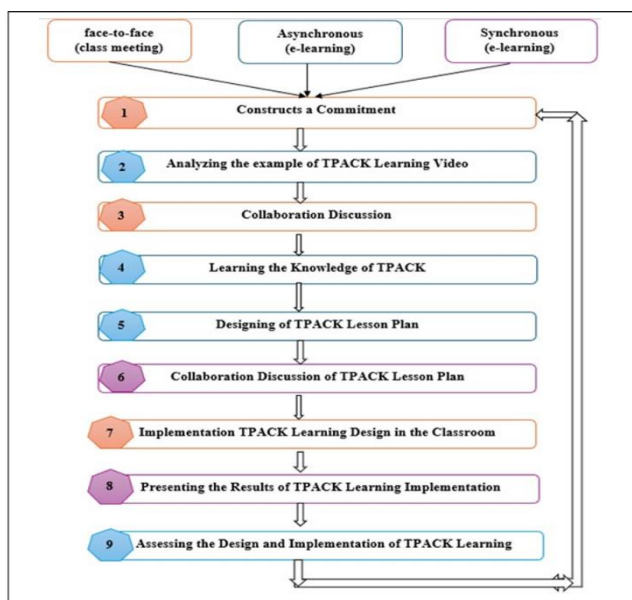


Fig. 1. Stages of Blended Learning TPD TPACK Program

**Program Device**

The program is carried out by utilizing the LMS platform (Fig. 2) as a place to run the e-learning model, accessing seven TPACK materials in the form of e-modules and videos (Fig. 3) consisting of TK, CK, PK, PCK, TPK and TPACK materials, TPACK material comprehension exercises (Fig. 4) and management information systems (MIS) for the preparation of learning plans by TPACK materials (Fig. 5).
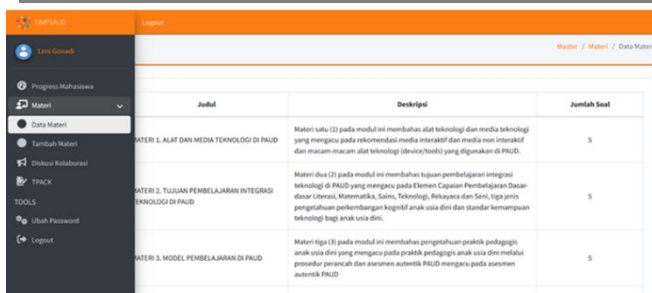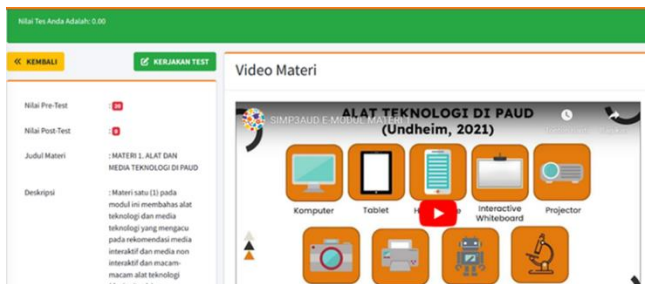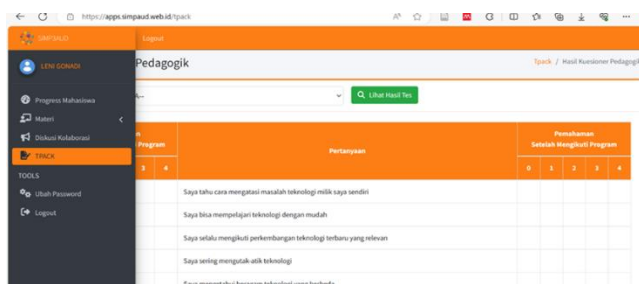
Fig. 2. Platform LMS



Fig. 3. TPACK E-Module



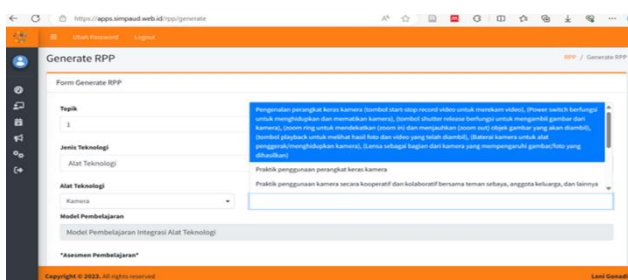Fig. 4. Practice Questions on the TPACK Material



Fig. 5. MIS of E-Lesson Plan TPACK

**Program Implementation**

The TPD TPACK blended learning program was validated by six experts selected by the researchers based on each rater's expertise: two information system experts, two TPD experts, and two learning experts. Pre-service teachers also validated the program by piloting all its stages in one class of pre-service teachers.

