



# Current Issues on Elementary Education Journal

Journal homepage: <https://ejournal.upi.edu/index.php/CIEE>



## Building technological pedagogical content knowledge through didactical design research

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### ABSTRACT

This study aims to gain an in-depth understanding of how 15 elementary school teachers in a professional learning community demonstrate how to build their technological pedagogical content knowledge. The qualitative method used is Didactical Design Research. Data collection uses triangulation techniques, namely document studies, observations and interviews. The results of the study show that studying in a professional learning community will make it easier for teachers to master technology so that it can make it easier for them to plan, implement and assess learning. It was also revealed that the teacher's teaching practice was in line with the plan that had been prepared beforehand. Based on the implementation of professional teacher learning activities, it can be concluded that the teacher's knowledge and skills in teaching develop very well, can further develop meaningful learning activities, and can better master student characteristics. In addition, students can be more independent and really help students in higher order thinking.

### ARTICLE INFO

#### Article History:

Submitted/Received 13/02/2023

First Revised 28/05/2023

Accepted 30/06/2023

First Available online 30/06/2023

Publication Date 30/06/2023

#### Keyword:

Technological Pedagogical  
Content Knowledge  
Didactical Design Research

**How to cite:** Sari, Atikah. (2023). Building Technological Pedagogical Content Knowledge Through Didactical Design Research. *Current Issues on Elementary Education Journal*, Vol 2 (1), 13-27.

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## 1. INTRODUCTION

It is important for teachers to have pedagogic abilities so they can carry out teaching and learning activities well (Shulman, 1987). However, in carrying out their main tasks, teachers often have difficulty presenting quality learning. To overcome this, teachers need to continue learning. Teachers can learn in professional learning communities. Teachers can learn by reflecting on a learning material together. Reflection is carried out in three stages, namely reflection for action, reflection in action and reflection of action. In addition, reflections were made on the practice of learning in class. Based on these reflections, teachers improve learning designs that are tailored to the learning needs of their students. The result of this reflection is an empirical didactic design (Suryadi, 2010).

The Covid 19 pandemic situation has also forced teachers to be able to provide high quality learning even though it is done from home. Mastery of technology will assist teachers in designing and implementing quality learning. Teachers need to always learn in order to improve their abilities. Professional learning communities really help teachers in facilitating teachers to learn, by sharing knowledge, skills and experiences. Teachers will also be able to find solutions and overcome the difficulties they face in carrying out their main tasks (Sari, Suryadi, Saodih, 2018).

Through a professional learning community, it is hoped that teachers can learn to master technological pedagogical content knowledge (TPACK) and apply it in classroom learning. TPACK is very important for teachers because TPACK uses technology in teaching and learning activities. These knowledge and skills will greatly affect the quality of learning and students' understanding of the subject matter provided. In addition, teachers can create an active, effective and fun learning environment. It can also increase creativity, innovation and stimulate students (Sarjoni et al, 2019) to be able to think at a higher level.

One of the effective teacher professional development designs is Didactical Design Research (DDR). Didactical Design Research (DDR) is research to create learning designs based on didactical situations that occur in the classroom. The purpose of DDR is to improve the quality of didactic designs (Suryadi, 2010). DDR is related to the relationship of three aspects, namely forming a tripartite school superintendent - teacher community - teaching materials (consisting of teachers - students - mathematics).

There has been a lot of research on TPACK, both knowledge (Ferdig, 2006; Dikmen & Demirer, 2022) and experience (Koh & Chai, 2016; Suh & Park, 2017). Based on this description, the main focus of this research is to build teacher technological pedagogical content knowledge through professional learning communities.

Koehler, et al (2013) explained the seven components of TPACK, namely content knowledge (CK), pedagogic knowledge (PK), technological knowledge (TK), pedagogical content knowledge (PCK), pedagogic technology knowledge (TPK), technology content knowledge (TCK) and technological pedagogical content knowledge content (TPACK). Content knowledge (CK) is related to the teacher's knowledge of the subject matter, including knowledge of concepts, theories, ideas, frameworks, methods of proof and evidence.

