

Biology Teacher's TPACK Profile in Central Java: Description of TPACK Mastery Based on Teaching Experience

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Abstract— TPACK is an integrated unit of three basic knowledge consisting of PK, CK, and TK. This study aims to find out how different TPACK biology teachers are based on teaching experience. This research was a descriptive study with survey method. The population in this study is a hypothetical population that includes all biology teachers in Central Java. The sample representing the hypothetical population is a conventional sample consisting of 31 biology teachers. The results showed that there was no difference in TPACK ability between senior teachers (teaching more than 15 years) and junior teachers (teaching less than 15 years). There is no difference in the TPACK of senior teachers and junior teachers because the way of teaching biology teachers in the class tends to be the same. Based on observations of learning that have been carried out, the average teacher uses the same models, methods, learning media, and technology.

Keywords: *TPACK, teachers, biology, teaching experience, senior teacher, junior teacher*

I. INTRODUCTION

Entering the era of the industrial revolution 4.0 and the challenges of the 21st century demand improvement in all areas of life, including education and teaching. The teacher must always develop teaching abilities by having a number of competencies. Based on the Republic of Indonesia Government Regulation No. 74/2008, it is explained several tasks of teachers as professional educators namely educating, teaching, guiding, directing, training, evaluating and evaluating students in early childhood education, formal education pathways, basic education and secondary education. In addition, there are also four types of teacher competence in the perspective of national education policy as stated in the Explanation of Government Regulation No.

19/2005 on National Education Standards, including pedagogical competence, personality competency, social competence and professional competence.

In developing these competencies, teachers in Indonesia must be able to master three basic knowledge that can be used as a reference in the world of teaching, including PK (Pedagogical Knowledge), CK (Content Knowledge), and Kindergarten (Technological Knowledge). The three basic elements will be integrated into one such element will be integrated into each other to form PCK (Pedagogical Content Knowledge), TCK (Technological Content Knowledge), TPK (Technological Pedagogical Knowledge, and TPACK (Technological Pedagogical and Content Knowledge) [1].

TPACK was formed based on the PCK description put forward by Shulman, which is a balance of two elements of knowledge, namely pedagogic (PK) and mastery of teaching material (CK). However, PCK is still considered to need an additional element in order to answer the opposition to the progress of science and technology in the 21st century, this element is the mastery of technology (Technological Knowledge) [2]. Efforts to exploit the potential for technological development in education differ from country to country. Even within a country, development may differ from one place to another. In Southeast Asia, especially in Singapore and Malaysia are at a more advanced stage in their efforts to exploit the potential of ICT in education [3].

Technology contributing to the world of education has been a debate for years. This is very possible because the method for identifying contributions cannot be placed outside the context of digital technology itself, but also from how to measure these contributions. The use of digital technology can

improve teacher professionalism [4]. Teacher TPACK is influenced by various factors. One factor that is thought to have an influence on teacher TPACK is teacher teaching time.

The ability to teach a teacher is inseparable from the teacher's teaching experience. Teaching experience is the period of work of teachers in carrying out their duties as educators [5]. Class mastery and management is still a problem which until now needs to be mastered by the teacher over time. A teacher is always faced with various conditions, both those that support or hinder the learning process. This situation will encourage teachers to overcome them. With a lot of teacher experience in teaching, it should make the teacher better in conveying the contents of the material to students[6].

TPACK needs to be mastered by teachers, not least by biology teachers in Central Java. Based on the balance sheet of the Ministry of Education and Culture of the Republic of Indonesia, the average UKG result of high school teachers in Central Java is 70.10. These results are ranked better than other provinces on the island of Java, including DKI Jakarta, West Java and East Java. Teacher competency test (UKG) is carried out to test teacher competency in the pedagogical and professional fields. UKG results that have been implemented are still not specifically discussing TPACK, so they have not been able to show the extent of teacher mastery regarding TPACK. For this reason, it is necessary to conduct research on the teacher TPACK as a whole in the field by conducting observations.

II. METHOD

A. Research Design

This research is a descriptive study using a survey method. This study was conducted to analyze how TPACK differences between biology teachers are based on teacher teaching time. In this case, the teacher's teaching time is divided into two groups, namely the senior teacher group (teaching more than 15 years) and the junior teacher group (teaching less than 15 years). Population in this study was hypothetical population terminology, while the sample that represents the hypothetical population is a conventional sample. The sample in this study amounted to 31 biology teachers who taught from a number of SMA in Central Java. The sample is taken based on the research needs, in this case the teacher used as the sample was teacher who currently exists and can be observed.

