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The Effect Supervision on Teacher Performance through TPACK as Mediating Variable

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Abstract **Original Research Article**

The teacher as a component in the learning process has an important role in integrating technology in learning activities carried out in schools. The phenomenon that occurs when many teachers still have low competence is evidenced by the competency test scores that are still below standard. On the other hand, the demands of the 21st century require teachers to be able to combine learning with technology, therefore the application of TPACK in learning is considered relevant to the developments and demands of the times. This study aims to determine the effect of teacher training and supervision on teacher competence mediated by the TPACK variable. This research is a quantitative study with the required data in the form of numerical data. Data were collected through a questionnaire distributed to 100 teachers who were selected by simple random sampling technique. The data were analyzed using the structural technique Equation Model (SEM) assisted by the smart PLS application. The results showed that teacher training had a significant positive effect on teacher performance with a p value of 0.000 ($p < 0.05$). Teacher supervision has no significant positive effect on teacher performance with a p value of 0.329 ($p > 0.05$). Teacher training has a significant positive effect on TPACK competency with a p value of 0.000 ($p < 0.05$). Teacher supervision has a significant positive effect on TPACK with a p value of 0.000 ($p < 0.05$). TPACK is able to mediate the effect of training on teacher performance. with a p-value score of 0.000 ($p < 0.05$). TPACK is able to mediate the effect of supervision on teacher performance with a p-value of 0.004 ($p < 0.05$). In facing the development of science and technology, therefore teachers must be able to prepare themselves to develop teaching activities with science and technology.

Keywords: Training, Supervision, Teacher Performances, TPACK.

1. INTRODUCTION

The teacher as a component in the learning process has an important role in integrating technology in learning activities carried out in schools. The implementation of the 2013 curriculum in Indonesia, which is included in the Regulation of the Minister of Education and Culture Number 81A, states that the learning pattern must be changed immediately, from a one-way learning pattern (teacher-student interaction) to an interactive learning pattern. Students are required to be more active in exploring information related to the material being discussed, so that the role of the teacher is only as a facilitator in learning activities. ICT is very important to support this learning activity[1]. Teachers are also required to have knowledge and skills in mastery of ICT in order to integrate ICT[2]. This is as stated in Permendikbud No. 22/2016 that in learning, the application of information and communication technology must be integrated systematically and effectively in accordance with the situation and conditions. The application of technology-based learning requires appropriate knowledge and basics relating to the material, pedagogy, and technology to be used[3, 4].

Teachers must have qualified pedagogical and professional competences to integrate technology in learning [5]. Pedagogic competence is related to the ability of teachers to process learning so that students can understand the lessons delivered[6]. This competency consists of the competence of the teacher in compiling the learning plan, the competence in implementing learning, and the competence in assessing the learning process[7]. Professional competence is related to the ability to master the learning material widely and deeply in the subject matter that will be

given to students[8, 9] states professional competence includes: professional development, understanding of understanding, and mastery of academic study materials.

The phenomenon that occurs in schools is that teachers still have not optimal mastery of material and literacy towards technology and information. This is evidenced by the results of the teacher competency test in 2019 which are still not satisfactory according to the government[10]. Based on data obtained from the Ministry of Education and Culture, it shows that the UKG (Teacher Competency Test) score in the results of the teacher competency test (UKG) in Maluku Province continues to experience a decline. The UKG figure for Maluku only reaches 34.5 percent, and puts Maluku in the lowest position nationally.

Based on the results of the competency test obtained, there are still many teachers who score below standard. Therefore, the government needs to hold periodic training to improve teacher competence. According to[11] The government continues to strive for programs that can improve the qualifications, competencies and skills of teachers in order to be able to master the five basic potentials of the 21st century. The five potentials are the ability to think critically, creatively, innovatively, communicate, work together, and collaborate. [12]. One way to apply the basic potential of the 21st century is by implementing the TPACK learning design. Research result[13-15] shows that training has an effect on teacher performance competence, besides that in the findings [16-19] training significantly affects the teacher's TPACK competency.

