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Impact of ICT Integration on the Development of Vocational High School Teacher TPACK in the Digital Age 4.0

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Abstract

To investigate the impact of the integration of information and communication technology (ICT) on the development of the Technological Pedagogical Content Knowledge (TPACK) framework for Vocational High School teachers in the Digital Era 4.0, this research will look at the integration of ICT. The evaluation of the Online Learning Implementation Plan (RPP) of the Computer and Network Engineering Department in the even semester of the 2020/2021 academic year revealed the impact of ICT on instructors' TPACK. The research design that was used was a qualitative case study. The study included 20 teacher participants from Private Vocational Schools who were majoring in Computer and Network Engineering in order to explore the influence of ICT adoption on their classrooms. Findings from this study reveal that integrating ICT into the TPACK framework, as measured by this research project, has a positive impact on teachers. Teachers are capable of resolving issues that arise during online learning activities and providing learning assessment values that are appropriate for their students' skills and learning performance. Schools must provide more effective and professionally targeted ICT support and training in order to improve teacher competence in order to educate vocational students for a digital future, as a result of these consequences. Considering the demands for the integration of ICT into the design of educational curricula in order to develop the TPACK abilities of teachers in the face of the digital revolution is something that the government can consider.

Keywords: vocational, ICT, TPACK, secondary school, engineering, educational curricula.

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1. Introduction

Students in their early twenties and thirties are well-versed in digital technology. Teacher competency development is essential in order to educate students for a better future by fostering technology capabilities and technological pedagogical content knowledge (TPACK). To measure educational success, educators must consider the use of technology in conjunction with pedagogy (Westbroek et al., 2019; Malik, et al., 2019; Susanto, et. al., 2020; Adalar, 2021). According to a survey of academic research on the possible dramatic impact of technology 4.0 on teacher education, technology integration can rethink the teaching role and retain the skills needed by educators as technology advances (Raman & Thannimalai, 2019; Teo., et al, 2021). Covid-19 pandemic experts believe that TPACK model learning is the best way to learn in the digital era, especially in the face of Covid-19. Because the TPACK model guide is good at integrating aspects of knowledge, mastery of materials, and technology, it's a solid choice (Mishra & Koehler, 2006; Mishra, 2019). Since the installation of large-scale Community Activity Restrictions (PPKM), educational institutions have increasingly used the TPACK paradigm.

Having the introduction of a new policy, Work from Home (WFH), all learning activities are carried out online as much as practicable. TPACK can also be used to increase teaching quality and enhance teachers' abilities, according to other studies (Nurhadi, et;. al, 2019). When schools equip teachers with self-efficacy training, they have a significant impact on their technology-based professional knowledge and skills (TPACK). There are many ways in which teachers can learn about the value of using technology in their classrooms through institutional support for TPACK development (Habibi & Yusop, 2020; Wang & Zhao, 2021). Research shows that pre-service teachers who completed the TPACK curriculum had a higher level of technology integration motivation than those who did not (Lachner et al., 2021). Technology and content knowledge concerning the mastery of TPACK were discovered to have a substantial impact on the collaborative abilities of teachers working at educational institutions (Guntara, et., al., 2021).

Additional problems and opportunities for 21st-century instructors can be found in the function of 21st-century learning (21CL). Due to the difficulty of integrating TPACK and 21CL, many pre-service teachers lack these skills. It has a favorable impact on teachers since they are able to handle difficulties and see the importance of student learning. Since the prior work relied primarily on correlational data and/or knowledge assessments of prospective teachers, this study examines the influence of integrating information and communication technology (ICT) into the creation of TPACK on educators. Research conducted by Sojanah et al. (2021) discovered a statistically significant association between teacher preparation and the perception of prospective teachers engaging in the teacher preparation program. Apart from the use of various research designs, previous literature studies concentrated on developing pre-service teachers' technological proficiency and critical thinking skills without connecting them to other important issues, such as ICT integration and the assessment of RPP during the Covid-19 pandemic (Sumeyra, et. al., 2021).