Pedagogic knowledge (PK) is related to the teacher's knowledge of learning practices, strategies, and learning methods. The use of learning strategies and methods should be adjusted to the level of development and learning needs of students. Elementary school students are those aged between 7-12 years. In this phase they will experience development in the physical, intellectual, socio-emotional, moral, spiritual, and socio-cultural aspects. The physical development of students will affect their personality,

especially with regard to body-image, self-concept, self-esteem and self-esteem issues (Nuhrisan, 2007).

In cognitive development, they are in the concrete operational phase (Piaget). In this concrete operational phase, they are able to think operationally, use logical reasoning but are still in concrete situations (Wood, Smith, & Grossniklaus, 2001; Cook and Cook, 2005). Piaget (Santrock, 2011) argues that one of the important tasks studied in this phase is seriation and transitivity and conservation (Slavin, 2008). In this phase students can master the basic skills of reading, writing and arithmetic and are already able to group or divide things into different rules or sub-rules and consider their interrelationships (Ojose, 2008). Socio-emotional development is marked by the growth of self-concept, self-esteem, and relationships with peers.

Technological Knowledge (TK) is related to the teacher's knowledge of technology that can be integrated into learning. Technology Content knowledge (TCK) relates to the mutual knowledge between technology and content. Pedagogic Content Knowledge (PCK) is related to the teacher's understanding of how to present learning according to students' learning abilities and interests. Technological pedagogical knowledge relates to technological understanding that can be applied to pedagogical practice.

Technology pedagogical content knowledge (TPACK) deals with the complex relationships between technology, pedagogy, and content that enable teachers to develop learning appropriate to the learning strategies used. The seven components will dynamically interact with each other in classroom learning activities.

## 2. METHODS

This research is a qualitative research using the Didactical Design Research (DDR) method. All data is displayed in descriptive form. This research involved 15 teachers from one of the elementary schools in West Bandung Regency. This research was conducted through 4 steps, namely reflection, making didactic designs, discussions in teacher working groups, and learning practices.

Reflection is carried out through 3 stages, namely reflection for action, reflection in action, and reflection of action. In reflection for action, repersonalization and re-contextualization is carried out, making maps of teacher learning needs, making indicators of success, prospective analysis, anticipating pedagogic didactics, and making hypothetical didactic designs. In reflection in action, workshops and open classes are held, and metapedadidactic analysis is carried out. In the reflection of action, reflection is carried out on repersonalization and re-contextualization as well as retrospective analysis.

All teacher activities are recorded and recorded through interviews, class observations, video recordings, and document studies. Open interviews were conducted to find out the learning activities carried out by the teacher, mastery of technology, and the development of teacher pedagogical competence during reflection for action and reflection of action. Class observations were made to observe the teacher's TPACK in reflection in action. Video recordings and document studies are carried out during reflection for action, reflection in action and reflection of action. This is done to see the development of teacher TPACK in the professional learning community.

The results of the interviews were transcribed and analyzed to describe the activities carried out by the teachers. The results of the observation sheets were analyzed to get an

overview of the interactions that occur in the class which can be used as material for discussion in improving the teacher's TPACK. Triangulation was done to get valid data.

### **3. RESULTS AND DISCUSSION**

#### **3.1 Results**

In reflection for action, repersonalization is carried out by giving a questionnaire regarding the teacher's self-evaluation. The results of the self-evaluation show that the teachers have been able to make good lesson plans, they can plan, implement and evaluate learning well. But there are still difficulties in using technology.