TPACK is a framework that contains the knowledge needed to integrate technology into learning [20, 21]. This framework was developed by[22] for the adaptation of PCK (Pedagogical Content Knowledge) by [23]. There are three basic components in the TPACK framework, namely technology, pedagogy, and content / materials[24]. The purpose of this TPACK framework is to develop the basic knowledge of a teacher in learning material and apply technology to improve students' understanding and experience and to find out the right pedagogy to convey learning content [25–29] stated that the TPACK competency possessed by teachers can have an effect on teacher performance.

Indicators to measure TPACK are 1) TK (Technological Knowledge) which is the teacher's knowledge of technology that supports learning activities[3]; 2) PK (Pedagogical Knowledge) is knowledge related to the process and practice in the delivery of material taught to students[30]; 3) CK (Content Knowledge) is the teacher's knowledge of subject matter to be conveyed to students[20]; 4) PCK (Pedagogical Content Knowledge) is an effective teaching that applies pedagogical and material understanding[31]; 5) TPK (Technological Pedagogical Knowledge) is knowledge using various technologies in teaching[26]; 6) TCK (Technological Content Knowledge) refers to knowledge that provides a new way of delivering specific material[32]; 7) and TPACK (Technological Pedagogical Content and Knowledge) which refers to the knowledge of teachers in integrating technology in the teaching process in any context[33]. The application of this framework to learning, it is hoped that teachers can deliver content or learning materials to students using technology-based media with appropriate pedagogy.

Teachers must have the TPACK ability to attract students' interest in learning in the subject matter presented [34]. A common problem that currently still afflicts our world of education is that there is an implementation of education that still uses conventional learning models, this is still experienced by most public elementary schools in Ambon city, while the expectations of the government with the issuance of PP Number 32 of 2013 are expected to process learning in educational units held interactively, inspiring fun and challenging as well as providing motivation to students to work, creativity according to the talents and interests of students. The ability to apply TPACK can make it easier for teachers to transform knowledge to students[35]. One of the factors that influence teachers to master TPACK competencies is supervision [17, 27, 28, 29]. Supervision of the learning process is a form of quality assurance in educational units which is carried out internally and externally. Internal supervision is carried out by the principal. Supervision really helps teachers in improving their ability to manage the learning process. The implementation of the developed supervision is carried out with a follow-up program through continuous mentoring activities.

The importance of implementing TPACK in integrating technology into learning activities in the school environment has made researchers interested in researching "The Effect of Training and Supervision on Teacher Performance through TPACK as a mediating variable". It is hoped that this research can examine more deeply about the application of TPACK in teacher performance. Researchers also hope that this research can reveal the factors that influence the application of TPACK in improving teacher performance.

2. LITERATURE REVIEW

2.1 Teacher Performance

Performance is an activity carried out to carry out, complete tasks and responsibilities in accordance with the expectations and goals that have been set[36]. teacher performance is the teacher's ability to demonstrate various skills and competencies[37]. The essence of teacher performance is none other than the teacher's ability to demonstrate the skills or competencies they have in the real world of work[38].

Teacher performance is something that is produced by a teacher in carrying out his / her duties based on ability, proficiency, experience, ability, and in accordance with teacher competence [39]. According to August W. Smith, Performance is output derives from processes, human or therwise, that is, performance is the result of a process carried out by humans. Teacher performance is the result of real work in quality and quantity achieved by a teacher in carrying out his duties in accordance with the responsibilities given to him, which includes compiling learning programs, implementing learning, implementing evaluation, and analyzing evaluation.[40]. The learning process will run well if it is supported by teachers who have high competence and performance because teachers are the spearhead and foremost implementers of children's education in schools, and as curriculum bearers [41]. Teachers who have good performance will be able to foster student enthusiasm and motivation to learn better, which in turn will be able to improve the quality of learning [42]. The indicators for teacher performance are as follows.

Table-1: Teacher Performance Dimensions and Indicators

Dimensions	Indicator
Learning Planning	Preparation of annual and semesterprograms Preparation of a syllabus Preparation of RPP
Implementation of Learning	Mastery of subject matter The effectiveness of the strategy applied Use of media in learning activities The teacher's ability to stimulate student involvement
Closing of learning	The ability of teachers to design evaluation tools to measure learning progress and success The teacher's ability to use various strategies and assessment methods The teacher's ability to provide feedback on the evaluation of learning outcomes undertaken

Source: [9]

2.2 TPACK (Technological Pedagogical and Knowledge)

The development of the 21st century has led to a new paradigm in which the 21st century education paradigm focuses on developing and mastering technological abilities in learning[20]. If the teacher's mastery of technology is getting better, the teacher can apply it in the learning process with the aim of improving the quality of education[43]. Teachers play an important role as agents and targets of change, support, and technology integrators in the classroom [44].

