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Relationships between teacher's instructional strategies and their knowledge: A study of seventh-grade mathematics teachers

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ABSTRACT

Many studies showed that teachers' knowledge of instructional strategies is related to another component of pedagogical content knowledge. However, studies on teachers' reasons for choosing their instructional strategies still need to be reported. Three mathematics teachers were investigated using a case study research design. The data were gathered through two semi-structured interviews, pre- and post-observation, as well as observations. Pre-observation interviews explored teacher's knowledge of instructional strategies (KIS) based on their experiences or knowledge. Meanwhile, the post-interview investigated teachers' reasons for choosing instructional strategies based on the observations. Five to ten lesson hours were allocated to observe the teachers' activities in learning on the topic of linear equations and inequalities of one variable. A cross-case analysis was performed to compare the teachers' KIS and their reasons for choosing instructional strategies in teaching practice. The findings showed that lecturing, questioning, and solving problems are the most dominant strategies used by teachers. Only one teacher used group discussion in her teaching activities. The finding also indicates that the knowledge of the student's understanding, curriculum, beliefs, and teaching context are factors that influence teachers in choosing instructional strategies. In addition, the reasons for choosing those strategies are varied.

INTRODUCTION

Researchers have studied that the quality of teacher learning affects the gain of student learning outcomes (Darling-Hammond, 2000; Rivkin, Hanushek, & Kain, 2005; Stronge, Ward, Tucker, & Hindman, 2007; Zhang & Campbell, 2015). A teacher's PCK is one instrument that can represent teacher quality. Unfortunately, there have been no reports on teacher's pedagogical content knowledge (PCK), especially on mathematics learning, based on the context of students' different mathematical abilities. Accordingly, this study will fill in the literature gap related to the teacher's PCK model for students with different abilities. This study aims to explore the PCK of mathematics teachers who teach students with different mathematical abilities, that is, low and high ability. The finding of this study is expected to be a framework for the development of teacher's professionalism that is suitable to students' context.

Halim, Abdullah, and Meerah (2014) have examined the perceptions of students with different science abilities (high, medium, low) towards teacher PCK. Based on the results of the research obtained, Halim et al. stated that teacher PCK should be different for students with high and low

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science skills. In other words, students' cognitive abilities are one of the critical factors that can affect teacher PCK. Some experts have also pointed out the need for the use of different learning strategies in students with different cognitive abilities (Krawec, 2014; Mancl, Miller, & Kennedy, 2012; Garderen, Scheuermann, & Jackson, 2013; Garderen, 2008).

Literature review

The concept of pedagogical content knowledge (PCK) was formulated by Shulman (1986) as a particular form of content knowledge required by teachers for teaching. PCK is not merely knowledge of content but knowledge of content and how to teach that content so that students can understand it. Shulman (1986) characterizes PCK as knowledge to present ideas or concepts, analogies, illustrations, examples, explanations, and demonstrations related to the subject matter. PCK also includes an understanding of the problems that cause a subject to be easy or difficult to learn as well as knowledge of students' pre-conceptions and conceptions based on differences in age and background that affect them in learning. Student's difficulties and misconceptions require teachers to know to determine the appropriate strategies for learning so that they can be overcome properly. Furthermore, Shulman (1987) states that PCK is a combination of content knowledge and pedagogy so that a topic can be mixed and adapted to the interests and abilities of students and presented in learning.

In contrast to Shulman (1986, 1987), Groosman (1990) defines PCK as a composition of four components, namely, the conception of subject-matter learning objectives, knowledge of student understanding, including knowledge of student misconceptions and difficulties, curricular knowledge, and knowledge of instructional strategies. Grossman emphasizes attention to students' misconceptions and difficulties rather than to the overall knowledge of students' characteristics. In addition, Groosman emphasizes pedagogical knowledge on knowledge of instructional strategies. Furthermore, Magnusson, Krajcik, and Borko (1999) describe PCK as a transformation of some knowledge, including material knowledge, for teaching. PCK knowledge shows the uniqueness of teacher knowledge. Furthermore, Magnusson, Krajcik, and Borko (1999) state that PCK is a teacher's understanding of how to help students understand specific material. PCK included the knowledge to manage, adapt, and present material to students who have different interests, abilities and knowledge to present material in learning. According to Magnusson, Krajcik, and Borko (1999), PCK is a transformation of various teacher knowledge that forms new knowledge that is unique and different from the knowledge of the teachers that form it. In contrast to the concept of Groosman (1990), Magnusson, Krajcik, and Borko (1999) modified the PCK model developed by Groosman by adding a knowledge component to assess students.

