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Research Article

Students' perceptions concerning the learning environment based on biology teachers' TPACK

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ABSTRACT

Research about students' perceptions concerning the learning environment based on biology teachers' TPACK still limited. The purpose of this study was to obtain information about the impact of biology teachers' TPACK on students' perceptions concerning their learning environment. TPACK scores were obtained from instrument in the form of multiple-choice test questions. Furthermore, students' perceptions of their learning environment were obtained using a Likert scale questionnaire. Two biology teachers were used as research samples determined by purposive sampling, which is referring to their TPACK score. Furthermore, students who became the research sample were students from those two teachers that consists of 64 students. The analysis results show that teachers have different TPACK ability at the level of TPACK forming components. Furthermore, there are differences in students' perceptions based on their teachers' TPACK ability. The results were indicated teacher professionalism, in this case, TPACK has the impact on learning environment. Therefore, teachers, schools, government, and education providers are expected to give special attention to teacher professionalism.

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INTRODUCTION

Technology use in Indonesia is growing rapidly in all aspects of society (Salam et al., 2018), for example, the increasing use of social media activities (Das, Gryseels, Sudhir, & Tan, 2016; McKemmish, Anwar, & Ardianto, 2017; Poushter, Bishop, & Chwe, 2018). However, in the education aspect, the use of technology still not effective because of problems faced by teachers, students, schools, and the government. Although the education ministry has made policies regarding the importance of integrating technology into learning, there are some factors that inhibit technology integration, such as teachers' beliefs in using technology and the availability of supporting facilities. The use of technology in learning known as the strategy to enhance the learning environment to become more positive. The teachers' ability to integrate technology determines how technology affects the learning environment (Sulisworo, Kusumaningtyas, Nursulistiyo, & Handayani, 2019). In

order to enhance the learning environment by technology use, teachers must act as a facilitator. So, learning is more student-centered, and it is suitable for the needs of students in the 21st-century (Srisawasdi, 2014).

The ability of biology teachers to integrate technology into their classrooms can be seen through teachers' Technological Pedagogical And Content Knowledge (TPACK) (Agustin, Liliasari, Sinaga, & Rochintaniawati, 2018). TPACK is often used as the teachers' ability of technology integration because components of TPACK have teacher professional competence, namely pedagogic and professional competence (related to content mastery) (Nofrion, Wijayanto, Wilis, & Novio, 2018; Rehmat & Bailey, 2014). Furthermore, TPACK also consists of pedagogical content knowledge (PCK) components which are potential indicators of the learning quality provided by the teachers. PCK will continue to develop according to teachers' teaching experience (Anwar, Rustaman, Widodo, & Redjeki, 2014; Widodo, 2017). Therefore, the ability of technology integration in this research is reviewed from the teachers' TPACK.

TPACK consists of three main components and four integrated components (a combination of the main components). The main components consist of Technological Knowledge (TK), Content Knowledge (CK), and Pedagogical Knowledge (PK). Furthermore, the integrated components consist of Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK), and Technological Pedagogical Content Knowledge (TPCK) (Koehler, Greenhalgh, Rosenberg, & Keenan, 1993; Valtonen, Sointu, Mäkitalo-Siegl, & Kukkonen, 2015).

Integrating technology can increase the effectiveness of learning activities, create student-centered learning and outcome-focused, as well as the transition to conventional learning towards modern learning. Furthermore, the rapid development of technology also helps students to learn more flexible and independent according to their respective abilities (Gupta & Fisher, 2012). Additionally, previous research shows that technology integration has benefited students and teachers, such as the rapid information transfer for students and supporting collaborative learning environment (Akturk & Ozturk, 2019).

The learning environment consists of several aspects like psychological, sociological, physical environment, and the interaction between teachers and students. These aspects can affect the quality of the learning environment such as students' attitudes and their learning outcomes. It is not enough for teachers only use tests and examinations to assess student learning outcomes, but teachers must also pay attention to psychosocial aspects so that teachers can create a conducive learning environment (Khine, Fraser, Afari, Oo, & Kyaw, 2018).