For example, according to research conducted by Roll & Ifenthaler (2021) on the multidisciplinary digital competence of pre-service vocational teachers, teacher attitudes toward digitalization can predict self-efficacy in relevant multidisciplinary digital competencies, but not actual achievement in those competencies. As a result of a lack of accomplishments, Vocational High Schools began to grow in the academic and professional arenas to prove their worth. SMKs have to put in extra effort to make new innovations in curriculum management and improved ICT development to increase the academic competency of SMKs in the digital 4.0 age, according to researchers. In response to the growing need for workers in Indonesia's manufacturing sector, the Minister of Industry issued Ministerial Regulation No. 3 of 2017 on Guidelines for the Guidance and Development of Competency-Based Vocational High Schools that Link and Match with Industry. There is a debate going on between vocational schools and senior high schools in general since they

have more practical classes than other high schools. This is because most SMK graduates go on to work in the workforce or to start their own businesses.

Current emergency remote teaching (ERT) requires teachers to slow down and limit the amount of content they give in lesson plans (Rodrguez-Muiz et al., 2021). Since the TPACK framework was examined in RPP, it is critical to investigate its influence. Previous research have shown that teachers had trouble analyzing the TPACK aspects that were meant to be included into lesson plans. It may not even be applicable in the real-world situation (Tseng, et. al., 2020). In the constantly changing and developing world with technology and digitalization, each generation has different lifestyles and interests (Sumeyra, et. al., 2021).

1.1. Research Question

After Drajati et al. (2021) proposed similar research on the adoption of TPACK-21CL, researchers developed further research on the impact of adopting TPACK on online lesson plans in teaching practice through case studies of teachers majoring in Computer and Network Engineering during the implementation of PPKM in Yogyakarta District, Indonesia. The study's problem is "How does ICT integration effect the development of TPACK for Vocational Teachers in the Digital Era 4.0?"

2. Literature Review

2.1. TPACK

The fundamental conceptual framework of TPACK in education for effective teacher instruction, according to Mishra & Koehler (2006), comprises of three core aspects: content knowledge, pedagogy, and technology. Knowledge of the subject matter is referred to as content knowledge; knowledge of teaching and learning methods, strategies, and practices is referred to as pedagogic understanding; and knowledge of current technology is referred to as technological knowledge. The integrity of knowledge of technology, pedagogy, and content is produced from concepts about teaching tactics for specific subject that interact to form knowledge of the three where technology may assist pedagogical aims and learning materials can be modified using technology (Shulman, 1986). As a result, this model is known as the TPACK skill integrative model (figure 1).

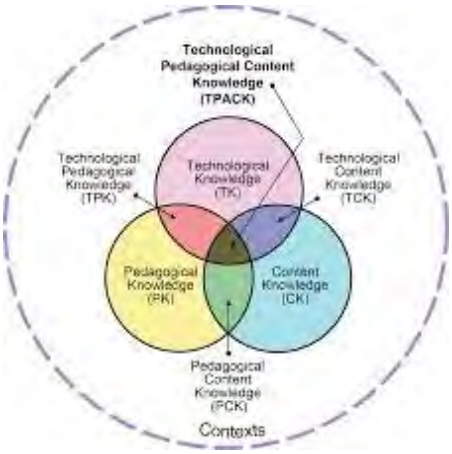

Figure 1. TPACK Model

Source: (Mishra & Koehler, 2006)

The TPACK model has had a significant impact on teacher education and professional development research and practice. TK, CK, and PK are three interconnected circles with an outer dotted circle in Figure 1. Since 2009, this image has stayed essentially unchanged (Mishra, 2019). In

the 21st century, TPACK research has grown to include material such as mathematics, economics, accounting, and the social sciences in the field of educational research. As an example, Darkwa & Agyei (2021) produced TPACK for pre-service accounting teachers through the use of Audio-Visual in a research study. TPACK and enough digital competence for mathematics composition were found in an exploratory study of mathematics teachers who use an abundance of digital resources and a high percentage of learning materials developed using e-learning apps. Since Emergency Distance Teaching (ERT) requires teachers to slow down and reduce the amount of content they give in lesson plans, this has been an unfortunate outcome for students and teachers alike.

2.2. High School Teacher

According to Article 18 paragraph [3] of the Law of the Republic of Indonesia Number 20 of 2013, "Vocational education is secondary education that prepares students to work in specific sectors." Vocational High School (SMK) is a type of formal education unit that arranges vocational education at the secondary level as a continuation of learning outcomes regarded as equal/equivalent to SMP/MTs. In general, SMK is geared toward students who want to work or start their own businesses. Learners are taught how to improve their skills. In contrast to high school, which is intended to prepare students to attend university and eventually employment (Mardiyati & Yuniawati, 2015). SMK graduates, on the other hand, do not rule out the prospect of furthering their study at the university level (Ariesky, 2013).

