The High School Biology Teachers Knowledge in Palu City to Framework the Technological Pedagogical and Content Knowledge

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Abstract. The knowledge of biology teachers for gathering the technology in learning is still lacking although supported by existing means. It is necessary first the data about the basic ability of teachers about framework TPACK by maximizing of using available technology that have been owned each schools. This study describes the knowledge of all biology teachers High School in Palu city for gathering framework TPACK. The method study was descriptive exploratory. Population of the study was all biology teachers of state high school in Palu city as many as 30 people, so the study were not used sampling. Data collecting by using questionnaire that afterwards analyzed by percentage with Likert Scale. In this research analyze 8 items that is TK (Technology Knowledge), CK (Content Knowledge), PK (Pedagogical Knowledge), PCK (Pedagogical Content Knowledge), TCK (Technological Content Knowledge, TPK (Technological Pedagogical Knowledge) and TPACK (Technological Pedagogical and Content Knowledge). The results of analysis obtained 77.54%, it means knowledge of biology teachers in gathering TPACK frame-teaching in high school in Palu city in good category.

Keywords: Biology teacher; High School; TPACK.

1. Introduction

Education is a process that happens to everyone throughout their lives. Almost everyone knows education and carries out education, because education is never separate from human life. The component that has been considered to be very influential in the education process is the teacher component. This is in line with [1] which states that the performance of teachers through the implementation of their duties as educators, instructors and trainers of students is expected to contribute meaningfully to the achievement of established educational goals.

The observation it found was in the general teachers have understood technology as a medium for learning that includes the use of LCD projectors and the use of laboratory equipment. However, most of the teachers still use learning methods and approaches that do not vary or are still limited to conventional learning such as learning conventional method. This situation results in the creation of an unpleasant situation in the classroom. Some schools already have Information and Communication Technology (ICT) rooms or multimedia facilities used in biology learning. While in some schools they already have these rooms but have not been used in biology learning. According to [2] that learning technology has advantages that can make students easier to do tasks,
save time and even add information as Sources learning resources. This situation makes students more quickly receive and obtain information, especially materials and lessons in schools. Teachers can respond to technology quickly so that the integration of technology can be useful to help the learning process. Teachers are expected to be able to collaborate on the ability to design and teach (pedagogical, mastery of content (material) teaching with technology) so as to create a learning effective and innovative. Special understanding is needed, namely the use of technology in (technological) learning, so this ability is often referred to as TPACK (Technological Pedagogical and Content Knowledge). Therefore, it is very important, teachers develop learning with TPACK framework, especially in learning biology so that students easily receive knowledge and understanding of biological concepts for students to be better.

Realizing the TPACK learning framework in schools needed, the importance of the data regarding the basic ability of teachers about the TPACK learning framework is maximizing the technology facilities that are already owned by schools. In addition, the data is intended to map teachers’ knowledge in TPACK learning. Based on the description above, the writer is interested in raising the theme of the problem about the knowledge of teachers using technology in pedagogic and content or what is called TPACK so that the knowledge of biology teachers in State High Schools in Palu City, Indonesia can be analyzed and described.

The purpose of this study was to describe the knowledge of biology teachers about the TPACK learning framework in the State High Schools in Palu City. The benefits of this study are expected to enrich knowledge about TPACK, improve performance in learning and encourage teachers to carry out innovative, creative and fun so as to improve the quality of learning in schools. Further, this study investigates the perceive and knowledge of TPACK (CK, PK, TK, TCK, PCK, TPK and TPCK) of biology teachers in Palu City, Indonesia. Therefore, the following research questions were examined in this study.

The rest of this paper is organized as follow: Section 2 describes the basic concept of TPACK. Section 3 presents the data used and proposed method. Section 4 presents obtained results and following by discussion. Finally, Section 5 concludes this work.

2. TPACK Rudimentary

The origin of TPACK is based on pedagogical content knowledge (PCK). The term PCK was first introduced by Shulman in 1898 as one of the three content knowledge domains: Subject matter content knowledge, curricular knowledge, and pedagogical content knowledge [3]. As Shulman pointed out, the PCK contains knowledge on how to teach a specific content, extending the content familiarity itself. It describes the relationship between the knowledge related to a particular subject to be taught (content) and knowledge of pedagogical methods to be used in teaching content. Khofer and Mishara added this integrated technology to furnish the framework of engage in that to activity. Building on the PCK, a new terminology was introduced by the TPACK framework was developed by [3] who integrated technological knowledge as a key component of the framework, creating technological pedagogical content knowledge (TPACK) is shown in Figure 1.