Recontextualization was carried out using document studies, class observations, and interviews. The results of the document study show that teachers have not been able to make lesson plans that integrate technology in learning. From the observations of researchers, teachers have never been given guidance to make lesson plans that integrate technology let alone discuss it with colleagues. The results of observations of teaching observations conducted in class, teachers have not used technology in teaching. The results of the interviews show that the teachers admit that they have not been able to make lesson plans that involve technology. This is due to the limitations of their knowledge and abilities.

The results of the teacher's learning needs map show that teachers still have difficulties in designing (planning) learning that integrates technology, implements PAKEM learning, and assesses technology-based learning. Furthermore, indicators of success are determined based on Permendiknas No. 16 of 2007.

Prospective analysis is carried out by looking at the didactic situation compared to the competencies that the teacher is expected to have for the present and the future. The result of the prospective analysis is the creation of a tripartite relationship between the school-teacher-community superintendent of teaching materials. The interaction produces a didactic situation. Then do a hypothetical learning trajectory (HLT) and teacher learning barriers. The result of HLT is to introduce teachers to TPACK learning technology starting from creating zoom links, Google forms, to teaching materials and learning media that suit students' learning needs. The results of the analysis of teacher learning barriers are that not all teachers own and are able to operate computers/laptops, need time, are not used to being online, have to catch up on learning materials. The result of anticipating pedagogic didactics is that activities in building teacher TPACK are carried out through 2 activities, namely workshops and open classes. The result of reflection for action is the Didactic Hypothetical Design (DDH).

In reflection in action, DDH is implemented. The workshop was held in 2 ways, namely on line and off line. The workshop was held in 4 meetings, namely making a google form, google meet/zoom, making power points, and making or downloading learning videos. In this workshop activity, the teacher looked serious in paying attention to the material provided, especially material about learning planning that integrates technology. Based on the field notes, the teachers admitted that they just found out and were reminded again about good and correct lesson planning. Teachers are also very enthusiastic in preparing lesson plans, especially in choosing teaching materials and learning media using technology.

Open classes are conducted online. Open classes are held from class I – IV at representatives of each class level. The open class consists of three stages, namely, 1) reflection for action; 2) reflection in action; and 3) reflection of action.

In reflection for action, the teacher does repersonalization and re-contextualization. The teacher observes the previous lesson plan and then adds it with teaching materials or learning media that use technology. Furthermore, the teachers conducted a prospective analysis of the hypothetical didactic design (in the form of lesson plans) with their colleagues. In addition, teachers are also directed to be able to predict student responses and carry out didactic and pedagogical anticipation. From this activity a hypothetical didactic design was produced which would be implemented in open class activities.

In open class, reflection during learning is carried out by teachers during open class activities by observing didactic situations that occur in class. One teacher acts as a model teacher and the other teacher acts as an observer. The model teacher implements a hypothetical didactic design in the form of lesson plans that are made together. Other teachers carry out a metapedadidactic analysis by observing the didactic situation in the class. Reflection is carried out on the flow of learning, student responses, collaboration, learning media and time allocation used.

The results of the metapedadidactic analysis stated that almost all teachers could implement their lesson plans well. Analysis results so that the learning flow is as expected. Student response was very good, especially in learning using video learning. Students dare to express their opinions and ask lots of questions about things they don't understand. There are also students who have difficulty participating in learning due to limited gadgets, signals and quotas. Collaboration between teachers and students looks very good, but collaboration between students and students is less visible because online activities limit them. The use of learning media, especially in learning videos, is very helpful for students. Students look easy to understand learning material and also students can be more motivated to learn. The allocation of study time is very flexible because it is adjusted to the conditions and situations of students. The results of interviews with teachers obtained the following data.

R: "How do you respond to this TPACK activity?"

T: "Very happy because I can work with colleagues."

T: "Very happy because I get a lot of knowledge."

T: "I became aware that I had more to learn."

T: "I am excited about preparing a lesson plan."

T: "Even though at first it was a bit difficult to learn, now I'm actually happy because the activities are very interesting."

R: "Is the material provided in accordance with your main duties?"