In mathematics education, the definition of PCK also varies among experts. Depaepe, Verschaffel, and Kelchtermans (2013) explain the definitions of PCK from experts into several categories. First, PCK is a relationship of two components, namely content knowledge and pedagogy. Sibbald (2009) defines PCK as an intersection between content knowledge and pedagogy. In this case, PCK knowledge combines content-specific knowledge and technical-specific instructional knowledge. Similarly, Inoue (2009). defined PCK as a synthesis between content knowledge and pedagogy. The PCK concept was proposed by Sibbald (2009) and Inoue (2009) is in line with the PCK concept defined by Shulman (1987) which stated that PCK is a particular form of a combination of content and pedagogy knowledge. Second, PCK is the teacher's knowledge needed to achieve learning objectives. This definition was proposed by Foss and Kleinsasser (1996), Ginsburg and Amit (2008), Meredith (1993), and Minden, Walls, and Anne (1998). Ginsburg and Amit (2008) stated that PCK is the practical knowledge needed to convey ideas or ideas, in this case, the material, in learning. Last, PCK is the embodiment of pedagogical knowledge of certain materials. Lehrer and Franke (1992) used the term PCK to describe pedagogical knowledge related to learning fractions.

Besides the differences in the PCK concept formulated by researchers, the components constructed in the PCK also varied considerably according to the researchers' point of view or the lens. Shulman (1986, 1987) defined PCK as having two components: knowledge of instructional strategies and representations and knowledge of students' misconceptions and difficulties. Shulman (1987) separates content knowledge from pedagogical content knowledge. Furthermore, Tamir (1988) elaborated on the PCK of biology teachers who participated in the training in four components: students, curriculum, instructional, and evaluation. Each component contains aspects

of knowledge and skills. Tamir (1988) defines PCK as "subject matter specific pedagogical" to emphasize the study of subject matter rather than content knowledge.

Furthermore, Groosman (1989;1990), after investigating six novice English teachers, formulated a PCK model consisting of four components: 1) teacher's conception of subject-matter learning objectives, 2) knowledge of student understanding, 3) curricular knowledge, and 4) knowledge of instructional strategies. Smith and Neale (1991), in their research on ten elementary school teachers in science learning, formulated three components of PCK: 1) students' conceptual knowledge, 2) knowledge of strategies for teaching content, and 3) knowledge to present content. Furthermore, Cochran, De Ruitter, and King (1993) developed the PCK model as "pedagogical content knowing," which includes four components: pedagogical knowledge, subject-material knowledge, knowledge of students, and knowledge of environmental contexts. Fernández-Balboa and Stiehl (1995) formulated the PCK model as a result of the exploration of ten professors from various fields of science, which consists of five components: 1) subject-material knowledge, 2) knowledge of students, 3) knowledge of instructional strategies, 4) knowledge of learning contexts, and 5) knowledge of learning objectives.

In mathematics education, researchers have also formulated different components of knowledge in investigating PCK. Some researchers adopt the PCK component proposed by Shulman (1986, 1987) which includes two components: knowledge of instructional strategies and representations, and knowledge of students' misconceptions and difficulties (Davis, 2009; Depaepe et al., 2015, 2013; Ginsburg & Amit, 2008; Harr, Eichler, Renkl, & Chen, 2014; Imre & Akkoc, 2012; Inoue, 2009; Isiksal & Cakiroglu, 2011; Kinach, 2002; Lee, 2010; Tirosh, Tsamir, Levenson, & Tabach, 2011). Some researchers have also developed different components of PCK but still refer to the components of teacher knowledge proposed by Shulman (1986, 1987).

Ball, Thames, and Phelps (2008) developed the mathematical knowledge for teaching (MKT) as a teacher knowledge model that integrates content knowledge and pedagogical content knowledge. PCK by Ball, Thames, and Phelps (2008) includes three components: 1) content and student knowledge, 2) content and teaching knowledge, and 3) curriculum knowledge. Another model for analyzing the PCK component was proposed by Blömeke, Suhl, and Kaiser (2011), Bukova-güzel (2010), and Escudero and Victoria (2007) which consists of three components that are knowledge of instructional strategies and representations, knowledge of students, and curriculum knowledge. The diversity of PCK components showed the wide of the dimensions of teacher knowledge studied by experts. In addition, the description of each component formulated by experts also varies.

Research framework

Based on the literature review, we formulated three components that are the primary concern of most researchers in investigating teachers' PCK: knowledge of instructional strategies and representations (KIS), knowledge of curriculum (KC), and knowledge of student understanding (KSU). Firstly, KIS involves knowledge of learning strategies for presenting the subject matter and knowledge of various forms of representation for presenting the subject matter. Secondly, KC includes knowledge of learning resources and media that are relevant to the material and knowledge of learning objectives according to the curriculum. Lastly, KSU includes knowledge of students' understanding of the prerequisite material, knowledge of students' difficulties and errors in solving problems, and knowledge of students' abilities and strategies in solving problems. Those components of PCK are used as a framework for exploring teacher's PCK.

METHODS

Research Design

This study investigated the mathematics teacher's reasons for choosing instructional strategies on linear equations and inequalities of one variable. The data were collected naturally without intervention to the teacher's activities and in accordance with the teacher's habits or experience.

A case study design was applied to investigate in-depth the teacher's reasons for certain characteristics (Merriam & Tisdell, 2016).

