International Journal of Instruction *October 2022 ● Vol.15, No.4*
e-ISSN: 1308-1470 ● www.e-iji.net *p-ISSN: 1694-609X*
pp. 77-100

Article submission code: 20210920025826
Received: 20/09/2021 Revision: 07/04/2022
Accepted: 30/04/2022 OnlineFirst: 20/07/2022

Elementary School Teachers' TPACK Profile in Science Teaching Based on Demographic Factors

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TPACK is an ability that must be possessed by teachers in the 21st century. Research on influencing factors is important to do because it can be used as the basis for developing TPACK for teachers in the 21st century. This study is aimed at analyzing the TPACK value of elementary school teachers in science teaching based on teacher demographic factors (gender, age, employment status, and teaching experience) and investigating the relationship between teacher demographic factor and teachers' TPACK value. The population of this research is 4180 elementary school teachers in Malang region, 175 elementary school teachers was taken as participant. Participant selection used purposive sampling method. The data was collected using 4 Likert scale questionnaire and interview and analyzed using Confirmatory Factor Analysis (CFA). It is found that the TPACK value for male teachers obtained higher scores than female teachers. For the age category, the result showed that the ability of teachers aged 30-40 years and under 30 have better technological skills outperformed older teacher. In terms of employment status, civil servant teachers showed slightly higher scores compared to non-civil servant teachers. Regarding to the teaching experience, the teacher's TPACK is proportional to the span of their teaching experience. In general, results indicated that there is relationship between teacher demographics factor and their TPACK. It is recommended for the school to make the policy that can improve the teachers TPACK profile such as to develop training on TPACK based on teacher's characteristics.

Keywords: teacher age, TPACK, employment status, gender, teaching experience

INTRODUCTION

The Covid-19 pandemic occurred around the world and changed the direction of education orientation. This situation influenced teacher's competence, especially in terms of a teacher's mastery ability to integrate technology in learning. Many problems

Citation: Kumala, F. N., Ghufron, A., & Pujiastuti, P. (2022). Elementary school teachers' TPACK profile in science teaching based on demographic factors. *International Journal of Instruction*, *15*(4), 77-100. https://doi.org/10.29333/iji.2022.1545a

are caused by the Covid-19 pandemic, for example students face a lot of glitches while learning and will need time to adjust (Sahoo et al., 2021), interaction is not optimal, inadequate facilities, and the use of learning media is not optimal (Firmansyah et al., 2021). Teachers in Indonesia have encountered learning problems, for example: one-way learning system without any interaction between teachers annd students. The teacher only gave assignments but lack of explanations, both online explanations and instructional videos (Wulandari, 2021). Teachers did not develop instructional media or only rely on online source. It happens since teachers are weak in mastering IT (Asmuni, 2020; Alfiani, 2021), teachers are not capable in operating online learning applications (Rigianti, 2020), teachers are less able to plan, implement, and evaluate learning while online/using technology (Pujiastuti, 2021). Students as well as parents were lack of knowledge about technology and online learning (Prawanti, 2020). The impact was that the enthusiasm and motivation of students decreased because students had difficulty understanding the material. Delivery method and content have a relationship with satisfaction of using e-learning (Thoo et al., 2021).

The thing that affects these constraints is the ability of teachers who do not master technology. Teachers are also less enthusiastic about developing online learning. At this time, teachers must transform culture in the learning process, master technological literacy, develop pedagogical skills in designing creative learning, make innovations based on life problems, and collaborate and think critically and communicatively. This ability refers to the skills of teacher's TPACK (Technological pedagogical and content knowledge).

TPACK is the ability of a teacher to master technology, content or material, and how to teach it (Koehler & Mishra, 2008) TPACK is a theoretical framework that connects technology, content, and pedagogy and how to use it in the classroom (Chai et al., 2017; J. B. Harris & Hofer, 2011) Teachers must have Technological Pedagogical And Content Knowledge (TPACK) because it connects technology, pedagogy, content and a theoretical framework that connects the use and function of technology in the classroom (Chai et al., 2013; J. B. Harris & Hofer, 2011).

TPACK consists of seven main components, such as (Koehler & Mishra, 2008); the first *Technological Knowledge* (TK) is the ability to use technology to meet the needs. For example; the use of the internet, computer, and digital video. The second, *Pedagogical Knowledge* (PK). These include the knowledge of methods used in the classroom to understand the characteristics of learners. The third, *Content Knowledge* (CK). It is the knowledge of the material and characteristics of the content in the lesson-taught activity (Shulman, 1986). The fourth, *Technological Content Knowledge* (TCK). It is an understanding of how technology and content influence each other. This knowledge is the ability to integrate content into technology. The fifth is Pedagogical Content Knowledge (PCK). It is some knowledge about teaching content' ability that represents content and pedagogy. The sixth is Technology and Pedagogical Knowledge (TPK). These abilities include the ability to choose technology based on material characteristics, determine strategies for using technology, and knowledge of pedagogical strategies, as well as the ability to apply learning strategies using technology. The seventh is Technological Pedagogical and Content Knowledge (TPACK). TPACK

requires an understanding on conceptual representation of technology use; constructive pedagogical techniques for using technology to teach content.

Mastering TPACK is very important for teachers to develop student competencies by integrating technology in learning (J. Harris et al., 2009). Therefore, TPACK can provide benefits for teachers, such as developing more effective learning and being a predictor of student achievement (Sangsa-ard & Thathong, 2014). TPACK produces effective and efficient learning and develop technology capabilities for students (Blackwell et al., 2016) In another opinion, TPACK is a framework for teachers to carry out 21st-century learning (Goradia, 2018). Koh & Chai (2013) and Etzkorn (2018) noted that TPACK gives benefit to teachers that they can develop learning to be more effective. TPACK also indicates students learning achievement since it improves students' engagement in learning (Putriani & Sarwi, 2014). TPACK increases students' achievement in learning, makes learning to be more effective, fruitful and improves teacher skill in integating technology with learning (Wahyudi, 2015: 42). TPACK also increases students' literacy in science (Irmita, 2017: 53).

