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The TPACK Approach Improves Student Collaboration Skills in 21st-Century Learning

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ABSTRAK

Pendidikan abad 21 menuntuk guru untuk mengembangkan aspek 6C peserta didik yaitu karakter, kewarganegaraan, berfikir kritis, kratif, kolaboratif dan komunikasi. Penelitian ini bertujuan menganalisis pengaruh pendekatan TPACK terhadap kolaborasi peserta didik dalam mata pelajaran PPKn di sekolah. Penelitian ini menggunakan metode penelitian kuantitatif. Populasi dalam penelitian ini yakni siswa kelas VII SMP yang berjumlah 178 siswa. Penarikan sampel dalam penelitian dilakukan dengan menggunakan teknik quota sampling dengan jumlah sampel akhir yang 75 peserta didik. Pengumpulan data dalam penelitian dilakukan menggunakan teknik non-tes, dengan instrument penelitian berupa angket atau kuesioner yang disebarkan melalui Google Form. Data yang diperoleh dalam penelitian kemudian dianalisis dengan menggunakna teknik analisis deskriptif kuantitatif melalui uji normalitas, uji linieritas, dan regresi linier sederhana. Hasil analisis penelitian menunjukkan bahwa pengaruh yang diberikan pada pendekatan TPACK terhadap keterampilan kolaborasi peserta didik memperoleh nilai koefisien korelasi sebesar 0.592 dengan nilai kontribusi sebesar 35.1%. Hasil tersebut kemudian menunjukkan bahwa terdapat pengaruh yang cukup signifikan anatara pendekatan TPACK terhadap keterampilan kolaborasi peserta didik di SMP.

ABSTRACT

21st-century education requires teachers to develop the 6C aspects of students, character, citizenship, critical thinking, creativity, collaboration, and communication. This study aims to analyze the effect of the TPACK approach on student collaboration in Civics subjects at school. This research uses quantitative research methods. The population in this study were seventh-grade junior high school students, totaling 178 students. Sampling in the study was carried out using a quota sampling technique with a final sample size of 75 students. Data collection in the study was carried out using non-test techniques, with research instruments in the form of questionnaires or questionnaires distributed via Google Forms. The data obtained in the study were then analyzed using quantitative descriptive analysis techniques through normality tests, linearity tests, and simple linear regression. The research analysis showed that the TPACK approach's influence on students' collaboration skills obtained a correlation coefficient of 0.592 with a contribution value of 35.1%. These results then show a significant influence between the TPACK approach and the collaboration skills of students in junior high school.

1. INTRODUCTION

21st-century education is developing and empowering students' potential to form character (Aldriani et al., 2021; Rosnaeni, 2021). Building a country with citizens whose character is by Pancasila is a big challenge for the Indonesian nation and is necessary to face the current shift in character. Therefore character building is not only the responsibility of one party but is the responsibility of the family, school, and community environment (Komara, 2018; Rahayu et al., 2022). The existence of the industrial revolution 4.0 supports the rapid growth of technology, communication, and information, bringing humans to the digital era. In the digital era, everyone can easily access the information they need without being hindered by space and time (Arianti & Pramudita, 2022; Komara, 2018; Mansir, 2022). In its development, there are four key factors in current learning: lifelong learning, learning that utilizes technology, learning that is free from intervention, and personalized learning (Marimon-Martí et al., 2022; Rahayu et al., 2022). Use information technology in education, such as IoT, AI, VR/AR, etc. Currently,

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learning and technology are inseparable. These conditions force teachers to adapt quickly to information technology in learning activities (Andrian & Rusman, 2019; Anggraeni & Sole, 2018; Effendi & Pratama, 2021). Use information technology in education, such as IoT, AI, VR/AR, etc. Currently, learning and technology are inseparable. These conditions force teachers to adapt quickly to information technology in learning activities (Kamila et al., 2022; Nuzulaeni & Susanto, 2022). Collaboration skills are one of the skills developed in 21st-century learning. In this skill, students are required to solve problems with the problem-based learning (PBL) model, Two Stay Two Stray (TSTS) and create a project (Team-Based Project) together or in groups with the hope of having a positive impact on strengthening the character education of students in facing the challenges of a very dynamic future (Saenab et al., 2019; Ulhusna et al., 2020). Implementing the PBL model in learning increases student collaboration (Krisna Dewi & Parmiti, 2022; Oktaviani, 2022; Septikasari, 2018; Tekad & Pebriana, 2022). Besides that, students' collaboration skills can also be improved by using student worksheet teaching materials (Mawaddah et al., 2022). Collaboration skills are closely related to forming students' character, especially in cooperation, solving problems, eliminating selfishness, and helping each other in group assignments (Ayun, 2021; Sunbanu et al., 2019). In addition, collaboration can train to adapt to people with different cultural backgrounds and values because education is an acculturation process (Aisyah, 2019; Reni et al., 2021). The learning process must also be based on four pillars: active learning, creative learning, effective learning, and joyful learning (Komara, 2018; Nuzalifa, 2021).