T: "It is very appropriate because it relates to the learning material in class."

T: "Interesting learning material."

R: "How is your experience using technology in learning?"

T: "Very happy because it helps me in learning."

T: "Helps in presenting new learning."

T: "It makes it very easy for me to teach."

T: "I'm not that good with technology yet, so I still have a lot of questions to ask."

T: "Inspires me to present active, effective and fun learning."

R: "How did the students react?"

T: "Students become more enthusiastic, ..."

T: "Now ask more questions."

T: "I'm happy because learning is more interesting. ..."

T: "More critical."

T: "More creative."

R: "How are student learning outcomes?"

T: "Very satisfying."

T: "As expected."

T: "Increased."

Reflection of action is carried out shortly after the implementation of learning. The results of the retrospective analysis explained that there were two data obtained, namely the evaluation and the impact of the teacher's TPACK. Data regarding the evaluation of building teacher TPACK was obtained from interviews with teachers and school principals. Teachers feel happy and very enthusiastic about participating in this TPACK activity because it increases their knowledge and skills in teaching. Teachers can discuss with colleagues who have the same goals and problems. The knowledge and skills acquired are in accordance with their main daily tasks so that they become solutions to the problems teachers face. TPACK also makes it easier for teachers to teach and students to learn because it fits the learning needs of teachers and students. The knowledge and skills possessed can be directly implemented by making lesson plans, carrying out learning, and conducting learning assessments using technology. Student learning outcomes are getting better and results can be quickly obtained.

The results of interviews with the principal explained that the principal was very supportive of teachers in improving their competence. The teacher becomes enthusiastic in learning and teaching and increases discipline. This is very good because the professional learning culture in schools is increasing. This change will provide various improvements in improving the quality of education in schools.

TPACK has an impact on increasing teacher knowledge, attitudes and skills, both in pedagogical competence, personal competence, social competence, and also professional competence.

### 3.2 Discussion

Pedagogical Content Knowledge (PCK) is very important for teachers (Shulman, 1986) to be able to carry out meaningful learning (Deng, 2017; Kleickmann, 2015; Ayers, 2017; See, 2014). The teacher's teaching experience will determine the teacher's pedagogical ability (Koh & Chai, 2016; Suh & Park, 2017). So that teachers who have good PCK will be able to plan, implement, and assess learning in accordance with the learning needs of their students.

The Covid-19 pandemic that hit the world forced teachers to carry out their main duties even though they were done online. The use of technology in learning will help teachers present quality learning that makes it easier for students to learn (Koehler, Mishra, Ackaoglu, & Rosenberg, 2013). It is important for teachers to adopt technology (Raygan, &

Moradkhani, 2020) because they will be able to carry out various learning innovations (Yilmaz, & Karaci, 2017; Koehler & Misra, 2005).

Professional learning communities will facilitate teachers to share their knowledge, skills and experiences and can help overcome the difficulties they face (Sari, Suryadi, Syaodih, 2018). Improved knowledge and skills of teachers will bring about positive changes in teacher attitudes and behavior which will impact on student achievement (Lieberman, 2009; Guskey, 2009) and school achievement.

To make professional learning activities effective, an appropriate and practice-based professional development design is needed. Also consider the goals for the student learning experience, student characteristics, student comfort with one another and with content, work environment, availability of resources, and the magnitude of change expected from teacher behavior and practice.

One of the effective teacher professional development designs is Didactical Design Research (DDR). Didactical Design Research (DDR) is research to create learning designs based on didactical situations that occur in the classroom. The purpose of DDR is to improve the quality of didactic designs (Suryadi, 2010). DDR is related to the relationship of three aspects, namely forming a tripartite school superintendent - teacher community - teaching materials (consisting of teachers - students - mathematics).