Table 1. Profile of the subject

No	Code	Gender	Teaching Experience	Education Background
1	T1	Male	13 years	Bachelor of Mathematics Education
2	T1	Female	9 years	Bachelor of Mathematics Education
3	T3	Female	8 years	Bachelor of Mathematics

Table 2. Learning observation activities

No	Subject	Material	Time
1.	T1	LEOV	6 lh
		LIOV	4 lh
2.	T2	LEOV	2 lh
		LIOV	3 lh
3.	T3	LEOV	4 lh
		LIOV	4 lh

lh = Lesson Hours (@40 minutes)

Research subject

The subjects of this study were three mathematics teachers (coded by T1, T2, and T3) from different secondary schools in Sukoharjo district, Central Java province, Indonesia, who taught 7th grade at a school. The first school has a high average student academic ability. Whereas the second school has moderate and the third one has low average academic ability. The subjects were selected based on the following criteria: 1) teaching in public schools, 3) having a minimum education level of undergraduate, 4) having a teaching certificate as a professional teacher, and 5) having worked as a teacher for more than five years. The profile of the subjects is presented in Table 1.

Data collection

To explore information related to the reasons teachers choose instructional strategies, researchers used two data collection techniques: observation and interviews. *Handycams* and *mobile phones* are also used as recording aids. Interviews were conducted twice: interviews before observation, to explore teacher knowledge data related to appropriate instructional strategies to teach linear equations of one variable (LEOV) and linear inequalities of one variable (LIOV) material to students based on teacher knowledge or teaching experience. Then, interviews after observation were used to explore information related to why teachers use instructional strategies in presenting LEOV and LIOV material in learning. Interviews are conducted in a *semi-structured* manner where researchers develop guidelines to guide the conduct of interviews. All interview results are then transcribed for analysis.

Furthermore, learning observations are carried out using observation guidelines, field notes, and supported by recording learning videos using *handycams*. Data obtained from observation guidelines, field notes, and repeated observations on the recorded results are used by researchers to make transcripts of learning observations to describe all teacher activities in learning activities. Learning observation activities for the three subjects are presented in Table 2 below.

Data validation

Researchers use triangulation methods to ensure the validity of the data obtained, namely interview and observation methods.

Data analysis

Researchers use interactive models Miles and Huberman (1994) To analyze research data, namely data reduction, data presentation, and conclusions. In detail, this research data analysis procedure uses the following stages: 1) Coding data obtained from data collection instruments, 2) Selecting data relevant to research objectives, 3) Classifying data according to indicators, 4)

relationships between data that have been grouped, 5) Make a summary of the results of data analysis of each group, 6) Triangulate methods, 7) Analyze triangulation data, 8) Make conclusions.

FINDINGS

There are three learning strategies typically used by teachers in teaching linear equations and inequalities of one variable, i.e. lecturing, questioning, and solving problems. Only T3 used group discussion in her teaching activities. The explanation of each strategy is as follows.

Lecturing

All teachers use lecturing to present the material. T1 and T2 use lecturing to explain concepts and problem-solving procedures and explain prerequisite materials needed to understand LEOV and LIOV. The learning strategies of both teachers tend to be more teacher-centered. In this case, the teacher presents the material in the form of concepts and procedures for solving problems, gives practice questions to students, and asks students to write the problem-solving on the board, then discuss the answer, which is to explain the concept of the material. The next teacher activity is dominantly with group discussions.

T1 explains that lecturing strategies are more effective for achieving learning objectives. Students better understand the steps of solving with lecturing strategies, where the teacher guides the solution of the problem gradually until getting the correct answer. In addition, T1 also links lecturing strategies with teachers' efforts to evaluate students' understanding of the material learned. In this case, the teacher presents an example of an incorrect resolution step to find out the student's response. If students can respond to missteps presented by the teacher, it means that students can already understand the material being studied. T1 also links the use of lecturing strategies with an understanding of student errors in prerequisite material and student errors in solving problems. According to T1, the mistakes that students often experience need to be explained in detail. Then, T1 also needs to explain in detail how to solve the problem step by step in order to reduce the mistakes that students often make. The following interview excerpts show why T1 uses the lecturing strategy.

> *"Explain directly; the teacher can anticipate explaining incorrectly first and how students respond to the wrong examples or steps first. This wrong step is not the first step, the second or third step after the student has mostly entered the main concept first. Then, the teacher gave examples of some steps that were deliberately made wrong. Then the student's response oh, not that; there must be 1 or 2 children who respond about the mistake and are able to justify it."*

> *"When initially explaining needs a more detailed explanation, you must repeat the prerequisite material, for example "–" minus "-"that sometimes some children who are still having difficulties must be repeated. Let alone enter the fractions and repeat them later. Sometimes on one board, some for doing, some for repeating prerequisite material."*

Furthermore, T2 explained that students can easily understand the material if it is explained first by the teacher. T2 uses lecturing strategies on the grounds that students' ability to understand the material is low, so teachers must explain the material to students in detail. According to T2, students are not able to understand the material independently as recommended in the curriculum. In addition, the limited time required to present a relatively large amount of overall material content in the curriculum is also the reason teachers use expository strategies to present material. T2 reasoned that the implementation of innovative learning strategies takes a relatively long time compared to lecturing. So, the teacher is worried that the material will not be conveyed to the students. Then, T2 also uses expository strategies to repeat explanations related to material that often experiences errors, both prerequisite material and the material being studied. T2's reasons for lecturing are presented in the following interview excerpts.