B. Instrument

The instrument of this study was using an observation sheet. The main data in this study is the TPACK of the teacher obtained from the learning process carried out by the teacher in the classroom. The instrument has been tested for validity and reliability so that it can be used to retrieve data.

TPACK data is limited to PCK, TCK, TPK, and TPACK. These limitations are adjusted to the research instrument in the form of learning observation sheets, so that the three mastery of basic knowledge (CK, PK, TK) are not observed, because it would be ideal if measured using a test instrument. Research data obtained by observing learning carried out by the teacher concerned. In this case, observations were made by looking at the level of conformity between the models, methods, and learning media with the material being taught. One other thing that was also observed was the compatibility between the elements of technology used by teachers and learning material.

C. Data Analysis

Data were analyzed descriptively and inferentially analysis. The data obtained will be tabulated and set forth in a descriptive narrative form. To find out how the difference in TPACK between the main teacher and middle teacher is used inferential analysis using the Independent Sample t-Test. To facilitate the TPACK grouping, teachers make criteria that refer to [7] as follows: 84-100 (very good), 68-83 (good), 52-67 (sufficient), 36-51 (poor), 0 - 35 (not good).

III. RESULTS

The results of the study were analyzed descriptively to determine the level of TPACK mastery of biology teachers. After being analyzed descriptively, to find out how the different TPACK mastery of teachers based on school accreditation was analyzed using the Independent Sample t-Test. The results of the study showe in Table 1.

Table 1 showed the TPACK profile of biology teachers. Based on the results obtained it can be said that the ability of the TPACK biology teacher is in the sufficient category, and the TPACK of the main teacher tends to be better than the TPACK of the middle teacher. However, this difference was not significant because the results of the Independent Sample t-Test obtained a significance value of more than 0.05 (0.405). The insignificant difference in TPACK between the main teacher and middle teacher can also be seen from the scores obtained, where the difference in value obtained does not differ greatly (64.91 and 57.85).

TABLE I. BIOLOGY TEACHER'S TPACK PROFILE

TPACK Components	Teaching Experience		Independent t-Test Results
	Senior	Junior	
PCK	88,86	77,30	0,057
TCK	54,21	49,16	0,576
TPK	61,69	53,78	0,340
TPACK	54,88	51,19	0,649
Average	64,91	57,85	0,405
Notes	Sufficient	Sufficient	No significant

These results can also be summarized in a diagram like the following:

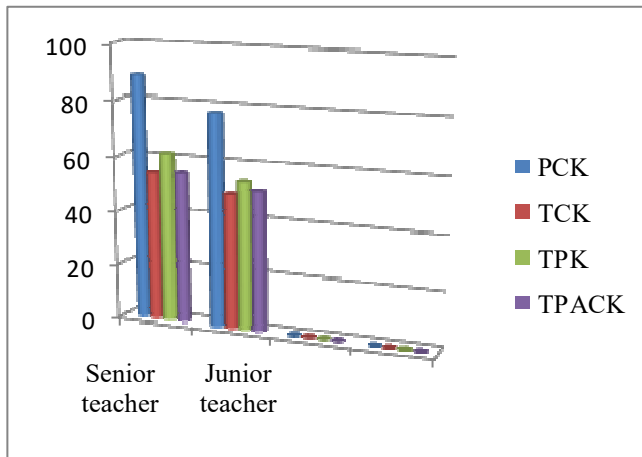


Fig. 1. Biology Teacher's TPACK Profile

Figure 1 showed descriptively how the TPACK differs between the main biology teacher and the middle biology teacher. Based on the diagram it can be seen that TPACK from the main teacher is better when compared to TPACK from the middle teacher. In this case, the main teacher means the teacher who has taught more than 15 years, while the middle teacher means the teacher who taught less than 15 years.

IV. DISCUSSION

Based on the research results obtained, it can be said that the TPACK biology teacher is included in the sufficient category. Teacher TPACK can be seen from how the teacher can integrate elements of technology with models, methods, and learning media that are used during the learning process. From the observations obtained the fact that the application of technological elements in the learning process is not so optimal. The lack of maximum use of this technological element is influenced by several factors, including the infrastructure of the school and the internal factors of the teacher. From the actual school infrastructure, there are already many schools that provide supporting facilities such as wifi, but the signal from wifi is not so good because wifi can only be accessed in one particular area called a hotspot area. This causes the integration of elements of technology in the learning process to be less than optimal. Meanwhile, from the teacher factor, information was obtained that some teachers were indeed still limited in mastering the elements of technology because teachers did not use ICT very often in their daily lives. The school also does not provide a policy for teachers to use technology elements in the learning process, which is what causes the lack of TPACK for biology teachers.