Vocational Schools are made up of departments that study about specific topics and organize educational programs that are suited to the various sorts of jobs available (Woods & Scharman, 2001). SMK graduates will be able to meet the global labor deficit as it develops (Horslen et al., 2021). As a result, for a brighter future of SMK development, the long-term effects and sustainability of SMK in terms of technology and the creation of appropriate procedures should be investigated further (Delcker & Ifenthaler, 2021).

Academic knowledge of SMK pupils is measured through the use of standardized examinations that are beneficial in determining students' ability in non-cognitive components of schooling (Bowers, 2011). The need for experienced SMK teachers is critical since SMKs are expected to meet the vocational requirements established by the government in order to achieve the goals of creating an SMK. According to the research, increasing the professional expertise of vocational school teachers can help them satisfy academic requirements (Schempp, 2016). Teacher certification status is also taken into consideration since, if a teacher does not have certification in their field of study, it is likely that student achievement may suffer as a result (Goldhaber & Brewer, 2000).

3. Method

3.1. Design

Yin's qualitative case study research design was used in this study (1994). Due to its ability to gather in-depth understanding of how ICT impacts TPACK framework for Vocational Teachers in Digital Era 4.0 through RPP Evaluation, the case study research design was selected in this study. TPACK lesson plans for computer and network assembly are used to examine the degree to which ICT has been integrated into the curriculum. In Yogyakarta, Indonesia, private vocational schools serve as the study site. During the academic year 2020/2021, the study took place over the course of one semester.

3.2. Participant

The participants in this study were 20 vocational school teachers with a bachelor's degree in computer engineering from Private Vocational High Schools in Yogyakarta who participated in the study. The group is made up of 16 male teachers and 4 female teachers whose ages range from 25 to 50 years old. Participating teachers must meet specific requirements, including having completed

teaching practicum courses, conducting online instruction, and teaching computer and network assembly subjects.

3.3. Instrument

Previous studies led to the creation of this tool of the trade. When teaching using the TPACK skill framework, the RPP emphasizes five key components: active engagement; constructive contribution; authenticity; intentionality; as well as collaborative effort. Content, pedagogy, and technology are all components of TPACK competencies. ICT plays a key role in mediating, acquiring, and utilizing ICT skills and abilities. A Likert scale was employed to measure the preferences of participants in even-choice categories, such as four options. Quantitative values of 5,4,3,2,1 for five positive choices and 1,2,3,4,5 for four negative questions are assigned to Likert category scale scores. Validity and reliability tests were used to assess the instrument's performance. According to the validity test results, all questions were legitimate because the value of rcount was greater than rtable (0.227). Cronbach's Alpha was 0.806, which is higher than 0.600, indicating that the test items utilized were reliable.

3.4. Data Collection

Data were gathered through the use of questionnaires, observations, and documentation. The first step in implementing data collection is to create a special online checklist questionnaire containing teaching practices created based on the TPACK framework for one semester that has passed, namely the odd semester of the 2020/2021 academic year, and the answers are quantitatively analyzed using a Likert scale. The instructor considers features of TPACK when creating lesson plans. Students and instructors have discussed the course plans. They revise their peers' lesson plans. The lesson plans were then deployed in online classes.

The researcher then made observations based on the teacher's experience. The Zoom program is used for online observation activities. The researchers first discussed obtaining an online observation schedule with the school group. Observations were conducted for 10-15 minutes on each subject using recording equipment and observation notes. The researcher double-checked each participant's response, logged every online educational experience that was presented, and watched behavior during the online observation. Documentation for this study was gathered from online lesson plans for the Yogyakarta Private Vocational School specializing in Computer and Network Engineering for class X (ten) semesters for computer and network assembly disciplines, as well as related journals.

3.5. Analysis Technique

In qualitative research, data analysis procedures are applied in three stages: data reduction, data presentation in a relevant short description, and drawing conclusions and data verification, followed by data verification. Following that, the researcher concentrated on the field data that had been obtained, which was then summarized and selected the most important ones in accordance with the TPACK framework in the lesson plans for computer and network engineering teachers. The second step consists of presenting statistics in tabular form as well as brief narrative descriptions to explain the impact of ICT implementation. The information is presented in a logical sequence, beginning with active, constructive, authentic, deliberate, and collaborative features of teaching that are mediated by the TPACK framework and ICT integration and working their way down the list. The final step is to draw conclusions and cross-check all of the data with the findings of the investigation.