Research begins with reflection. Reflection is the taking of past experience as a starting point for learning (Dewey, 1933). By reflecting, the teacher will continuously improve the learning design (Sari, 2019). Reflection can make teachers professional because teachers will be effective in teaching subject matter and have good teaching skills (Santrock, 2011). In addition, teachers can motivate students, communicate and work together, and can use technology. Learning can be presented in a sophisticated way so that it can guide and facilitate students in understanding subject matter, can increase their learning achievement (McMeeking et al, 2012) and develop 21st century competencies (Darling-Hammond et al, 2017).

Designing the teacher's TPACK development was carried out through various reflections by researchers, principals and teachers. By using a reflective process, it is hoped that teacher professionalism development activities can match the learning needs of teachers, student learning needs and can anticipate and take appropriate action (Sari, 2019). Good design is a design that starts from reflection (Myers, 2009; Mizell, 2010).

Reflection is carried out in 3 stages, namely reflection for action, reflection in action, and reflection of action. In reflection for action, the first is repersonalization and recontextualization. Repersonalization uses teacher self-evaluation which is useful for connecting theory and teaching practice (Majzub, 2013). Teacher self-evaluation is used to improve learning (Freddano & Siri, 2012). Recontextualization is carried out by interviews, observations, document studies, and video recordings, the results of which will be triangulated. Triangulation is very important in order to get valid data.

Second, make a map of the teacher's learning needs. It begins with a diagnosis of the teacher's learning needs. This needs to be done so that the program provided can be in accordance with learning needs and can be a solution to various problems faced by teachers. In addition, teachers can also learn and improve their knowledge, attitudes, and

teaching skills. The diagnosis of the teacher's learning needs is then used as the basis for making a teacher's learning needs map.

The professional development of teacher learning according to the learning needs of teachers will be able to increase the knowledge, attitudes and skills of teachers (Ramaligea, 2014), carried out in stages, continuously to increase teacher professionalism (Kemdikbud, 12a). Third, determine indicators of success. The indicator for the success of teacher building TPACK activities is based on Permendiknas No. 16 of 2007. Indicators of success in developing teacher professionalism are important in order to be able to assess the performance of teachers based on the evidence that has been collected.

Fourth, prospective analysis. Prospective analysis is important to do to see the didactic situation compared to the competencies that teachers are expected to have for now and in the future. The didactical situation in the development of teacher professionalism will occur through a tripartite relationship between school supervisors - teacher community - teaching materials. The interaction between the three will greatly affect the success of the activity.

Confrey et al. (2010) which states that if a researcher is going to develop HLT then he must make conjectures, describe it empirically, which is supported by images through the relationships that build learning (i.e. activities, tasks, tools, forms of interaction and evaluation methods), to move from ideas to informal ideas, through improvements starting from representation, articulation, and reflection, to concepts that are increasingly complex over time. HLT is carried out in order to be able to anticipate various strategies and correct teacher misunderstandings with rich and accurate explanations (Yilmaz, 2015). HLT can assist researchers in improving the quality of activity development design (CCSSI, 2010) and is a first step toward a teaching theory centered around research on learning (Sztajn et al, 2012). HLT also provides opportunities for teachers to be able to collaborate in learning (Wawro et al., 2012) so they can generate productive ideas (McClelland, Acock, & Morrison, 2006).

An analysis was also carried out on the difficulties or learning obstacles experienced by teachers and students. Learning barriers are important to analyze so that the material is easily accepted and can be useful (Brousseau, 2002). The teacher's response is predicted by developing conjectures about the didactic situation being developed. Various possible responses, both requiring didactic and pedagogical actions, need to be anticipated in order to create dynamics of changes in didactical and pedagogical situations according to capacity, needs, and acceleration of the learning process (Suryadi, 2010).

Fifth, pedagogical didactic anticipation, carried out so that the actions given are appropriate, the learning stages run smoothly, and contextually so that the results are optimal. In addition, researchers also anticipate the timing of the implementation of teacher professionalism development activities so that they are in accordance with the learning needs of teachers.

