PE - 6

COMPETENCY PROFILE OF TECHNOLOGICAL PEDAGOGICAL CONTENT KNOWLEDGE (TPCK) OF PHYSICS TEACHER ON WAVE MATERIAL AT SMA

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Abstract

A research has been conducted to study the Physics Teacher's competency profile based on component of Technological Pedagogical Knowledge (TPK), Technological Content Knowledge (TCK), Pedagogical Content Knowledge (PCK) and Technological Pedagogical Content Knowledge (TPCK) on Wave Material in Senior High School. This research is a qualitative research. The intake of research subject used Snowball sampling. Data obtained were analyzed by Spradley's model. The result of this study described each TPCK component of Physics Teacher. The conclusion indicated that teachers with TPCK have "very good" competence compared by TPK, TCK, and TPK. Teachers with competence of TPCK combine aspects of pedagogical and content with technology ability to implement innovative strategies for effective learning in the classroom. This study is expected to be an evaluation by Physics Teachers to improve the quality and learning outcomes of students in senior high school.

Key words: content knowledge, learning outcomes, pedagogy, technology ability.

INTRODUCTION

Information and communication technology (ICT) is an essential tool of the 21st century. Technology is becoming a necessary tool to promote student learning, so teachers must be prepared and have competencies to integrate these digital tools into their classroom provides a challenge for students to build competence, especially in serving what students needs to meet the 21st century skills. Generally, the success of the quality of education is influenced by various factors including the professionalism of teachers, teaching and learning process as weel as student's achievement. Transformation of these cases is recommended to produce learners that have adequate knowledge of competence, independence, and quality. There have been numerous calls for teacher to step forward and to help transform the profession, leading areas in curriculum development, assesment, and leadership (Holland, Eckert, & Allen, 2014). Teachers must become 21st century learners themselves, learning from inquiry, design and collaborative approach.

Historically, teacher education has been focused on the content and pedagogy knowledge. Reports from Blockgrant Congress of Physics Teacher in Makassar region which is done by Better Education Through Reformed Management and Universal for Teacher Upgrading (2011) states that the problems of physics teacher quality oriented to low motivation in the learning plan, including to prepare the lesson plan, create media of learning, preparing a

class action research, and how to integrate ICT in the classroom. The success of teachers in the teaching process focuses on its competency. There are many professional teacher development programs shifting towards a 21st century teacher education model that includes practice in designing and implementing inquiry, collaborative learning projects, and bringing many more opportunities for teacher to master 21st century teaching method field (Trilling & Fadel, 2009).

Competence and ability to be possessed by the teacher, especially in teaching consist of three interconnected-indicators, including the understanding of technology, pedagogic, and teaching material. Technological Pedagogical Content Knowledge (TPCK) is a term framework and understanding of teacher regarding aspect of technology, pedagogic, and content (Mishra & Koehler, 2006). TPCK provide teacher to improve their quality of teaching (Srisawardi, 2014).

Research indicates that integration can increase the achievement of technological mastery and other aspects of the learning enviroment such as creativity engagement and authentic learning. The interaction of these components can make student feel comfortable in learning process especially in science learning. Science learning, especially physics requires concept understanding, drawing conclusions quantitatively and qualitatively especially that difficult, and abstract. These can be found in the subject of Wave. This is a reason the researcher choose the topic. The presence of teacher as a facilitator and have known ability of TPCK applied in learning and teaching is expected to answer the problems mention previous. Based on this, the research intend to study about the physics teacher competency profiles that divided as TPK, TCK, PCK, and TPCK. Developing TPACK in education requires an curricular system that would reveal the complex, multi-dimensional reationships by treating all three components in an epistemologically integrated manner. This study will answer the research questions what is the profile competence of TPCK in teaching Wave at SMA? This research was done in 3 high schools of Makassar. This study is expected to be an evaluation of Physics Teacher to improve their understanding about TPCK competency. Thus, it can be improve the motivation and learning outcomes of high school students.

RESEARCH METHOD

This reseach is a qualitative research to describe the TPCK competencies. The intake of resarch subjects using the Snowbal sampling method. The main instrument in this study is the researcher. It was assisted by auxiliary instrument in the form of guidelines for in-depth interviews and closed quiestionnaire. The study was conducted at three high schools in the Makassar city. The subjects are 4 physics teachers and 8 students of third grade who have studied wave material. Methods of data collection was a combination of interview and observation. Interviews used are structured and semi-structured interviews. Structured interview refers to the interview guide. If some information that need to be studied in depth, semi-structured interview is carried out. Data in this study was analysed by using Spradley's model which including domain analysis, analysis of taxonomic, and componential as well as cultural theme analysis (Sugiyono, 2011).