4. Result and Discussion

The findings indicates that the design of TPACK has inspired teachers to master new technological tools such as Zoom, E-learning, Webex, Google, and Canva. Teachers also study pedagogical ICT integration skills. This affects teachers' deep grasp and awareness of re-uniting ICT

tools, pedagogy, and content in diverse learning activities. The new ICT expertise will be highly valuable for Computer and Network Engineering teachers. This will improve sensitivity to the evolution of digital technology while also developing more educational lesson plans with diverse online learning activities. Findings from reviewing lesson plans for computer and network assembly subjects revealed five TPACK aspects:

4.1. Active Aspect

TPACK is initially examined in the online RPP majoring in Computer and Network Engineering through the active participation of students in the online learning process. Teachers may be able to construct online learning activities based on active use of ICT. When teachers use the maximum amount of ICT during the learning process, they can encourage students to learn. The active aspect of constructing TPACK is critical to the online learning process since it speeds up and simplifies lesson plan implementation, according to previous research. In order for students to improve their ability to learn, they must take an active role in the learning process (Alsofyani & Eynon, 2013). In addition, teachers must have a better understanding of how to construct online learning activities that require students to use ICT.

Rather than only studying theory, computer and network assembly is required in this course, so students must put what they learn into reality as much as possible. Technology integration utilizing TPACK can redefine the teacher's role, increase the quality of education, and retain the skills teachers need as technology progresses, according to previous studies (Nurhadi et al., 2019; Raman & Thannimalai, 2019; Teo et al,, 2021). As a result, it is apparent that teachers need instruction in how to develop active learning activities from higher education institutions.

Online learning is used in the majority of lesson plans from the active aspect, such as the presentation of assignments through video streaming, practical video tutorials, and class debates, among other activities. The first conclusion that can be drawn from these data is that kids are unable to completely develop their own knowledge on their own. Consequently, the subject matter is not digested to its fullest potential. The pedagogy is also lacking because the majority of teachers prepare the four key parts of their lesson plans only online, in violation of the PPKM policy, which requires them to carry out learning activities with the help of a computer. The pedagogy comprises of a scientific learning approach, cooperative learning tactics, problem-based learning models, as well as approaches such as study group discussions, questions and answers, and assignments, among other elements. Teachers can also assist students in their tasks by utilizing the Google Classroom, Zoom, Google Meet, and Youtube tools, among others. Institutional support for teacher TPACK development can, in this situation, provide instructors with real chances to learn the value of technology integration in the classroom (Habibi & Yusop, 2020; Wang & Zhao, 2021).

In spite of the widespread use of ICT in the classroom, teachers still have an impact on students' technological expertise. Educators and students alike are eager to learn more about technology in order to improve their academic results. Teachers are motivated by the discussion of a subject, whereas students are motivated by their desire to learn more about a subject via the internet. Among the findings linked to lesson plans for integrating technology and physical activities in online classes is displayed in table 2.

Table 1. Teachers of the Computer and Network Engineering Department apply active learning activities with technology in online classes

Criteria	Aspect	Number of learning activities
0	Teachers use media or ICT to deliver subject matter	0
1	Students use ICT tools occasionally	0
2	Students use ICT tools 50% usage	0

3	Students use ICT tools more than 50% of usage	12
4	Students use ICT all the time	6
	Average score	3,44

Table 2 shows that teachers earn an average score of 3.44 and an achievement rate of 68.85 percent when implementing active activities utilizing ICT technologies. This signifies that the average level of active exercise falls into the "pretty good" category. The researchers discovered six learning activities from online lesson plans for private vocational schools in Yogyakarta that were the basic requirements for establishing student competence. This demonstrates that teachers directed their students to use ICT tools throughout their online study period. Its goal is to evaluate knowledge and attitudes. Participating in online learning requires discipline, as well as being honest, responsible, kind, and confident in submitting comments. Knowledge assessment is evident from the outcomes of assignments on Google Classroom, as well as a review of video observations via comments on the homepage and assignment forums.

The 12 learning activities demonstrated that teachers had instructed pupils to make the most of their learning time. Its objective is to evaluate students' abilities. The assessment of student skills is done by seeing and analyzing work based on the findings of practicum reports, individual practicum reports, and group projects uploaded to students' Google Drive.