Based on the linkage of success indicators, prospective analysis and didactic and pedagogical anticipation, it is used as a basis for designing a teacher professionalism development strategy. The strategy for teacher professionalism development activities is carried out in two types, namely workshops and open classes. This is intended so that teacher professionalism development activities not only provide input to teachers, but also take the form of teacher professional teaching practices (van Driel & Berry, 2012). In



addition, the more teachers are given emotional support during the training from their peers, the more professional and active teachers will be involved in their work.

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The result of reflection for action is a hypothetical didactic design (DDH) to build TPACK through Didactic Design Research (DDR). Good design is a design that starts from reflection (Myers, 2009; Mizell, 2010). Planning and design for the development of teacher professionalism should be made very carefully so that it can run effectively and efficiently (Mizell, 2010).

In reflection in action, DDH is implemented. There are 2 activity strategies, namely workshops and open classes. Workshop is a type of teacher professional development that places more emphasis on imparting knowledge to individual teachers (OECD, 2009) where teachers can share and reflect on their work experiences as a way of articulating ongoing work and training.

In workshops, the main focus is to make lesson plans by creating learning designs (RPP). Instructional design supports two main learning objectives, namely improving the quality of teaching and facilitating the integration of technology in teaching and learning. In addition, teachers can conduct research and analyze all activities that have been carried out (Lockyer, Heathcote, Dawson, 2013).

Thorndike stated that the teacher needs to make a lesson plan so that the teacher knows exactly what will be taught, what material will be given, what response is expected, and when to do reinforcement or remedial. Lesson planning is made by the teacher through a process of reflection on the concepts to be taught (Myers, 2009; Mizell, 2010) which not only emphasizes context dependence but also sees planning as a practice (John, 2006).

Teachers who make more lesson plans will be more confident and will be successful with their students than teachers who have little or no teaching preparation at all (Darling-

Hammond, 2000). Teachers who make careful preparation and lesson planning will produce effective learning designs that suit the characteristics of students, meet students' learning needs, and can overcome learning difficulties experienced by students (Sari et al, 2017a). The lesson planning process allows teachers to evaluate their own knowledge with regards to the content to be taught (Reed & Michaud, 2010).

Teachers need to make lesson plans together with their colleagues. Lesson plans that are made together, the results will be far more consistent in sequencing and compiling teaching materials for teaching than those who use different textbooks and work on them individually (Li et al, 2009).

Open class is one of the strategies in teacher professional development because it can enrich teachers' knowledge and teaching practices (Wu & Clarke, 2018) and can maintain a learning culture among teachers. Through open classes, teachers can also collaborate with their colleagues to jointly improve teacher competence which will lead to increased school quality (Lipscombe et al, 2019). Open class is meant for teachers to be skilled in presenting active, effective and fun learning.

Open class is a strategy in teacher professional development because it can enrich teachers' knowledge and teaching practices (Wu & Clarke, 2018) and can maintain a learning culture among teachers (Sun et al, 2015). Through open classes, teachers can also collaborate with their colleagues to jointly improve teacher competence which will lead to increased school quality (Lipscombe et al, 2019). Teacher professionalism will also increase because teachers make continuous improvements, have collective responsibility, and have common goals (DuFour et al., 2006; Sather, 2006).

Throughout the activity, the teacher reflects, namely reflection for action, reflection in action, and reflection of action. In reflection for action, the teacher conducts a prospective analysis, and makes a lesson plan. It is important for the teacher to carry out prospective analysis so that the teacher can carry out didactic and pedagogic anticipation (Suryadi, 2010) so that the didactic situation that the teacher will present can make it easier for students to understand the subject matter. This is in accordance with the opinion of Hattie (2012) which states that in making lesson plans, teachers should consider using learning objectives and success criteria, have broad and deep goals, consider students' attitudes and initial achievements, set high expectations and targets, and encourage students to study.

