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Analysis of Technology Pedagogic Content Knowledge Ability for Junior High School Teacher: Viewed TPACK Framework

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Abstract—For a teacher, TPACK's ability is very important in improving the implementation of teaching and learning processes in the IR 4.0 era. This is stated in the TPACK framework which contains seven interrelated domains. This study investigates some mathematics teachers' competence of Technology Pedagogic and Content Knowledge (TPACK) based on TPACK framework. The 30 teachers were from junior high schools in Cirebon West Java and being given questionnaires and semi-structured interviewed related to the seven domains of the TPACK framework. The result is the availability of facilities and infrastructure are limited which causes they do not have the drive to be able to create with technology. Consequently, they rarely take part in technology-related training activities.

Keyword: Technology Pedagogic and Content Knowledge (TPACK)

I. INTRODUCTION

The fourth industrial revolution (IR 4.0) wants to change the human work environment into a robot. Some teachers have used technology, both in the teaching process, material procurement, or consultation / discussion. Seeing this IR 4.0 era, it is time for education in Indonesia to improve in order to be able to compete with other nations - and a very basic one is related to the quality and competence of Indonesian teachers. This exposure shows more or less the important position of a teacher in this IR 4.0 era, so that Indonesian teachers need to look at how the quality has been achieved and how to catch up, so that the Indonesian people are equal with other nations and ready to compete in the face of IR 4.0. The presence of the development of science and technology can be used as a way to improve the quality of learning undertaken by a teacher. To be able to realize this, a teacher needs to understand and possess the ability of Technological Pedagogical Content Knowledge (TPACK) on him.

A robot can compete with the human brain, but humans have advantages that will not be owned by a robot that is

copyright, taste, and intention. Knowledge possessed by someone must be more capable than a robot. We make technology as a medium to help in learning achievement. Likewise, a teacher must integrate his technological abilities into the learning process. For this reason, TPACK's ability as a measure of teacher readiness in facing IR 4.0 era is very important

The idea of TPACK appeared formally in an educational journal in 2003 and began to be heavily discussed in 2005 which was originally abbreviated as TPCK but changed to TPACK to facilitate its pronunciation [1]. TPACK is a development of Shulman's PCK 1986. Technological Pedagogical Content Knowledge (TPACK) is a framework for integrating technology in teaching [2]. Further explained the three main knowledge studies in TPACK are technological knowledge, content knowledge, and pedagogical knowledge and the interaction between each of the two knowledge and between all of that knowledge. The following is a picture of the TPACK framework, which will then be discussed one by one related domains within the framework.

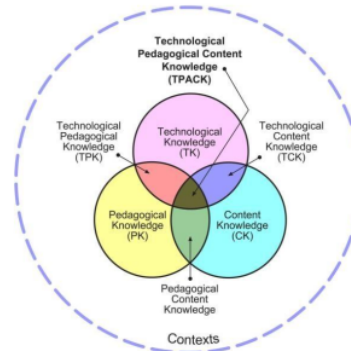


Fig. 1. Kohler's TPACK framework [2].

Research on Pedagogical Content Knowledge (PCK) has been widely carried out both in Indonesia and outside Indonesia. These studies include An et al. [3], Kim [4], Turnuklu and Yesildere [5], Hill et al. [6], while some examples of research conducted in Indonesia are Aminah and Wahyuni [7].

Other research conducted by Aminah [8] about pedagogic abilities and self-confidence of students facing PPL. This research was conducted at the time of micro learning, data was taken from questionnaires and interviews from 45 students, the results reported that the pedagogical ability of subjects when participating in micro learning was included in good criteria, but subjects' self-confidence it is still considered low because the reasons expressed feel insecure if they have to follow the high school field practice with the reason that they are not sure of mastering the material well (content knowledge).

Continued research has been carried out by Aminah [9], reported that the ability of PCK mathematics students has been included in the good category, but when teaching practice activities subjects were still less utilizing digital media during the learning process. From the various studies, in general, the results obtained indicate that PCK and TPACK are important knowledge for the development of professional skills of teachers and prospective teachers.