4.2. Constructive Aspect

It is the constructive component of students' use of ICT tools in online learning activities that is being evaluated in the second aspect of the lesson plans in the TPACK framework, which is part of the TPACK framework. When students manipulate information, communicate what they have accomplished, and reflect on their experiences, they are engaging in constructive behavior, according to the research. In collaboration with Audio-Visual technology, Darkwa and Agyei (2021) created TPACK for pre-service accounting teachers. It is possible to use these insights to assist teachers in developing more successful constructive activities in a variety of diverse and more inventive settings.

According to the findings of the research conducted by Guntara et al., (2021), ICT integration has the strongest favorable link with constructive oriented pedagogical knowledge. When it comes to constructing lesson plans utilizing the TPACK framework, the level of teacher confidence is a significant factor to consider (Koh, et. al., 2014). In light of the RPP analysis, the teacher permits students to use ICT in order to construct ideas and syntheses based on converged content knowledge. The second statement is derived from the findings linked to the constructive element, which show that teachers have pretty high understanding in planning constructive activities using ICTs. Table 3 shows the results of an online lesson plan for instructors to use constructive activities with ICT to teach computer and network assembly learning materials. The findings are based on computer and network assembly learning materials.

Table 2.Teachers of the Computer and Network Engineering Department implement constructive activities that are integrated with the use of ICT in online classes

Criteria	Aspect	Number of learning activities
0	Teachers use media or ICT to deliver content	0
1	Students use ICT tools to engage in content reproduction	0
2	Students use ICT tools to go beyond content reproduction but still largely articulate their convergent knowledge	8
3	Students use ICT tools to synthesize information and build verbal, written, visual expression, conceptual, product-oriented skills from online learning content	6

4	Students use ICT as described at level 3, and articulate personal reflection or application of online learning content	4
	Average score	3,40

According to table 3, teachers receive an average score of 3.40 and a success rate of 69 percent when carrying out constructive activities utilizing ICT resources. This signifies that the average level of construction activity is considered to be fairly good. There are eight lesson plans that demonstrate how teachers constructed teaching and learning activities in which ICT technologies assisted students in articulating knowledge through content reproduction in the same manner. The lesson plans include six learning activities that demonstrate how ICT tools have assisted students in searching for information linked to learning materials to product-oriented learning expressions in the form of various content. Four learning activities demonstrate how ICT tools assisted students in obtaining knowledge, creating digital narratives, and reflecting on their learning experiences. According to the constructive aspect, teachers have relatively high understanding in constructing constructive activities for online learning activities utilizing ICT resources.

4.3. Authentic Material Aspect

According to the lesson plan, the third part of TPACK is authentic material that is used in conjunction with ICT technologies during the online learning process. Actual material features are employed to describe an empirical occurrence, allowing students to gain experience applying their concepts in real-world situations while still in school. Abu-Hardan, Al-Jamal, and Sa'Di (2019) reported that previous research has discovered the favorable impacts of using ICT in strengthening authentic material abilities, particularly language skills, and that ICT integration is considered to be an effective learning tool (Abu-Hardan et al., 2019). The TPACK module can assist in the development of authentic material aspects by supporting the competencies that teachers want students to have. Teachers who have completed the TPACK curriculum report more technological motivation for technology integration than teachers who have not completed the TPACK module (Lachner et al., 2021).

According to the findings from the authentic material component, the same reason that teachers have incorporated empirical phenomena into learning materials in order for students to improve learning abilities can be found in the authentic material element. It is personal experience in relation to learning materials that is being investigated as an empirical phenomenon. Table 4 displays the results of the teacher's RPP assessment of authentic content conducted with the aid of ICT technologies.

Based on this lesson plan, genuine material employing ICT technologies in online learning is the third TPACK component. Students learn how to apply their theories in real-world contexts by employing authentic material characteristics to explain an empirical phenomenon. Findings from the past show that ICT integration is an effective learning technique for strengthening authentic material abilities, especially language skills (Abu-Hardan, Al–Jamal & Sa'Di 2019). Teachers can use the TPACK module to enhance their students' development of real material elements. Teachers who have completed the TPACK curriculum are more enthusiastic about integrating technology into their classrooms than those who have not completed the TPACK module (Lachner et al., 2021). Students' learning abilities can be improved by incorporating empirical phenomena into teaching materials, according to findings from the authentic material aspect. When it comes to learning materials, personal experience is the empirical reality in question. Table 4 shows the results of the teacher's RPP assessment of authentic materials using ICT technologies.