In reflection in action, the teacher conducts a metapedidactic analysis. Metapedidactic analysis is important for teachers to carry out acculturation analysis and didactic situation analysis (Suryadi, 2015). NCEE (2013) suggests that teachers can deliberately incorporate individual differences in lesson planning by monitoring progress and adapting learning so as to help ensure that all students are encouraged to learn challenging and appropriate concepts and skills, so as to go beyond their current understanding. this.

In reflection of action, the teacher does a retrospective analysis. Retrospective analysis was carried out on learning adaptation, didactic situation analysis, and didactic contract analysis. Retrospective analysis is very important to be carried out by teachers in order to measure the progress and success of student and teacher learning. The progress and success of student learning can be measured through the achievement of predetermined learning objectives. Meanwhile, the success of the teacher in teaching can

be seen from the suitability of the didactic designs made by the teacher with the learning activities carried out.

Retrospective analysis can help teachers to improve subsequent learning designs so that learning designs are obtained that suit the learning needs of students. Hattie (2012) states that teachers need to have the skills to provide a way when to place learning and make students make progress according to the criteria for learning success. It is important for teachers to have a commitment to see future challenges, both for teachers and for students. Then can connect it so that students can face the challenges of the times.

The results of the retrospective analysis are used to refine the learning hypothetical didactic design (DDH) so as to produce an empirical learning didactic design (DDE) (Suryadi, 2010) in the form of a revised lesson plan. The results of Toom's research (2006) state that teachers can use past learning reflection material to improve the quality of subsequent learning. This can only be obtained through learning events experienced by the teacher directly. The results of this reflection are very good for self-development so that the quality of learning can always be improved from time to time (Suryadi, 2010).

In the reflection of action to build the teacher's TPACK, a retrospective analysis was carried out on the entire series of activities. Retrospective analysis is urgently needed because it evaluates the effectiveness of teacher TPACK activities and to improve teacher TPACK development designs. Development design will provide attachments to tasks, activities, roles, images and space, illustrating ideas that can be applied in co-learning and co-production between services, practices and better results (Carvalho & Goodyear, 2017). Developmental design supports two main goals, namely improving the quality of teaching and facilitating the integration of technology in teaching and learning (Lockyer et al, 2013). Design development will also motivate and facilitate in achieving the expected goals. The result of the retrospective analysis is an empirical didactic design for the development of teacher professionalism.

## **5. CONCLUSION**

This research is to develop technological pedagogical content knowledge of elementary school teachers. The research findings show that (1) the teacher's technological pedagogical content knowledge will develop if the teacher continuously learns; (2) the most effective way of learning for teachers is through a professional learning community; (3) to improve the quality of learning, teachers should always revise their learning designs. Several factors were identified as limiting the technological pedagogical content knowledge of elementary school teachers so that it is less developed, including previous school experience, knowledge of technology for teaching, lack of courage to innovate, time constraints, curriculum, student behavior and learning environment. In addition, weak knowledge of mastery of technology and learning theory.

Continuous development of teacher professionalism in Indonesia has become a necessity. It is important that teachers have technological pedagogical content knowledge but content knowledge also needs to be emphasized. This is none other than because the development of teacher professionalism places more emphasis on technological pedagogical content knowledge, but the integration of content knowledge is very weak.

The importance of experience and knowledge for teachers needs to be addressed by policy makers, by providing other experiences and knowledge on an ongoing basis and not

just demanding their hard work. This is useful to provide opportunities for teachers to reflect on learning practices in class as a way to develop their knowledge and skills in the future. This can be done in several ways, such as (1) creating programs that provide opportunities for professional learning, (2) involving teachers in professional learning communities, and (3) involving teachers in ongoing research activities.

## 6. ACKNOWLEDGMENTS

The author gratefully acknowledges the thoughtful comments and suggestions on earlier drafts from the West Bandung District Education Office and anonymous reviewers. I would like to thank all the participants and those who have supported me.

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