TPACK is defined as a conceptual model used to help teachers understand the relationship between technology, pedagogy and content (knowledge) [45]. Good teaching with technology requires at least three components, namely Pedagogical Knowledge (PK), Content Knowledge (CK), and Technological Knowledge (TK) and the relationship between these components is not an independent part [46].

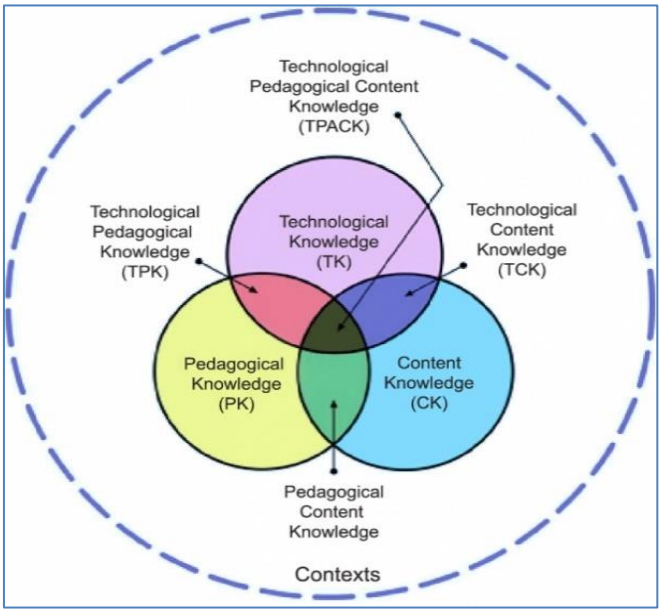

Fig-1: TPACK Framework

The three are interconnected to form Pedagogical Content Knowledge (PCK), Tecnological Pedagogical Knowledge (TPK), Technological Content Knowledge (TCK), and Technological Pedagogical and Content Knowledge (TPACK). Furthermore [47] explained that TPACK represents a collection of knowledge needed by teachers to teach effectively with technology. The technology referred to in TPACK is the use of information technology as proposed by the Committee of Information Technology Literacy of the National Research Council (NRC). TPACK helps teachers see holistically the attachment between technology and learning activities[48, 27] involving 138 teachers stated that TPACK could affect teacher performance in carrying out the assessment. [49] Stating that the use of TPACK can provide authentic and sustainable professional development to teachers [28] stated that TPACK can help teachers in teaching with the Blended Learning approach [50] stated that TPACK can be used to increase the knowledge of pre-service teachers.

Table-2: TPACK Dimensions and Indicators

Dimensions	Indicator
TK (Technological Knowledge)	Can learn technology easily. Have the technical ability to use technology
PK (Pedagogical Knowledge)	Can guide students to study independently. Can plan learning activities
CK (Content Knowledge)	Understand strategies for developing understanding of the subjects in learning Have sufficient knowledge about the teaching subject
PCK (Pedagogocal Content Knowledge)	Make curriculum / syllabus development Carry out educational and logical learning
TPK (Technological Pedagogical Knowledge)	Can adapt the use of technology learned for different teaching activities Can use information and communication technology for forum discussions with students
TCK (Technological Content Knowledge)	Can use appropriate technology (multimedia / simulation resources to represent subject content). Carry out the learning process using technology media such as multimedia microscopes, LCD projectors, computers
TPACK (Technological pedagogical content knowledge)	Able to operate ICT media for teaching through an appropriate learning approach model Able to develop ICT-based learning models in teaching.

Source:[47]

2.3 Teacher Training

According to [51] states that, "training is the process of teaching new or existing employees the basic skills they need to carry out their jobs. Training is an effort to improve the quality of human resources in the world of work [52]. Training is a systematic process for changing employee behavior, which is directed to achieve organizational goals. Training related to current job skills and abilities. The orientation is nowadays helping employees supervise specific skills and abilities in order to be successful at work. Training is a short-term educational process that uses a systematic and organized procedure in which non-managerial employees learn technical knowledge and skills for a limited purpose [53, 54]. The majority of supervisors in almost all over the world believe that training is an effective way to increase teacher knowledge and pedagogic skills so as to increase teacher competence in teaching students well [13].