Table 3. *Teacher of the Department of Computer and Network Engineering presents authentic material using ICT in online classes*

Criteria	Aspect	Number of learning activities
0	Empirical phenomena or problems are not presented with ICT	0
1	Empirical phenomena or problems presented with ICT by teachers	0
2	Students integrate and understand empirical phenomena or problems with ICT tools	14
3	Students use ICT tools more than 50% of the time, but not all phenomena or empirical problems are used as cases, and students use ICT tools to support solving these problems	0
4	Students work on empirical phenomena or problems as described at level 3, plus students' personal experiences or reflections on empirical phenomena or problems	4
	Average score	3,38

A score of 3.38 was attained in the lesson plans involving real materials and the use of ICT technologies, indicating a level of achievement of 67.61 percent in this area. This signifies that authentic material is rated as sufficient in terms of its authenticity. There are 14 learning activities that illustrate how ICT technologies can only deliver information on empirical phenomena, and four lesson plans that demonstrate how students have been involved in real-world cases that support their theories. The learning activities are organized as follows: It is clear from the authentic material component that teachers must more suitable knowledge in order to inculcate an understanding of empirical phenomena that are associated with learning materials.

4.4. Aspects of Intentional Activities

The fourth and last factor is the integration of online activities with ICT tools. In this element, the student's own learning objectives are the focus. When compared to the other two components of deliberate action, this one obtained a score of 4,31. An important part of ICT integration has been established by the instructor. Table 5 shows the findings of the evaluation of the TPACK framework in the RPP for ICT-based intentional activities.

Table 4.*Teachers of the Computer and Network Engineering Department apply intentional/intentional activities that are integrated with the use of ICT in online classes*

Criteria	Aspect	Number of learning activities
0	ICT tools are not used to support students in diagnosing online learning	0
1	Teachers use ICT tools to provide feedback to their students	0
2	Students use ICT tools to evaluate learning performance	4
3	Students use ICT tools to conduct self-evaluations and get feedback from teachers through ICT tools, and consolidate this feedback to improve learning performance	0
4	Students continue to use ICT tools for self-evaluation and as a source of learning materials to improve learning performance	12
	Average score	4,31

An average score of 4.31 was given to findings relating to features of deliberate activities that were linked with ICT tools and an achievement rate of 85.21 percent was achieved using the TPACK framework. As a result, deliberate behaviors fall into a favorable classification. Four learning activities in the lesson plan demonstrate that the teacher has chosen ICT technologies to give self-evaluation resources that students can use to assess their learning performance. The 12 learning activities demonstrate that teachers have chosen ICT tools by giving a self-evaluation platform for students to evaluate their own learning performance and receive feedback from their teachers in real time.

The conclusion that can be drawn from these findings is that the vast majority of teachers recognize the importance of integrating ICT with student self-evaluation activities in order to determine students' intentions and motivations for the material and learning objectives provided by the teacher. This is the driving force for the use of ICT, particularly for deliberate actions carried out by teachers in schools, which have a significant positive impact on their TPACK as a result (Habibi & Yusop, 2020; Wang & Zhao, 2021). Learning activities such as delivering assignments and doing peer reviews with friends are made possible through the use of Google Docs, E-Books, and E-Learning.

4.5. Aspects of Collaborative Activities

The fifth feature of TPACK assessed in lesson plans is collaborative activities integrated with ICT throughout the online learning process. This feature encompasses student activities in collaboration with the learning community and class discussions focused on knowledge exchange. The collaborative action aspect, like the previous one, obtained the second-highest score after the intentional activity aspect. This demonstrates that teachers can discern disparities in pupils' knowledge of how to use ICT. Perhaps because SMK pupils' knowledge levels are measured using standardized assessments that are beneficial in determining kids' skills (Bowers, 2011).

In this instance, the involvement of experienced teachers is critical in promoting occupational standards (Schempp, 2016). Teacher certification status can be considered since a teacher who is not certified in their field of study is likely to have an adverse effect on student achievement (Goldhaber & Brewer, 2000). The use of ICT in ordinary chores includes creating lessons on assembling computers and virtual networks via PC simulation software and PC assembly apps, followed by peer reviews and comments. Table 6 summarizes the findings regarding several areas of joint efforts.

