International Journal of Evaluation and Research in Education (IJERE)
Vol. 13, No. 1, February 2024, pp. 31~42
ISSN: 2252-8822, DOI: 10.11591/ijere.v13i1.24642

Elementary teachers' understanding of pedagogical content knowledge analysis disaster mitigation: stories from Indonesia

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Article Info

Article history:

Received Jun 8, 2022
Revised Oct 23, 2023
Accepted Nov 9, 2023

Keywords:

Curriculum
Disaster
Mitigation
Pedagogical content knowledge
Primary school teachers

ABSTRACT

The notion of pedagogical content knowledge (PCK) analysis disaster mitigation often been overlooked in the field of elementary school, because many teachers think that it is too early to practice the concept to student. This article attempts to explore elementary teachers' understanding on PCK analysis. The method adopted in this research is case study. There were 16 elementary school teachers from six different schools in three different cities in province Riau, Indonesia, selected as participants. Data are collected through rubric the observations and interview using a grounded approach. Findings of this study highlight the extent to which elementary teachers are not yet ready to teach disaster mitigation due to their limited content knowledge and understanding of disaster mitigation. The findings also illuminate complexities faced by teachers in PCK in their teaching. The findings need school authorities must incorporate disaster mitigation materials into their teaching curriculum. Schools need to prepare teachers for teaching disaster mitigation by inviting first responders, such as firefighters, emergency service, or officials from National Board for Disaster Management. Finally, the teachers need to improve their understanding of disaster mitigation and their teaching technique to deliver the mitigation materials relevant to the students.

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1. INTRODUCTION

Teacher is a profession that requires special skills. The professional work of a teacher cannot be done by just anyone outside the field of education. The teaching profession requires certain knowledge in depth and is only obtained through appropriate educational institutions. A teacher in carrying out his duties should be based on scientific knowledge that can be scientifically accounted for [1]. Teachers have an important role in improving the quality of education, this is because teachers interact directly with students in classroom learning. Through the learning process, the quality of education can be seen. The learning process will determine the success or failure of students in obtaining learning goals.

Teachers must have good competence to improve the quality of education. A teacher must have competence in order to complete the learning function. Competencies that must be possessed by a teacher are pedagogical competence, personality competence, professional competence, and social competence. The role of teachers in learning, should have pedagogical competence. Pedagogical competence of teachers is a competency that distinguishes the teaching profession from other professions. Teachers need to master

developmental theory and learning theory to carry out their duties. A teacher must have mastery over student development, learning theories, curriculum development, evaluation techniques, and mastery of teaching methods and models. Teachers teach students how to learn and help them use learning models that support better academic, social and personal growth. The teacher is responsible for making learning interesting so students are motivated and eager to follow the learning [2].

Pedagogical content knowledge (PCK) has many characteristics of good model. The novelty of PCK is able to revitalize the study of teacher knowledge, provide a new analytical framework for organizing and collecting data on teacher cognition, highlight the importance of subject matter knowledge and its transformation for teaching, incorporate findings throughout related constructions, and provide a more integrated vision of teacher knowledge and classroom practice. In addition, PCK is an intuitively interesting construction, which has been actively incorporated into the vocabulary of many teachers and researchers [3].

PCK is an academic construct that represents an interesting idea. This is an idea rooted in the belief that teaching requires more than just conveying knowledge of subject content to students, and that student learning is far more than just absorbing information for accurate regurgitation later in life. PCK is the knowledge that teachers develop over time, and through experience, about how to teach certain content in certain ways to lead to an increase in students' understanding. However, PCK is not the same single entity for all teachers of a particular field of study. PCK is a specialized skill with individual privileges and important differences that are influenced by (at least) the teaching context, content, and experience. PCK may be the same (or similar) for some teachers and different for others, but after all, PCK is the cornerstone of teachers' professional knowledge and expertise. It stands to reason that in order to recognize and appreciate the development of PCK of each individual, teachers need to have a rich conceptual understanding of the content of the particular subjects they teach [4].

PCK is an important part of the teacher's knowledge base. PCK is the basic type of knowledge that teachers need to plan, teach in the classroom, and evaluate student learning outcomes [5]. PCK relates to the teacher's knowledge of the content presentation and specific and appropriate strategies to achieve student comprehension on a particular subject [6]. Teachers' strategic roles in improving the quality and development of pedagogical content are necessary, even a must. Teachers are required to link their subject with contextual examples so that their students achieve good learning outcomes [7]. In other words, a teacher must better prepare the content to be taught in her classroom, as reflected in their teaching materials. Teachers should teach the basics of disaster mitigation because school is the right way to form and develop students' knowledge [8]. Disaster mitigation is a form of attitude in dealing with disasters, both at the time of prevention, when it occurs, and after the occurrence of disasters. Disaster mitigation is defined as efforts made to reduce the impact of disasters caused by nature, humans, or both. School is an effective and efficient way to continue, grow and develop disaster mitigation knowledge throughout the learning process.