> *"Yes, the strategy should be according to the curriculum, sir. However, those children, if not explained, do not understand. Once the previous year tried using K13, it was the same. For example, using videos, namely LEOV examples. I looked it up on the internet. However, if I was given a question, I still asked, so I had to keep going around the group, explaining one by one. So it is better to explain from the front rather than later going around back and forth."*

> *"The curriculum structure is very complex, and teachers are required to complete the subject matter with limited time. To anticipate not achieving curriculum targets, classroom learning is carried out with the lecture method, with the hope that all subject matter is delivered because time is limited. If I use innovative strategies or media, it will take much time."*

> *"Students should be constantly reminded, sir. If you move segments, the sign must change. That explanation must be repeated over and over again. Even then, there are still many who forget."*

Then, T3 explained that the teacher still needs to explain the material to students even though it is not in detail, and then students are asked to follow the way of solving described by the teacher. According to S3, students still need clarification if they are immediately given problems directly without any initial explanation from the teacher. In other words, teachers understand that students still need to be guided by lecturing because they cannot understand the material independently. T3's reasons for lecturing are presented in the following interview excerpts.

> *"If I immediately give a real-world problems to my students, they are sometimes still confused. So it still needs a detailed explanation but it's not really complete. Then my son asked to follow the steps or ways of solving that I conveyed like that."*

In addition to making students better understand the material, the lecturing strategy is also used by T3 to re-explain prerequisite materials and materials that students still experience errors or difficulties. For example, when a student makes a mistake in the completion steps, the teacher explains the correct completion procedure to the student again. The teacher must also repeat the explanation related to the prerequisite material.

Questioning

The observations show that all teachers also use questioning strategies in learning. However, the reasons for the three teachers using questioning strategies vary. T1 uses questions aimed at guiding students to understand the material. For example, when presenting open and closed sentence material, the teacher gives examples of mathematical sentences $x + 7 = 10$. Next, the teacher asks the students, "Is this an open or closed sentence?" Then, when guiding students to understand the story, the teacher asks the students, "Is your sister three years younger than your brother, meaning you increase or decrease?" T1 explains that the questioning strategy aims to evaluate students' understanding of the material that students have learned. If students can answer the teacher's questions, it means that students already understand the material, and vice versa.

The use of questioning strategies also aims to strengthen students' understanding of the material presented. Students who are not yet strong in their understanding of the material, become more confident in their understanding after being able to answer the teacher's questions. T1 also explained that questioning strategies are needed to repeat questions related to topics that some students still experience errors, such as errors in solving by moving segments. By repeatedly asking students, the mistakes that students often make will be reduced.

> *"This provides questions to check student understanding after the teacher explains, for example, the meaning of open and closed sentences. Then, make sure that students know which are open sentences and closed sentences and know the arguments. When chased, why open and close? They are able to express their opinions. That is the first reason to come back to ask. It will help not only answer 2 or 3 students but also students whose understanding is less than 100%. The answer of the child who is able to answer the question may help to perfect the child's understanding of open and closed sentences."*

> *"The teacher has to keep repeating, keep repeating. Because the initial concept of segment displacement operations must be completely established, if it is just a little wrong, it is all wrong. So do not get tired of always asking questions."*

Furthermore, T2 explained that the questioning strategy aims to alert students to operations that often experience errors. This strategy is shown by the teacher's frequent questioning of arithmetic operations, algebra, and solving procedures, such as "2 moved to the right so what?" (settlement procedure), "-2 – 10 how much?" (number operation), "$3x$ let it be x what?" (algebraic operations). In the interview, S2 explained that students still often experience errors in performing number operations, especially those involving negative numbers, not changing the sign of terms that

change segments in solving problems and making mistakes in carrying out division operations involving algebraic terms.

T3 explained that the questioning strategy used aims to encourage students to want to answer, communicate, and be able to to understand the material better. For example, T3 explains that to understand the steps to solve a story problem, the teacher can guide by using questions such as the following interview excerpts.

> *"If I am in math, I emphasize that per sentence my child is told to look for what is known, like that. Try to read one sentence first, what you know there. Well, what is the base? How tall is it? There are indeed such inducements so that the child will answer, want to communicate. So he knows what is known, what is asked, what formula he knows, and then the next step is to solve [K3]." (S3, interview after observation).*

In addition, the questioning strategy also aims to guide students who experience errors or difficulties in the prerequisite material and material studied. For example, when students write down the set of inequality solutions $y \geq 5$ with $HP = \{6,7,8, \dots\}$, the teacher asks the students, "Notice something is wrong, isn't it here?" Some students replied, "There is, ma'am." The teacher then asked, "Where did you try to do wrong?" In this case, T3 guides students to understand mistakes made by asking students questions.