Furthermore, the learning environment can be seen from the opinions of students about their academic experience. The learning environment includes students' perceptions about the learning environment in their classroom, including their relationships with teachers and fellow students, as well as their involvement in the classroom. Although each of the students has their own personal view about the learning environment, there is also a sense of togetherness between students and teachers, so the learning environment is a common perception among teachers and students in the classroom. Students' perceptions often define the learning environment because of their responses to various learning environments and their opportunities to form views that are able to provide credible perspectives for making judgments (Barr, 2016).

Students' perceptions of the learning environment consist of five aspects that describe the situation of teachers and students as well as the interaction among them. Student cohesiveness refers to the extent to which students know, help and support each other. Teacher support refers to the extent to which teachers help, be friends, trust and pay attention to their students. Involvement refers to the extent to which students have an interest and are attentive in participating in learning, active in discussions, working on additional tasks from their teacher and feel comfortable in the classroom. Cooperation refers to the extent to which students are able to work together rather than compete with each other in their learning. Furthermore, equity refers to the extent to which students are treated equally by the teacher (Afari, Aldridge, Fraser, & Khine, 2013; Alt, 2018; Khalil & Aldridge, 2019; Khine et al., 2018).

Previous research on the learning environment is focused more on students' perceptions about the learning environment (Khine et al., 2018), creating a positive learning environment (Barr, 2016), and its impact on the development of students' learning outcomes (Sandilos, Rimm-Kaufman, & Cohen, 2017). The research that focused on differences in the learning environment was carried out by Widodo, Maria, and Fitriani (2017), who aimed to analyze the learning environment during virtual laboratory and real laboratory activities.

Previous research about teachers' TPACK is still examined the description of teachers' TPACK, for example, studies conducted by Lestari (2015), Nofrion et al (2018), and Pusparini, Riandi, and Sriyati (2017). Meanwhile, research about students' perceptions concerning the learning environment based on biology teachers' TPACK still limited. Therefore, it is necessary to conduct a research to describe the relationship between biology teachers' TPACK and students' learning environment. The purpose of this research was to

obtain information about the impact of biology teachers' TPACK on students' perceptions concerning their learning environment.

The results of this research are expected to be useful information for education providers, teachers, researchers, and students about the importance of increasing teacher professionalism through the application of the TPACK model. Biology teachers who have good TPACK are expected to be able to create a learning environment that suits students' needs.

METHOD

Research design

This research is quantitative with survey research design. The data collection method for biology teachers' TPACK and students' perceptions used a cross-sectional survey. The use of a cross-sectional survey helped researchers explain the questions asked by the sample (Fraenkel, Wallen, & Hyun, 2012). The study began with the distribution of test questions through training activities. The test results were then analyzed descriptively. Based on the results, the researchers determined the schools, teachers, and students to obtain information about the student's learning environment. The research was conducted from July to October 2018.

Research samples

The sample consisted of two teachers and 64 students from two junior high schools in Banda Aceh City-Aceh Province. The sample of teachers is determined by purposive sampling, which is based on their TPACK score. Both biology teachers have almost the same total TPACK value. However, when assessed by TPACK forming components, it will be seen the differences in some of the TPACK forming components. Furthermore, the students who became the sample of this study were students of the two teachers. The aim is to obtain a complete information of their perceptions of their learning environment. To obtain more in-depth information, the researcher also asked a number of questions related to the learning and teaching process to both teachers. For ease of analysis and discussion, the school and the teachers are given a different code, namely SMP A, SMP B, Teacher A, and teacher B. Both of science teachers are from Biology Education background.

Instruments

The data of biology teachers' TPACK were obtained from multiple choice test instruments. The indicators are based on TPACK for 21st-century skills (Valtonen, Kukkonen, Kontkanen, Mäkitalo-Siegl, & Sointu, 2018; Valtonen et al., 2017) and TPACK survey for Meaningful Learning (Chai, Ling Koh, Tsai, & Lee Wee Tan, 2011; Deng, Chai, So, Qian, & Chen, 2017; Koh, Chai, & Tsai, 2013). The development of this instrument is also adapted to scientific content and the integration of technology with pedagogically meaningful way which suitable the 21st-century skills framework (Valtonen et al., 2017), which focuses on communication, collaboration, critical thinking, and creative thinking (Valtonen et al., 2017) and meaningful learning dimensions (Koh et al., 2013). From the results of teachers' TPACK analysis, the two teachers were chosen who had average TPACK that were not much different, coded as Teacher A (SMP A) and Teacher B (SMP B). Furthermore, the description of biology teachers' TPACK profile is carried out. To obtain in-depth information, teachers of SMP A and SMP B were observed and interviewed.