Indonesia is a country that has a very high potential for danger (hazard potency). These potentials include earthquakes, volcanic eruptions, floods, windstorms, landslides, and forest and land fires. Forest and land fires are almost routine in Indonesia, especially in Kalimantan and Sumatra. Where the largest forest and land fires only occurred in 2019 in Riau Province. Riau Province is an area with the majority of peatlands. Peatlands in Riau Province are widely used for oil palm plantations and industry. Land clearing for plantations and industry causes peatlands to become dry so that peatlands are flammable, especially in the dry season.

Forest fires have caused many sectors of life to be damaged, losses caused in terms of physical and material. Forest and land fires can cause smog that causes mild to acute respiratory distress. These fires could be categorized as a disaster and cause mild to acute respiratory distress. The smoke produced from fires contains some harmful gases and particles such as sulfur dioxide (SO2), carbon monoxide (CO), formaldehyde, aclerin, nitrogen oxides (NO2), and ozone (O3) [9]. In addition, forest fires also affect the education sector. Forest fires affected educational sectors in some ways. First, fires forced the schools to be closed. In the 2019 fire, for instance, schools were closed for more than a month. This disaster surely disrupted the learning process at schools, let alone the emergence of respiratory infections for the community, especially schoolchildren.

In general, primary schoolers who do not understand disaster mitigation will not understand the necessary procedures to be taken on the occurrence of a disaster [10]. Without knowledge of procedures and preparation, the affected people could become victims. Students are one of the groups whose risk is high during disasters. In addition to their already vulnerable conditions, the disasters' high risk among these school children is due to a lack of understanding of potential disaster risks in their emergent surroundings. Children's lack of knowledge and understanding of disaster risks can result in a lack of preparedness in dealing with disasters [11]. Students' early recognition of disasters can minimize losses resulting from the disasters. It is where the urgency of teaching about disaster mitigation is crucial. Knowledge will also influence the domain in shaping one's behavior. Experience shows that natural disasters to date have caused

significant losses and damages due to a combination of disaster types and the complexity of other issues [12]. Therefore, in order to minimize the loss and suffering caused by the impact of a disaster, knowledge of disaster mitigation is required.

Elementary school is a formal place in demanding knowledge that has an important role in carrying out natural disaster preparedness. Understanding of natural disaster preparedness for students is the responsibility of a teacher. Teachers need to teach and introduce potential disasters in their area and related techniques for disaster mitigation [13]. Various teaching materials and learning media development can be a form of innovation in education. Teachers must have adequate knowledge and experience in disaster mitigation, especially typical disasters in their region [14]. Consequently, teaching disaster mitigation requires teachers to prepare specific learning content in preparing students to perform disaster mitigation procedures when disasters occur.

PCK is an important aspect for teachers in providing their knowledge to students at school. The lack of mapping of the PCK level for teachers in primary schools is the basis of this research as an action to increase teacher capacity, especially in mitigating natural disasters. Therefore, this research attempts to fill the gap in existing research and literatures by exploring topics on understanding PCK on disaster mitigation in Indonesia and the extent to which they negotiate the subjects in curriculum.

2. RESEARCH METHOD

This research using adopts descriptive qualitative because it involves qualitative data and analysis stage. Qualitative methods for processing data obtained from the observations and interview. The description design method is employed for the aim of collecting and describing information concerning the present status of phenomena [15], [16]. This study was conducted on 16 elementary school teachers in Riau Province, Indonesia. Students in elementary schools have not been able to independently identify the potential for forest and land fires, so teachers have an important role in providing information about disaster mitigation in schools, especially teachers who live in forest and land fire prone areas such as Riau Province. Subjects involved in the study are detailed in Table 1.

This research was conducted by examining the pedagogical content knowledge skills of teachers in the discussion of smoke disaster mitigation through content representation (Co-Res) questionnaires and interviews conducted. Through the study, the ability of teacher PCK will be clearly described and the quality of teaching on mitigating smoke disasters can be predicted. There are four categories of achievements used in the study, as shown in Table 2. Rubric assessment of the Co-Res questionnaire of PCK achievements is can be seen in Table 3.

