

Teachers' Ability to Integrate Reasoning and Student Wellbeing in Pedagogical Content Knowledge

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Abstract—This research aimed to analyze the teachers' ability in integrating reasoning and students' wellbeing in the PCK. Research method used was case study. The subject of research is two science teachers in grade VII of junior high school in Bandung. Teachers' PCK were analyzed before and after reasoning and students' wellbeing training. The results showed that PCK early made by teachers have not integrated reasoning and students' wellbeing yet. After being given training, teachers developed their PCK and integrated reasoning and students' wellbeing at PCK. The integration of reasoning in the PCK were presented with the questions created by teachers which asked the reasons based on the students' answers. Students' wellbeing which considered by the teacher at PCK is linked to the cognitive domain of students' wellbeing itself. Description of teacher reflection illustrates that teachers have the ability to integrate reasoning and students' wellbeing into the PCK.

Keywords— *reasoning; students' wellbeing; PCK*

I. INTRODUCTION

Students will learn a lot of knowledge when teachers have the knowledge and skills in the learning activities. Those abilities are teacher can use the time effectively, implement a strategy that demands students to be active in their learning process, communicate the rules and learning objectives clearly, and prevent the problems in learning by introducing the social contract at the time of starting early learning activities and then apply it consistently [10].

One way to document the teachers' ability in terms of content knowledge and the ability to teach through Content Representation and Professional experience and Pedagogical Repertoires that are components of Pedagogical Content Knowledge (PCK). PCK is the knowledge owned by the teacher who continues to evolve over time. Teachers can acquire it through experience about how to teach certain material with specific ways to develop students' understanding [21].

The CoRe contains a description of the concepts or materials as well as teaching ability of teachers relating to any content or a specific topic. One of the characteristics of effective science teacher is having a deeper understanding of the concepts in science [23]. PaP-eRs explains specific aspects of the CoRe and the teachers' ability to teach the content itself [22]. Teachers' PCK who teach the same subject area depends on the expertise and the specialness of different individuals who are influenced by the context or learning atmosphere, content knowledge, and experience [23][20]. A PaP-eRs illustrates the reasoning included how to teach a specific aspects of the content of science and was designed to uncover things that specifics of the PCK. Teachers' PaP-eRs can be obtained in a type of forms in accordance with the teacher chooses. These can be journal, a flow chart about ideas, and a reflective note. It could be about teachers' thinking and reasoning ability that are supported by pedagogical ability of the teachers against to certain content which is delivered to the reader.

The complete knowledge possessed by a teacher who deals with content and pedagogical aspects. CoRe document as a form of conceptualization of a material are equipped with document PaP-eRs is a form of reflection on professional performance after teachers teach [14]. CoRe and PaP-eRs aim to present the knowledge of teachers as well as connecting with practice [5]. Teachers' PCK consists of orientation in teaching, knowledge of students' understanding, knowledge of curriculum, knowledge of learning strategies and teaching, and knowledge assessment [29]. An overview of teacher knowledge contained in the PCK are the situation of teaching and student responses, the way teachers teach and make decisions in situations of particular teaching (also with regard to the content and the response from the students), the relationship happened/didn't happen, and the way the material is presented and the reason [21].

A professional teacher should also have the ability to apply various strategies in delivering lessons in the learning process [30]. On the learning process required an ability of reasoning and the ability to make the learning activities that could develop the depth of students' understanding at some of the materials which was being taught by teachers [16]. Teachers have difficulties in designing and developing learning activities that can bring up the student's reasoning ability. Teachers also haven't been able to analyze the potential of learning in each learner [40]. Whereas the teacher should need to focus on the development of professional knowledge [39].

Method or teaching strategies can affect the students' reasoning ability. Students' reasoning ability can be developed through stages of learning activities that implement the learning strategy for reasoning. Students' reasoning abilities are still not developed well mainly argumentation [18]. Instructional design primarily based on the problems can develop the students' reasoning ability because reasoning has important roles in the process of problem solving. Therefore, teachers need to pay attention to and customize the existence of space scientific reasoning ability interactions between students in solving problems [17].