Stated that teacher performance can increase pedagogic competence which has an impact on increasing teaching competence and carrying out assessments for students [14, 15,] stated that teachers' professional development that has been carried out by teachers has an impact on increasing teacher skills in preparing lesson plans, teaching methods, teaching tools, classroom management, and cooperation. Similar results were also found by [54] which states that training conducted for teachers can increase the effectiveness of learning so as to improve student learning outcomes. Contrary to some of these findings,[55] states that training can increase pedagogic competence but does not have an impact on professional competence.

Besides having an impact on teacher performance, According to[16]in his research which involved 14 team teachers and 67 teachers stated that teacher training could affect the TPACK competency. The training provided is an opportunity for teachers to learn how to redesign learning opportunities effectively so that with new skills and knowledge the teacher becomes easier to understand TPACK competencies [17]. Teacher training in geographic information system (GIS) services, with a focus on using technological, pedagogical, and content knowledge (TPACK) can improve teacher success in the classroom [18]. stated that teacher training using the TPACK model was able to effectively impact the adaptability of teachers in

facing social education challenges [19]. In his research which involved 36 teachers stated that teachers who were given ICT training had a more reliable TPACK ability.

Table-3: Teacher Training Dimensions and Indicators

Dimensions	Indicator
Instructor	In accordance with the scientific field Competent Experienced
Participants	Competence before participating in training Understanding of the training topic Competence after training
Method	Delivery of materials that utilize technology Audio Visual used
Theory	Curriculum development Classroom management strategy
Destination	Improved teaching skills Adaptive to the times

Source: [56]

2.4 Teacher Supervision

Supervision is defined as a process of monitoring a person's ability to achieve organizational goals[57, 58] defines the task of supervision, which includes: a) The task of planning, namely to determine policies and programs. b) Administrative duties, namely making decisions and coordinating through conferences and consultations carried out in an effort to seek improvements in the quality of teaching. c) Direct participation in curriculum development, namely in formulating objectives, making teaching guides for teachers, and selecting the content of learning experiences. d) Carry out teaching demonstrations for teachers, and e) Carry out research [59] Argued that the main task of supervision is to improve the teaching situation.

Supervision is all assistance from school leaders, which is aimed at developing the leadership of teachers and other school personnel in achieving educational goals [60]. It is in the form of encouragement, guidance, and opportunities for the growth of skills and abilities of teachers, such as guidance in business and implementation of reforms in education and teaching, selection of learning tools and teaching methods that are better, ways of systematic assessment of phases of the entire teaching process, and so on[61]. In other words, supervision is a coaching activity that is planned to assist teachers and other school employees in carrying out their work effectively[62]. The function of supervision or supervision in education is not just a control to see whether all activities have been carried out in accordance with the plans or programs that have been outlined, but more than that. Supervision in education contains a broad meaning. Supervision activities include determining the conditions or requirements of personnel or materials necessary for the creation of an effective teaching and learning situation, and efforts to meet those requirements.

The professional experience of teachers can work either against or against being influenced by mentors and school supervisors[63, 64] states that teacher supervision has a positive impact on teacher performance. Therefore, the competence of supervision is also one of the things to consider if you want to improve teacher performance. [65,66] states that the use of different methods of supervision from a supervisor to the teacher also affects teacher performance which has an impact on the acquisition of student learning outcomes [67]. In his research which involved 151 teachers, found that the principal's leadership and school climate jointly affected teacher work productivity [66]. Considers the principal as the foremost leader of teachers whose role can affect teacher performance [65]. Argues that the principal plays an important rule in regulating the collegial coaching model in charge of ensuring teacher performance runs well. Contrary to some of these findings,[66]states that supervision is focused on inspection rather than supervision; The supervision carried out is more looking for teacher errors than looking for solutions to problems [68]. Stated that the supervision carried out for professional development had an impact on increasing the competence of TPACK teachers. [69] states that the presence of supervisors also affects the characteristics of teachers who influence the competence of TPACK [70]. Stated that supervision also affects TPACK skills in relation to teacher teaching practices.