Table 1. Research subjects

Name (Initials)	Sum	Age	Gender
WF, MN, WPM, Y, IF, TGV, RA, WHK, ADH, and FR	10	29-55	Woman
FM, YR, S, AF, YM, and MHI	6	30-56	Man

Table 2. PCK achievement categories

Levels	Categories
4	Very ready
3	Ready
2	Not yet ready
1	Not ready

3. RESULTS AND DISCUSSION

Pedagogical content knowledge is the knowledge possessed by a teacher in the presentation of content and the use of appropriate strategies for the achievement of student understanding. PCK is an important knowledge for teachers to create better learning opportunities, especially in teaching disaster mitigation in schools in disaster-prone areas. This PCK can be reviewed through the Co-Res questionnaire. Co-Res is one of the methods used to access teachers' understanding of a content or material. Co-Res contains a description of important concepts in teaching certain topics to know the mastery of the teacher before doing learning. The Co-Res questionnaire was given to find out a clear picture of the teacher's PCK ability on mitigating forest and land fire disasters. From the teachers' Co-Res questionnaire, the authors categorize the response into very ready, ready, not yet ready, and not ready at all. The detailed results are presented in Table 4.

Table 3. Rubric of Co-Res assessment of PCK achievement

Indicators	Levels			
	4	3	2	1
Interesting idea/concept (learning materials) related to smoke disaster.	Assessment criteria on material learning are met	Assessment criteria about material learning are sufficiently fulfilled	Assessment criteria on learning materials are less fulfilled	Assessment criteria on learning materials are not met
The importance of teaching the concept of smoke disaster	Assessment criteria on teaching of concept are met	Assessment criteria on teaching of concept are quite fulfilled	Assessment criteria on teaching of concept are less fulfilled	Assessment criteria on teaching of concept are not met
Some concepts that are not yet ready to teach to students	Assessment criteria on Some concepts that are not yet ready to teach fulfilled	Assessment criteria on Some concepts that are not yet ready to teach are quite fulfilled	Assessment criteria on Some concepts that are not yet ready to teach are less fulfilled	Assessment criteria on Some concepts that are not yet ready to teach are not met
Difficulties in teaching materials related to this smoke disaster	Assessment criteria on Difficulties in teaching materials are met	Assessment criteria on Difficulties in teaching materials are quite fulfilled	Assessment criteria on Difficulties in teaching materials are less fulfilled	Assessment criteria on Difficulties in teaching materials are not met
The students' condition (initial knowledge/ways of thinking/interests) becomes a consideration in teaching the smoke disaster	Assessment criteria about students' condition are met	Assessment criteria about students' condition are quite fulfilled	Assessment criteria on students' conditions are less fulfilled	Assessment criteria on students' conditions are not met
Factors considered in teaching the concept of the smoke disaster	Assessment criteria on Factors considered in teaching are met	Assessment criteria on Factors considered in teaching are quite fulfilled	Assessment criteria on Factors considered in teaching are less fulfilled	Assessment criteria on Factors considered in teaching are not met
The procedure selected to teach the concept of the smoke disaster	Assessment criteria on the procedure selected to teach are met	Assessment criteria about the procedure selected to teach are quite fulfilled	Assessment criteria on the procedure selected to teach are less fulfilled	Assessment criteria on the procedure selected to teach are not met
Ensuring students' understanding of the smoke disaster concept	Assessment criteria on ensuring students' understanding are met	Assessment criteria on Ensuring students' understanding are quite fulfilled	Assessment criteria on Ensuring students' understanding are less fulfilled	Assessment criteria on Ensuring students' understanding are not met
The use of existing technology in learning the material	Assessment criteria on use of existing technology are met	Assessment criteria on the use of existing technology are quite fulfilled	Assessment criteria on the use of existing technology are less fulfilled	Assessment criteria on use of existing technology are not met

Table 4 shows that the ability of teachers' PCK is still low, which is seen from the percentage of teachers, most of them are in the category of unprepared and unprepared. Of the nine indicators analyzed from teachers, six indicators showed that none of the teachers were in the category of being very well prepared. This is certainly expected so that teachers can develop their quality, especially from the PCK aspect. PCK is an opportunity that needs to be possessed to improve teacher professionalism. Educators must have good PCK, by having knowledge of the material and how to teach it or a mixture of content and pedagogics that form a knowledge of how a topic, problem, or issue is organized and represented that is adapted to the learner's abilities.

Table 4. Data recapitulation from Co-Res

No	Indicators	Category			
		Very ready	Ready	Not yet ready	Not ready
1	Interesting idea/concept (learning materials) related to smoke disaster.	0%	18.75%	15.62%	10.93%
2	The importance of teaching the concept of smoke disaster	0%	9.37%	31.25%	6.25%
3	Some concepts that are not yet ready to teach to students	0%	14.06%	25%	7.81%
4	Difficulties in teaching materials related to this smoke disaster	0%	9.37%	25%	9.37%
5	The students' condition (initial knowledge/ways of thinking/interests) becomes a consideration in teaching the smoke disaster	0%	14.06%	15.62%	12.5%
6	Factors considered in teaching the concept of the smoke disaster	12.5%	18.75%	12.5%	9.37%
7	The procedure selected to teach the concept of the smoke disaster	12.5%	14.06%	12.5%	10.9375
8	Ensuring students' understanding of the smoke disaster concept	0%	18.75%	31.25%	3.12%
9	The use of existing technology in learning the material	18.75%	9.37%	31.25%	1.56%

This research has limitations that can affect the results of the study, these limitations are: i) The results of the study depend on the honesty of the respondents in answering the questionnaire given; ii) Respondents' busy activities and schedules affect the concentration and quality of the answers, so as to minimize this, interviews are conducted; and iii) The conceptual framework used by researchers in assessing PCK is only assessed based on its relationship with disaster mitigation in general, so there is still a possibility that there is still a possibility that other relevant concepts have not been included in the study.