Each teacher has different TPACK abilities due to several influencing factors. In general, the influencing factors include within oneself, culture, socioeconomic status and school structure (Harris & Hofer, 2011), age (Absari, 2020),. Based on several studies, TPACK are influenced by the teacher's self-motivation (Voithofer (2019); Sojanah (2021); Raygan (2020); self-confidence (Stewart (2013); Adulyasa (2017). TPACK is influenced by the digital ability of teachers, facilities and infrastructure (Sojanah 2021), school climate (Raygan, 2020), school management (Adulayasa (2017); Stewart (2018). Previous research has revealed the factors that affect TPACK. Those factors are the key to develop teachers' TPACK.

Besides the previously mentioned factors, there are several other demographic factors that have not been studied, namely aspects related to gender, age, teaching experience, and teacher employment status. These four aspects affect the quality of teachers in teaching. Gender affects a person's behavior and habits, one of them is technology. Several studies have shown that women and men have different technological abilities. Male teachers have higher ICT abilities than female teachers (Castillo et al., 2018; Mahdi & Al-Dera, 2013; Vitanova et al., 2015). Another opinion explains that men's and women's technological abilities are almost the same (Yawson & Yamoah, 2021; Gnambs, 2021), because women have technological skills in accessing simple software such as word processing, spreadsheets, presentation software (Siddiq & Scherer, 2019). On the other hands, men are more interested in technical knowledge systems, for example, operations and critical networks (BenYishay et al., 2020; Christoph et al., 2015). The second aspect is age. Age affects the ability of teachers to teach, because age is related to teaching experience. Age also affects a person's ability to use technology. The Digital or ICT skills of teachers are inversely related to age (Saikkonen & Kaarakainen, 2021; Anzari et al., 2021).

The other aspect is teaching experience, teacher teaching experience affects teacher teaching effectiveness and teacher performance (Rahida Aini et al., 2018). High teaching experience will increase capability in teaching so that teachers can effectively

design curriculum and develop the learning (Irvine, 2019; Kini & Podolsky, 2016). Senior teachers can improve students' learning skills (Nyagah & Gathumbi, 2017) and make learning more effective because they have better classroom management than young teachers (Ünal & Unal, 2012). The next aspect is employment status. Employment status will affect teacher performance and teacher motivation in teaching. It occurs as employment status in Indonesia affects the amount of honorarium received by teachers. A person's performance is influenced by financial motivation, internal principles and goals (Chien et al., 2020), internal motivation (Wilkesmann & Lauer, 2020). Teacher performance will affect the teacher's ability to teach in the classroom (Milanowski, 2009) and internal motivation is an essential factor for improving quality and performance in teaching (Love et al., 2018) and the teacher's ability to learn throughout life (Shin & Jun, 2019).

In addition, there are no studies that measure the ability of Teacher's TPACKs based on their demographic characteristics (teaching experience, gender and employment status) especially for elementary school teachers. All demographic aspects are crucial to review in relation to teacher TPACK. However, this research is limited to measure the TPACK ability of elementary school teachers in science learning based on aspects of gender, age, employment status and teaching experience. Based on this condition, this study aims to describe and determine the relationship between TPACK of elementary school teachers in Indonesia and teacher demographic aspects (gender, age, teaching experience and employment status.

METHOD

This study is aimed at analyzing the TPACK value of elementary school teachers in science teaching based on teacher demographic factors (gender, age, employment status, and teaching experience) and investigating the relationship between teacher demographic factor and teachers' TPACK value. The research was conducted on 175 from 4180 elementary school teachers in Malang City. The sampling technique used a purposive sampling technique. The participants was taken around 35 people in each sub-district in Malang City. Sub-districts in Malang City consist of five sub-districts (Blimbing, Klojen, Kedungkandang, Lowokwaru, Sukun). Malang City is one of the big cities and education cities in Indonesia. Most areas in the city of Malang have good access to information and technology.

In carrying out this research, questionnaires were distributed using a google form. The questionnaire contains questions that refer to 7 aspects of TPACK consisting of TK, PK, CK, TPK, TCK, PCK and TPACK which were developed from research (Onal, 2016). The questionnaire was shown in table 1. Instrument used in this study is TPACK's instrument developed by (Onal, 2016) which have been adapted based on science learning in elementary schools context. The instrument used has validated using content validity method. The content validity method is done by expert of science instructional material for elementary school, expert of research method and expert of testing. Content validity was done by matching the question items and the criteria that are being described by each TPACK variable that is being measured. Table 1 shows the development of instrument.

The questionnaire used a scale of 1-5. The results of filling out the questionnaire were then data are categorized according to age, gender, employment status and teaching experience. Then averaged according TPACK aspect, divided by the maximum value and multiplied by 100 and analyzed using the SPSS crosstab and LISREL 8.80. The data derived from the result of crosstab SPSS analysis were qualitative data in which it is used to describe the characteristics of teacher's TPACK profile, while the LISRELL 8.80 is used to measure the relationship between teacher's TPACK and teacher's demographic factors. Additionally, data taken from questionnaire is used to support the findings derive from both crosstab and LISREL 8.80. Data derived from the result of questionnaire were descriptedly analyzed using SPSS26 Crosstab while data on the relationship beween teacher's demographic factors and teacher's TPACK profile were analyzed using LISREL 8.80. The criteria used to measure the result is index on Chisquare point, RMSEA ≤ 0,08, CFI ≥ 0,95, NFI ≥ 0,90, RMR ≤ 0,05 (Elastika, Et.al, 2021) dan t value > 1,96.