Further information is provided in the data collection section. Testing the credibility of the data in this study was performed by: 1) triangulation of sources that examine the information obtained through several sources; 2) use of reference materials or related literature such as journal, books, proceeding, articles; 3) checking of members to find out how much data obtained was given by the data providers; 4) peer examination to obtain criticms, questions of possibility of bias.

TPCK competency guidelines can be seen in the following table:

TABLE 1. TPCK Competency

Indicators	Characteristics
Pedagogical Content Knowledge (PCK)	Understanding of approach and learning strategy, pedagogical strategies and techniques, representation and formulation of scientific concepts, knowledge of what makes those concept difficut or eady to learn, knowlede of misconceptions, prior knowledge or cognitive difficulties, and knowledge of students theories of epistemology.
Technological Content Knowledge (TCK)	Understanding of how science subjects are transformed by the specific technological enviroments, operational and 8technical skills related to specific scientific knowledge, resources and tools available for science subjects.
Technological Pedagogical Knowledge (TPK)	Understanding of how technology can support specific pedagogical strategies in the classroom, ICT-based learning strategies, handling students technical difficulties. `
Technological Pedagogical Content Knowledge (TPCK)	Understanding about learning strategies and approriate technology, a combination of content, pedagogy, and technology use in class, as well as the implementation of a variety of learning strategies to integrate the use of technology-based learning media.

Adapted from (Mishra & Koehler, 2006; Jimoyiannis, 2010)

RESULT AND DISCUSSION

This study begins by identifying the Physics teacher ability with closed questionare. Furthermore, to obtains a teacher's TPCK competence profile as shown in Figure 1 conducted by in-depth interview and observation were conducted.

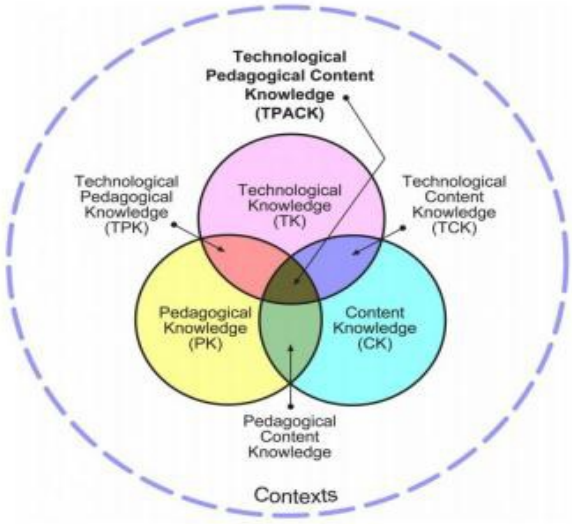

Figure 1. Framework of TPCK competency

The overall purpose of the research was to enhanced Physics teacher's knowledge and skills based on TPCK competency. The research questions aimed at a deeper investigation, as follows : 1) representations and perceptions of each teacher about the various competency; 2) knowledge and skill to integrated technology into learning process; 3) the difficulties they expect to face at during their efforts to integrate ICT in Pysics learning, especially in Wave Material.

The results shown by these figure :