The teacher gives the opportunity to students to practice argument capability that has helped students learn complex skills i.e. identify strategies and using evidence rather than memorizing facts and content [4]. The confidence and the good science teachers' ability about the content and pedagogical practices in teaching will affect the student's experience in learning including in directing student reasoning ability [2]. Reasoning ability can be trained and developed in the school. Reasoning ability can be developed in the process of learning activity classes with different approaches and learning methods which are developed by the teachers [6].

Reasoning in science is explained as something that involves the relationship between ideas with evidence found both of these things and how to coordinate with one another [38]. Reasoning is also understood as a logical thinking process that uses induction and deduction to reach conclusions [31]. Reasoning is required for all high level thinking activities. Reasoning is used to connect two parts of an argument that is a claim with evidence. The process of making an argument with the justification of everything that is believed to be the truth upon the knowledge, attitudes, and values that are supported by the evidence and the logical reason [6]. Based on Toulmin's Pattern, there are six components that can reinforce the reasoning in an argument that are the data, claim, warrant, backing, qualifier, and reservation/rebuttal. Based on the six components of argument, there are three of the most important components namely claim, evidence, and warrant. These three components must be presented in every argument. Nevertheless, the six components should be arranged so that it shows the connectedness [15].

The quality of an argument can be strong or weak is determined by the understanding of a concept supported data/evidence, warrant, backing, and how the students construct those components. A strong argument has a lot of relevant and specific justification to support the conclusions

with the evidence of the concept are accurate. The argument is weak indicated by absence of consideration of scientific knowledge, not accurate, not specific, and inaccurate [15].

Students' ability to think logically and liveliness of students to create new knowledge is influenced by the learning process in the classroom [33]. Students need attention and support in reaching achievements [25]. It is known as wellbeing. A student wellbeing depends on the students' learning process, the interaction between the students, as well as the interaction between teachers and students [3]. Student wellbeing can be defined as a state of balanced good mood and a good attitude, resilience, and satisfaction with one's self, relationships and experiences at school [1][24]. Wellbeing is considered as a point of balance between what is owned by an individual with the challenge facing both psychological, social and physical [11].

Based on the inferred by ACUEI, that the students who have high levels of wellbeing are likely to become good problem solvers, showed a good performance and better achievement, have positive social relationships and meaningful, shows kindness such as forgiving and kind, more resistant to stress, have good mental, and good physical health. Students' wellbeing consists of the physical affective, cognitive, economic, and social domain [26]. The domain of students' wellbeing that focused on learning activities in schools is the cognitive, affective, and social domain [13][19][26].

When interacting with students, teachers must have a role in providing warmth, confidence, and interpersonal support in the learning process [9]. Good teachers have a good interaction with students, a good person, and give the opportunity of students making choices [36]. This alignment that the core competencies of teachers refers to the condition of the students such as the competency of the pedagogic competence, personality, and social competence [12]. The relationship of teachers with students includes aspects of social, intellectual, emotional, moral and social cultural background was not good [40]. Students build knowledge through social interactions with other students or educators so as to provide an opportunity for them to mutually evaluate and improve understanding by way of expressing ideas and share their understanding with others [37].

Based on the background, a teacher with the ability of content and pedagogic is already supposed to be able to improve students' ability in developing the students' reasoning ability and the learning experience of students in the learning situation that is safe and comfortable. Therefore, science teachers felt need to prepare both in terms of the content to be taught as well as the pedagogy ability which will be used to teach the content by giving consideration to the aspects of the reasoning and students' wellbeing. This can be facilitated through the integration students' wellbeing and reasoning on PCK. Therefore, the teachers need to be given training relating to reasoning and students' wellbeing and to analyze teachers' ability in integrating them into the PCK.

II. RESEARCH METHOD

Research methods used a case study. This design is used to carefully investigate a case, the activity of one or more individuals. This case is limited by the time and activity. The complete information is collected using various procedures of data collection based on the specified time [9]. The subject in this study are two science teachers of junior high school in Bandung. Instruments used to measure teachers' PCK is a CoRe (eight questions developed by Loughran, 2012) and PaP-eRs.

Research conducted in the form of information gathering teachers' PCK ability before and after training. The training is related to the PCK, reasoning, students' wellbeing and the integration into PCK. The training was conducted as many as three sessions and each session last for 4 hours. Session I : reasoning and students' wellbeing, session II : PCK and integrating reasoning and students' wellbeing into the PCK, session III: integrating reasoning and students' wellbeing into the PCK and application into lesson plan. Then analyzed teachers' PCK before and after training.