Table 1
TPACK instrument for science learning in elementary school

No	TPACK	Statement	Label
1	TK	I can install an app and use it in my teaching.	TK1
		I can choose and use appropriate technologies/applications to achieve my learning goals.	TK2
		I can solve any technological technical issues that may arise in my learning.	TK3
		I can help students overcome technical obstacles during learning.	TK4
2	PK	I can understand teaching strategies, methods, and techniques.	PK1
		I can analyze the mistakes students experience.	PK2
		I can use the best teaching strategies and methods to teach specific concepts.	PK3
		I can use teaching strategies and methods according to the characteristics of the students.	PK4
		I can act against potential problems that may exist in the classroom.	PK5
		I can do class management well.	PK6
		I can develop student processes and product assessments.	PK7
		I can develop a fun class.	PK8
3.	CK	I can master the concept of Science	CK1
		I can solve everyday problems with scientific thinking.	CK2
		I can determine the scope and order of the materials I will discuss in my teaching.	CK3
		I can explain the concept of Science according to the characteristics of the students.	CK4
		I can use a variety of ways/strategies to teach and solve Science problems.	CK5
		I can make analogies to students and improvise in teaching Science materials.	CK6
		I can give you an example of Science in everyday life.	CK7
4.	TPK	I can plan and predict the use of technology can affect my learning.	TPK1
		I can evaluate students using an application/technology.	TPK2
		I can develop online learning that can develop students' skills, motivation, and knowledge.	TPK3
		I can use a variety of methods and approaches during online teaching.	TPK4
5.	TCK	I can use software already installed on my computer (MS Office, calculator, paint, and more) to teach science.	TCK1
		I can use flash animations and graphic images to make it easier to explain science.	TCK2
		I can make multimedia or presentations (ppt, sway) to teach science.	TCK3
		I can search on the web/google about subjects and concepts related to teaching science.	TCK4
6.	PCK	I can teach science according to the theoretical basis and curriculum.	PCK1
		I can explain the content of science subjects in the curriculum.	PCK2
		I can determine the learning strategies, methods, and techniques suitable for science subjects.	PCK3
		I can improve students' ability to incubate/ like scientists.	PCK4
		I can identify learning difficulties in science learning.	PCK5
		I can handle science misconceptions.	PCK6
		I can associate science material with other materials.	PCK7

7.	TPACK	I can consider science content, teaching and learning strategies, and relevant technologies during science learning planning.	TPACK1
		I can use technology-assisted evaluation tools to assess the learning process.	TPACK2
		I can use technology tools to measure students' understanding of learning science.	TPACK3
		I can use technological tools to identify student misconceptions in learning science.	TPACK4
		I can integrate technology with science classes appropriately and effectively to improve student's skills and make science learning more accessible and comprehensive.	TPACK5
		I can help others in the school to teach the concept of science using learning strategies and techniques.	TPACK6

Another instrument used besides questionnaire is interview. There were seven questions intems in the interview, each question is developed based on TPACK. The interview guide of elemantary school teacher's TPACK in Tabel 2.

Table 2
Interview Guide of Elementary School Teacher's TPACK

Aspect	Interview Question
TK	How do you define your competence in dealing with current technological advances?
PK	Would you please tell your experience in planning, implementing, and evaluating lesson?
CK	How do you master science materials for Elementary school? What materials do you think are difficult?
TPK	Would you please tell your experience in planning, implementing, and evaluating your lesson using technology?
TCK	Would you please tell your experience in constructing science teaching media using technological devices?
PCK	Would you please tell your experience in teaching science concept as well as its application?
TPACK	Would you please tell your experience in constructing science teaching media using technological devices? Would you please tell the difficulty you have encountered?

The interview was done both offline and online in order to discover teacher's TPACK profile. 50 out of 175 teachers who had fiiled out the questionnaire were interviewed. The data findings derived from the result of interview were used to support the findings of quantitative data.

FINDINGS

The TPACK profile of teacher from each factor is shown in Table 3. The descriptions of the values in table 3.

Table 3
The TPACK value of the cross tab test results

Demographic		∑	TK	CK	PK	TPK	TCK	PCK	TPACK	Average
Gender	Man	43	70	74	77	73,2	76,3	73,8	72	73,75
	Woman	132	67,7	72,3	71,2	66,6	66,4	70	64,5	68,38
Employment status	Civil Servant	91	69,7	73,8	73,7	68,6	67,8	72,4	66,5	70,35
	Non civil servant	84	70,8	71,5	70,7	67,85	70,0	69,3	66,1	69,47
Age	20-30 years	48	73,6	70,8	71,4	70,2	74,2	69	68	71,02
	30-40 years	70	73,2	73,6	73	70	70,2	72,2	69,2	71,62
	40-50 years	38	67	74,8	73,4	67,6	66,8	72,2	64,4	69,45
	>50 years	19	56,8	70,6	69,4	58,4	54,8	68,2	56,2	62,05
Teaching Experience	<5 year	50	72,8	70,65	70,8	69,7	73,9	69,0	67,2	70,57
	5-10 year	15	80	75,5	72,2	73,66	75,6	72,7	73,5	74,74
	10 -15 year	57	68,68	71,44	70,2	65,96	65,4	69,0	63,7	67,76
	16-20 year	31	68,06	74,67	73,5	68,54	67,5	73,5	67,9	70,52
	>20	22	65	76,47	75,0	67,04	63,6	75,0	63,9	69,43

Teacher's TPACK value based on gender

Gender refers to a person's character as a male or a female. Table 3 displays the TPACK value of 43 male teachers and 132 female teachers. In Table 3, the TPACK score for male teachers is slightly higher than that of female teachers, especially for TPK, TCK, and TPACK. It is supported by data findings on the interview in which the respondent of male teacher explained that in teaching he used software application and more sophisticated learning resources. *"I used internet-based application such as youtube, quiziz, and, canva to explain the materials I teach and to evaluate learning process, during online class I used googlemeet, sometimes I developed my own teaching media using application on the internet to make students more motivated in learning"* said one of the respondents from male teacher. Conversely, based on the result of interview to female teacher it is found that female teacher used video take from youtube and power point presentation to explain the materials. *"I used powerpoint, youtube video, quizez/khoot more frequently as teaching media"*. In the development of media "*I mostly take from the internet. It occurs since the time to study applications is limited (other schoolwork and homework) as well as experiencing difficulties with some applications"*. said one of respondents from female teacher. However, both male and female teachers used LMS and Whatsapp to communicate with parents. Moreover, based on the result of interview to some male teachers it is found that male teacher are more willing to develop media independently. In terms of mastery of learning material and learning development, male teachers said that they did not face problems, especially when explaining the scope of science material, while female teachers had problems. Figure 1 is an observation of the measurement to the results and factor analysis using CFA.