The data about students' perceptions concerning the learning environment obtained from an instrument that developed based on What Is Happening In this Class? (WIHIC) instrument that consists of five aspects namely, student cohesiveness, teacher support, involvement, cooperation, and equity (Afari et al., 2013; Khine et al., 2018) (see Table 1). This instrument consists of 35 items, which were assessed based on a 5-point Likert scale, where 1 represents "Never", 2 represents "Rarely", 3 represents "Sometimes", 4 represents "Often", and 5 represents "Always". The results of this instrument formed five groups of data based on these answers.

Before being used to obtain the data, the instrument was tested on 41 students from one of Junior High School in Bandung. The instrument is distributed to the students using Google Form. The results of validity and reliability indicated that there were two invalid statements that must be issued. Furthermore, the reliability test result showed very high reliability (Cronbach's alpha = 0.927).

Instruments distribution and data analysis

The questionnaires distributed by visiting schools and giving questionnaires to students used direct administration to a group method. The instruments distributed through training activities carried out at Teacher

Training and Education Faculty-Universitas Syiah Kuala, Aceh Province. The training was carried out by researchers in collaboration with Teacher Training and Education Faculty-Universitas Syiah Kuala and Education and Culture Office of Banda Aceh, Aceh Province. Instruments for students are distributed to students in their respective schools.

Data analysis was carried out through descriptive statistics. Teachers' TPACK analysis is done by making a percentage of correct answers for each of the TPACK forming components. Furthermore, in order to facilitate analysis, grouping, and drawing conclusions, the data about students' perceptions of class climate are divided into three groups (initially five groups), namely routine (combination of "Often" and "Always" response groups), non-routine (combination of "Rarely" and "Sometime" response groups), and never.

Table 1. Variables, components/aspects, and indicators used in this research

Variables	Components/Aspects	Indicators
Science teachers' TPACK	Technological knowledge	Skills to use technology efficiently
		Interest in following the latest technological developments
	Content knowledge	Understand the concepts, laws, and theories of science and its application
		Develop science learning material
	Pedagogical knowledge	Understand the characteristics of students
		Organize learning activities that educate
		Develop students' potential (critical thinking, creative thinking, collaboration, communication)
		Communicate with students effectively, empathetically, and politely
		Organize assessment and evaluation of processes and learning outcomes
	Pedagogical content knowledge	Develop science learning materials that support students' potential (critical thinking, creative thinking, collaboration, communication)
		Implement appropriate learning activities with science learning materials
	Technological content knowledge	Use appropriate technology for the representation of science materials
		Use appropriate technology to develop science learning materials
	Technological pedagogical knowledge	Use appropriate technology to support learning activities
		Using appropriate technology that supports students' independence and communication
		Use appropriate technology that supports students' thinking skills (critical and creative thinking)
	Technological pedagogical content knowledge	Implement technology-based learning activities in accordance with science learning materials effectively
		Develop and share information about effective technology-based learning activities
Students' perceptions concerning the learning environment	Student cohesiveness	Students' perceptions of classmates
		Students' perceptions of student relationships that support each other with classmates
	Teacher support	Students' perceptions of the learning media that provided by the teacher
		Students' perceptions of teacher attitudes in supporting learning activities
		Students' perceptions of the use of technology in learning activities
	Involvement	Students' perceptions of their attitude in participating learning activities
		Students' perceptions of the questions raised by the teacher during the discussion
		Students' perceptions of the assignments given by the teacher
	Cooperation	Students' perceptions of cooperation between themselves and classmates in learning activities
		Students' perceptions of cooperation between themselves and classmates in completing the assignments given by the teacher
		Students' perceptions of collaboration between themselves and classmates in sharing information obtained from the internet
	Equity	Students' perception of the extent to which students are treated equally by the teacher
		Students' perceptions about the extent to which students are treated equally by the teacher in providing support