The data in this study were obtained by analyzing the findings and then the specific a conclusion is drawn. The data obtained based on the data of the instrument such as CoRe, PaP-eRs, and the results of the interview to know the teachers' ability in integrating reasoning and students' wellbeing into the PCK. The data presented by the arrangement of information systematically and then do the triangulation by analyzing the suitability of CoRe, PaP-eRs and the results of the interview. Final results of the research obtained an overview of the teachers' ability in PCK and in integrating reasoning and student wellbeing at PCK.

III. RESULTS AND DISCUSSION

Teachers' PCK before training suggests that teachers haven't been able to integrate reasoning and still a little thinking about the students' wellbeing. Students' wellbeing which is thought by teachers related to the way teachers motivate, guide students in learning, facilitate the students with several of media, and teachers think about student health and mental condition as a consideration in teaching concepts. Teachers' PCK after training can be identified from the answers to the questions number two up to eight at the CoRe. The first question does not indicate the existence of integration of reasoning to the content or material being taught by the teacher. This document is supported by a narrative note from the teacher described on PaP-eRs.

A. PCK of Teacher A

Knowledge of the content of the subject matter is the initial conditions that are very important in determining the success of a learning activity [34][35]. The teacher A split three big ideas on the material of the ecosystem and one big idea on global warming. The teacher A though that ability to teach those material. Teacher A feels that sufficient knowledge and experience to teach those concepts.

Based on teacher A's PCK after training, teacher A consider to bring up students' reasoning based on important or whether those concepts were studied by students. Teacher A is

making the reasoning questions and asking those questions on learning activity. The students are expected to respond with various answers in class. The answers are revealed by the students will make teacher A asking follow-up questions to explore deeper students' understanding. Teacher A is also considering to bring up students' reasoning based on an idea/concept associated who haven't the time known by the students yet. If the concept of ecosystem components at the level of microorganisms, the biogeochemical, and antibiotics being asked by the student then teacher A makes the reasoning questions and will ask those questions on learning to the students. Consideration of teacher A is also linked to his difficulties in deep understanding of the material. This is resolved by referring students to analyze, find the reasons and evidence of the questions asked by the teacher A related concept. The other things that teacher A is considered by the condition of the students. Although in fact students not used to perform certain ability. Conditions form knowledge, interests, or way of thinking of things that others have been there in the person of students [21]. The teacher thought that student should have prior knowledge. This is important that to considered help students to understand the related concepts. So the teacher explores students' prior knowledge by asking more questions to help the students analyze and give the reasons logically.

On the learning process, it is required the reasoning ability and the ability to make the learning activities of the teacher who can develop the depth of the students on a material [16]. Teacher A uses certain ways to bring up the students' reasoning by providing questions that make students think logically against the answers given. These questions are presented both in writing and orally. Teacher A will continue to unearth the reasons against the answers given by the students.

On learning activities, teachers A choose a sequence of teaching by exploring students' prior knowledge and invite students to develop the students' reasoning ability. Teachers' ability in asking questions is still limited to yes and no answer. Teacher A explores the students' reasons against to their answers. After that, teacher A delivers learning objectives with the expectations of students understand the benefits of learning the material. In the core activity, teacher A uses media and the worksheet so that the students can discuss students' answers to questions asked by the teacher A in class discussion. In the class, teacher A also follows up questions to explore deeper students' understanding with regard to the material being taught but it is still hard done by the teacher.

Teacher A also thinks students' wellbeing with how to help the students to understand and masters the subject matter by facilitating students with media. Teacher A also facilitates media and gives interesting activity in class. Teacher A guides students by asking questions so that students in cognitive can give reasons in answering questions. Teacher A also helps students to master the material by asking students to learn in groups so that students can understand the matter by discussing with members of their group. Teacher A also assists students to develop the students' reasoning ability with the aim of enabling students to master the subject matter, gives the opportunity to students to answer and gives reasons against

the answer, motivates the student answers and responds it well. Teacher A also thinks that mental condition and health can influence the students in learning.