TPACK becomes a central element in achieving learning objectives, because if TPACK is applied correctly, students will get more meaningful learning. TPACK can be implemented by collaborating on three

main elements namely TK, PK, and CK. The teacher is said to be able to apply TPACK well if it is first able to synthesize aspects of TPACK. Where these aspects consist of PK, CK, TK, PCK, TCK, and TPK [8]. Utilization of elements of technology is still limited to just finding information related to the material. The strategy of applying TPACK in learning is important to do, because it can improve learning activeness and mastery of students' concepts [9]. TPACK is also the main foundation in responding to the challenges of learning in the 21st century. In line with this statement, [10] states that good knowledge about TPACK makes it easy for teachers to find solutions to face problems that exist in the class, TPACK can also be used to raised teacher competence in schools.

The results also showed that senior teachers tended to have better TPACK compared to junior teachers. The senior teacher can be assumed to be an educator who already has a lot of experience and has increased knowledge as time goes by. The learning process provided will experience adjustments to the experience and the amount of training conducted by a teacher, where the more experience a teacher gets, the better the teaching method will be [11]. senior and experienced teachers are supposed to have good competence to support their performance according to the teaching field. The same thing was stated by [12], which states that learning is a change from behavior that follows how much practice and experience of a teacher in the world of teaching. The more experienced teacher will be better able to a) monitor and understand the events presented, b) interpret the learning strategies used, c) hypothesize the reasons for visible behavior, and d) offer a solution strategy for the problem identified [13]. Senior teachers who are observed are on average certified teachers, whereas certified teachers are indeed mostly filled by teachers who are already senior and have a lot of experience.

In Indonesia, certified teachers have the understanding that they must have the competence to carry out education services in certain education units after passing the competency test organized by the certification body [14]. The main teacher who is observed to have demands for certification that must be fulfilled, among them are required to take and complete a bachelor's degree, have been devoted to teaching at least three full years, and has a valid and accountable teaching license sheet [15]. Teacher certification programs can improve the quality of education, but the size of the effect of this increase is different for each school category [16]. Based on these explanations, it is not surprising that primary teachers tend to have better TPACK compared to middle teachers. However, this difference is not significant because based on the Independent Sample t-Test, a significance value of (0.405) is obtained which is greater than 0.05.

There is no difference in the TPACK of senior teachers and junior teachers because the way of teaching biology teachers in the class tends to be the same. Based on observations of learning that have

been carried out, the average teacher uses the same models, methods, and learning media. Many of the teachers use the discovery learning model which is a learning model that should be used in the 2013 curriculum. The learning method that is often used by teachers is the discussion method, where the use of technological elements in the discussion method is also still limited in the use of the internet as material for finding information for students when the discussion takes place. Learning media that are often used by teachers are only power points, which only contain text and are less interesting. The use of instructional media must be a primary concern for a teacher. The selection and use of instructional media must be carefully considered, taking into account aspects of the compatibility of the media with teaching materials and also the characteristics of students [17]. In this case, a good learning media is an audio visual learning media.

Based on the research results obtained, it can be said that mastering TPACK is a mandatory requirement for teachers, regardless of how long the teacher teaches. For primary teachers and intermediate teachers, they should have a TPACK that is qualified to answer all challenges in the 21st century. Teachers need to know that in order to enter the 21st century an innovation in learning is needed, both related to approaches, models, strategies, media, or learning technology. Teachers are required to be more intuitive in understanding teaching content, pedagogical methods, and appropriate technology [18]. It is imperative for a teacher to be able to design and develop learning by integrating technological elements in it in order to increase the success of students in this advanced and modern learning environment, because by applying technology will produce more optimal learning [19].

The use of technological elements as informal learning resources enables students to have high collaboration skills, easy sharing and exchange of knowledge, and direct themselves to continue learning to solve problems [20]. Knowledge of technology refers to how teachers use elements of technology in everyday life, especially digital technology and information and communication technology. The existence of this ability needs to be maintained given the increasingly advanced and developing science and technology [21]. Educational practices developed by integrating the use of technological elements used by educators must be in accordance with the context and class curriculum, and most importantly how students learn with technology, not just use the technology elements for learning [22].

V. CONCLUSION

Based on the results of research that has been carried out, it was obtained that there was no significant difference between the TPACK of the main teacher (teaching more than 15 years) and middle teacher (teaching less than 15 years) with a

significance value of more than 0.05 (0.405). There is no difference in the TPACK of senior teachers and junior teachers because the way of teaching biology teachers in the class tends to be the same.

ACKNOWLEDGMENT

Thank you to all those who have helped in completing this research, especially for biology teachers who have been willing to help carry out this research.

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