RESULTS AND DISCUSSION

Information regarding biology teachers' TPACK relationship and students' perceptions of the learning environment is rather difficult to obtain, especially if linked to inferential statistical analysis. The problem lies in the greater number of teachers sampled, the more the number of students. Therefore, this study tries to obtain information about the relationship between biology teachers' TPACK with students' perceptions about their learning environment in descriptive statistics. To obtain more comprehensive information, the selected teachers

are teachers who have a total TPACK score that is almost similar, but different in terms of TPACK forming components.

In order to obtain comprehensive information about differences in students' perceptions concerning the learning environment based on their teachers' TPACK ability, the discussion was carried out in three stages. First, the results of the analysis are displayed in the form of a percentage table (Table 2), which is the answer or response (from students and teachers) based on the components and aspects of forming variables (students' perceptions of their learning environment and teachers' TPACK). The teacher answers displayed are a percentage of the average value of the teacher's correct answers in each of their TPACK components score. The student perceptions responses shown are student data from the routine response group. This stage aims to show the differences about teachers TPACK ability and students' perceptions clearly based on their respective schools.

Second, a percentage of student responses are displayed based on each statement item. It aims to obtain detailed information about differences in students' perceptions of each statement given. Third, the descriptive results are built based on a comparison of the mean values of each aspect of the learning environment. This was done to strengthen the results of the analysis of the previous stage.

Table 2. The comparison of teachers' TPACK profile and students' perceptions concerning their learning environment

Sample	Components	Teacher A (%)	Teacher B (%)
Teachers' TPACK (percentage based on the number of correct answers)	TK	100	60
	CK	100	100
	PK	58	67
	PCK	57	71
	TCK	75	50
	TPK	50	33
	TPCK	40	60
	Mean	69	63
Sample	**Components**	**SMP A (%)**	**SMP B (%)**
Students' Perceptions (percentage based on routine response group)	Student cohesiveness	28	67
	Teacher Support	18	45
	Involvement	58	67
	Cooperation	49	71
	Equity	64	81

Table 2 shows that the average percentage of biology teachers' TPACK scores is slightly different. However, when viewed from each TPACK forming component, there will be a clear difference, where 6 out of 7 TPACK forming components for the two teachers have different percentages. Teacher A excelled in technology components and technology integration components, such as TK, TCK, and TPK. While Teacher B excelled in pedagogical components and pedagogical integration components such as PK, PCK, and TPCK.

In accordance with the results of Swallow and Olofson (2017), this difference can be caused by the teachers' background, where the teachers' background is able to moderate the formation of their TPACK. Teacher A is one of the instructors of multimedia utilization in learning in Aceh Province that is why he has good technological knowledge. Furthermore, a teacher who teaches at SMP B, besides being a science teacher, she also works as a vice principal in Kindergarten at the institution, so that she has a good understanding of pedagogy, especially an understanding of student characteristics.

The results of the interview with Teacher A have obtained information that SMP A has facilities such as projectors and internet connections. However, both facilities cannot be used for various reasons. Furthermore, the results of the interview with Teacher B have obtained information that SMP B has complete facilities, such as projectors available in each class, internet connections that can be used by students, and tablet (iPad) for each student of class VII. These results indicate that the school facilities, in this case the technological facilities can assist teachers in creating a positive learning environment. Research results from Huda (2019) show that the availability of facilities and teacher competencies in using technology are factors that can influence teachers in using technology. In addition, motivation and support from schools also have an impact on the use of technology by teachers.

The results of the analysis of the learning environment based on aspects of forming variables have shown general information about students' perceptions of the learning environment in both schools. To get a more specific information, further analysis conducted based on statement items.