The Figure 1 above explains that the main components in TPACK are divided into 3 components which include components of Technology knowledge (TK), Content knowledge (CK), and Pedagogical knowledge (PK). So that the component divides into several slices in the TK component with CK being the Technology Content Knowledge (TCK), in the TK component with PK being a component of Technology Pedagogical knowledge (TPK). While the CK and PK components are PCK's Pedagogical Content knowledge components. So that from some components the slice becomes the TPACK component that gathers all the components. In detail, each component will be discussed as follows:

a. Technology knowledge TK namely knowledge of various technologies ranging from low technology such as pencils and paper to digital technologies such as internet, video, interactive whiteboards and software programs.
b. Content knowledge (CK) is knowledge of scientific material that will be taught or taught [3]. A teacher must know about the content of the knowledge they will teach.

c. Pedagogical knowledge (PK) is related to teaching methods and processes and includes knowledge in classroom management, assessment, development of plans learning (RPP) and student learning.

d. Pedagogical content knowledge (PCK) related to content knowledge related to the teaching process [4]. PCK is different from various types of content, because PCK is a combination of content and pedagogy with the aim of developing the practice of teaching a better content.

e. TCK Technological Content Knowledge (TCK) which is knowledge about how technology can create new representations for specific content. By using specific technologies, teachers can change the way teachers practice and understand concepts in specific content.

f. Technological pedagogical knowledge (TPK): TPK is knowledge of how various technologies can be used in teaching to understand that the use of technology can change the way teachers teach.

g. Next, the last component is Technological Pedagogical and Content Knowledge (TPACK): TPACK deals with the knowledge needed by the teacher to integrate technology into the teaching of certain content. The teacher has an understanding intuitive of the complex interactions between the three basic components of knowledge (content, pedagogy and technology) by teaching content using appropriate pedagogic methods and technology. In this component is the accumulation of the three components major namely TK, PK and CK.

The TPK-related professional development for experienced teachers should promote both autonomous and collaborative instructional decision-making while simultaneously encouraging open-minded consideration of new instructional methods, tools, and resources. Activity types that are keyed directly to required curriculum standards can provide both flexible scaffolding and authenticity of purpose for experienced teachers’ TPCK-related learning a balance of helpful, non-on straining structure/scaffolding for new implementation ideas while acknowledging experienced teachers’ agency and expertise in the classroom [5].
3. Proposed Method

This section presents the proposed method.

3.1 Research Method

In this study, survey research methodology was descriptive of a TPACK knowledge for biology teachers high school in Palu City, Indonesia. The population in this study were all Biology subject teachers of the State High School in Palu City while the samples of this study were all biology teachers who taught at State Senior High School 2, 3, 4, 5, 6, 7, 8, and 9. The total number of teachers are 30 people from 8 men and 22 women. Teaching experience different range from 5-32 years and with the qualifying postgraduate and Graduate degree education with certificate. In this research is a population sample that is a whole teachers of biology that is in high school in Palu city (see Table 1).

| High School                  | Total Teachers |
|------------------------------|----------------|
| High School 2 Palu City      | 5              |
| High School 3 Palu City      | 5              |
| High School 4 Palu City      | 4              |
| High School 5 Palu City      | 5              |
| High School 6 Palu City      | 5              |
| High School 7 Palu City      | 3              |
| High School 8 Palu City      | 1              |
| High School 9 Palu City      | 2              |
| **Total**                   | **30**         |

3.2 Research Variable

Variables This research variable is the knowledge of biology teachers in applying the framework Technological Pedagogical Content Knowledge (TPACK) learning in State High Schools throughout Palu City.