3.1. Interesting idea/concept (learning materials) related to smoke disaster

Teaching preparation begins with mastery of the proper meaning, purpose, theory and elements of learning. Teaching preparation skills are the first steps that must be done by teachers in the classroom. Teaching preparation is defined as the main thing that contains all theoretical knowledge, basic skills, and a deep understanding of learning objects and situations. In teaching preparation, a teacher should know clearly about what should be owned and learned by students related to learning materials.

Learning materials are one of the materials needed for the formation of knowledge, skills, and attitudes of learners. Learning materials are important to be mastered by teachers in order to meet the competency standards that have been set. Learning materials are interpreted as a key component that is used as a basis for teachers in teaching in the classroom. Learning materials are used by teachers as a basic source that provides the content of the lesson. Learning materials are also intended as something that needs to be prepared by teachers so that learning activities run in accordance with the expected goals. The material selected by the teacher in learning should contain material that can really support the learning objectives.

Education is one of the means that are considered effective in reducing the impact caused by natural disasters, especially in schools that are in disaster risk areas [17]. Teachers who play a role in education in school, before starting learning should have good knowledge and understanding of students. A teacher is required to be able to connect the knowledge that students already have with new materials/concepts to be taught. This can be done in several ways, including through questions, providing concrete objects, presenting interesting media, and others that can stimulate students' knowledge of the material taught. The impact of teacher readiness in teaching disaster mitigation materials is that the learning presented will be interesting and learners can understand the concept of disaster mitigation. This is because teachers who are ready to teach disaster mitigation will connect learning materials with experiences that have been experienced and close to students.

It could be said that teachers' readiness affects their teaching of disaster mitigation. Prepared teachers could deliver the content of mitigation through interesting learning materials and simulation [18]. As a result, students are accustomed to experiencing the smoke conditions in their area. Students have an initial knowledge and the concept of smoke disaster mitigation. On the contrary, when teachers are not ready with their PCK, students will not understand the causes and the dangers of smoke disasters. Based on the Co-Res questionnaire filled out by the teachers, four teachers showed that their content knowledge was ready. These teachers explain the learning materials in detail and adjust them according to the needs of the students. For example, the teacher explores the nature of smoke and its causes; teach students emergency procedures when a smoke disaster occurs; simulate a smoke disaster situation; and remind students to protect and preserve the environment so that smoke disasters do not occur.

There were five teachers showed that their content knowledge was not ready. These teachers were only able to write down actions before, during, and after the smoke. The teacher did not discuss the material to be taught, and he had no understanding of smoke disaster mitigation. When asked about the smoke disaster, he only mentioned that in order to prevent it; one should not burn carelessly; Someone has to plant a tree in the school environment. When a smoke disaster is near, one should reduce playing or outdoor activities and wear a mask. He also asked his students to always take care of the environment and not to light fires outdoors. The other seven teachers indicated that their content knowledge was unprepared. Teachers are only able to answer questions about smoke disasters that do not meet the expected answers so that they have no connection with the question.

From this, it is known that the teacher's PCK on the indicator of ideas/concepts (learning materials) is interesting related to the smoke disaster is still not good. Where the majority of teachers are in the achievement of the category is not ready and not ready. This will certainly affect the provision of disaster mitigation concepts in the classroom. Teachers who have mastery of material concepts that are not good regarding smoke disaster mitigation will teach materials inappropriately to students. Improper teaching of materials will have an impact on students' lack of readiness in applying the material that has been studied.

3.2. The importance of teaching the concept of smoke disaster

Natural disasters of forest and land fires (karhutla) are natural disasters that still need the attention of the Indonesian nation. Forest and land fire disasters have many impacts on the life sector, including air pollution (smoke) that interferes with human activities. It is certainly the obligation of all elements in society

to reduce the impact caused. Elements of the community have their respective roles in anticipating and tackling natural disasters of forest and land fires (karhutla).

Teachers as the main actors in the world of education are tasked to provide an understanding of the concept of natural disasters of forest and land fires (karhutla). A teacher needs to learn skills regarding the urgency of the concept to be taught to students. Teachers need to classify or provide mapping of how students are willing to receive the material well according to their sense, thoughts, and feelings. Teachers need to consider what will make students able or willing to learn the concept of disaster mitigation. This can be seen through the benefits and benefits that students will get when learning the concept of disaster mitigation.