Solving problems

Problem solving is at the core of learning mathematics. All teacher activities facilitate students to solve problems by giving practice questions to students. T1 facilitates students to solve questions with the aim of evaluating students' understanding of the material learned and skilled in solving questions as presented in the following interview excerpts.

> *"The goal is first to find out the extent to which students are able to solve both in fractions and rounds, then the operation of moving the right and left segments, then the accuracy of the negative positive operations, the point is proficiency, fluency of students in solving problems. If they are smooth, the final result is correct, it means they are capable. If they already understand, already understand, strengthened by a few more practice questions. This means that in addition to knowing that their understanding is correct, that understanding if it has been recorded in their line of thinking, it needs to be strengthened. How to strengthen it, with a lot of practice. Which steps do not need to be written down, but still correct steps. It was the most effective reinforcement for children in memory as well as those measures ."*

T1 provides LEOV and LIOV practice questions from simple to relatively complex forms such as the following example $\frac{7}{2}(4x-5)+\frac{17}{2}=-\frac{2}{3}(10x-1)+11$. T1 explained that the reason for giving complex form questions is so that students are accustomed to solving high-level questions. The teacher hopes that by getting used to solving high-level questions, students will find it easier to solve simpler school exam questions.

Furthermore, T2 facilitates students to solve questions so that students actively participate in learning. T2 explained that if students are not given practice questions, then only certain students pay attention to learning because student learning motivation is low. By being given questions, students should try to solve, although sometimes they only pay attention to their friends' answers. In T3, teachers facilitate students by providing more and varied practice questions aimed at achieving learning objectives, namely students can better understand the material. T3 provides questions to do in groups. Then the teacher facilitates students to present the results of their work in front of friends.

Group discussion

Among the three teachers, only T3 used group discussion activities in learning. The teacher facilitates students to learn in groups to complete the tasks given by the teacher. After completing the assignment, students were asked to present the results of group work in front of the class. T3 explained that the group discussion strategy aims to encourage students to learn collaboratively and communicate which are abilities that need to be developed in mathematics learning according to the 2013 national curriculum, in addition to problem-solving skills.

> *"In the 2013 curriculum it was directed students to collaborate, work together. So I use a cooperative model, I form a group, in that group I make heterogeneous, some are smart and some are lacking. Well, my goal, suppose in one group there are 4 students. 2 students are less able to follow the learning, 2 students can.*

What I hope here, 2 students who are less able to understand mathematics, can be interested and can be taught by their friends in that group, so that the abilities of children in that group can be close to the same. For that presentation, I trained children to dare to move forward, children want to move forward and present the results of their work is already very good. Although it is true or false later. If for example it's wrong, I fix it, your mistake is here. But if for example it is true, yes, I give it ... like.. some kind of added value."

In addition to the implementation of learning strategies according to the curriculum, the use of group discussion strategies is also related to learning strategies that can attract students' attention and can encourage students to better understand the material. T3 explains that students prefer to study together in groups as opposed to using only conventional learning. If the teacher uses conventional learning, sometimes students are lazy to think, write, and do the tasks given by the teacher. Conversely, students are more enthusiastic about participating in learning if they use cooperative strategies in completing tasks.

Teacher's belief

The learning strategy that the teacher chooses to present the material appears to be related to the teacher's beliefs. T1 explained that the learning strategy used has not adapted the learning approach of the 2013 Curriculum which refers to a scientific approach that contains activities of observing, questioning, collecting data, processing data or reasoning, and communicating (5M). Based on the results of the interview, T1 explained that conventional learning strategies are more effective to help students understand the steps of solving problems. Teachers who have been teaching in conventional ways for years find it difficult to change to use innovative learning strategies according to the new curriculum.

"Changing the way teachers teach is also not easy. Especially teachers who have been teaching in the conventional way for many years, even dozens or decades in the same way. Of course it is difficult to change it. ……. In my opinion, it is more effective if the children are guided slowly, step by step to solve the problem. It's more relatable, the children understand better. "

Excerpts from the interview with T1 show the teacher's belief that an effective learning strategy is to guide students through systematic problem-solving steps. In other words, T1's belief in effective learning strategies has an impact on teacher learning strategy selection.

Furthermore, T3 understands that learning according to the 2013 Curriculum must be able to encourage students to learn collaboratively. Based on this understanding, T3 uses learning strategies by facilitating students to work together in groups to complete tasks. Then, T3 also develops communication skills, as one of the abilities that need to be developed in the 2013 Curriculum by facilitating students to present work results in front of the class. This shows that T3 believes that the learning strategies used must be in line with curriculum objectives that not only achieve aspects of knowledge and skills but also aspects of attitudes such as cooperation and communication as presented in the following interview excerpts.