The reality on the ground shows that the collaboration skills possessed by students are still relatively low. It is indicated by the lack of students' ability to solve the problems presented. It aligns with the results of observations and interviews carried out at SMP Muhammadiyah 08 Batu. The results of observations and interviews show that in the learning process, students are less able to solve the problems presented, especially in learning using the problem-based learning (PBL) model, Two Stay Two Stray (TSTS), and creating projects (Team-Based Projects) together or in groups. Furthermore, the observations and interviews also revealed that students' ability to master technology was still limited to using online games and had not been able to master the use of technology for learning. Apart from students, teachers also have not shown mastery of technology. It aligns with data from the Ministry of Education and Culture, which shows that as many as 60% of teachers have not mastered information and communication technology (ICT). The high number of tech illiterate is due to several things, such as the minimum level of training and education and teacher literacy related to technology in learning (Yeni Rostikawati, Ely Syarifah Aeni, 2020). In addition, the lack of school facilities and infrastructure related to ICT is also a problem related to the low teacher mastery of ICT. If left continuously, this will certainly impact the lack of ability of students and teachers to master technological developments.

One of the efforts that can be made to overcome these problems is by applying the TPACK approach in the learning process. The TPACK (Technological, Pedagogical, Content, Knowledge) approach is an approach used in current learning because it can improve the quality of learning (Almaiah et al., 2022; Narbito, 2022; Sholihah et al., 2023). TPACK is the knowledge needed to incorporate technology in learning. It is hoped that teachers can use, master, and apply the technology mentioned in the latest learning issues (Almaiah et al., 2022; Santos & Castro, 2021). Using technology in learning activities also causes learning to be meaningful because learning becomes varied and can optimally achieve the planned learning objectives (Furroyda et al., 2022; Misyana et al., 2021). As a professional educator, the teacher has the task of teaching, educating, guiding, directing, training, assessing, and evaluating students. So that it does not only educate from a cognitive point of view but also in terms of affective and psychomotor which are types of learning outcomes (Nusa et al., 2021; Rachman & Nuriadin, 2022; Reinita et al., 2022), based on Law Number 14 of 2005 concerning teachers and lecturers, a professional teacher must possess at least four competencies, pedagogical, professional, personality, and social competencies. So that with these competencies, the teacher has an important role in developing an independent learning curriculum in Indonesia, including critical thinking, collaboration, communication, creativity, citizenship, and character education (Quddus, 2020; Rismorlita et al., 2021).

Several previously conducted studies revealed that the TPACK-based CTL learning model affected third-grade Civics cognitive learning outcomes (Furroyda et al., 2022). Other studies reveal significant differences in critical thinking skills and cognitive learning outcomes taught through the TPACK and conventional approaches (Nurwahyunani & Azizy, 2023). Further research revealed that using the TPACK-based Discovery Learning model affected students' cognitive learning outcomes (Sholihah et al., 2023). Based on some of the results of these studies, it can be said that applying the TPACK model in the learning process can positively influence student learning processes. In previous studies, no studies specifically discussed the TPACK approach's effect on students' collaboration skills in 21st-century learning.

2. METHOD

This research belongs to the type of quantitative research, which is carried out in six stages of research, including the identification stage and formulating research problems, the framework preparation stage, the hypothesis formulation stage, the hypothesis testing stage, the discussion preparation stage, and the conclusion drawing stage. The population in this study was 178 students at SMP Muhammadiyah 08 Kota Batu. Sampling in this study was carried out using a quota sampling technique, with the final sample size being 75 seventh-grade students. The basis for selecting quota sampling is that the researcher has determined the criteria/characteristics of the particular sample and the number of quotas desired by the researcher. Data collection techniques are used through questionnaires or questionnaires distributed through Google Forms. Before the researcher distributes the questionnaire or questionnaire, the researcher first tests the instrument so that the questionnaire or questionnaire distributed is valid and reliable. Meanwhile, data analysis techniques used normality, linearity, simple linear regression, and product-moment correlation tests. In more detail, the indicators of the TPACK approach (variable x) and collaboration skills (variable y) can be seen in Table 1.