In general, the students of SMP B are having more cohesiveness than students of SMP A (Table 3). The students of SMP B regularly (routine) collaborating, getting help, and helping each other in using technology. However, they were difficult in helping other students. Furthermore, the students of SMP A showed a high percentage of "non-routine" in each activity. Another result is the students having more cohesiveness in collaborating outside learning activities. This is evidenced by the high percentage "I collaborate with friends in class". This statement is a general statement, which is not explained that students cooperate in what kind of activities. Furthermore, other activities related to the lesson, the percentage of routine not higher than the percentage of general activities.

Table 3. The results of students' perceptions about the student cohesiveness

Statements	Responses (%)					
	N		NR		R	
	A	B	A	B	A	B
I collaborate with friends in class	0	0	63	4	37	96
I help classmates who experience difficulties in learning	0	0	68	56	32	44
Classmates help me when I experience difficulties in learning	0	2	74	36	26	62
My friends and I help each other in using technology in learning in the classroom	26	7	58	29	16	64

Description: N=Never; NR=Non-Routine; R=Routine; A=SMP A; B=SMP B

The results showed problems in the cohesiveness of students, especially the students of SMP A. According to Sartika, Said, and Ibrahim (2013), the caused students find it difficult to interact, especially in terms of helping each other in learning activities is that students often get unpleasant treatment from classmates while studying. For example, ridiculed by friends when unable to answer questions from the teacher so students do not dare to express their opinions in class. King (2019) said that this problem greatly affects collaborative learning, where the objectives of the learning cannot be achieved. Therefore, the students are only able to develop their cohesiveness outside learning activities. Whereas in fact, according to Borůvková and Emanovský (2016), the effectiveness of learning groups is largely determined by the extent of interaction that allows members to clarify their own understanding, build their respective contributions, filter meaning, ask questions, and answer questions, based on feelings of comfort and respect.

The use of technology (conventional and ICT technology) in learning activities is still not routinely carried out, especially the teacher from SMP A (Table 4). This is indicated by the non-routine use of several technologies, such as LCD projectors, media presentations, computer-based simulations, and social media. Furthermore, the two schools are not routinely using conventional media (learning props and lab work). Activities that are routinely carried out by the teacher are giving instructions to complete the assignments, describing the learning objectives, and asking the students to obtain information using the internet. These results indicated that the use of learning media, both ICT and learning props have not been used routinely.

Table 4. The results students' perceptions about teacher support

Statements	Responses (%)					
	N		NR		R	
	A	B	A	B	A	B
The teacher use a LCD projector (e.g. Infocus) in learning activities	26	0	68	42	5	58
The teacher uses media presentations (e.g. Ms. PowerPoint) through the computer in learning activities	53	0	47	56	0	44
The teacher uses computer-based simulation media (e.g. virtual laboratories) in learning activities	58	60	42	33	0	7
The teacher uses learning props in learning activities	32	11	58	60	11	29
The teacher gives instructions to complete the assignment	0	0	47	9	53	91
On the topic of learning that requires lab work, the teacher invites us to do lab work in the laboratory	58	62	37	22	5	16
The teacher guides us in designing group activities	84	29	5	33	11	38
The teacher always sends assignments through social media (e.g. Facebook and WhatsApp)	21	7	74	49	5	44
The teacher asks us to gather information using the internet	0	0	32	24	68	76

Description: N=Never; NR=Non-Routine; R=Routine; A=SMP A; B=SMP B

There are several learning media that used in science learning such as PowerPoint, picture, and video (e.g. animation and discovery) through LCD projectors, science KIT, learning props, lab work, doing observation in the school environment, and natural surroundings are needed in learning activities. The teacher has to make

sure that learning media is appropriate to students' needs. The other benefits obtained from the use of learning media are making the abstract subject more concrete, overcoming constraints of space and time, and overcoming limitations of the human senses. Thus, the information on learning materials presented by the right media will give an impression and longer to be remembered by students (Indayani, 2015; Nurina, 2017).

The low percentage of SMP A is caused by the availability of media as a tool that helps to learn. Based on the results of the interview with the teacher was obtained information that in SMP A is lacks electricity. If the laboratory computer is used, the electricity in the school will be extinguished. Based on the results of the description on this aspect was obtained information that "teacher support" was correlated with the availability of school facilities and infrastructure.