"In the 2013 curriculum it was directed students to collaborate, work together. So I use a cooperative model, I form a group, in that group I make heterogeneous, some are smart and some are lacking. Well, my goal, suppose in one group there are 4 students. 2 students are less able to follow the learning, 2 students can. What I hope here, 2 students who are less able to understand mathematics, can be interested and can be taught by their friends in that group, so that the abilities of children in that group can be close to the same. For that presentation, I trained children to dare to move forward, children want to move forward and present the results of their work is already very good."

Teacher's knowledge

Teacher knowledge is one of the factors that influence the selection of teacher instructional strategies. T1 and T3 explain that all strategies used to present the material aim to help students understand the material. This shows that both teachers associate the learning strategies used with efforts to achieve learning objectives which is one aspect of curriculum knowledge. In other words, the teacher's knowledge of the learning objectives that students must achieve affects the strategies used by the teacher to present the material.

In addition to knowledge of learning objectives, teacher knowledge of student understanding also affects the strategies used by teachers to present material. All teachers use lecturing and

questioning to guide students who still often experience errors in prerequisite materials and materials studied. Students still need to be guided step by step and explained repeatedly so as not to repeat making mistakes in solving problems. In addition to understanding student errors related to prerequisite material and the material studied, understanding of students' weak ability to understand the material, low student learning motivation, and learning strategies that are attractive to students are also reasons teachers use certain learning strategies. Thus, the teacher's knowledge of students' comprehension ability is one of the factors that influence the strategies used by teachers to present material.

Teaching context

The context of teaching is one of the factors influencing the selection of teacher instructional strategies. The limited time available to present the entire content of the material is the reason T1 and T2 use the lecturing strategy to present the material. Both teachers understand that the learning strategies used should be in line with the curriculum which must use a scientific approach, problem-solving-oriented, and collaborative. However, the content of the curriculum, especially grade VII, which is relatively large and limited time to present the material is the reason for the two teachers to use lecturing strategies to present the material.

> *"The teacher is more focused on delivering the material content according to the available time. If it is according to the curriculum, the 7th grade material is a lot, sir. Now that must be conveyed all. Later, if it is not delivered, continue to pass the semester exam, the material will come out, the children will protest." (interview with T1)*

> *"Because the curriculum structure is very much and teachers are required to complete the subject matter with limited time. To anticipate not achieving curriculum targets, classroom learning is carried out with the lecture method with the hope that all subject matter is delivered because time is limited. If you use the media, it will take a lot of time." (interview with T2)*

The relation between teacher's instructional strategies and PCK component

Based on data analysis, the reasons for the three teachers in determining the learning strategy used to present the material are presented in Figures 1, 2 and 3.