3.3 Data Analysis

These considerations include the approval of research implementation in each school. The method used is observation by interviewing biology teachers and documentation. Observation in this research is teacher interview give were informed by the integrated the TPACK learning in the classroom. We interviewed and recorded the teacher at the end of 30 minutes of the weekly sessions for approximately 30–60 minutes to reflect on her perception of the session’s activities. I was face-to-face interview and case document analysis. The sampling technique was purposive sampling, namely sampling with the researchers' own considerations. The research instrument used a questionnaire with a measurement scale using a Likert Scale. Data analysis using percentage analysis from [6], using the following formula:

\[
\text{Percentage (\%)} = \frac{\text{Total Score Ideal}}{\text{Score Each Item}} \times 100
\]

Namely total score is total of all respondents' answers and ideal score is item weight high multiple total respondents. Data obtained from the results of the questionnaire analysis by using the percentage formula described from the results of the observation and then making a report on the results of the study. The validity of the research instrument is to measure the depth of the instrument test. Before the questionnaire is distributed to the teacher, testing of the observation indicator is done first by testing.
the content validity. To test the content validity (content validity), the validator i.e. lecturer has been consulted to conduct an assessment of each question. Based on the validation, this instrument is declared valid and can be used as a measurement tool for research. The answers to each item questionnaire using the Likert Scale results from these calculations are grouped into the following Table 2 categories with [7]:

Table 2. Likert Scale to Describe Percentage

| Presentation | Criteria |
|--------------|----------|
| 81 – 100 %   | Very good |
| 61 – 80 %    | Good     |
| 41 – 60 %    | Less     |
| 21 – 40 %    | Low      |
| ≤ 21 %       | Very Low |

4. Results and Discussion

This section presents the results obtained and following by discussion.

4.1 Results

The results regarding knowledge of biology teachers in implementing the framework of Learning and Content Knowledge Technological Pedagogical High School in Palu, which is presented in Table 3.

Table 3. Percentage of knowledge scores of TPACK Biology Teachers in Public High Schools Throughout Palu City

| Variable | Percentage |
|----------|------------|
| TK       | 70.75%     |
| PK       | 81.67%     |
| CK       | 80.14%     |
| TCK      | 72.80%     |
| TPK      | 73.67%     |
| PCK      | 84.25%     |
| TPACK    | 79.50%     |

Total TPACK 77.54%

The data is obtained from questionnaire analysis with questions totaling 47 questions developed from 33 indicators of variables developed by Shulman in [4] and Suryawati in [8]. Based on the data above, biologically the knowledge of biology teachers in applying the framework is TPACK learning significantly different for each component. Based on the results of a single ANOVA test, it is obtained that f count is 8.53 and f table is 3.29 with a value 99% confidence α (0.01) Because f counts> f table at the significance level total is 5.46, then H0 is rejected and H1 is accepted (see Table 5). Because the ANOVA test showed a significant difference, BNT continued testing to found out whether there was a difference between each TPACK variable with a confidence level 99% (see Tables 4, 5 and 6).

Table 4. Variance Analysis of TPACK

| Groups | Count | Sum | Average | Variance |
|--------|-------|-----|---------|----------|

5
Table 5. Single Factor ANOVA

| Source of Variation | SS    | df | MS     | F      | P-value  | F crit |
|---------------------|-------|----|--------|--------|----------|--------|
| Between Groups      | 1197.22 | 6  | 199.5367 | 8.530387 | 5.46E-06 | 3.291012 |
| Within Groups       | 935.6511 | 40 | 23.39128 |        |          |        |
| Total               | 2132.871 | 46 |         |        |          |        |

Table 6. BNT Continued Test

| Indicator | TK | TCK | TPK | TPACK | CK | PK | PCK |
|-----------|----|-----|-----|-------|----|----|-----|
| TK        | 70.75333 | 72.8 | 73.66667 | 79.5 | 80.14286 | 81.66667 | 84.25 |
| PK        | 735 | 364 | 337 | 221 | 561 | 516 | 437 |
| CK        | 1061.3 | 81.66667 | 80.14286 | 72.8 | 90.14286 | 91.66667 | 11.2 |
| TCK       | 5 | 15 | 4 | 3 | 70,75333 | 72.8 | 9.47619 |
| PCK       | 9 | 926 | 84.25 | 4.91667 | 1.66667 | 8.8077012 | 1.3910345 |
| TPK       | 3 | 364 | 73.66667 | 2.33333 | 80.8077012 | 88.8077012 | 1.3910345 |

The data shows that the PCK component has the highest percentage compared to other components. The main components related to technology show low results compared to PK and CK components. In the TK component, the mean score was significantly different from PK and PCK, namely pedagogic. The results of the data analysis on every point on the variables of technological knowledge (TK) is explained in the Table 7 below:

Table 7. Percentage of Score on Problems in Variables Knowledge Technology (TK)

| No. | Indicator | Questions | Percentage (%) | Criteria |
|-----|-----------|-----------|----------------|----------|
| 1   | Understanding of the basic components of the computer | Do you know the basic components of the computer? Do you know the management of components on the computer? | 73 | Good |
| 2   | Easy to learn to use technology | Are you easy to learn by using technology? | 77 | Good |
| 3   | Know how to solve | Do you know the problems on the | 56 | Enough |
technical problems on the computer? Do you know how to overcome technical problems on a computer? 53 Enough
4 Advanced using word processing programs (MS Word) Do you know how to manage Microsoft Word programs? 77 Good
5 Advanced using number processing programs (MS XL) Do you know how to manage Microsoft Excel programs? 75 Good
6 Advanced using presentation programs (MS Power point) Do you know how to manage Microsoft Power Point programs? 75.3 Good
7 Following the latest technological developments Do you know the latest technological developments? Do you know the use of smart-phones in accessing technological developments? 69 Good
8 Advanced using printers, scanners, projectors and cameras Do you know how to operate printers and scanners? Do you know how to operate the projector and camera? 73 Good
9 Using the internet as a communication medium Do you know internet use as a communication medium? 79 Good
10 Saving data Do you know the types saving data? Do you know how to used saving data 73 Good
71 Good

From Table 7 above, the results of the data collection show that the average score on the question in the knowledge Technological variable (TK) questionnaire is 70.75% with the category the percentage of knowledge is in the good category. This is based on Table 3.3. However, there is the lowest percentage in the matter No. 5 with a percentage of 53% in the sufficient category. The next variable is Pedagogical Knowledge (PK) which consists of 6 indicators developed into 9 questions. Based on the data analysis results in Table 7, the percentage of score in variables problem of pedagogical knowledge (PK) is given in Table 8 as following:

| No | Indicator | Questions                                                                 | Percentage (%) | Criteria         |
|----|-----------|---------------------------------------------------------------------------|----------------|-----------------|
| 1  | Implement a varied learning strategy | Do you know the strategies in learning? Do you know the application of learning strategies varies? | 83             | Very Good       |
|    |           |                                                                           | 80             | Very Good       |
| 2  | Able to manage and master the class well | Do you know how to manage and control in class? | 84             | Very Good       |
| 3  | Have knowledge in assessing student performance in class | Do you know what kind of assessment students have in class? Do you know the process of assessing student activities in class | 83             | Very Good       |
|    |           |                                                                           | 84             | Very Good       |
| 4  | Using assessment methods and techniques | Do you use evaluation methods and techniques in a variety of ways? | 83             | Very Good       |
| 5  | Recognizing possible misconceptions and learning difficulties for students | Do you know students who experience misconceptions and difficulties in learning? | 78             | Good           |
Do you know how to deal with students who experience misconceptions and difficulties in learning? 79 Good

6 Reflective actions to improve the quality of learning
Do you know reflective actions to improve quality in subjects? 81 Very Good

Average 81.67 Very Good

Based on the data from Table 8, in general the teacher's knowledge in the category is very good. In the next variable about Content Knowledge (CK) which consists of 5 indicators developed into 7 questions. The percentage of scores in variables questions of Content Knowledge (CK) is given in the Table 9:

**Table 9. Percentage of scores in variables questions of Content Knowledge (CK)**

| No. | Indicator | Questions | Percentage (%) | Criteria |
|-----|-----------|-----------|----------------|----------|
| 1   | Understand the concepts, laws and theories of biology and their application flexibly | Do you know the basic concepts of biology and their application? | 83 | Very Good |
|     |           | Do you know the laws in biology? | 82 | Very Good |
|     |           | Do you know theories in biology and their application? | 81 | Very Good |
| 2   | Knowing the development of science, especially biology | Do you know the development of science (Science is very good in natural knowledge) especially biology? | 83 | Very Good |
| 3   | Participating in seminars or activities related to the field of biological sciences | Do you participate in seminars or activities related to the field of biological sciences? | 77 | Good |
| 4   | Using the latest sources (such as books or journals) to add to the treasures of biological science you have | Do you know the use of the latest sources (such as books or journals) to add to the treasures of biological sciences? | 75 | Good |
| 5   | Design and carry out biological experiments for learning or research purposes. | Do you know the design and implementation of biological experiments in the learning process? | 80 | Good |

Average 80.14 Good

The Table 9 above shows the Content Knowledge (CK) percentage, the average score which is 80.14% is classified as good. In general, the percentage with the very good category is in the range of
80-83% and the highest percentage in indicators 1 and 2 is 83%. The Table 10 below describes Technological Content Knowledge (TCK) to discuss technology that is associated with biological science. In this variable consists of 3 indicators developed into 5 questions. A more detailed explanation is presented in the following Table 10.