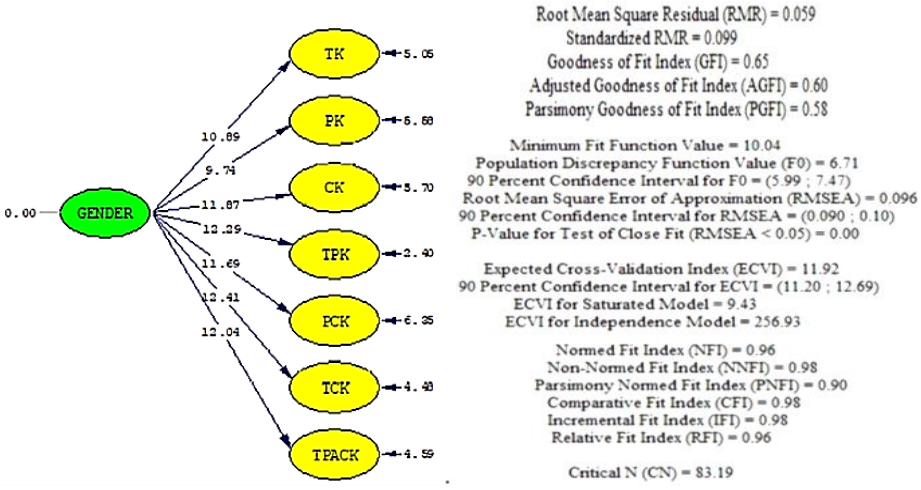

Figure 1
Factor analysis TPACK and gender

Based on Figure 1, all t-values 1.96 (TK: 10.89, PK: 9.74, CK: 11.87, PCK: 11.69, TCK:

12.41, TPACK: 12.04), and based on the RMSEA value of 0.096 and included in the marginal FIT, CFI score is 0.98 (standard score is >0.95) it is considered as fit model. PNFI scored 0.90 (standard score is >0.90 it is considered as fit model. RMR cored 0.059 (standard score is 0.05) it is considered as marginal fit. So H0 is rejected and H1 is accepted. It appears that each TPACK indicator or latent variable (TK, CK, PK, TPK, TCK, PCK, and TPACK) is positively affected by gender.

Teacher's TPACK value based on age

The TPACK value of elementary school teachers based on age is divided into four categories. Table 3 shows the results of the TPACK value on elementary school teachers in science learning based on age factor. Based on table 3, 20-30 years teachers have good skills and creativity, especially when implementing teaching using technology. Within that age range, teacher's technology skills are excellent in TK, TCK, TPK, and TPACK, with the value approaching teachers under 20-30 years-old. In mastery of learning materials and science scope, teachers under 30-years-old still under the value because they have less than 30 years of work experience. This is in accordance with an interview with a 25-year-old teacher who stated *"I enjoy using technology in my learning. In my learning, I use several applications to support and increase student activity and motivation. Some of the applications that I use are quiziz, bandicam, canva and the use of LMS for students". However, my ability to teach a material, I asked my seniors several times and when I was going to teach I needed to study some material both in books and the internet".*

The results of interviews with teachers aged between 30-40 years old show that teachers have fairly good technological skills, especially in the use of technology for learning. The 30 to 40 -years-old teachers are actively developing technology-based learning, but the frequency is not as much as teachers under 20-30 years-old. 30-40 years-old teachers tend to use videos and ready-to-use learning media. In the overall TPACK aspect, this age category gets the highest score among other age categories. Because they are still able to use technology, supported by already qualified experience. As stated by a 34-year-old teacher he says "*I used technology such as powerpoint, youtube, electronic books and LMS in the learning process. I don't have experience problems in teaching, but several times the students were constrained by the facilities they had. In understanding the material and mastering the class, I was quite capable of mastering it. I got this from my teaching experience which has been more than 10 years*".

Based on the result of interview, it is found that 40 to 50-years-old teachers have good competence in delivering learning material. However, about teaching use teachnology, only 42% of teachers use virtual learning such as google meet and classrooms. The majority of teachers prefer to implement task-based learning using WhatsApp. Uniquely, 40 to 50 -year-old teachers have the highest value in CK, PK, and PCK. However, in terms of technology mastery, teachers' ability is still lower than 30-40 -years-old teachers. In the implementation of science learning, teachers do not experience many problems in mastering the material and teaching skills. This is in accordance with the results of the interview from the teacher *"in using technology, I mostly use WhatsApp, I send materials and videos to WhatsApp or when I teach online dealing subjects and*

teaching methods (composing devices, carrying out learning and evaluating students), I I don't have any difficulties as I have taught the material several times". However, some teachers stated that there were also some who had a little difficulty in understanding science material because they had been teaching in low grades. It is the interview to one of teachers in the second grade, he says *"I don't really know some of the scope of science material, because I teach simple science materials for students in grades 1-3 (low grades)".*

The >50 -years-old teachers, when it comes to technology integration, face many difficulties. 76% of teachers prefer to use WhatsApp, ask students to do assignments on the textbook, and use textbook books in teaching. This age group of teachers are those who are able to master the materials but are not expert in using technology. One of those teachers says *"During my teaching time, I used technology such as WhatsApp in teaching and sending assignments to school, while offline I used conventional learning using textbooks. In terms of teaching ability and understanding of material related to science material, I am quite able to understand because of my teaching experience when teaching and some of the training that I have attended".* Furthermore, the results of the t test values are in Figure 2.