Furthermore, when information and communication technology develops very quickly and starts to enter schools evenly, and children begin to get used to using information and communication technology in their daily lives, it's time for teachers to start implementing information and communication technology in their learning. However, integrating information and communication technology in classroom learning is a challenge that is not easy to face. To answer these challenges, an important theoretical framework emerging in the use of information and communication technology by teachers is the TPACK.

TPACK has been widely studied, including research conducted by Yurdakul [10] the findings of this study are that natural digital capabilities are predicted to have a significant relationship of TPACK competence. A teacher needs to have an understanding of how technology can be coordinated with PCK to integrate technology, it turns out the results of research [11] revealed that the belief of a teacher is very important in shaping TPACK. The results of the study indirectly state that teachers need Technological Pedagogical Content Knowledge (TPACK) for effective learning in the classroom although more in-depth research on Technological Pedagogical Content Knowledge (TPACK) still needs to be done.

However, in reality, there are still many teachers who do not understand what TPACK is, many teacher competitions need to be built through the TPACK framework, one of them is through training, based on interviews with the chair and members of the MGMP Mathematics junior school, almost all teachers in Cirebon regency do not understand what is TPACK, there are still many who have not used digital media, there are still many who have not used teaching material that follows the conditions of student learning barriers, even though this is one of the ways to overcome student problems in learning.

II. RESEARCH METHODOLOGY

This research used a qualitative research method, the research was conducted before conducting digital design training materials training, 30 junior high school mathematics teachers were used as research subjects. Data retrieved using questionnaire and interview instruments.

III. RESEARCH FINDINGS AND DISCUSSION

The study began by distributing questionnaires about how teachers' understanding of Technological Pedagogical Content Knowledge (TPACK) from the questionnaire given was then conducted interviews to check the answers filled in, the first question was whether ladies and gentlemen knew about Technological Pedagogical Content Knowledge (TPACK), from 30 respondents were only two people who knew about TPACK, of the two people were then interviewed for cross-checking answers, R1 answered learning through technology-assisted pedagogical approaches/methods (internet/application related material), R2 answered Learning that utilizes technology products as sources and supporting learning tools, and R3 answer the combined pedagogic, technology, knowledge. When clarified further inquired they did not know.

Next to the second question relating to the first domain of TPACK namely Technological Knowledge (TK) includes understanding how to use computer software and hardware, other technologies, equipment for presentations in learning. Technological Knowledge also includes the ability of teachers to adapt and to learn new technologies. Research that leads to this domain is the result of research from [12] his findings that the use of computers has the potential to open collaborative interactions between students in solving problems. From this research, a question related to the TK domain was given, "Have you ever participated in training using the 3D flip?" The answer was that there were only two out of 30 respondents. Still in this domain we give a follow-up question which is "do you often use google form as an evaluation tool? Only one respondent answered yes, after being interviewed from 29 respondents who answered no 54% the reason was that they could not make it, the rest was related to the network at school and the constraints of facilities and infrastructure at school.

Still related to this domain the next question is "do you often use PPT slides? Two respondents answered often. 5 respondents answered rarely, 23 respondents answered not to use. From the results of the interview 23 respondents gave reasons for constraints with inadequate facilities and infrastructure, 3 respondents answered not yet smoothly operating computers and projectors, 2 respondents gave reasons because the PPT slides only used data once so it was less effective.

Relating to the next TPACK domain, namely the Content Knowledge (CK) domain, is the knowledge or specificity of the discipline or subject matter. Content Knowledge is different at each level. A teacher to teach is expected to master this ability, this study has been written by several researchers such as Abbitt [13], Tzavara and Komis [14]. Content Knowledge ability is very important because it determines the specific way of thinking of teachers from certain disciplines in each material, for example mathematical ability, a teacher must be

able and understand the indicators of some mathematical abilities to be taught. As defined by Kilpatrick et al. [15] the notion of mathematical ability "requires five abilities that influence each other namely strategic competence, smooth procedures, conceptual understanding, reasoning, and disposition.