Table-4: Teacher Supervision Dimensions and Indicators

Dimensions	Indicator
Academic Supervision Planning	Academic supervision planing program
	Academic supervision planning schedule
	Academic supervision instruments
Implementation of Academic Supervision	Academic Supervision Introductions
	Academic Supervision Techniques
	Goal setting
Academic Supervision Evaluation	Analysis and evaluation Reporting
Follow-up Academic Supervision	Make improvements

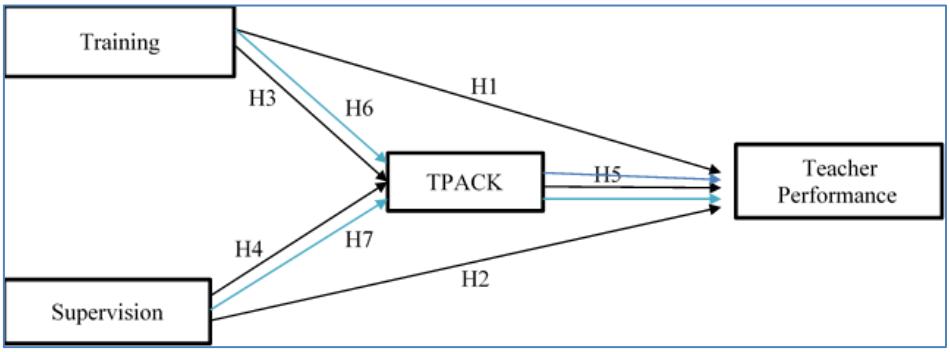

Fig-2: Research Framework

3. METHODS

This research is a quantitative study where the research data is displayed in the form of numbers. The data in this study were obtained through a questionnaire distributed to 100 teachers. Samples were taken by simple random sampling technique, that each member of the population has the same opportunity to be selected as a sample. The sampling technique used was to draw all members of the population[71]. Data analysis used structural approach Equation Model (SEM) assisted by smart PLS application[72]. The stages of data analysis in this study are:

1. Measurement model stage, this stage is done to test the validity and reliability of each indicator. The validity test in this study uses the convergent validity by correlating the item score (component score) with the construct score which then produces the loading factor value. The instrument is declared valid if it has a loading factor value> 0.6. After doing the validity test, then the reliability test is carried out to determine the reliability of the instrument. Measurement of the level of reliability in this study uses the coefficient alpha or Cronbach alpha and composite reliability, an item is declared reliable if it has a coefficient value> 0.6 [73].
2. Structural Model Test Stage, this stage is the stage of testing the hypothesis which aims to determine whether there is an influence between variables or a correlation between constructs measured using SmartPLS. Structural or inner model is measured by looking at the r-square which shows how much influence between variables in the model. Then proceed with the estimation of the path coefficient obtained by the bootsrapping procedure with a value that is considered significant if the t-statistics is greater than 1.96, with a p-value <0.05, while to see the direction of the effect, the Beta value coefficient is used.

4. RESULTS

4.1 Evaluate the Outer Model

Outer model analysis defines how each indicator relates to its latent variable. Outer loading testing in this study is used to test the validity and reliability of the instrument items using.

Table-5: Test research instruments

Instrument Test	Test used
Validity test	Convergent Validity AVE
Reliability Test	Cronbach Alpha Composite Relibility

The following is the outer loading and AVE value of each indicator in the research variable:

Table-6: Loading factor score

Variable	Instrument Code	AVE	Outer Loading	Information
Teacher Training (X1)	X1	0.568	0.737	Valid
	X2		0.724	Valid
	X3		0.706	Valid
	X4		0.702	Valid
	X5		0.722	Valid
	X6		0.714	Valid
	X7		0730	Valid
	X8		0.738	Valid
	X9		0.731	Valid
	X10		0.737	Valid
	X11		0.715	Valid
	X12		0.770	Valid
Teacher Supervision (X2)	X2.1	0.529	0.763	Valid
	X2.2		0814	Valid
	X2.3		0.733	Valid
	X2.4		0.754	Valid
	X2.5		0.778	Valid
	X2.6		0.749	Valid
	X2.7		0.747	Valid
	X2.8		0.712	Valid
TPACK (Z1)	Z1	0.573	0.717	Valid
	Z2		0.718	Valid
	Z3		0.724	Valid
	Z4		0.725	Valid
	Z5		0.737	Valid
	Z6		0.655	Valid
	Z7		0.724	Valid
	Z8		0.701	Valid
	Z9		0.691	Valid
	Z10		0.708	Valid
	Z11		0824	Valid
	Z12		0.705	Valid
	Z13		0.729	Valid
	Z14		0.762	Valid
Teacher Performance (Y)	Y1	0.524	0.743	Valid
	Y2		0.752	Valid
	Y3		0.744	Valid
	Y4		0.714	Valid
	Y5		0.714	Valid
	Y6		0.779	Valid
	Y7		0.752	Valid
	Y8		0.789	Valid
	Y9		0.752	Valid
	Y10		0.793	Valid

Based on the data presentation in the table above, it is known that each indicator of the research variable has an outer loading value of> 0.6 with each variable having an AVE score> 0.5. so that all indicators are declared worthy or valid for research use so that they can be used for further analysis.

4.1.1 Reliability Analysis

In the smart PLS, there are 2 types of reliability tests, namely the Cronbach Alpha test and the Composite Reliability test. Cronbach Alpha measures the lowest (lowerbound) value of reliability. The data is declared good if it has a Cronbach alpha value> 0.6. While composite reliability measures the real reliability value of a variable. Data is stated to have high reliability if it has a composite reliability score of> 0.7 Based on the calculations carried out, it was found that all instrument items were reliable with all variables having a Cronbach Alpha score> 0.6 and Composite Reliability> 0.7.

Table-7

Variable	Cronbachs's Alpha	Composite Reliability
Training (X1)	0.915	0.929
Supervision (X2)	0.919	0.931
TPACK (Z)	0.893	0.915
Performance (Y)	0.930	0.939

4.1.2 R-Square test

Coefficient determination (R-Square) is used to measure how much endogenous variables are affected by other variables. Based on data processing that has been done using the smartPLS program, the R-Aquare values are obtained as follows:

Table-8: R-Square score

	R Square	R Square Adjusted
Performance (Y)	0.70	0.694
TPACK (Z)	0.70	0.695

The score in the table shows that the performance variable (Y) is explained by training, supervision and TPACK by 70.3%. While the TPACK (Z) variable is explained by the training variable, the monitoring variable is 70.2%.