The program organizer, the university, through lecturers, gave a presentation related to the TPD TPACK blended learning program to pre-service teachers. This meeting is face-to-face to listen directly to the situation, expectations and obstacles that are worried about when participating in the blended learning TPD TPACK program. A total of 38 pre-service teachers registered to be able to access the LMS. Furthermore, pre-service teachers opened the LMS platform to access TPACK learning videos. Participants analyzed the TPACK learning videos displayed and continued at the face-to-face collaborative discussion stage.

In the next stage, pre-service teachers learn TPACK knowledge in e-modules consisting of six materials: TK, CK, PK, PK, TPK, and TPACK. Pre-service teachers also answer TPACK knowledge questions on the e-module material. All answers are stored in the system, and pre-service teachers can find out the pretest scores and TPACK knowledge posts that have been successfully obtained.

Furthermore, pre-service teachers prepare TPACK knowledge-based learning plans through a management information system on the LMS platform. The learning plan's results were discussed with 38 pre-service teachers accompanied by one lecturer who acted as a facilitator. The discussion was carried out synchronously using the Zoom meeting platform.

Based on the TPACK learning plan, which has gone through a collaborative discussion process, pre-service teachers implement the learning plan in the classroom. Five groups of pre-service teachers; one group consists of seven members, and the division is determined by the facilitator, referring to the learning plan made. Pre-service teachers determine one as a member who plays the role of a teacher, one member as an assistant teacher and six people as students, then carry out learning according to the learning plan. The facilitator observes and documents the learning process. Teachers and facilitators give feedback to each other.

Pre-service teachers documented the implementation of learning through videos and a brief narrative of the process. The documentation results shared by pre-service teachers on the LMS platform and pre-service teachers doing assessments from other groups were accompanied by facilitators and discussions and synchronously used in this stage with the Zoom meeting platform.

**Feasibility Blended Learning Tpd Tpack Program**

This research feasibility program engaged six experts from academia and practice who assessed the two components of the feasibility of the blended learning TPD TPACK program and a program trial involving 38 pre-service teachers to determine the program's significance in improving TPACK knowledge. The research flow is shown in Fig 6.
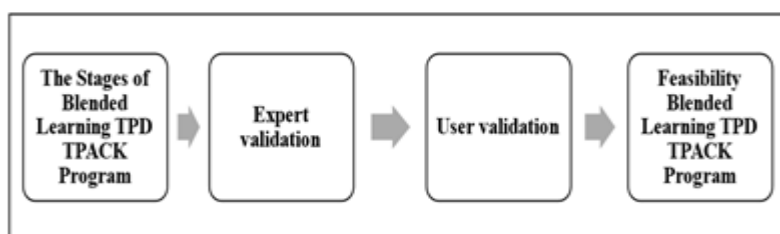


Fig 6. The Flow of Research Feasibility of Blended Learning TPD TPACK Program

**Expert Validation**

Table 1 shows six experts, three from the university and three from the education practitioner, engaged in this program feasibility rater.

Table 1. TPD TPACK Blended Learning Program Feasibility Assessment Team

| Elements | Qualification | Experience | Amount |
|---|---|---|---|
| Academics | Professor | >10 Year | 3 |
| Education practitioners | Master | >10 Year | 3 |
| Preservice Teacher | Sem 5 | | 38 |

The interview instrument for the feasibility of the blended learning TPD TPACK program by six experts refers to the effectiveness component of TPD [32] and the TPACK framework [33], as shown in Table 2. The TPD

effectiveness component has seven subcomponents, which are described as seven indicators with 39 questions. The TPACK framework component has six subcomponents, which are described as six indicators with 11 questions.

Table 2. Interview Instrument for the Feasibilityy of TPD TPACK Blended Learning Program by Experts

| Component | Subcompo- nent | Indicator | Number of Question Items |
|---|---|---|---|
| TPD Effectiveness (Darling-Hammod et al., 2017) | Materials focus | 1. TPACK Materials | 1 |
| | Interactive Learning | 2. Content of the TPD material | 5 |
| | Collaboration | 3. Collaboration discussion | 3 |
| | Direct practice | 4. Stages of a blended learning program | 18 |
| | Expert Engagement | 5. Expert supports | 4 |
| | Feedback and reflections | 6. Formative and summative tests | 2 |
| | Sustainability | 7. Systematically | 6 |
| Total number of questions | | | 39 |
| TPACK Framework (Mishra & Koehler, 2006) | TK | 8. TK Materials | 2 |
| | CK | 9. CK Materials | 2 |
| | PK | 10. PK Materials | 2 |
| | PCK | 11. PCK Materials | 2 |
| | TPK | 12. TPK Materials | 2 |
| | TPACK | 13. TPACK Materials | 1 |
| Total number of questions | | | 11 |
| Grand total of questions | | | 50 |

**User Validation**

As shown in Table 1, 38 pre-service teachers in the fifth semester were involved in determining the significance of the TPD TPACK blended learning program for the TPACK knowledge of pre-service teachers.