Mitigation is a series of efforts in order to reduce the impact of disasters, either through physical development efforts or awareness efforts and increased ability to deal with disaster threats [19]. Disaster mitigation is important to teach students, so that students can act wisely on the efforts that can be made before and during disasters. With hope, when the disaster occurs again students already know what to do to reduce the cause and effect of the disaster.

The reason why the concept of smoke disaster is important to teach is to ensure students' understanding of the causes and consequences of this smoke disaster. It is hoped that students can respond wisely when there is a smoke disaster in their environment. Students are also expected to take care of their health and protect those around them. In general, the concept of teachers that are considered important is vigilance before disasters, adequate preparation, and readiness when disasters occur. The Co-Res questionnaire showed that two teachers mentioned that they were ready to teach disaster mitigation. In other words, their PCK is in the 'ready' category. Teachers emphasize the importance of studying smoke disaster mitigation. They also wrote down what treatment students could take during a disaster. Teachers provide briefings on the importance of mitigating smoke disasters. Ten teachers indicated that their PCK was not ready. The teachers wrote the importance of teaching smoke disaster mitigation, so that students know how to avoid smoke disasters. Four teachers indicated that their PCK was not ready. The teacher only answered questions regarding the impact of the smoke disaster, but did not discuss what steps students could take.

From the results of the research conducted, it is known that PCK teachers on indicators of the importance of teaching the concept of smoke disaster are still not good. Where the majority of teachers' knowledge abilities are in the achievement of the category is not ready and not ready. This of course still needs to be improved teacher knowledge from the importance of a concept taught so that students want to learn the concept of mitigating natural disasters of forest and land fires (karhutla) in the classroom. Teachers who have knowledge of the usefulness of studying disaster mitigation will be able to deliver materials easily and precisely. The delivery of the material will be easier to understand and provide a positive impetus for students to apply it in life.

3.3. Concepts that are not yet ready to be taught to students

Teachers have an important role in carrying out their duties in the world of education. Teachers act as designers, implementers, and assessors in the learning process. In carrying out these roles, teachers need to know how the level of ability possessed by students. Teachers must be able to identify precisely the scope of students' abilities, whether the student's ability is in the category that is not good, good, or very good. The scope of ability possessed by students is a consideration for teachers in teaching.

Teaching is a complex act that requires skills in conveying a message. This skill needs to be mastered well by the teacher in order to carry out the learning process well. Teachers as teachers must be able to provide learning concepts that are in accordance with the standards of their abilities. Teachers should not force a concept to be learned and understood by students. The concept given by the teacher should be based on the things that the child needs and needs. This is included so that the expected ability in children can be awakened perfectly.

Teachers as facilitators in schools, should carry out preparations before teaching in the classroom. Teachers can make various efforts in preparing students mentally to be able to master the material well. The teacher's efforts can be done in various ways, including by knowing the purpose of learning, formulating learning activities to be carried out, and knowing the limits of material concepts that must be mastered by students. It aims to provide a clear picture of the concept or scope of the material to be studied. The concept of the material to be taught by the teacher should pay attention to the scope of knowledge needed by students. Before teaching disaster mitigation, teachers need to review what concepts need to be taught and not yet the time is given to students. This is done so that the depth and breadth of the material is in accordance with the development of students.

The unreadiness of teaching the concept of disaster mitigation is heavily due to teachers' ability to make decisions about what is needed or not needed to teach students [20]. Thus, their knowledge is off-kilter. It also relates to determining the depth and breadth of the material provided. By not explaining the concept of

disaster, teachers were hard to teach the consequences for the people ignited bushfire [21]. Based on the results of PCK teachers, it was shown that three teachers were in the ready category. Teachers consider learning content that connects disaster mitigation with students' abilities and needs. He thinks teaching the concept of mitigation is important, and he doesn't simplify the concept of smoke disaster. The overflow of teachers indicates that their PCK is not ready, so they only consider content about disaster mitigation with student abilities. However, they did not understand how the concept would be taught. The other five teachers revealed that PCK was not ready, they were only able to answer the initial question and did not understand the mitigation of smoke disasters.

From the results of the research conducted, it is known that teacher PCK on concept indicators that have not been taught to students related to the smoke disaster still needs to be improved. This can be seen from the teacher studied there are only three teachers who are on the achievement is ready, and the majority of other teachers are at the achievement not ready and not ready. This will certainly affect the concept of disaster mitigation that teachers will teach to students, where teachers have not been able to clearly identify the limits of concepts that need to be taught to students.

3.4. Difficulties in teaching material related to the smoke disaster

Smoke is one of the consequences of natural disasters of forest and land fires (karhutla). There are various ways that can be done to overcome or reduce the impact of smoke disasters, including disaster mitigation. In the world of education, teachers have a role to explain to students about disaster mitigation. But in the process of teaching disaster mitigation, of course there are various obstacles faced. This obstacle relates to the way teachers present material systematically in the classroom. Before presenting information in the classroom, the teacher must understand about the concept to be explained and know how to explain the concept.