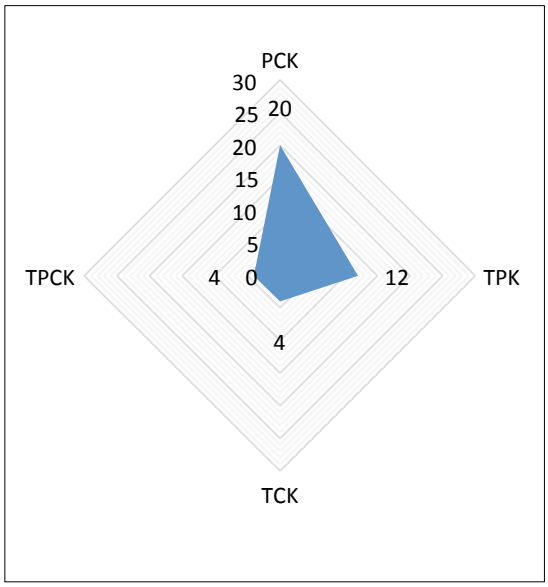

Figure 2. The T1 Competency

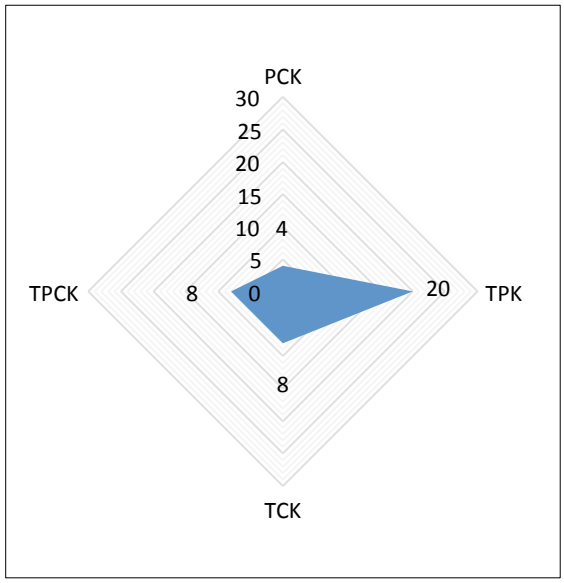

Figure 3 . The T2 Competency

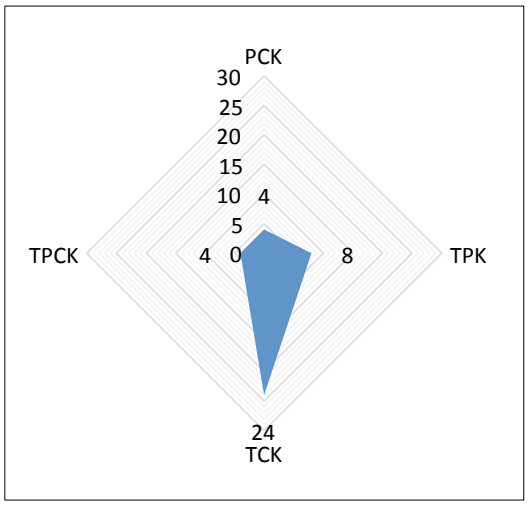

Figure 4. The T3 Competency

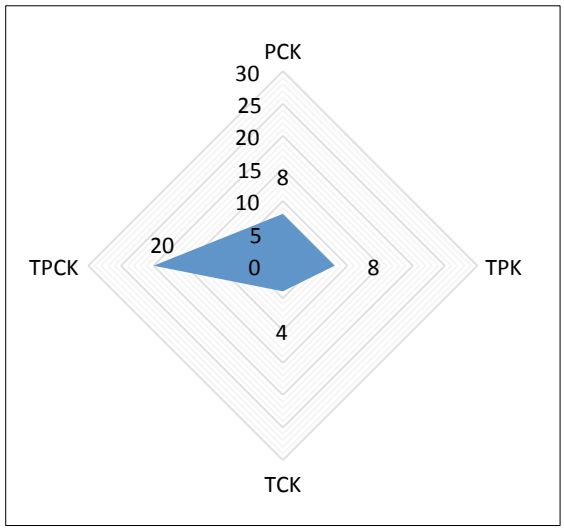

Figure 5. The T4 Competency

a) Teacher with PCK Competency

PCK competence of teacher meet the following criteria: 1) understand the theory, law, and flexible concept and its application; 2) creative and innovative in the development of science-related; 3) requires teacher to have a profound mastery of the subject matter in a way to teach it to students**.** From Figure 2, showed that T1 likely to argued that argued that enough with the two components namely pedagogy and content, so teacher can teach in a class with well.

Special aspects of pedagogy, the T1 also mentioned that the importance of good

planning before teaching, including the preparation of the lesson plan, teaching experience is necessary also to improve understanding of the content or subject matter. T1 also mentioned that for the material of Wave, which according TI is a difficult and abstract as well as not easily to understood by students, except for student who have a good understanding of the capabilities.

From the interview script above, it appears obvious that T1 has a knowledge of the character of learners. This makes it easy for teachers to analyze the needs of learners. Knowledge of the teaching profession has two contributing factors, namely the content knowledge and teaching ability (Karami, 2013). The integration of technology can be a major supporter, especially facing learners with variety of learning styles in the 21st century. Learners are taught to express their opinion about their expectations for learning more interesting physics is concerned, if it can be simulated in a computer-based programs. It is necessary to avoid saturation of learners in un understanding the material wave. The S_1 and S_2 scripts interview by (as learners from T1):

S5090 S_1 : Our teachers apply learning models directly. We've never even learn physics by using technology. References only from books alone. When actually be fun, if learning to use computer applications. The material of this wave is very confusing, because it has a lot of the formula.