Table 5.*Teachers of the Computer and Network Engineering Department plan to implement constructive activities that are integrated with the use of ICT in online classes*

Criteria	Aspect	Number of learning activities
0	No collaborative activities with ICT platforms	0
1	Students work on content reproduction activities with ICT platforms	0
2	Students work on tasks that go beyond the reproduction of content involving convergent expression when working together with ICT platforms	4
3	Students work well with ICT platforms that require different levels of knowledge expression	0
4	Students work well with ICT platforms in activities that require different expressions of knowledge	12
	Average score	4,13

According to Table 6, it is known that the TPACK framework-based features of constructive activities that are examined from the lesson plan receive an average score of 4.13 and an achievement rate of 80.60%. Integrated constructive actions, thus, fall within the area of positive behavior. 12 learning activities demonstrate students working together and splitting the tasks given by the teacher based on different manifestations of knowledge in four different learning activities. The data show that when teachers design lesson plans, the goal is to develop students' preparedness to learn online, which is one of the five criteria mentioned. For students, it is inevitable that they must be acclimatized to online learning methods. Even when students have a good understanding of ICT, slow internet connections make it difficult for them to do their homework or participate in other online learning activities.

Previous studies show that socially disadvantaged pupils with poor internet connection became a big problem that proved to be unsolvable by stakeholders in the educational system, and (Delcker & Ifenthaler, 2021). However, the key factors for the success of the digital era following the Covid-19 pandemic are the development and communication of meaningful agendas by educational institutions, the availability of reliable ICT infrastructure, and teacher competence in identifying and applying appropriate and effective digital teaching methods and tools for their students, as opposed to the creation and communication of meaningful agendas by educational institutions (Nurhadi et al., 2019; Habibi & Yusop, 2020; Wang & Zhao, 2021; Guntara et al., 2021). Teacher reactions demonstrate the relevance of ICT integration, as well as the construction of a TPACK framework that is current with the times. As a result, it is probable that this model will undergo adjustments in the future.

Additionally, previous study has shown that TPACK mastery has an impact on instructors' cooperation abilities in educational institutions (Guntara et al., 2021). According to theory, an effective TPACK model guide should incorporate knowledge, mastery of materials, and technology (Mishra & Koehler, 2006; Mishra, 2019). When compared to the previous research by Drajati and colleagues (2021) that focused on the adoption of TPACK-21CL by English teachers, this study in-depth uncovered empirical evidence and identified problems related to inadequate infrastructure, especially the internet network, during the Covid 19 pandemic, which caused an increase in ICT use.

PPKM is in effect as a matter of urgency. The average score and achievement value of the TPACK framework are also greater than in prior studies, indicating that the TPACK model established in the teachers' lesson plans is of high quality. Since ICT has a long-term impact on the digitization process in schools, it is essential to have an acceptable quality of ICT infrastructure in order to successfully incorporate it into the curriculum. For vocational teachers in the digital age, this is a particular source of concern and challenge when it comes to the integration of ICT into their total professional knowledge and skills (TPACK). Due to the fact that SMK contains more practical learning activities than theoretical learning activities, the teacher in this case provides an alternative to some known and simple programs so that students can learn independently when the internet is unavailable. As a result of the fact that they cannot meet face-to-face with their teachers to practice offline, students are expected to be able to refine their talents and skills at home.

5. Conclusion

Basically, the TPACK guide in the teacher's lesson plans is designed to facilitate the student learning process. Therefore, teachers should not be complacent and should continue to innovate, develop tools, and design learning in order to achieve learning objectives. TPACT is a general framework so that teachers must be able to translate it into a practical level. Knowing that the integration of ICT and PPKM helps teachers in developing the TPACK framework, further research is expected to develop a practical level with a wider dimension. Because this research is a qualitative research, the results cannot be generalized to all SMKs. Although the findings report challenges and impacts for the reasons the authors have mentioned, no extreme cases were identified.

Private Vocational Schools in Yogyakarta have no problem integrating ICT because comprehensive preparation and digital investment will be there. The identified problems are external problems outside the school related to government policies and internet networks. The long-term impact of ICT integration in teacher TPACK development should be explored in future studies with large-scale quantitative assessments. In addition, an in-depth post-Covid19 evaluation for future digitization in the context of developing a more brilliant vocational school.

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