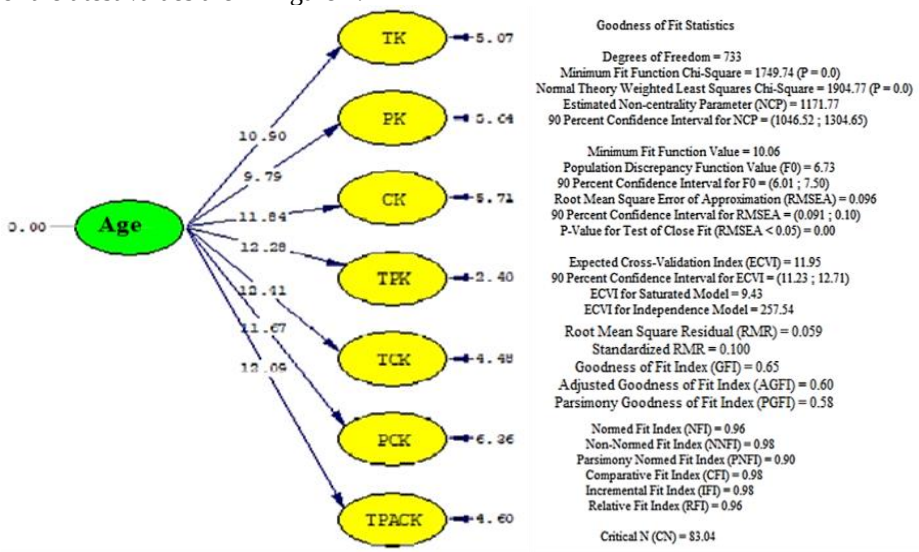

Figure 2
Factor analysis TPACK and age

In Figure 2, all t-values ≥ 1.96 and the structural equation show that every latent indicator or TPACK variable (TK, CK, PK, TPK, TCK, PCK, and TPACK) is positively affected by age. If it is observed that RMSEA value is 0.096 and includes in the marginal FIT, the CFI value is 0.98 (standard> 0.95) so that it includes in the fit model, for the PNFI category the value is 0.96 (standard> 0.90) included in the model fit category. The RMR value gets a value of 0.059 (standard 0.05) then it includes in the

marginal fit category. It means that age is related to teacher's TPACK.

Teacher's TPACK value and employment status

Based on Table 3 the TPACK value comes from respondents based on their employment status: civil servants and non-civil servants. The teachers consist of 91 civil servants and 84 non-civil servants. Civil servant and non-civil servant teachers score entirely different. Civil servant teacher scores were higher in CK, PK, and PCK and received almost identical TK, TPK, and TPACK. The grades of TK, TPK, and TPACK are related to the technological abilities of a teacher, In this study, the value was almost the same because they studied technology from various sources and internet access. For the analysis of employment status, civil servants get a higher score than non-civil servants.

Based on the data, there were slight differences on the level of teacher's pedagogical competence and lesson mastery. Civil servant teachers got higher score on those aspects than non-civil servant teachers. This is because Civil servant teachers attended more training on teacher's profesionalism and they supervised routinely. This fact is based on the information given by Civil servant teachers during interview. "*We obligatedly frequently join training on teacher's profesional development held by local government, besides, we are monitored and evaluated routinely by the supervisor so that we have to be ready to perform our best anytime we got supervised"* said one of the Civil servant teachers. The other way around, the non-civil servant teachers were those who were mostly fresh graduate teachers under 30 years old. Thus, age has positive correlation with teacher's TPACK profile. The non-civil servant teachers under 30 years old were eager to update with current technological issues, they are willing to learn to use technology by themselves. This finding is based on the result of interview in which one of the the non-civil servant teachers under 30 years old said *"I am happy to try and integrated technology in my class. I often find the tutorial in operating technological advances from the internet and try to study it then use it in my class".* In order to develop teacher's profesionalism, the non-civil servant teachers under 30 years old attend workshop and study the tutorial in operating technology from the internet independently. Furthermore, the data for the relationship between TPACK and employment status is shown in Figure 3.

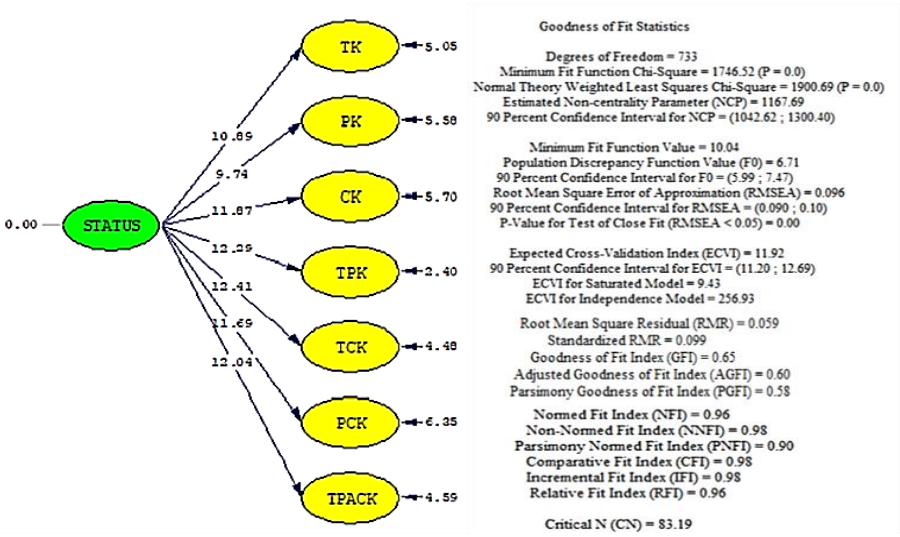

Figure 3
Factor analysis TPACK and employment status

In Figure 3, all t-values are ≥ 1.96 (TK: 10.89, PK: 9.74, CK: 11.87, TPK: 12.29, PCK: 11.69, TCK: 12.41, TPACK: 12.04) so that H0 is rejected and H1 is accepted in RMSEA score, CFI, PNFI and RMR (see appendix). Based on the output score of SEM, the RMSEA score is 0.096 this score is in marginal FIT, CFI score is 0.98 (standard score>0.95) therefore it considered as fit model, the PNFI score is 0.96 (standard score>0.90) this also consired as fit model. The RMR score is 0.059 (standard score≤ 0.05). It appears that each latent indicator or TPACK variable (TK, CK, PK, TPK, TCK, PCK, and TPACK) is positively affected by the teacher employment status. It means that the empoyment status of teachers affects teacher TPACK.