B. Teacher B's PCK

Teacher B divided the material into five big ideas for ecosystems and one big idea for global warming. Teacher B felt that has sufficient knowledge and experience to teach that concepts. Teacher B made the reasoning questions and will be asked on learning activity in the classroom to the students. Based on such reasoning questions, the student is expected to respond with various answers in class. Teacher B will explore deeper students' understanding related to the material. Teacher B is also consider to bring up students' reasoning based on the reserve concepts such as humidity, temperature, biomes, biosphere, biomass, and antibiosis. If these concepts are appeared or asked by the student then teacher makes the reasoning questions and will be asked in learning activity to develop the students' reasoning ability. The efforts made by teachers is to invite students to analyze, find the reasons and evidence of the questions asked by the teacher related the concept. Other matters considered by the teacher B relates to a misconception in students' thinking. Teacher B solved this condition by giving questions related to the material with misconception and develop the students' reasoning ability.

Based on the identification of the reasoning in the PCK, teacher B brings out the reasoning of students by providing a question in learning activity. The question relates to the real fact or observation. This is in line with the research that some things can be done to develop the capabilities of the develop the students' reasoning ability students are learning by giving problems or cases relating to the concept that will be studied [18]. On learning activities, teacher B chose sequence of teaching by exploring students' prior knowledge and invite students to develop the students' reasoning ability by using the media or doing experiment. In the class discussion, teacher B also asked a lot of questions to students directly.

Based on the identification of students' wellbeing in the PCK, teacher B thought the students' wellbeing by providing motivation to students, inviting the students to understand the goals and benefits of the subject matter. Teacher B provided the opportunities for students to observe, experiment, communicate, ask and answer questions, and gives a good response to the students. Teacher B also helps students to master the material by asking students to learn in groups so that students can discuss with members of the group. This description suggests that teachers deliver classroom activities which can also increase the social abilities of students. This line that the teacher was supposed to provide classroom activities that can also enhance social and emotional abilities of students. Professional learning experiences support teachers to manage student behavior in a way effectively [7]. Based on the results of teacher B's reflection has raised learning reasoning and students' wellbeing.

Based on PCK of teacher A and teacher B shown that they explore the students' reasoning by asking questions related to the concept, ask the solutions of the problem that are given, and explore the reasons against to the answers given by the students. Based on the students' answers, the teacher can

develop other questions to explore deeper knowledge so that student can master the learning materials. Tytler reveals that the reasoning in science is simply described as something that involves the relationship between ideas and evidence as well as ways to let it connect [38].

Content knowledge in the PCK needs to be combined with the pedagogical knowledge [27]. The pedagogical ability is required by teachers in integrating the student's wellbeing in the PCK. Teachers also strive to think of students' wellbeing. Teachers did some activities that can make student feel wellbeing. This is supported by an explanation that the optimal students' wellbeing is the sustainable, positive attitudes and relationships at school, resilience, self-optimization and a high level of satisfaction with learning experience [1]. The study also shows that teachers are quite difficult to recount and reflect on the how the reasoning and students' wellbeing integrated into learning. Therefore, the explanation of narrative described by teacher also illustrates that the teacher is hard enough to do reflection in depth. This is because teachers have a limited knowledge about any components that need to be reflected and how exactly the process of reflection itself done [28].

IV. CONCLUSION

Teachers have the ability to integrate reasoning and students' wellbeing into the PCK after training. Teachers' PCK after training showed that teachers try to think of the students' wellbeing. The teachers consider the students' wellbeing especially on domain related to cognitive such as mastery the concepts. If the students' wellbeing was managed well by the teachers, then it can effect to the students' reasoning. Teachers seek the development of students' reasoning abilities by constructing questions that can stimulate the students to be able to connect the claim with evidence by expressing logical reasons. The process of reasoning which is done upon the knowledge, attitudes and values that are supported by the evidence and logical reasons would be good if students feel wellbeing. Teachers' PCK also give an idea how important to think of students' wellbeing so that students' reasoning abilities emerge and develop. In addition, the teachers finally consider that prepared the content, methods, media and experiential learning can help teachers develop students' reasoning and wellbeing so that can result an effective learning process. In addition, the teachers' reflection also becomes the important thing so teachers can elaborate on pedagogical ability to improvement the learning activities.

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