The TPACK knowledge test instrument consists of 30 questions based on the TPACK e-module material, which consists of five questions on each material component, as shown in Table 3.

Table 3. Test Instrument for the Preservice Teacher TPACK Knowledge

| No | Component TPACK (e-module material) | Number of Question Items |
|---|---|---|
| 1. | Technology Knowledge TK) | 5 |
| 2. | Content Knowledge (CK) | 5 |
| 3. | Pedagogical Knowledge. (PK) | 5 |
| 4. | Pedagogical Content Knowledge (PCK) | 5 |

| 5. | Technological Pedagogical Knowledge (TPK) | 5 |
|----|-------------------------------------------|---|
| 6. | Technological Pedagogical Content Knowledge (TPACK) | 5 |
| | Total number of questions | 30 |

Before being distributed to pre-service teachers, the TPACK knowledge test instrument is tested for validity by a panel of experts. When one modifies or combines an instrument in a study, the original validity and reliability may not apply to the new instrument, and it becomes important to re-establish validity and reliability during data analysis [34]. This stage aims to ensure that the instrument does not contradict the concept, the language is easy to understand, and the construction is valid [35], [36]. Experts analyze each item of the instrument's questions and determine which items are appropriate and which are not appropriate in terms of meaning and measurement requirements. Inappropriate items will be retrieved; this process ensures the validity of the instruments.

# RESULT

The results of interviews with experts on the effectiveness component of TPD and the TPACK framework were analysed using Krippendorff's Alpha. Consider the instrument using an ordinal scale. Krippendorff's Alpha can be applied to nominal, ordinal, interval, and ratio data, making it a flexible tool for different types of research [37], [38]. The expected Krippendorff's Alpha ($\alpha$) value in this study is minimal, with a value ($\alpha$) of 0.61 - 0.80 or with a conclusion of a high level of agreement. This range indicates a high level of agreement among the assessors, indicating that the assessment is reliable [39]. A paired t-sample test to analyse the TPACK knowledge test results of 38 pre-service teachers. Paired sample t-tests to compare pre-and post-intervention scores, assess the effectiveness of treatments, and evaluate the reliability of educational measurements [40], [41].

**Feasibility of the Blended Learning TPD TPACK Program from the TPD Effectiveness Component**

Based on the data from the interview results of the assessment of six experts, Krippendorff's Alpha ($\alpha$) data analysis was carried out using the SPSS Version 29.0 and Hayes' Macro applications. Table 3 shows the results of the alpha value ($\alpha$) of expert agreement on the effective components of TPD.

Table 3. Krippendorff's Alpha ($\alpha$) Value Expert Agrees on TPD Effectiveness Components

| Component | Rater Elements | Alpha Rating ($\alpha$) | Interpretation of Deal Levels |
|-----------|---------------|------------------------|-------------------------------|
| TPD Effectiveness | Expert | 0.8203 | Very High |

Based on Table 3, the effectiveness component of TPD, the result of the alpha value of the Krippendorff's from the expert team is ($\alpha$) 0.8203, indicating a very high level of agreement between the expert team on the effectiveness component of TPD. It can be concluded that the TPD effectiveness component of blended learning TPD TPACK program is declared feasible to be implemented as a professional development program for pre-service teachers.

**Feasibility of the TPD TPACK Program from the Components of the TPACK Framework**

Table 4. showing the results of Krippendorff's Alpha ($\alpha$) value agreed by the expert team on the TPACK framework components.

Table 4. Krippendorff's Alpha ($\alpha$) Value Expert Consensus on TPACK Framework Components

| Component | Rater Elements | Alpha Rating ($\alpha$) | Interpretation of Deal Levels |
|-----------|---------------|------------------------|-------------------------------|
| TPACK Framework (Mishra & Koehler, 2006) | Expert | 0.7833 | High |

Based on table 4, TPACK framework components, the result of the Krippendorff's alpha value of the expert team is (α) 0.7833, indicating a high level of agreement between the expert team on the TPACK framework components. It can be concluded that the TPACK framework component of the blended learning TPD TPACK program is declared feasible to be implemented as a professional development program for pre-service teachers.

**Significance of the Blended Learning TPD TPACK Program on Improving Knowledge of TPACK Pre-service Teachers**

The researcher did the normality test of the Shapiro-Wilk test before conducting a t-test of paired samples. The Shapiro-Wilk test aims to test whether the given dataset is usually distributed [42]. The results show that the Shapiro-Wilk test performs well with sample sizes as small as 20 and is most robust for larger sample sizes [43]. Researchers must choose the level of significance carefully based on the context of this study to determine the reliability of the test instrument. A sig value greater than 0.005 generally supports the assumption of normality, which is essential for many parametric tests and statistical procedures [44], [45].