Indicators of difficulties in smoke teaching materials discuss how teachers can present concepts well. This indicator also discusses how teachers are able to identify the difficulties faced in learning the concept of smoke disaster mitigation. Some indicators of teachers' knowledge about learning materials, according to Regulation of the Minister of National Education (Permendiknas) No. 16 2007 Republic Indonesia, are ability to analyze learning materials based on the difficulty levels and understanding of the materials being taught. General pedagogical knowledge refers to the principles and strategies of classroom management and organization that concern general knowledge. The principles and strategies of teaching are also controlled by educators' beliefs and practical knowledge [22]. It is much related to the teachers' ability to analyze the students' knowledge and predict their ability to conceive the material provided. Based on the Co-Res questionnaire, two teachers are in the ready category. The teacher mentioned that he had difficulty teaching smoke disaster mitigation because of the facilities in the school. Eight teachers are in the category of not ready. Teachers mentioned that they had difficulty in mitigating the smoke disaster, but they did not explain the difficulty. The other six teachers are in the unprepared category. The teacher gave an incomplete answer and claimed not to understand the mitigation of smoke disasters.

From the results of the research conducted, it is known that the teacher's PCK on this indicator still needs to be improved. This can be seen from the teacher has not been able to explain the difficulties he faced clearly in teaching smoke disaster mitigation in the classroom. This is reinforced by the results of the ability of teachers who are the majority of whom are on the achievement of not ready and not ready. This will certainly affect the low mastery of student concepts regarding smoke disaster mitigation.

3.5. The students' condition (initial knowledge/ways of thinking/interests) becomes a consideration in teaching the smoke disaster

Basically, what has been on each individual student is different. This difference can be seen from the interests, abilities, pleasures, experiences, and ways of learning that students have. Students' ability to learn also has differences, where there are students who more easily understand the material by seeing, by listening, or doing it directly. Teachers as educators need to have knowledge about the differences that students have. This difference will be a consideration for teachers in developing learning that is more in accordance with student conditions. Learning that considers the condition of students will affect the achievement of optimal learning. Teachers who are able to pay attention to student conditions, it will be easier to present materials to be understood easily by students.

Every teacher must have consideration in designing or teaching a learning material. This can be viewed from the number of students, the limitations of tools and materials, the allocation of time, and the environment and different learning conditions. Teachers need deep thinking to relate concepts to various things by looking at the conditions (initial knowledge of learners/ways of thinking/interests) students. Teachers can teach the concept of disaster mitigation to students gradually to be able to review how important it is to learn disaster mitigation. Indeed, each teacher must have specific considerations in designing the instructional materials and teaching techniques.

Some aspects need to be considered, such as the number of students, the limitations of tools and materials, time allocation, and diverse environments and learning conditions. This identification requires deep thinking and teachers' ability to link the concepts with the student's initial knowledge/ways of thinking and interests. Based on the results of PCK, teachers showed that three teachers are on the achievement ready. Teachers easily admit that a student's initial knowledge is an influential aspect, because teachers like him need to clarify whether students have misunderstandings or misunderstandings about disaster mitigation. Five teachers whose PCK was not prepared to give incomplete responses that showed that they did not understand how the misunderstanding occurred. Meanwhile, eight teachers whose PCK was not ready to give incomplete answers and stated they had no knowledge of smoke disaster mitigation.

Thus, the teacher's PCK on the indicator of student condition is still concerning. Where the majority of teachers are not able to solve the misunderstanding of the concept of disaster mitigation owned by students. The misunderstanding is caused because the teacher has not mastered the concept of smoke disaster mitigation well and does not consider the condition of students before teaching the concept of smoke disaster mitigation in the classroom. This will certainly affect the unsustainable concept of smoke disaster mitigation.

3.6. Factors considered in teaching the concept of the smoke disaster

The task of teachers in providing good learning facilities is not an easy thing. Teachers need to consider various factors before teaching in the classroom. This factor can be seen from the internal and external students. Teachers should be accustomed to seeing various factors that support and hinder students in understanding a material concept. When he wants to teach a material, the teacher must prepare well the things he will do when teaching with the aim of getting an idea of the learning process that will take place.

Teachers must be able to read the environment and identify student experiences as the basis for teaching a material, especially materials about mitigating smoke disasters. Learning about the concept of disaster mitigation in the classroom should be based on something ordinary and close to the life of students. For example, giving examples of forest and land fire disasters (karhutla) that students in Indonesia experience almost every year. Teachers will more easily teach the concept of smoke disaster mitigation to students, especially students who have felt directly (being near the source of forest and land fires).