Table 10. Percentage of score on questions in variables Technological Content Knowledge (TCK)

| No | Indicator                                                                 | Questions                                                                                                                                      | Percentage (%) | Criteria |
|----|----------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|----------------|----------|
| 1  | Using technology to help understand the concepts, laws and theories of biology | Do you know the use of technology to help understand the concept of biology? Do you know the use of technology to help understand the laws of biology? Do you know the use of technology to help understand biological theory? | 75             | Good     |
|    |                                                                             | Do you know the use of technology to help understand the concept of biology? Do you know the use of technology to help understand the laws of biology? Do you know the use of technology to help understand biological theory? | 73             | Good     |
|    |                                                                             | Do you know the use of technology to help understand the concept of biology? Do you know the use of technology to help understand the laws of biology? Do you know the use of technology to help understand biological theory? | 74             | Good     |
| 2  | Knowing computer applications related to biology                             | Do you know computer applications related to biology?                                                                                           | 67             | Good     |
| 3  | Developing student activities and tasks that involve the use of technology   | Do you know how to develop student activities and tasks with the use of technology?                                                             | 75             | Good     |
|    |                                                                             | Do you know how to develop student activities and tasks with the use of technology?                                                             | 75             | Good     |

Average 72.8% Good

The acquisition of the above data is explained that the average acquisition is 72.8%. Based on the percentage, it is included in the good category. The highest percentage obtained is achieved in indicator 3 which is 75% where it is in the good category. The acquisition was obtained in the range of 67-75%. The next variable is Pedagogic Content Knowledge (PCK) which consists of 4 indicators and questions. More clearly explanation about the percentage of each question is described in the following Table 11:

Table 11. Percentage of Score on Questions in Variables Pedagogical Content Knowledge (PCK)

| No. | Indicator                                                                 | Questions                                                                                                                                      | Percentage (%) | Criteria |
|-----|----------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|----------------|----------|
| 1   | Choose an approach and biology learning                                    | Do you know learning strategies which approach and strategy are in accordance with existing materials with biological material?             | 85             | Very Good|
| 2   | Preparing the RPP                                                         | Are you able to prepare a self-made RPP?                                                                                                     | 82             | Very Good|
| 3   | Being able to make difficult biological material is easy for students     | Do you know how to facilitate biological material that is difficult for students to understand?                                               | 83             | Very Good|
| 4   | Make your own questions to measure students 'understanding of the material taught | Do you know how to make questions to measure students' understanding of the material being taught?                                         | 87             | Very Good|

Average 84.25 Very Good

The Table 11 above shows that the average score on the variable Pedagogical Content Knowledge is (PCK) 84.2% of the percentage included in the excellent category. Overall the questions are in a very
good category. From the range of 82-87%. The highest percentage obtained in the matter of making questions to measure student understanding about the material being taught is 87%. The lowest indicator in making the RPP itself is 82% is category very good. The next 6th TPACK variable is Technological Pedagogical Knowledge (TPK) is a combination of technology and pedagogic. This variable consists of 3 indicators and questions. At each percentage gain is more specifically explained in the Table 12 below:

Table 12. Percentage of Score on Problems in Variables Technological Pedagogical Knowledge (TPK)

| No | Indicator                                                                 | Questions                                                                 | Percentage (%) | Criteria |
|----|---------------------------------------------------------------------------|---------------------------------------------------------------------------|----------------|----------|
| 1  | Using the application computers in class learning                         | Do you know how to use computer applications in learning?                 | 74             | Good     |
| 2  | Choosing technology that is appropriate to the learning approach and strategy in the classroom | Do you know the choice of technology that is appropriate to the learning approach and strategy? | 75             | Good     |
| 3  | Using internet facilities (such as social media, blogs) to communicate with students | Do you know the use of internet facilities (social media or blogs) in communicating with students? | 72             | Good     |