Table 5. Significant Scores of TPACK Knowledge Test Pretest and Postest

| Instruments | Sig.Pretest | Sig.Postest | Sig (2-tailed) |
|---|---|---|---|
| TPACK Knowledge Test (38 preservice teacher pretest-postest) | 0.88 | 0.46 | 0.001 |

Based on Table 5, the results of the normality test of the TPACK PAUD knowledge test on the pretest score is sig 0.88, and the posted score is sig 0.46. Therefore, the pretest sig and postes values of the TPACK knowledge test greater than 0.005 indicate that the data is normal. Furthermore, a paired sample t-test was used to determine the significance of the results. The value of sig. A low (usually < 0.05) indicates a null hypothesis rejection, indicating a significant difference between the paired mean [46], [47].

The results of the t-test of paired samples showed a sig. (2-tailed) $0.001 < 0.05$, it was concluded that there was a significant difference between pretest and posters. Thus, the blended learning TPD TPACK program significantly increases pre-service teachers' knowledge of TPACK.

# DISCUSSION

The TPD program, with a blended learning model, positively impacts teachers' knowledge and skills in understanding TPACK. Previous research shows significant results in the understanding of TPACK with a blended learning model where teachers access the material online and continue with a face-to-face discussion process [48]. Blended learning has been successfully applied in various educational contexts in the learning process at the university level [49]. In addition, blended learning applied in the context of professional development programs that allow for global collaboration and the growth of cooperation [50], [51].

The blended learning TPD TPACK program is a TPD program that combines the blended learning model and the TPACK framework. The study results showed that the TPD TPACK blended learning program met two eligibility components based on assessments from six experts. The agreement rate on the effectiveness component of TPD is very high. Effective TPD programs should modernize traditional training methods, incorporate mobile technologies, and provide pre-training sessions to prepare teachers to use technology [52], [53] High levels of agreement on the components of the TPACK framework. The TPACK framework is essential to prepare teachers to integrate technology into their teaching practices effectively [54] [55].

The first component, TPD effectiveness, includes the feasibility of TPACK materials, TPD materials, collaborative discussions, stages of the blended learning program, formative and summative tests, and the feasibility of consistency of the blended learning TPD TPACK program in line with the effectiveness of TPD recommended by [32] which includes seven components of TPD program effectiveness. Therefore, by combining face-to-face meetings and e-learning methods to deliver the Blended Learning TPD TPACK program, experts agree that this method is in line with what pre-service teachers in Indonesia need. The results of previous research that stated that blended learning emerged as a new trend in e-learning proved to be quite

promising for TPD innovation in Indonesia [3]. In addition, blended learning is integrated into curriculum design to be more relevant and adaptable to various local and global characteristics [4], [5], [6].

The second component, the TPACK framework, includes the feasibility of TK, CK, PK, PCK, TPK, and TPACK materials in line with the TPACK framework recommended by [33]. TPACK is considered a promising theoretical framework for understanding the knowledge teachers need for effective information technology integration [7]. Therefore, by applying the TPACK framework to the Blended Learning TPD TPACK program, experts agree that this framework follows the professional development framework needed by pre-service teachers in Indonesia. In answer to the results of previous research, the technology dimension (TPACK) shows the lowest achievement compared to other dimensions, so this is a finding material for further stimulation [56]. In addition, the results of previous research also show that effective professional development is essential to improve teacher TPACK; the strategies include technology modelling, pedagogical alignment, and practice deepening [8].

The results of the program trial also show that the Blended Learning TPD TPACK program significantly increases the TPACK knowledge of pre-service teachers in line with the goals of the TPACK framework in the TPD program to improve teachers' knowledge of technology and pedagogy. TPACK is a promising theoretical framework for understanding the knowledge teachers need for effective technology integration [7].

## CONCLUSION

The Blended Learning TPD TPACK program was declared feasible as a TPD program that combines the TPACK framework and blended learning methods and showed significant results in increasing the TPACK knowledge of pre-service teachers. The university can implement the program that organizes the teacher education program as one of the curriculum designs of the TPACK professional development program for pre-service teachers. The stages of the Blended Learning TPD TPACK program can be implemented at different levels in the pre-service teacher education program by adjusting the TPACK knowledge material on the e-module. This research is still limited to the results of the assessment of the feasibility and significance of the program through data analysis based on the results of interviews with closed questions from the assessment team and the results of the TPACK knowledge test from pre-service teachers, other factors of the feasibility and effectiveness of program implementation have not discussed in this study. Thus, further research can be carried out with experiments in a broader scope and prioritize the observation results from program implementation.

## ACKNOWLEDGMENT

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