Table 1. Indicators of Variables X and Y

No	X variable	Indicator	Y variable
1	Technological Knowledge	a. Have the ability to use technology b. Can learn technology easily	Contribute actively
2	Pedagogical Knowledge	a. Students can adapt to the learning strategies and models used by the teacher b. Can solve problems in group work assignments	Work productively
3	Content Knowledge	a. Have an understanding of the material provided by the teacher b. Give examples to students to increase their understanding	Responsible
4	Technological Content Knowledge	a. Students understand the material provided by the teacher through technology b. Facilitate student activities and tasks that involve technology	Shows flexibility
5	Pedagogical Content Knowledge	a. Increasing students' understanding of civic b. material through learning strategies used by teachers c. Understanding the material by looking at the pictures	Respect for others
6	Technological Pedagogical Knowledge	a. Using computer applications in learning b. Using Internet facilities to communicate with teachers, for example, to collect assignments	
7	Technological Pedagogical Content Knowledge	a. Teachers can create effective learning by integrating Civics, pedagogical, and technological knowledge. b. Implement appropriate learning strategies and use technology in the implementation of learning.	

3. RESULT AND DISCUSSION

Result

The TPACK approach research data was taken from the distribution of research questionnaires with 75 students and 28 statements. With the lowest score of 56 and the highest score of 93 with a range of 56-93, the TPACK Approach data will be grouped into 5 scales: very low, low, moderately high, high, and very high. Data analysis used to find the mean and standard deviation (STDEV) using the help of the IBM SPSS version 25 software application obtained an average value of 70.14 with a standard deviation (STDEV) of 7.92. For more clarity, the distribution of variable X can be seen in Table 2.

Table 2. Distribution of X and Y variables

No	Category	Interval
1	Very low	<63
2	Low	64-70

No	Category	Interval
3	Enough	71-79
4	High	79-86
5	Very high	>87

After the TPACK instrument validity test results with r table of 0.235, which refers to 70 respondents. If the instrument is declared valid if r count > r table, using an error rate of 5%. Based on the TPACK instrument validity test results from the table above, there are 31 statements where 3 of the questions or items are invalid, including numbers 6,7, and 9. At the same time, the rest produce 28 valid statement items, including numbers 1, 2, 3, 4, 5, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19,20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31. For items declared invalid, they will not be used in the research instrument. The validity test with the collaboration instrument shows that the rtable is 0.235 for respondents with a total of 70. The instrument's validity is if the value of r count > r table, using an error level of 5%. All statement items from numbers 1 to 15 are declared valid with a r count > r table value of more than 0.235. Then, 15 of these items will be used in the research instrument.

The reliability of the two instruments was declared reliable because the Alpha value > 0.7 was based on calculating the minimum standard of the research reliability test. It means that the two instruments have accuracy, stability, and consistency. The data normality test uses the IBM SPSS version 25 application based on Kolmogorov-Smirnov, making decisions with the following conditions: (a) If the Asymp. Sig. (2-tailed) > 0.05, then the data is normally distributed, and (b) If the Asymp. Sig. (2-tailed) < 0.05, then the data is not normally distributed. Below are presented the results of the normality test in Table 3.

Table 3. Normality Test One-Sample Kolmogorov-Smirnov Test

N		**75**
Normal Parameters[a,b]	**Mean**	0.000000
	Std. Deviation	4.78886400
Most Extreme Differences	**Absolute**	0.070
	Positive	0.042
	Negative	-0.070
Test Statistic		0.070
Asymp. Sig. (2-tailed)		0.200

Based on the SPSS program's normality test, the result is that the Asymp. Sig (2-tailed) of 0.200. From these results, it can be seen that the value is > 0.05. Therefore, the data can be declared normally distributed to proceed to the linearity test stage. In the linearity test, there is a decision-making with the following provisions: (a) If the significance value/deviation of linearity is > 0.05, then it can be stated that the variable (X) is parallel/linear with the dependent variable (Y) and (b) If the value of significance/deviation of linearity <0.05, it can be concluded that the independent variable (X) is not parallel/linear with the dependent variable (Y). For more details, the results of the linearity test with the ANOVA table can be seen in Table 4.