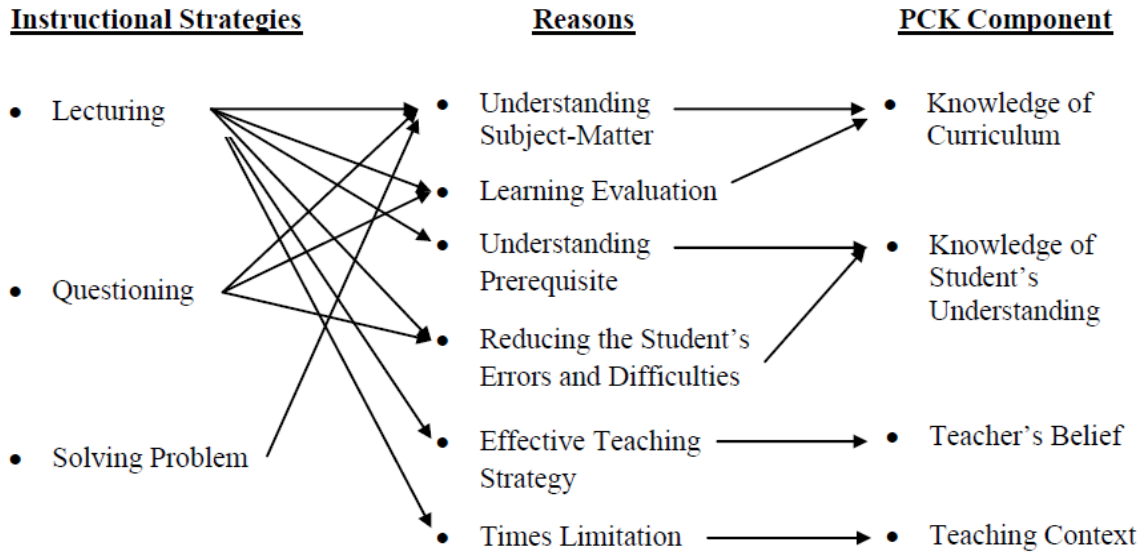

Figure 1. T1's Reasons in choosing instructional strategies

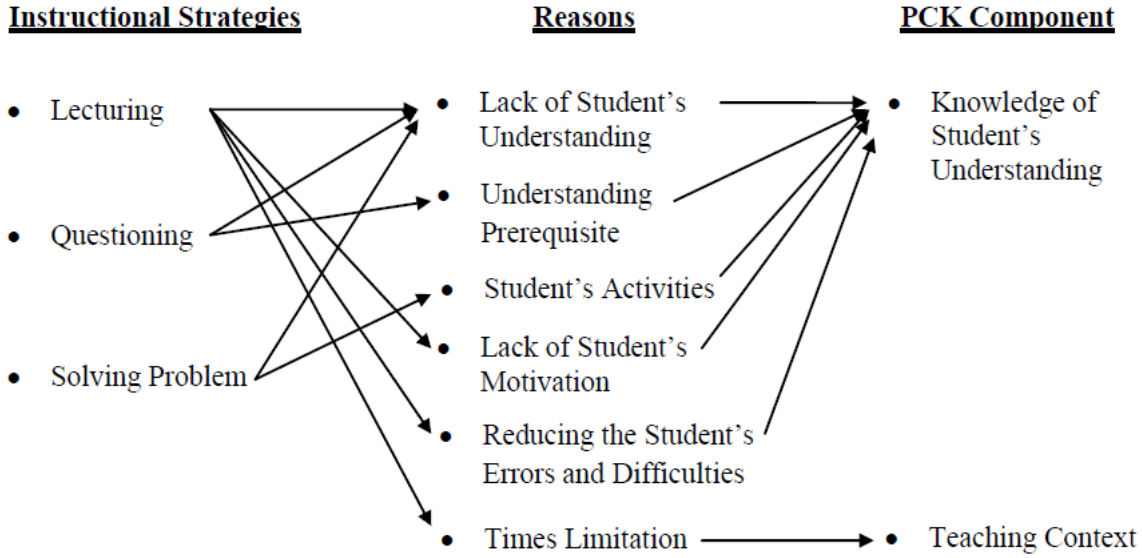

Figure 2. T2's Reasons in choosing instructional strategies

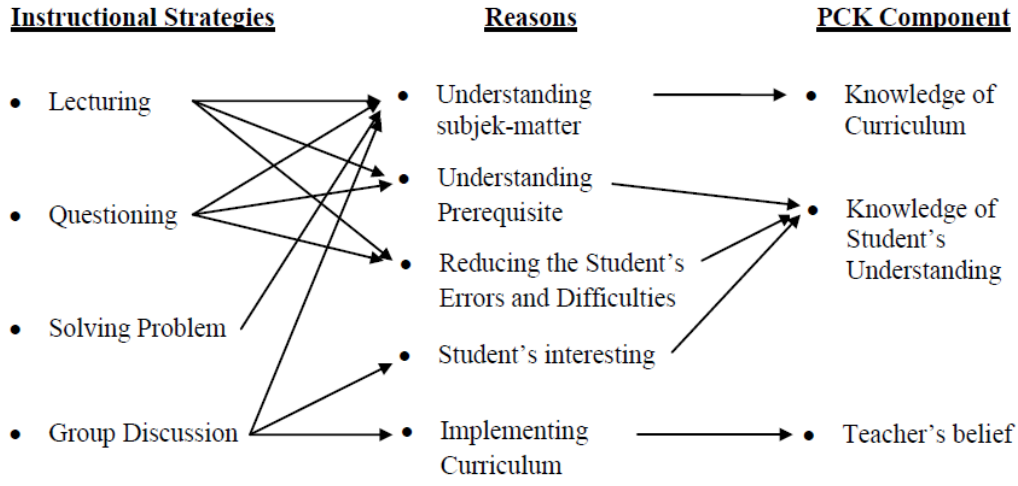

Figure 3. T3's Reason in choosing instructional strategies

DISCUSSION

This study aims to investigate the reasons teachers use learning strategies in presenting material, especially LEOV and LIOV. Figures 1-3 show that all teachers use lecturing, questioning, and problem-solving strategies in presenting material. Only T3 applies learning by involving student participation in group discussion activities and presentations of group work results. Meanwhile, the other two teachers are more likely to have their learning centered on the teacher. In this case, the teacher presents material in the form of concepts and procedures for solving problems, gives practice questions to students, and asks students to write the problem solutions on the board, then discuss student answers. The strategies used by teachers are in line with the results of the study Suastika (2017) which explains that most of the math teachers studied tend to use a teacher-centered learning approach. Learning begins with explaining definitions or formulas related to the topic being studied, then discussing example questions, and ends with doing practice questions. Similarly, research Tanujaya, Prahmana, and Mumu (2017) In his study on mathematics teacher learning strategies in Manokwari, Papua also explained that learning is still teacher-centered and teachers are the only source of learning. Learning seems monotonous and boring. In addition, students are only passive and carry out what is instructed by the teacher. Students only remember the formulas given by the teacher and use them to solve the problems given by the teacher. These results show that, although the new curriculum has been implemented since 2013, which encourages learning to be carried out with discovery, problem-based, problem solving, student-centered learning strategies, but implementation in schools show that learning still tends to be teacher-centered.