Average 73.67% Good

From Table 12, the results of the collection of data are known that the average is 73.67%. Based on the percentage included in the good category. In general, it is seen that the acquisition is still in the range of 72-75%. In the table above shows indicators that have a low percentage score compared to others. The last variable is a combination of the basic components of TPACK which generally contains the three basic components. In this variable, the questions and indicators are 4 with each percentage discussed in the following Table 13:

Table 13. Percentage of Score on Problems in Technological Pedagogical Technological Variables and Content Knowledge (TPACK)

| No | Indicator                                                                                                                                 | Questions                                                                                                                                 | Percentage (%) | Criteria |
|----|-----------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|----------------|----------|
| 1  | Choose learning strategies and technologies that are appropriate to the biological material that will be delivered in classroom learning activities. | Do you know the choice of learning strategies and technologies that are appropriate to the biological material that will be delivered in classroom learning activities? | 84             | Very Good |
| 2  | Integrating biological knowledge, pedagogical knowledge, and technological knowledge possessed for making effective learning | Do you integrate biological knowledge, pedagogical knowledge, and technological know-how that is owned to realize learning that is effective? | 80             | Good     |
| 3  | Help my colleagues understand how to integrate biological knowledge, pedagogical knowledge, and technology knowledge | Do you help your colleagues understand how to integrate biological knowledge, pedagogical knowledge, and technology knowledge? | 76             | Good     |
| 4  | Applying different learning strategies and using various computer applications in the implementation of biology learning. | Do you apply different learning strategies and use various computer applications in implementing biology learning? | 78             | Good     |

Average 79.5% Good
The results of the data collection revealed that the average score on the questions in the Technological Pedagogical and Content Knowledge questionnaire was 79.5%. The highest percentage of indicators about the choice of learning strategies and technology that are in accordance with the biological material that will be delivered in the classroom learning activities is 84% which is very good. While the lowest gain on the indicator is about helping colleagues/friends to understand how to integrate biological knowledge, pedagogical and knowledge technology knowledge is 76% that is good.

4.2. Discussion

Based on the results of research conducted in State High Schools in Palu City using a questionnaire, it can be explained that most teachers have understood well about TPACK applied in biology learning. Based on the data presented in the figure above shows that the teacher's knowledge of technology is still lacking compared to the component pedagogical. Technology involves the tools used to convey content and apply practices in a better way, the focus must be on curriculum and learning. Integration is defined not by the amount or type of technology used, but by how and why it is used [9].

The knowledge of biology teachers in TPACK on the TK variable is the use of technology in everyday life is low compared to other variables even though it is still in the category good. The indicator on the TK variable, which is categorized as sufficient is the knowledge in dealing with technical problems on the computer. Obtaining a percentage in the aspect this value is still in the good category. This value is lower when compared to the pedagogic aspect. This is in line with previous studies by [10] who found the results of technology knowledge by music teachers were still in the low category compared to pedagogical knowledge and content. Because the role of technology in the learning process is very important for teachers to create effective learning. In the 21st century today it requires teachers who are able to master the latest technology so as to print a generation that can compete in this century.

Based on the results of the interviewed, it was found that the factors that influence this are the age of the teacher and the lack of learning. In addition, due to more busyness by the teachers, causing teachers to be less able to take the time to learn new things, especially technological advances in supporting the learning process in the classroom. Lack of training / workshops related to the use of the latest technology. This is inversely proportional to the existence of school facilities that have been met with the presence of Wi-Fi and LCD Projector even though the numbers are still limited. And from these facilities are still underutilized in the learning process so that understanding of teacher technology is not good. Based on reports in the study of technological integration in general education, researchers have found that the use of technology by teachers depends on them after acquiring the necessary knowledge, skills and attitudes, often through independent learning or formalized professional development [11]. The previous study in [12] stated that focusing on chemistry student, learning was studied in the field of history and geography. Which is more stressful on students in general and technology learning is explored differently.

The knowledge of biology teachers in State High Schools throughout Palu City on the pedagogical component is very good. It can be seen in Figure above that each variable that has a aspect pedagogical has a high percentage compared to technology and content. In accordance with PP No. 74 of 2008 Article 3 is the ability to manage student learning which includes understanding of students to actualize their various potentials. This is because the teacher’s teaching experience ranges from 5-25 years. In addition, science qualifications obtained from education previous were taken. Most teachers have been certified and have studied postgraduate.