S5100 S_2 : Based learning social media, may be applied. A lot of physics-based learning applications android that I get. Well, the teacher should have social media accounts as well, so that students can communicate directly, especially to ask physics problems. teachers will be more flexible in my opinion.

From the analysis results described previously, T1 has competence of PCK. Pedagogic ability and a good understanding of the matter wave but has shortcomings that a lack of understanding of the technology that is owned. Meanwhile, the students are always in need of innovation in learning, especially in the 21st century. PCK Refers to the unique form of professional knowledge that teacher posses knowledge in making the content accessible to the student through some pedagogical method (Chai, Eugenia, Wenhao, Hong, & H.L.Koh, 2013)

b) Teacher with Technological Pedagogical Knowledge (TPK) Competency

TPK refers to knowledge about pedagogical uses of integrated technology without considering the content knowledge. Technology and pedagogic aspect describe TPK which also refers to a general understanding of the application technology in education without reference to a specific content. Researcher found that T2 as an object of this research has TPK competency.

Researcher finding (shown by interview transcript below) about the characteristic TPK 1) teacher has ability to facilitate students to use technology to plan and monitor their own learning.; 2) teacher has an ability to collaborate with each other using technology.

T5100 : I am not only teaching physics on school. But also, I teach ICT lesson. That's why I always use the online discuss forum in my class. Sometimes, my student

complain because Wave Subject is too hard. But I try to facilitate them by using the technology such as internet and others, and they can find the material.

c) Teacher with Technological Content Knowledge (TCK) Competency

TCK are technological representation of content knowledge and/or content specific hardware or software. Some of the advantages possessed by the TCP component is able to connect the subject to be taught with digital and non-digital technology. From the analysis results, T3 is quite dominating in the field of capabilities TCK. From the results obtained observations of teachers who implement competency TCK prefer to use the IT-based learning media. T3 has a good understanding of the technology. In general, the ability in the field of content also supports the process of learning. Generally, the understanding of the tecshnology is not supported with pedagogical abilities. In addition, TCK by itself is not related to teaching (Chai, Eugenia, Wenhao, Hong, & H.L.Koh, 2013).

T5110	*P : When did you start deepening learning technologies? and what technology you frequently use as a medium of learning??*
S512	*T :Since college I've attended training presentation media use as tools / media learning. My interest to IT, makes me to continue to teach using media.*

T3, which has the capability of this TCK, not have the capacity to know the misconceptions and learning difficulties experienced by learners. Unlike the case of T1 with PCK competence. Technology that is understood by the teacher should be applied to the subject of wave can be a "breakthrough" in physics learning. Teachers are required to know and hone their ability in terms of teaching, including the ability pedagogic (Maat & Effendi, 2014).

d) Teacher with TPCK Competency

Based on identification results obtained, T4 meets the fourth aspect of TPCK. T4 has an understanding aspects of technology, pedagogy, and content are well integrated. Teachers with TPCK competency have an understanding of learning strategies and appropriate technology, a combination of technological knowledge, pedagogical, and content, and apply that learning is not monotonous, varied, and accompanied with the knowledge and application of classroom learning media. T4 is a teacher in the classroom where TPCK apply. T4 tend to use ICT in learning. When asked the reasons for using ICT, T4 view that, matter waves that requires a deep understanding of all learners, then as a teacher in this case T4, need to prepare a strategy in accordance with the analysis of the needs of learners. Ability to plan a good learning process, presented by T4, that there is in the readiness of teachers in terms of making lesson plans, learning strategy, and prepare instructional media.

Generally, T4 has a good TPCK integration competence. Script interview below shows the perception of students who are taught by T4.

S512	*T : We are pleased to learn Physics kak, because we have started to use the media that is easy to use. So, despite the difficult material, but the teachers are always trying to understand our difficulties. No significant problems.*

TPCK represents what teachers need to know about technology in education and its value in subject matter instruction (Jimoyiannis, 2010).

CONCLUSION

1. Profile of competencies possessed by the subject teacher of Wave Physics in high schools as follows PCK, TCK, TPK, and TPCK.
2. TPCK competence is a very good competency to adapted in the subject of physics learning because it has characteristics such us understandinng of learning strategies, appropriate technology, and combination with pedagogical and content.

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