Teachers need to consider specifics when they want to design a learning that is carried out. This consideration can be seen from various factors, including the urgency or usefulness of the material. In teaching disaster mitigation in the classroom, teachers need to pay attention to how and what disasters are common or have been experienced by students so that learning can produce something meaningful. Motivating factors on the importance of teaching mitigation concept is crucial for teachers to include in their course planning, material development, and teaching techniques [23]. Smoke disasters have happened before and are likely to happen again. Therefore, teachers need to have a better understanding of smoke mitigation and then teach the students.

Based on the results of the PCK, two teachers are in the category of very prepared. The teacher explained several factors that influence to teach the concept of smoke disaster mitigation. One of them is the frequent forest fires in Indonesia every year, especially in Riau province, where teachers and students live. With this annual disaster, it is inevitable that students need to be aware, prepared, and equipped with the necessary knowledge and practical mitigation procedures. Four teachers revealed that their PCK was ready. Given that wildfires have just occurred in the province, teaching mitigation is important to prepare for the necessary mitigation procedures. Four teachers whose PCK is not ready to consider the importance of teaching mitigation concepts have a lot to do with the health impacts they cause. Six teachers whose PCK was not ready admitted that they did not understand the supporting factors to teach disaster mitigation.

The teacher's ability to consider various factors in learning has started well compared to the previous five indicators. This can be seen from the six teachers studied showing achievements in the category are very ready and ready. Where they can relate the learning of smoke disaster mitigation with forest fires that occur almost every year. Even so, there are still teachers who are not ready and do not understand well about the supporting factors for the teaching of disaster mitigation concepts which will certainly affect the low level of student understanding.

3.7. Techniques to teach the concept of the smoke disaster

Teaching and learning are not an easy task. Teachers need to see the different potentials of students, differences seen from the mindset and imagination of students. Learning activities need to be chosen by teachers in order to provide space and freedom for students to create and develop their creativity. Knowledge of teaching techniques and methods must be mastered by teachers to choose the right activities in teaching a concept of learning materials.

Teaching is a skill that must continue to be trained. Teaching is not just conveying material, but it is necessary to consider facilities and media that are in accordance with the concept of the material to be taught.

Teaching is an activity that demands renewal and the process of finding the best learning techniques that will later be applied to students. Teachers have strong control and play a role in determining the activities to be carried out in class. Teachers should be able to provide learning that encourages students to be actively involved and facilitates the abilities or potential that students have well.

Teachers need to choose the right techniques in teaching the concept of disaster mitigation. This can be done with simple and contextual teaching steps so that students will be encouraged to make a connection between the knowledge they have and the application in everyday life. The impact if the teacher is right in choosing techniques to teach this disaster mitigation concept is that teachers will more easily teach material concepts and students will be easier to understand learning. The procedure in teaching the smoke disaster concept can be done by the teachers explaining simple and contextual things [24], [25]. They can relate the learning materials to real-world situations and connect their knowledge to practical application. In doing so, their understanding can be achieved.

Based on the results, two teachers showed that his PCK was very prepared and explained how he adapted the materials and media used. Three teachers said that his PCK was ready and explained the steps in teaching the concept, although it was not supported by the smoke disaster mitigation learning media. Another four teachers indicated that their PCK was not prepared by not responding adequately to the questions given. The teacher is supposed to explain the procedure of how he will teach disaster management efforts. Seven other teachers mentioned that their PCK was not ready because of their lack of understanding of smoke disaster mitigation.

Mastery of teachers regarding learning techniques is still a concern. This can be seen from the number of teachers who are in the achievements are not ready and not ready compared to teachers who are in the achievements are very ready and ready. Thus, teachers must learn well about learning techniques that can be used to help make it easier for students to understand the material, especially materials about mitigating smoke disasters.

3.8. Specific techniques to ensure students' understanding of the smoke disaster concept

Teachers must have specific techniques to know the extent to which students can understand the learning material. This technique is related to the assessment that is used as an evaluation material. Assessment is the process of measuring students' learning outcomes in terms of cognitive, affective, and psychomotor. Teachers must carry out the assessment process in classroom learning. A teacher needs to understand the concept of assessment techniques to find out whether learning goals can be achieved or not. If there are shortcomings in the learning process, then through proper assessment the teacher can correct the shortcomings experienced by students. Good judgment will affect the provision of good solutions as well.

There are many ways that teachers can do to determine whether learning goals can be achieved by students or not. Teachers can evaluate in various ways either directly or indirectly. A teacher must carry out an evaluation process in order to take appropriate actions to overcome problems in learning in the classroom. The evaluation process is used as a benchmark to find out the success of a learning through student achievements towards expected learning goals. The evaluation process will have an impact on the efforts made by teachers in improving the implementation of learning that has not been maximized.