Teacher's TPACK value and teaching experience

Based on Table 3, teaching experience is closely related to the teachers' age (Vitanova et al., 2015). The 5 and 5 - 10 years of teaching experiences dominate TPACK's abilities in technology such as TK, TPK, and TCK. 16 - 20 and more than 20 years of teaching experience get the highest value on Content Knowledge and Pedagogical Knowledge. Teacher's TPACK get higher scores for 5 to 10 years of teaching experience. The average 5 - 10 years of teaching experience teacher's TPACK value is constant, this category has high technological abilities, and mastery of material and the pedagogy competence has developed. However, teaching abilities do not related to technology. Teachers having more than 25 years of teaching experience obtain the better PK, CK, and PCK.

Based on interview, teachers with 5 to 10 years and less than five years of teaching experience can use several ready-made learning technology applications or learning management systems (LMS) they also could develop learning media.In addition, they

stated that they could use virtual learning. In fact, in the category 11-15 years and 16-20 years of teaching experience, they use less sophisticated technology. For example, they use ready-to-use learning videos from YouTube. However, in mastering the material and pedagogical skills based on the two categories of teaching experience, they have a higher ability than the others.

The data of teaching experience has correlation with teacher's age because the average age of teacher start teaching is 21-25 years old. It can be inferred that, the teacher over 30 years old the more experienced in teaching, this fact is supported by the satatement of one of the respondents, "*I am 25 years old and has 2 years experience in teaching. I have been operating technology in class while I am teaching for 2 years using powerpoint, teaching video and zoom meeting for online learning. I think my competence in teaching science is good but before I teach I always study it*". However, the 35 years old teachers who have 13 years experience in teaching explained that they were still update with current technology development, yet they were less willing to learn more and improve their skill in dealing with technology because they have many works to do in school. "*I sometimes join workshop related to technology in education, but I cannot be always update with current technology development since I have many works to do. I do not have problem in teaching or mastering the science materials I teach because I have been teaching it almost everyday*" said one of the respondents. Additionaly, the teachers who have learning experience 16-20 years explained that they were almost not update with current technology advances because of pressure in job and the technology itself. Figure 4 shows the calculation results according to SEM.

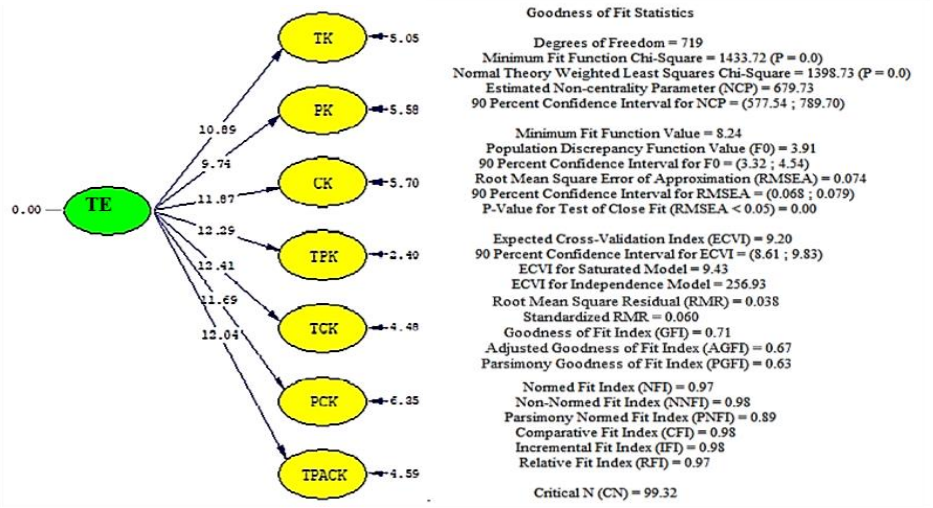

Figure 4
Factor analysis TPACK and teaching experience

Based on Figure 4, all t-values ≥ 1.96 (TK: 10.89, PK: 9.74, CK: 11.87, TPK: 12.29, PCK: 11.69, TCK: 12.41, TPACK: 12.04), and in the attachment, the RMSEA value is 0.074, the CFI value is 0.98 (standard > 0.95), the PNFI value is 0.97 (standard > 0.90),

and the RMR value is 0.038 (standard 0.05). Those all values meet the FIT category. so H0 is rejected and H1 is accepted. It appears that each latent indicator / TPACK variable (TK, CK, PK, TPK, TCK, PCK, and TPACK) is positively affected by the teaching experience.

DISCUSSION

Teacher's TPACK value based on gender

Gender in demographic factors affects the teacher's TPACK. Where the TPACK value of male teachers is slightly higher than female teachers. Male teachers have slightly higher abilities in the aspects of TPK, TCK, and TPACK. These three domains are closely related to the teacher's ability in teaching-material technology. Male teachers have higher ICT ability than female teachers (Castillo et al., 2018; Mahdi & Al-Dera, 2013; Vitanova et al., 2015) because men have a higher interest in technology than women (Marth & Bogner, 2019).

Another opinion explains that men and women have almost the same abilities (Santrock, (2011); Gupta (2019); Lažnjak et al. (2011). Men's and women's technological abilities are almost the same (Yawson & Yamoah (2021); Gnambs, (2021), because women have technological skills in accessing simple software such as word processing, spreadsheets, presentation software, image processing, and actions related to communication, social networking, and security issues (Siddiq & Scherer, 2019). On the other hands, men are more interested in technical knowledge systems, for example, operations and critical networks (BenYishay et al., 2020; Christoph et al., 2015). The brain's ability, intelligence, math skills, and science both have something in common (Santrock, 2011). Furthermore, the difference in the abilities of men and women comes more from cultural beliefs (upbringing and cultural beliefs) and biological inevitability (Slavin, 2009). The different behaviors between genders derive from different experiences based on adult habits that reinforce this behavior.