This is based on the results of research conducted by [13] by obtaining teacher competencies which have a positive and significant effect on student achievement in SMK 2 Bandung. From this it can be interpreted that student achievement can be seen from the teacher's competence in the learning process in the classroom. The main competencies of teachers include pedagogic competence, professional skills and competencies. Whereas in the results of this study it was found that the teacher's knowledge on pedagogical aspects was very good, possibly affecting the achievement of students in state high schools throughout Palu City.

This study obtained results that are in line with previous research [4] regarding the ability of biology
teachers regarding TPACK in Senior High Pekanbaru State Schools in good categories. The ability of teachers in the technology (TK) variable basic included in the good category. Whereas in the previous research the researchers found that the ability of (TK) in the category enough. It can be seen that the capabilities technological of biology teachers in State High Schools in Palu City are better than those of biology teachers in Pekanbaru State High School. The timing of the research in 2017 so that this research is more recent and there is still a lack of research on the knowledge of biology teachers in applying the framework TPACK. This research can be taken into consideration for future researchers. Previous research also conducted by [14] at University Malang State found that TPACK had an important role in the ability to develop learning tools. With physics teacher candidates who have ability, a high TPACK they will also have the ability to develop learning tools good. The ability of TPACK and the ability to arrange learning tools for physics teacher’s candidate increased after being taught using the POST-learning model PACK. From this study it can be seen that the treatment with TPACK can improve the ability of prospective teachers who can apply the knowledge and abilities possessed to students.

5. Conclusion

Based on the results and discussion described in the previous chapter, it can be concluded that the knowledge of biology teachers to the framework Technological Pedagogical and Content Knowledge (TPACK) learning in High State Schools in Palu City is in the good category. So that further research can look at the abilities of biology teachers in developing learning tools using the TPACK framework and can explore about misconception with the scale to relationship to TPACK.

References

[1] Soetjipto and Kosasi. 2006. Teacher Training Profession. Jakarta: Rineka Cipta.
[2] Sutrisno. 2011. Introductory Learning Innovative With Information Technology and Communication. Jakarta: gaung Persada (GP) Press
[3] Mishra, P., & Koehler, M. J. 2006. Technological Pedagogical Content Knowledge: A Framework for Teacher Knowledge. Teachers College Record, 108(6), 1017-1054.
[4] Shulman, L.S. 1986. Those Who Understand: Knowledge Growth in Teaching. Educational Researcher, 15 (1) , 4 – 14
[5] Scharber, C., D. Aaron., G veletsianos., C. Miller. 2009. Using The Technological, Pedagogical, And Content Knowledge Framework to Design Online Learning Environments And Professional Development. J. Educational Computing Research, 41(3) 319-346.
[6] Sudijana Anas. 2005. Introduction to Educational Evaluation. Jakarta: Paja Grafindo Persada.
[7] Ridwan. 2002. Research Variables Measurement Scale. Bandung: Alfabeta
[8] Suryawati, LN and Hernandez. 2014. Technological Pedagogical Skills Analysis Content Knowledge (TPCK) of Pekanbaru City State Senior High School Teachers. Journal of Biogenesis. Biology Education Study Program Department of Mathematics and Natural Sciences FKIP University of Riau Pekanbaru. 11 (1), 67-72.
[9] Earle, RS. 2002. The Integration of Instructional Technology into Public Education: Promises and challenges. ET Magazine, 42, 5-13. Retrieved from http://bookstoread.com/etp/earle.pdf
[10] Bauer William I. 2012. The Acquisition of Musical Technological Pedagogical and Content Knowledge. Journal of Music Teacher Education National Association for Music Education 22(2) 51–64
[11] Baylor, AL, & Ritchie, D. 2002. What Factors Facilitate Teacher Skills, Teacher Morale, And Perceived Student Learning in Technology Using Classrooms? Computers & Education, 39, 395-414.
[12] Khan, S. 2011. New Pedagogies On Teaching Science with Computer Simulations. Journal of Science Education & Technology, 20(3), 215-232.
[13] Widar D H. 2017. Effect of Teacher Competence on Student Achievement of SMK City 2 Bawang. e-Proceeding of Management. Business Management Study Program Telecommunications and Information, Faculty of Economics and Business, Telkom University. Vol 4 No. 1.