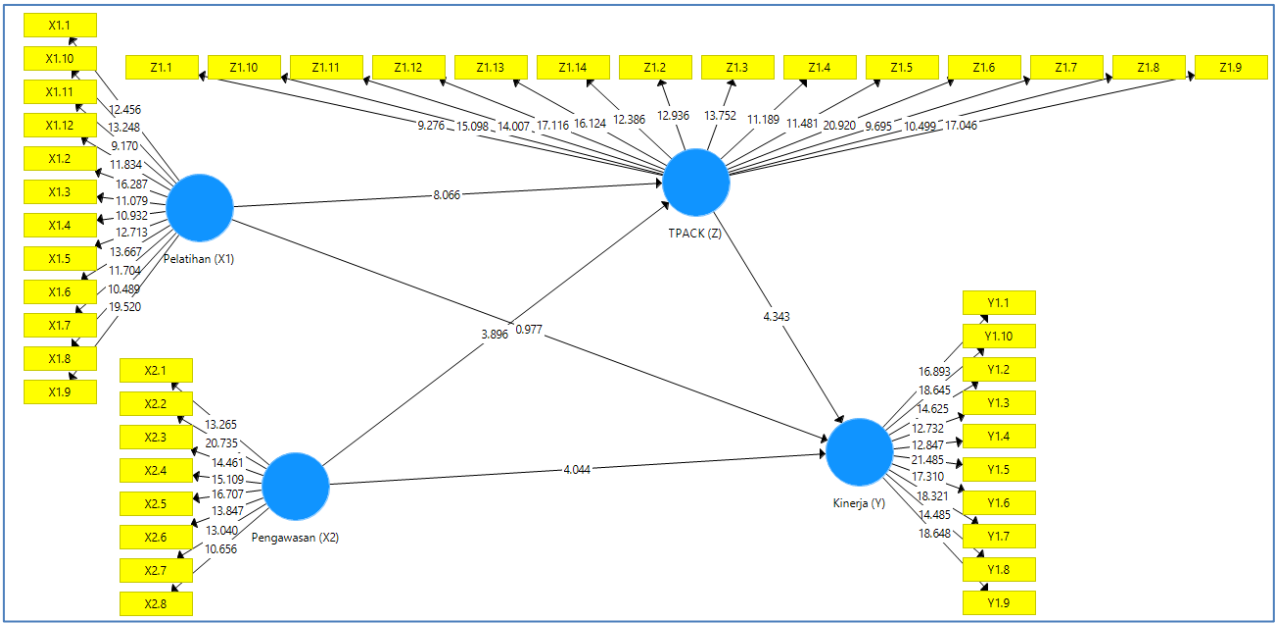

Fig-3: Summary of the Hypothesis Results

Tabel-9: Hypothesis testing

	Hypothesis	Beta	Standard Deviation (STDEV)	T Statistics (| O / STDEV |)	P-Values
Direct Effect	Training (X1) -> Performance (Y)	0.383	0.095	4,044	0.000
	Supervision (X2) -> Performance (Y)	0.113	0.116	0.977	0.329
	Training (X1) -> TPACK (Z)	0.598	0.074	8,066	0.000
	Supervision (X2) -> TPACK (Z)	0.303	0.078	3,896	0.000
	TPACK (Z) -> Performance (Y)	0.419	0.097	4,343	0.000
Indirect Effect	Training (X1) -> TPACK (Z) -> Performance (Y)	0.251	0.068	3,693	0.000
	Supervision (X2) -> TPACK (Z) -> Performance (Y)	0.127	0.044	2,908	0.004

5. DISCUSSION

5.1 Effect of Training on Teacher Performance

The results of the tests conducted show that teacher training has a significant positive effect on teacher performance. This is indicated by a p-value score of 0.000 (p <0.05) with a t-statistic of 4.044 (p> 1.96) and a beta score of 0.383. Teacher performance is the key to the success of education, because the presence of teachers is very influential on all existing educational resources. Improving teacher performance through training is one of the activities capable of supporting the success of the Institute in achieving its goals. Through the training provided, teachers can learn new skills, and the desire to learn must be maintained. Other than that, through teacher training, it can increase the ability and motivation to continually upgrade knowledge so that it makes it easier for teachers to carry out their work. This statement also supports the findings[14,15,73] which states that training has a positive impact on teacher performance.

5.2 The effect of supervision on teacher performance

The results of the tests conducted show that teacher supervision has no significant positive effect on teacher performance. This is indicated by a p-value score of 0.329 (p> 0.05) with a t-statistic of 0.977 (p <1.96) so that supervision has no effect on teacher performance. The essence of supervision activities is to carry out school administration coaching which aims to create a better teaching and learning situation and provide feedback to teachers so that they are motivated in carrying out tasks and able to guide students to be better. However, the facts in the field found that many teachers felt uncomfortable with supervision activities that suppressed the freedom of teachers to express their opinions and sought to find fault with teachers. Other than that, senior teachers tend to think that supervision is an unnecessary activity because they consider that they have more ability and experience, which causes many supervision activities to get less response from the teacher. This result is as stated[64–67,74] that supervision activities cannot have an impact on improving teacher performance.

5.3 Effect of Training on TPACK

The results of the tests conducted show that teacher training has a significant positive effect on TPACK competencies. This is indicated by a p-value score of 0.000 (p <0.05) with a t-statistic of 8,066 (p> 1.96) and a beta score of 0.598. The training given to teachers is one of the activities used to prepare teachers to face the progress of the times. Training is able to increase teacher knowledge and competence so that they are able to collaborate learning strategies with technology that are the demands of 21st century education. The knowledge and competences obtained by teachers in training activities are able to provide teachers with readiness to integrate aspects of technological knowledge, pedagogy and content in the learning process (TPACK). This is consistent with the findings[16–19].