Regarding the results of TPACK's capabilities, especially in terms of technology such as TPK, TCK, and TPACK, these capabilities are caused by sociocultural factors such as 1) culture, 2) interests, 3) lifestyle, 4) stereotypes (Wang & Degol, 2017), and 5) equality of digital access. Some places still show that gender affects access to ICT (Brimacombe & Skuse, 2013; Rashid, 2016). The subjects in this study were female teachers who, on average, were married and had more limited time to self-actualize than male teachers. Working Indonesian mothers generally have multiple roles or have more roles than male teachers in their families (Aziza, 2020; Ramadhani, 2016; Triana & Krisnani, 2018)

The difference in TPACK's value might be because men tend to be more confident and have higher efficacy on their ICT knowledge and skills (Saikkonen & Kaarakainen, 2021). Meanwhile, women underestimate themselves, especially in technology, regardless of their actual knowledge and skills(Aesaert et al., 2017; BenYishay et al., 2020; Siddiq & Scherer, 2019) Self-confidence is a personal ability that affects his or her ICT capabilities (Mlambo et al., 2020; Tam et al., 2020; Vitanova et al., 2015); Therefore, to increase self-confidence, TPACK, and ICT skills, teachers need to attend

ICT training. Based on those findings, it can be concluded that there is relationship between gender and teacher's TPACK profile. Male teachers generally score slighly higher than felame teachers for this aspect.

Teacher's TPACK value based on age

The SEM test data shows that there is a relationship between age and TPACK ability. Based on the average result data on all aspects of TPACK, it is known that the highest teacher TPACK is for teachers aged between 30-40 years. This is because technological capabilities are still capable and mastery of pedagogy and mastery of matrices is quite good because of the teaching experience they have.

In this study, the age categorization of teachers was divided into 4, one of them was 20-30 years of age. The number of teachers in the age category is around 16% (Kemdikbud, 2021). For teachers who are 20-30 years old, they have better abilities in the technological aspect. Indeed, teachers under 30 have a better ability to master technology (Anzari et al., 2021) because the age range is interested in technology. At that age, teachers enter early adulthood and in Indonesia, on average, they have just graduated from a bachelor's program, these teachers are still updated in technological developments apart from that from Erikson's theory of development, this period is marked by the importance of having a closer relationship with the surrounding environment and being able to live together in an adult environment. If this does not happen then self-isolation will occur. Based on this, teachers in early adulthood use technology to be able to live, develop, and do not isolate themselves from their social environment. This is in line with a survey from Indonesian Internet Service Provider Association (APJII) which states that the largest active internet users in Indonesia are people aged <25. In addition, in this age range, teachers have not been given a heavy task compared to their age, so they have time to learn technology and seek information than elder teachers.

For teachers who are more mature 20-30 years old. namely in the age range of 30-40 years, their population is 33.5% of the total number of teachers in Indonesia, and the highest number of all teacher age groups. In this age category, teachers already have enough experience and the average teacher in Indonesia in this age range is married and has a family. At this stage the teachers have many teaching experiences so that the pedagogical abilities and mastery of the teacher's material are good. However, teachers at this age in following technological developments are not as fast as at the previous age, because teachers at this age since teachers at this stage have more roles both in the workplace, social environment and family environment. This role causes teachers at this age have to balance study time and work time. Although cognitively, this stage is a very good stage of cognitive development (Slavin, 2009).

Teachers aged 40-50 enter middle adulthood. At this stage, there are 21.2% of all primary school teachers in Indonesia. The teachers were quite mature and in Indonesia several teachers had become school principals. In terms of teaching, the teacher's ability is as good as the teacher's teaching experience, as indicated by the data that the teacher's ability in the pedagogical aspect and mastery of the material is very good, but the aspect

of technological ability is lacking. It occurs due to the rapid development of technology, and the lack of time that teachers have to study technology that continues to develop because the role that teachers have is greater than the previous age. So that teachers still use simple technology.

There are quite a lot of teachers who are over the age of 50 having difficulty in using technology because of the rapid development of technology, and the ability or work power of teachers is starting to decline. However, in terms of experience, teachers at this age have more experience than others. Teachers aged >40 years have more experience than teachers aged below (Aloka & Bojuwoye, 2013). Senior teachers can improve students' learning skills (Nyagah & Gathumbi, 2017) and make learning more effective because they have better classroom management than young teachers (Ünal & Unal, 2012). However, some of the obstacles faced by 25-years-old teachers are mastery of the material and the scope of understanding of science material which still needs to be improved and motivated to always learn and they must improve their pedagogical skills. The value of other technologies' mastery decreases inversely with the age of the research subject. The Digital or ICT skills of teachers are inversely related to age (Saikkonen & Kaarakainen, 2021; Vitanova et al., 2015),(Anzari et al., 2021).

Teacher's TPACK value and employment status

Employment status of teachers affects teacher TPACK. Non-civil servant teacher's TPACK has lower values than civil servant teachers (Ansari, 2020). In general, the older civil servant has increased teaching experience, more training opportunities, and higher salary. The high teacher fees will make it easier for teachers to get information, facilitate themselves in developing self-quality, for example attending seminars, meeting the needs of facilities and infrastructure for teaching and meeting personal needs. So that high honors must be more committed through better performance and teaching. The performance in this study leads to teacher's TPACK.

Financial motivation, internal principles and goals (Chien et al., 2020) internal motivation (Wilkesmann & Lauer, 2020), policy or norm-authority for teachers, teachers' autonomy (de Brabandera & Glastraa, 2014) and teachers' self-efficacy (Dybowski et al., 2017) affect the performance of a teacher. If we observe several studies, self-efficacy is positively related to enthusiasm and job satisfaction (Skaalvik & Skaalvik, 2017). In addition, self-efficacy affects classroom management skills in pre-service teachers (Bay, 2020) and is negatively associated with anxiety and depression in the workplace(S. Huang et al., 2019). Self-efficacy affects commitment in teaching (Chatzistamatiou et al., 2014) and career orientations (Kotova, 2021). The conclusion is that financial motivation, internal motivation, and self-efficacy affect performance. Internal motivation is an essential factor for improving quality and performance in teaching (Love et al., 2018) and the teacher's ability to learn throughout life (Shin & Jun, 2019).