In this study, we provide a question related to the CK domain, namely "do you pay attention to indicators of a mathematical ability when developing evaluation tools? 2 respondents answered never, the rest said yes. When asked why it was not noticed, R1 answered that he did not have time, we only looked at the questions from the book, while R2 answered that there were too many tasks to pay attention to. The next question is "What material is difficult to teach students, (this can be seen from the difficulties experienced by students when receiving certain material)" answers from respondents are the following materials, Number patterns, Determine quadratic functions, Equation of lines, Algebra, Build space, set, geometry of transformation, statistics and opportunities, graphs and quadratic functions, tangent equations, pythagorean theorem, building curved sides, factoring, social arithmetic, determining the nth term formula of a sequence of numbers from an object configuration.

Pedagogical Knowledge (PK) is the third TPACK domain, namely the ability to describe the peculiarities of knowledge for teaching. A skill that must be possessed by teachers to develop learning to be managed and organized into a learning activity to achieve the expected learning goals. Pedagogical Knowledge has also been examined by Jaiman et al. [16]. In this domain in our study we ask the question "Do you always make lesson plans when you want to teach according to student needs? 3 respondents answered no, the rest answered yes, after confirming the answers stating they did not make lesson plans when they wanted to teach their reasons the answers from the three were the same, namely having had lesson plans from the previous year.

Pedagogical Content Knowledge is a TPACK domain whose four abilities mean understanding of the uniqueness of teaching that influences each other's content and pedagogy. In this study the question "does mother always change learning methods according to the material?" All respondents answered yes, and what methods are often used, they answered the method that was based on the curriculum being used.

Technological Content Knowledge (TCK) is the fifth TPACK domain, this ability describes the knowledge of the reciprocal relationship between technology and content (material). Inviting students to participate in learning to use technology, not just teachers who use the media. In this study we give the question, "in the material of space construction, linear programming, or PLDV, do you invite students to participate in using learning software such as geogebra? Only 2 respondents said yes, 2 respondents answered sometimes, the rest answered no, when interviewed about their reasons it turned out that the answer was sometimes they were limited to representatives to come forward, practicing what had been taught, for those who answered no, 11 stated Inadequate infrastructure, 15 people said that teachers and students could not operate the software.

Technological Pedagogical Knowledge (TPK) This knowledge allows teachers to understand the use of what technology is appropriate to achieve pedagogical goals. Technology can also provide new methods for teaching that make it easy to apply in the classroom. For example with the advent of online learning teachers must be able to develop new and appropriate pedagogical approaches. In this study the question arises "do you often use online learning, and make the right patterns in these studies?" 1 respondent answered ever, 5 respondents answered sometimes with reasons for waiting for complete facilities, the rest answered not yet diverse reasons 10 people answered could not, 14 respondents gave reasons because of inadequate facilities and infrastructure.

Technological Pedagogical Content Knowledge (TPCK) This component is knowledge where the teacher must be able to integrate all the previous components into a unified whole, namely technological knowledge, pedagogy, and content synthesized and used to design student learning experiences. For this we interviewed teachers, it turns out they do indeed need and need training in advance to understand everything, so that teachers are able to design learning by integrating technology.

IV. CONCLUSION AND SUGGESTION

Most respondents were not yet aware of the ability of Technological Pedagogical Content Knowledge (TPCK), most teachers had technological capabilities but were not optimal, the availability of limited facilities and infrastructure that caused them to not have the drive to be able to be creative with technology. As a result, they rarely take part in technology-related training activities.

Facing the Industrial Revolution 4.0, a teacher must be able to integrate technology into learning and from the results of student learning experiences, but from the results of this study it is suggested that teachers should take part in training related to technology-based learning, further suggestions for research in conducting training activities in order to build TPACK.

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