Table 4. Linearity test

			Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Collaboration*	Between Groups	(Combined)	1665.028	28	59.465	2.882	0.001
TPACK		Linierity	916.942	1	916.942	44.44	0.000
		Deviation from linearity	748.086	27	27.707	1.343	0.186
	Within Groups		948.972	46	20.630		
	Total		2614.000	74			

Based on the calculation results that have been calculated with the help of the SPSS version 25 program in the ANOVA table, it is found that Sig., which is equal to 0.186, can be interpreted as> 0.05. So that it can be interpreted and concluded that if the independent variable (X) is parallel/linear with the

dependent variable (Y), the research data can pass two tests, normality, and linearity, so that it can proceed to the linear regression test. A simple linear regression test using the IBM SPSS version 25 program, then the simple regression results are obtained with the magnitude of the regression coefficient Y = 13.655 + 0.444X. Therefore the constant value is 13,655, which means that the consistent value of the Collaboration variable is 13,655, while the regression coefficient X is 0.444, and for every 1% addition of the TPACK value, the collaboration value increases by 0.444. With a positive regression coefficient, it can be stated that the influence caused by variable X on Y is positive based on the results of a simple linear test described in Table 5.

Table 5. Simple linear test

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	916.942	1	916.942	39.443	0.000
Residual	1697.058	73	23.247		
Total	**2614.000**	**74**			

The value contained in the coefficient of variable X which has a value of 13,655, means that if the score of the TPACK approach increases by 1 unit, the score of the collaborative skills variable (Y) also increases by 0,444 units. Moreover, if the TPACK approach character score is low or decreases, then the collaboration skills variable (Y) decreases with a decrease in score of 0.444 units. The first hypothesis for this study is that the TPACK approach has a significant effect. It can be shown through the ANOVA test in the SPSS version 25 program. The following is a table of the TPACK approach ANOVA test results. More details can be seen in Table 6.

Table 6. Results of the TPACK approach ANOVA test

Data	Mean	Sig.	F count	Description
Approach TPACK	70.14	0.000	39.44	Signification Level 0.05/5%

According to the table data above, it can be seen that Fcount is 39.44, and the value of Ftable with df : 73 = 3.97 at a significance level of 0.05 is concluded Fcount > Ftable. In this way, it can be stated that the influence of the TPACK approach at SMP Muhammadiyah 08 Batu can be accepted and implemented well for students. The second hypothesis for this study is that students' collaboration skills at SMP Muhammadiyah 08 Batu have a significant influence, which can be proven through the results of the ANOVA test in the SPSS program with the presentation in Table 7.

Table 7. ANOVA test results for collaboration skills

Data	Mean	Sig.	F count	Description
Skills Collaboration	44.80	0.000	39.44	Significance level 0.05/5%

Based on the table above, it is known that the Fcount is 39.44, then when compared to the Ftable calculated using df 1:73 = 3.97 at a significance level of 0.05, it can be concluded that Fcount > Ftable. According to the table above description, the rcount value can be known from rtable with the formula df = n-2, 75-2 = 73 using a significance level of 0.05 with a one-way test and therefore getting a rtable value of 0.191. The correlation table above shows the Pearson Correlation/rcount value obtained is 0.592, meaning that it is greater than the rtable value, 0.191, with a significance of 0.05/5%, so it is concluded that Ha is accepted. Ho is rejected, meaning there is a strong influence between the TPACK approach and skills collaboration.

Discussion

Based on the results of the analysis that has been carried out, several findings were obtained in this study, including the first finding relates to the analysis of the TPACK approach. The TPACK approach is a learning approach that integrates three elements, technology, pedagogy, and material content in learning activities. TPACK has at least six components, including technological knowledge, content knowledge, pedagogical knowledge, pedagogical content knowledge, technological content knowledge, technological pedagogical knowledge, and pedagogical and content knowledge (Quddus, 2020; Rismorlita et al., 2021). Based on the results of this study, the influence of the TPACK approach at SMP

Muhammadiyah 08 Batu is acceptable, and the teacher has applied the learning approach well to students so that students can accept the learning approach, learning methods, and learning strategies applied by the teacher well. It is evidenced by the good response of students in the discussion or group learning process, and students are eager to dig up information related to the material that the teacher has given. There was enthusiasm when the teacher divided the groups, explained the material that each group would obtain, and used the jigsaw learning model. In addition, it is proven by Fcount data which is equal to 39.44 and Ftable value with df 1:73 = 3.97 with a significance level of 0.05/5% so that Fcount > Ftable = 39.44 > 3.97. The TPACK approach is believed to be able to have a very significant positive influence on the learning process of students because the teacher's ability to use technology and integrate it into the learning process effectively can help the way teachers teach and can increase students' understanding (Perdani & Andayani, 2022; Suyamto et al., 2020). The TPACK approach can not only be used in offline (offline) learning modes but can also be used in online (online) learning modes (Furroyda et al., 2022; Misyana et al., 2021). Implementing the TPACK approach in online learning significantly influences student learning outcomes (Almaiah et al., 2022; Narbito, 2022; Santos & Castro, 2021). Implementing the TPACK learning approach at SMP Muhammadiyah 08 Batu, which is carried out for students, aims to increase understanding of the material provided by the teacher and describes the various types of knowledge that teachers need to teach effectively with the help of technology and various procedures. In addition, the TPACK approach is expected to impact students facing 21st-century education positively.