Performance is related to job satisfaction. Good performance produces proper job satisfaction. Performance improvement can develop with various things, such as allocating more budget for teacher salaries, making policies or programs to improve

teaching performance, and increasing teacher job satisfaction towards the quality of education (Kadtong et al., 2018). The performance improvement program is aim at increasing teacher self-efficacy (Trauth-Nare, 2015), building motivation (S. Huang et al., 2019), and developing teachers' metacognitive (Colognesi et al., 2019). Self-efficacy is important because it is specific, and it is easy to develop (Nielsen et al., 2019). It is the tool to provide opportunities for researchers or policymakers to develop teacher self-efficacy through several workshops and training.

In addition, generally Civil Servant teachers in Indonesia have more teaching experiences. They have been teaching before becoming Civil Servant teachers. Besides, Civil servant teachers have more opportunity to join workshop or training and they were supervised periodically. The supervision makes teachers to be anytime ready in delivering their best lesson and instructional media. The supervision influences teachers' score for profesionalism. This makes teachers to get use to performed their best. This policy creates culture to be best in teaching, therefore the pedagogical competence and knowlendge on science of Civil servant teachers outperformed the non-civil servant teachers.

Teacher's TPACK value and Teaching experience

Based on the SEM for data analysis, the teaching experience affects the teacher's TPACK. The highest average score for TPACK abilities in the range of 5-10 years of teaching experience. This teaching experience is related to the teacher's age. Where in 5-10 years of experience teachers are quite capable of mastering science concepts and teaching them, also still have good skills in the field of technology.

Teaching experience is one of the factors that influence teacher's ability in mastering the materials. Several teachers in Indonesia who have longer teaching experience will have more comprehensible experience in teaching science. In this case, the teachers who teach in elementary school will be in turn to teach others grades, from grade 1 to grade 6 so that they will get more experience in teaching science because science is being taught to grade 4, 5 and 6 only. This is based on Indonesian curriculum policy for elementary school that science is taught to grade 4, 5 and 6. It is important to set teachers to teach in each grade starting from grade 1 to 6 in order to widen their experience and competence in teaching science. Teachers' comprehensibility in science is better if they get more chance to teach science. Teachers who are not get use to teach grade 4, 5, and 6 will have less ability to master science materials. Additionally, Indonesian curriculum for grade 1, 2 and 3 were theme based and no science subject. Thus, teachers who have less chance to teach grade 4, 5 and 6 will have less experience in teaching science.

Teacher teaching experience affects teacher teaching effectiveness and teacher performance (Rahida Aini et al., 2018). High teaching experience will increase capability in teaching so that teachers can effectively design and develop (Irvine, 2019; Kini & Podolsky, 2016) the CK, PK, and TPACK. Teaching experience also affects teacher self-efficacy (Infurna et al., 2018). As the previous discussion, self-efficacy is very important for teachers to recognize the students' potential and difficulties. Thus,

teachers can improve student achievement. Appropriate teaching practices also develop students' social and emotional abilities (van der Zanden et al., 2021).

Teaching experience affects teachers' technological abilities (Ifinedo et al., 2020). However, the results are inversely proportional. Teachers with less than ten years of teaching experience still have high abilities. Amateur teachers aim to learn the curriculum and teaching ability of professional teachers. This implies that mastering the curriculum and teaching will improve teachers' skills. Professional teachers are more interested in learning about extracurricular assignments and innovation (Louws et al., 2017). For teaching capability, amateur teachers and professional teachers have a slightly different focus even though their objectives are the same, mastery of the curriculum and learning development (Fox et al., 2015).

Amateur and professional teachers need support to be confident and interested in developing higher quality education (Fox et al., 2015). Amateur teachers need both formal and informal guidance because it positively affects their job satisfaction and learning commitment. Teachers need training or critical reflective activities so that professional teachers can support and produce other new teachers (Mittelmeier et al., 2018).

It goes without saying that the differences in teaching experience to TPACK profile is related to environmental factor. Teachers who live in the environment where technology is easily to be access were eager to integrate technology in their teaching. This condition makes the teachers to improve their TPACK profile related to technology. Conversely, teachers who live in the environment where technology is not easily to be access were not eager to integrate technology in their teaching. In Malang most schools environment have the same characteristics because they were live in the same region.

CONCLUSION

To sum up, demographics factors that consist of gender, age, employment status, and teaching experience affect the teachers' TPACK. The analysis results on the teachers' TPACK based on gender explain that male teachers get higher values than female teachers, especially on TPACK's aspects related to technology. The values of teachers' TPACK based on age indicate that teachers under 40 have better TPACK abilities in the technological aspect than elder teacher. However, it is inversely proportional to the TPACK value, which is related to pedagogical ability. The teacher's age is directly proportional to the teacher's teaching experience. It refers to teachers' TPACK data based on their age-related to TPACK data based on teaching experiences. Moreover, TPACK's ability on teaching experience and age shows the same values. TPACK ability based on employment status shows that civil servant teachers have higher values than non-civil servant teachers. It relates to salaries, opportunity, commitment, pengawasan and pressure in the work of teachers that affect their performance. Internal and external motivation and self-efficacy also affect teacher performance.

It is recommended for the school to make the policy that can improve the teachers TPACK profile such as to develop training on TPACK based on teacher’s characteristics. Besides, it is necessary to develop training that can increase teachers’

motivation in teaching for instance by doing teachers' reflection training and by providing facilities that support teachers to improve their TPACK profile. It is suggested for the future researchers to conduct research on other factors that influence teachers TPACK profile for example culture, school structure, school policy, curriculum, teachers' motivation so that they will discover the contribution of those factors. The result of this research is limited to this current research and cannot be generalized to all teachers in Malang region.

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