5.4 Effect of Supervision on TPACK

The results of the tests conducted show that teacher supervision has a significant positive effect on TPACK. This is indicated by a p-value score of 0.000 (p <0.05) with a t-statistic of 3,896 (p> 1.96) and a beta score of 0.303. Supervision activities have an important role in motivating teachers to change their performance for the better. The principal as the school supervisor is required to participate in order to better understand education, to help control the management of education. Including teacher competency development. To provide quality education or produce reliable output requires adequate moral support, one of which is through supervision by the principal. Supervision is carried out by carrying out evaluation activities to further find a follow-up to the problems faced. One of the problems discussed recently is related to the use of technology in learning activities. TPACK is a reflection of the teaching and learning process that develops integration between computers and internal technology applications curriculum. Quality teaching requires a complex and interconnected nuance of understanding among the three main sources of knowledge, namely technology, pedagogy, content and how these three sources are applied according to their context. This finding also supports the research[68].

5.5 The effect of TPACK on teacher performance

The results of the tests conducted show that TPACK has a significant positive effect on teacher performance. This is indicated by a p-value score of 0.000 (p <0.05) with a t-statistic of 4.343 (p> 1.96). Teachers have the main obligation to teach students. The quality of performance given also affects how the output of graduates is produced. Pedagogic competence cannot be separated from mastery of the material (content) because it is mutually sustainable, thus forming the PCK (Pedagogical Content Knowledge) concept. In addition to teaching skills, a teacher needs to learn about the use of technology in learning, one of which is by mastering TPACK skills. TPACK is seen as one of the competencies that are in line with the challenges of the 21st century. 21st century learning is pursued by utilizing information and communication technology (ICT) in the learning process, such as computers, networks and other digital and non-digital computing technologies, as well as audio, video and others. So that with mature TPACK mastery it can affect the quality of teacher performance. These results are supportive[27,28,75] which states that TPACK can affect teacher performance.

5.6 The effect of training on teacher performance is mediated by TPACK

The results of the tests conducted show that TPACK is able to mediate the effect of training on

teacher performance. This is indicated by a p-value score of 0.000 ($p < 0.05$) with a t-statistic of 3.693 ($p > 1.96$). The results of this study imply that a training process will have a more significant effect through providing TPACK skills. Training is one of the strategies for sustainable professional development. The development of modern times, teachers must constantly update and upgrade various knowledge and understanding of learning to suit the development of society, the characteristics of students, and the development of science and technology, one of which is by participating in various trainings. Training can provide new skills that are useful for teachers as teachers who deliver learning material to become facilitators who guide students to make learning easier. TPACK can make it easier for teachers to deliver abstract material that is easily understood by students through the integration of Pedagogical Knowledge (PK), Content Knowledge (CK), and Technological Knowledge (TK). This finding is in accordance with the research results[27,28,76].

5.7 The effect of supervision on teacher performance is mediated by TPACK

The results of the tests conducted show that TPACK is able to mediate the effect of supervision on teacher performance. This is indicated by a p-value score of 0.004 ($p < 0.05$) with a t-statistic of 2.908 ($p > 1.96$). Based on the results of data processing, it was found that supervision had a significant effect on teacher performance mediated by TPACK. TPACK is able to fully mediate the influence of supervision on teacher performance. The amount of supervision that is carried out inconsistently with always looking for mistakes make the supervision process not get a good response from the teachers. That way, many teachers are ignorant of the results of the evaluations that have been carried out. As a result, many teachers tend not to be interested in carrying out performance development activities. The presence of TPACK which integrates Pedagogical Knowledge (PK), Content Knowledge (CK), and Technological Knowledge (TK) are able to mediate the effect of supervision on teacher performance. It is not enough to improve the performance of teachers in the 21st century through supervising activities[77]. The latest developments in science, technology and art in the field of education require teachers to also have knowledge about technology and its use in learning and learning. TPACK is a work or framework that can be used to analyze teacher knowledge related to technology integration in learning which can have a significant effect on teacher performance[25, 29,78].

CONCLUSION

Academic supervision is a series of activities to help teachers improve and develop their abilities in carrying out the teaching and learning process in order to achieve learning goals. Based on the research results, it can be concluded that: training has an effect on teacher performance and TPACK, supervision has no effect on teacher performance, but supervision has an effect on TPACK, TPACK is able to mediate the effect of training and supervision on teacher performance. In facing the development of science and technology, therefore teachers must be able to prepare themselves to develop teaching activities with science and technology.

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