The second finding relates to the results of the analysis of collaboration skills. Collaboration skills are one of the skills that students in 21st-century learning must possess. 21st Century Learning uses a blended learning system that combines science, technology, problem-solving skills, and research (Arianti & Pramudita, 2022; Hernández-Sellés et al., 2019). Collaboration is a process in which there are activities of mutual assistance and understanding to achieve common goals by playing methods while learning from the surrounding environment (Komara, 2018; Rahayu et al., 2022; Wahyuni, 2022). Collaboration skills are also important in learning activities because they can add to students' cognitive, affective, and psychomotor aspects (Khoiriyah, 2021; Supena et al., 2021). The study results showed that students at Muhammadiyah 08 Batu Middle School had good collaboration skills, that students at Muhammadiyah 08 Batu Middle School had good collaboration skills, and could be implemented in the teacher's learning process of group assignments. It is evidenced by the calculated F data of 39.44 with the Ftable df value of 1:73 = 3.97 at a significance level of 0.05/5%, so the results obtained are Fcount > Ftable = 39.44 > 3.97.

The results of the analysis then show that collaborative learning has a very positive effect on learning activities so that it can attract the interest of students or students to play an active role in the learning process (Aldriani et al., 2021; Ode et al., 2017; Rosnaeni, 2021). Collaboration skills possessed by Muhammadiyah 08 Batu Middle School students have a significant influence and can be accepted and applied by students. This can happen because the TPACK learning approach contains elements, including collaboration skills, which can increase understanding of the material teachers provide in Civics learning. The third finding relates to the effect of the TPACK approach on students' collaboration skills. Based on the results of the research that has been done, the value of Fcount = 39,443 with a significance level of 0.000 <0.05, so there is an influence between the two variables. The results of this study can show how strong the correlation or relationship (R) is between the TPACK approach to students' collaboration skills. For the processed data, the result or correlation value (R) is 0.592, and the coefficient of determination (R2) is 0.351, meaning that the effect of the TPACK approach on collaboration skills is 35.1%. In comparison, the remaining contribution is 64.9%. The TPACK approach and collaboration skills are two things that are interconnected because both of them have related meanings in terms of 21st-century learning. The TPACK approach is a learning approach that integrates knowledge with technology. Teachers who apply the TPACK learning approach will be able to provide good learning. by 21st-century learning with effective mastery of technology and pedagogy into precise and specific content (Arianti & Pramudita, 2022; Komara, 2018; Mansir, 2022). In addition, teachers with TPACK abilities will have good knowledge, material/content, art/innovation in teaching, and strategies to achieve the learning process (Kamila et al., 2022; Nuzulaeni & Susanto, 2022). Therefore, the TPACK approach and collaboration skills can be applied in schools to develop and follow the learning process. The effect of the TPACK approach on the collaboration skills of SMP Muhammadiyah 08 Batu students has a significant influence, although not too dominant, with a value of 35.1%, so it can be concluded that both have a relationship of influence and interrelationship with one another. The results obtained in this study align with previous research results, which also revealed that the TPACK-based CTL learning model affected third-grade Civics cognitive learning outcomes (Furroyda et al., 2022). Other studies reveal significant differences in critical thinking skills and cognitive learning outcomes taught through the TPACK and conventional approaches (Nurwahyunani & Azizy, 2023). Further research revealed that using the TPACK-based Discovery Learning model affected students' cognitive learning outcomes (Sholihah et al., 2023). So based on some

of the results of these studies, it can be said that applying the TPACK model in the learning process can positively influence student learning processes.

4. CONCLUSION

Based on the results of data analysis and discussion, it can be concluded that there is an influence exerted on the TPACK approach on students' collaboration skills with a correlation coefficient of 0.592 with a contribution value of 35.1%. These findings reinforce that integrating technology, pedagogy, and knowledge content in learning activities can impact the development of students' collaboration skills in the 21st century.

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