Based on Table 5, the students from SMP B has a higher percentage of involvement than the students from SMP A. In SMP A, students were not routine in paying attention to the teacher during the teaching-learning process. They also did not want to be involved in answering the teacher questions during the discussion. According to Rosegard and Wilson (2013), the lack of students' attention in learning activities can be caused by learning methods or media that used by the teacher are not able to attract the attention of students. The way that the teachers can do to gain students' interest and attention is by implementing several methods such as hook, trigger, attention getter/grabber and other anticipatory methods.

Table 5. The results students' perceptions about involvement

Statements	Responses (%)					
	N		NR		R	
	A	B	A	B	A	B
I pay attention to the teacher during the teaching-learning process	5	0	53	44	42	56
I am looking for the answers from the questions given by the teacher	5	0	47	49	47	51
I asked by the teacher to provide evidence of each answer that I gave	0	0	47	42	53	58
I am looking for the answers from the questions during discussions	0	0	16	27	84	73
I answer the questions given by the teacher during discussions	58	11	32	36	11	53
I assume it is important to complete each assignment given by the teacher	0	0	16	22	84	78
I solve problems using information that I get by myself using the internet	0	0	16	2	84	98

Description: N=Never; NR=Non-Routine; R=Routine; A=SMP A; B=SMP B

Furthermore, the students' desire to answer the teacher's questions during the discussion can be influenced by students who still do not understand the questions or do not know the answers. Based on this problem, it can be concluded that teacher pedagogy is very important in learning activities. The teacher must be able to adjust learning activities to the students' condition during learning activities. According to Barendsen and Henze (2019), the approach that appropriate to solve problems caused by students is the use of an authoritative approach. Authoritative is the dominant behavior of the teacher. Teachers can stimulate students to engage in learning activities using their authoritative characteristics.

Table 6 shows the level of "cooperation" of students from SMP B is very good. This is indicated by the high percentage of routine choices in each statement. This result is different from the responses of the students from SMP A, they are still not routine in sharing textbooks and learning materials from the internet in the classroom during discussions. The reason is students are not permitted to use smartphones in school. Furthermore, facilities in schools also do not support students to carry out these activities.

Table 6. The results students' perceptions about cooperation

Statements	Responses (%)					
	N		NR		R	
	A	B	A	B	A	B
My friends and I work together to achieve learning goals in the classroom	0	0	42	22	58	78
My friends and I in listen to each other and respect each other's opinions during learning activities the classroom	32	9	53	31	16	60
My friends and I discussed how to solve problems in the assignments given by the teacher in the classroom	0	0	26	11	74	89
I cooperate with friends in the classroom when we have group assignments	32	4	47	31	21	64
My friends and I share information from the internet to solve the problems given by the teacher in the classroom	0	0	32	22	68	78
I share my textbook and learning materials from the internet with friends in the classroom during discussions	37	24	42	36	21	40
My friends and I study together through social media	0	0	16	13	84	87

Description: N=Never; NR=Non-Routine; R=Routine; A=SMP A; B=SMP B

Based on the information obtained from the teacher, SMP A has a Wi-Fi connection, but it is not permitted to use by students so that the students unable to use the internet in their learning activities at school. Furthermore, the students in SMP A are not routinely cooperating with friends in the classroom and they are not routinely listening to each other and respecting each other's opinion during learning activities. This is caused by the low level of cooperation between students in SMP A. The ways that teachers can do to increase the level of collaboration between students is to apply the Jigsaw (Kusuma, 2018) or Think-Pair-Share learning methods (Rosita & Leonard, 2015).

According to Pielmeier, Huber, and Seidel (2018), student characteristics are related to the formation of effective teaching and learning activities in the classroom. Therefore, the teacher must know the characteristics of each student. Through this problem, it is known that the role of teacher pedagogy knowledge is important. Based on Table 7, it indicated that both of SMP A and SMP B show a high percentage of routine in each statement, except statements about the opportunity to express opinions during discussions from SMP A. The students from SMP A are not routinely getting the opportunity to express their opinions in class discussions. Therefore, the teacher must be able to regulate the classroom conditions so that the teacher can provide equal opportunities to the students.