Consideration of the value and meaning of learning is a process in ensuring students' understanding of a concept. Teachers need to conduct an evaluation process to find out students' achievements in understanding the concept of disaster mitigation. This is done so that teachers can take appropriate actions in emphasizing or improving concepts that have been and have not been understood by students, so that the goals of the disaster mitigation concept can be achieved. The specific way to ensure the students' understanding of concepts in learning is the evaluation process. Evaluation is a process of considering the value and meaning of something to be considered [26]. Moreover, it is also defined as the considering process of the learning process value and meaning [27], [28]. Evaluation in learning is determining conditions, describing, obtaining, and presenting information to achieve the learning objectives [29].

The Co-Res questionnaire showed that four teachers had PCK achievements ready. Where the teacher sees the student's initial understanding before teaching a concept. Ten teachers indicated that their PCK was not yet ready because they lacked understanding of how to ensure students' understanding related to the concept of disaster mitigation. Two other teachers said they did not know how to see and understand the abilities students had about mitigating smoke disasters.

The ability of teachers in conducting the evaluation process in learning is still a concern. This can be seen from 16 teachers showing that the achievements in the category are not ready and unprepared. Where they are not ready and do not understand well about the techniques of assessing the knowledge possessed by students, so it will affect the achievement of learning goals that are less than optimal.

3.9. How to utilize existing technology in learning materials

The era of globalization is characterized by the rapid development of technology in life. This requires that humans must be able to increase their resources so as not to be left behind and able to compete in these developments. In addition, technology can also make it easier for humans to live their lives. Teachers as people who play a role in education, need to utilize technology to help the learning process.

The era of globalization is a challenge for teachers to provide quality learning with the use of technology. This is expected so that technology and education can run side by side and be able to provide a meaningful learning experience. Education in the current era of globalization requires teachers to be able to do information and communication technology (ICT)-based learning. ICT-based learning can help teachers in improving students' ability to understand disaster mitigation concepts. Teachers can utilize technology as a medium and learning resource for students so as not to be left behind by the ever-evolving technological advances.

Education in the current globalization era demands ICT-based learning. Therefore, as organizers of learning in the global era, teachers must use ICT media, especially computers and the internet. Information technology-based learning is to assist them in improving the learning quality. If they ignore it, they will be left behind in information, limited learning resources, and inequality ability with the students who have been already familiar with the use of computers and the internet [30]. Based on three teachers said that his PCK was very prepared by stating that he used information and communication technology as a learning resource. This technology is used to simulate smoke disaster mitigation. As a result, students can better understand the concept of disaster mitigation through simulation materials. Two teachers revealed that their PCK is at a ready achievement, where they use creative learning media to support the teaching process on the concept of smoke disaster mitigation. Ten teachers showed that his PCK was at an unprepared achievement. Teachers only use technology media that is less varied because they are not very mastery of technology. One other teacher who was on the achievement was not ready, claiming that they did not use media that utilized technology. This is because they do not understand how technology is used in learning.

From the 16 teachers studied, there are still many who are at the stage of not being ready and not being ready to utilize technology in learning, namely eleven people. Nevertheless, there are five teachers who are in the category of very ready and ready. They realize that technology will continue to evolve and they must be able to adapt to learning new technologies. This awareness will be able to increase the understanding of student disaster mitigation concepts with the technological experience presented by teachers.

4. CONCLUSION

The current research shows that teachers' pedagogical content understanding on disaster mitigation is below average. Content representation methods are used to assess teachers' comprehension of a topic or curriculum. The Co-Res questionnaire provided an accurate image of the teacher's pedagogical content knowledge in minimizing forest and land fire disasters. During the research, the instructors are asked to describe how their plans connect to disaster mitigation education. As a result, they are not yet prepared to teach students about mitigation techniques. That means their efforts are required to strengthen their capacity to pre-pare ahead of time.

In the context of PCK, the teacher's competencies must be improved. This is be-cause PCK is considered as an opportunity to improve teacher professionalism. Educators must have mastery of the content of the material and how to teach it or a mixture of content and pedagogics that form a knowledge of how a topic, problem, or issue is organized and represented that is adapted to the learner's abilities. PCK's novelty may be increased by synthesizing and integrating many domains of knowledge, such as those relating to assessment, curriculum, students, instructional methodologies, teaching goals, and the nature of science. In this setting, teachers must have a solid comprehension of mitigation materials and media that may help students recognize the necessity of natural disaster mitigation.

From the findings and discussions of the result, it is recommended that learning about disaster mitigation is essential for students, especially those living in areas where natural disasters frequently occur. Therefore, school authorities must incorporate disaster mitigation materials into their teaching curriculum. Schools need to prepare teachers for teaching disaster mitigation by inviting first responders, such as firefighters, emergency service, or officials from National Board for Disaster Management. Finally, the teachers need to improve their understanding of disaster mitigation and their teaching technique to deliver the mitigation materials relevant to the students.

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