All teachers demonstrate the use of questioning strategies to guide students through understanding the material. However, the questions given by teachers tend to be closed-type questions. Answers to closed-ended question types only need to recall previously learned factual or procedural knowledge. The questioning strategies used by teachers are in line with the results of the study Eliasson et al., (2017) and Zayyadi, Nusantara, Hidayanto, Sulandra, and Rahman (2019) which shows that the majority of questions used by teachers in learning are closed questions that belong to low-level questions. Teachers still have difficulty formulating questions that can stimulate students' higher-level thinking skills. Different levels of questions, high or low, have an influence on students' ability to understand the material (Chin, 2006; Jensen, Mcdaniel, Woodard, & Kummer, 2014). Students who are given high-level questions have a deeper conceptual understanding and are able to remember the information in the material better. Students can also solve HOTS-type questions better than students who are often given low-level questions. Giving students high-level questions that can develop mathematical thinking skills is still a challenge for teachers. Thus, the development of the teacher's ability to compile quality or high-level questions is very necessary to be able to develop students' higher-order thinking skills.

The results also showed the relationship between teacher confidence and the learning strategies used by teachers. This is in line with several research results that state that teacher confidence in learning is one of the factors that influence the learning strategies used by teachers to present material (Belbase, 2013; Chan & Elliott, 2004; Dejene, 2020; Teo & Zhou, 2016). T1 states that conventional learning is more effective in helping students understand the material compared to using learning strategies recommended in the 2013 Curriculum, such as discovery, problem-based, and scientific approaches. Teachers' beliefs related to effective learning are reflected in presenting material where teachers focus more on explaining and guiding students to solve problems rather than developing other abilities, such as critical and creative thinking, collaboration, and communication. In addition to belief in learning, T3 demonstrates a belief in the necessity of implementing recommended learning strategies in the curriculum that encourage students to be able to collaborate in solving problems and communicating work results to other students. This can be seen from the teacher's activities facilitating students to work together to complete tasks in groups and asking each group to present in front of the class.

Limited time to present material is one of the learning contexts that become an obstacle for teachers in carrying out learning, in addition to large classes, lack of peer support and managers, unavailability of relevant learning resources, poor student learning attitudes (Fernández-Balboa & Stiehl, 1995). The results showed that the relatively large content of material using the 2013 Curriculum learning approach was not in accordance with the availability of time to present the

material. This is in line with the results of the study Retnawati (2015) which revealed that teacher obstacles in implementing the 2013 curriculum include difficulties in planning lessons that contain 5M properly, including managing learning time for one semester because the material content is too much, teachers run out of time to deliver material according to the learning design, especially for students with low mathematical abilities, the presentation of material in books is often constrained because students have not mastered the prerequisite material, And scientific learning takes a very long time. In different curriculum contexts, some researchers also state that limited time is one of the obstacles for teachers to present innovative learning (Mangwende & Maharaj, 2020; Meara, Prendergast, Cantley, & Harbison, 2019; Refugio et al., 2020; Viro, Lehtonen, Joutsenlahti, & Tahvanainen, 2020). This certainly needs to be the attention of policy makers related to the development of school curricula, especially the content of material that must be presented to students. Because the success of curriculum implementation depends on the ability of teachers to apply it in learning.

Understanding the reasons for choosing teacher instructional strategies in presenting material can provide useful information for policy makers regarding the factors that influence the selection of these strategies. This information will assist policy makers in developing teacher professional development programs that are tailored to their needs. For example, one of the reasons teachers are more dominant in lecturing is the limited time to present material in a relatively large curriculum. This information can help policymakers to redesign the curriculum so that there is a balance between the demands of completing the material in the curriculum and the encouragement to implement innovative learning strategies, so that students participate in learning, and

CONCLUSIONS

This study investigates the reasons for teachers in choosing instructional strategies in presenting LEOV and LIOV materials. The dominant lecturing, questioning, and problem-solving strategies used by teachers to present material in learning. Only one subject presented the lesson using group discussion and asked students to present the results of the group assignment in front of the class. There are several reasons teachers use lecturing strategies, namely students can better understand the material, evaluate student understanding, help understand prerequisite material, reduce student errors and difficulties, effective strategies help students understand the material, low student understanding, low student learning motivation, and limited time presenting material. Furthermore, the reason teachers use questioning is to help students understand the material, evaluate student understanding, reduce student errors and difficulties, and help understand prerequisite material. Then, the reason the teacher asks students to solve the problem is to help students understand the material and encourage students to participate in learning. Teachers' reasons for choosing instructional strategies can be classified in the PCK components, namely curriculum knowledge, student understanding knowledge, teaching context, and teacher beliefs. Further research related to teacher instructional strategies with PCK components will provide stronger information regarding effective learning strategies.

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