Table 7. The results students' perceptions about equity

Statements	Responses (%)					
	N		NR		R	
	A	B	A	B	A	B
I had the opportunity to express my opinion during class discussions	11	2	53	42	37	56
The teacher gave me the same opportunity to answer questions with other friends in the classroom	5	2	21	9	74	89
The teacher treated me the same as other friends in the classroom	5	0	42	7	53	93
I get the same amount of help from the teacher as other friends in the classroom	0	0	32	13	68	87
The teacher encouraged me as other friends in the classroom	0	0	16	20	84	80
The teacher gives praise for the results of my work as other friends in the classroom	0	0	32	16	68	84

Description: N=Never; NR=Non-Routine; R=Routine; A=SMP A; B=SMP B

The results of the descriptive analysis of the five aspects showed that the role of pedagogical knowledge is very important, especially in supporting the students in forming positive learning environment. Therefore, the teacher should not only increase content knowledge, they also must always improve pedagogical knowledge, including technological knowledge. These three knowledge's can determine teacher professionalism (Nofrion et al., 2018). This is in accordance with Yeh, Lin, Hsu, Wu, and Hwang (2015) which states that professionals are those who can decide what to do based on the current conditions and justify their choices and practices. Furthermore, to understand the level of "Routine" and item analysis statements, the difference of students' perceptions of the learning environment is also determined from the mean obtained from the total score of each aspect of the learning environment.

The comparison of the mean values (Table 8) showed that SMP B has a higher mean value in all aspects of the learning environment. These results reinforce the results of the analysis based on the level of "routine" and item analysis before. These results prove that the learning environment in SMP B is more positive compared to SMP A.

Table 8. Comparison of mean values for each learning environment aspect

Aspect	SMP A	SMP B
Student cohesiveness	12.21	15.33
Teacher support	23.21	29.91
Involvement	25.37	27.49
Cooperation	23.32	26.89
Equity	23.63	25.31

As reviewed from the teachers' profile and school facilities, the relationship between students and the use of technology in SMP A is lower than SMP B. The teacher has less pedagogical knowledge that affects relationships between students. Furthermore, although Teacher A has good knowledge of technology (TK, TCK, TPK), the use of technology in learning activities is still low. This is caused by problems with school facilities. Therefore, in assisting teachers to improve their professionalism, the government and education

providers must pay attention to the teachers' TPACK ability and school facilities. The results of Evens, Elen, Larmuseau, and Depaepe (2018) research suggest that increasing teacher professionalism (in their research using the PCK approach) must be done thoroughly. Their results showed that the explicit application of PCK to teachers was more useful in the development of their PCK, compared to the application of PCK separately between PK, CK, and PCK.

The relationship between students and the use of technology by the students of SMP B are higher than SMP A. These results were influenced by teachers' pedagogical knowledge (PK, PCK, and TPCK) that are better than Teacher A. Furthermore, although Teacher B has the lower technological knowledge than Teacher A, the level of technology use at SMP B is higher than SMP A. Both of these comparisons showed that teachers' abilities and school facilities affect the condition of the learning environment. According to Gupta and Fisher (2012), technology has the potential to be an effective tool to improve teachers' pedagogical knowledge by helping teachers to give attention, fast feedback, and motivation for students.

CONCLUSION

The results showed that the learning environment of students can be influenced by teacher professionalism, in this research in terms of their TPACK ability. The results of this study indicate that differences in pedagogical and technological teacher abilities can have an impact on students' learning environments. However, it is interesting that biology teachers who have pedagogy and are supported by good technological facilities (even though their technological abilities are not prominent), help shape a positive learning environment. Explicitly, the results of this study also show that incomplete technological facilities can inhibit the integration of technology in learning activities.

The results of this study provide important information for the government and education providers. Both parties are expected to give special attention to improving teacher professionalism. Implementation of training activities for teachers to increase professionalism should be done regularly, especially in the increased professionalism in today's digital age.

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