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# PCK-STEM Primary School Teacher Disaster Mitigation: Preliminary Test Using PaP-eRs

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**Abstract** This manuscript is written based on a portion of research conducted on elementary school teachers in areas that are often flooded. The purpose of this manuscript is to map the initial abilities of PCK teachers in teaching disaster mitigation. Data was collected using the PaP-eRs which was compiled in reference to basic teaching skills. From the results of the discussion shows the level of PCK disaster mitigation of elementary school teachers in categories that have not yet emerged and are emerging. The basic teaching skills found did not show satisfactory results for all aspects assessed. This means that primary school teachers in teaching disaster mitigation still need to be improved at a higher level. In addition, in general teachers need to improve their abilities in all aspects of basic teaching skills, especially related to teaching disaster mitigation with the STEM.

Keywords: PCK, Disaster Mitigation, Elementary Schools, PaP-eRs

## 1. Introduction

STEM is an integration between science, technology, engineering and mathematics that develops in developed and developing countries. STEM is an integration of the four fields in real world problems and problem based learning. This approach can create an active learning because it combines the four fields as a whole in solving problems found in the real world and in the learning itself (Torlakson. T, 2014)

This approach can provide training to students to be able to realize the integration of the four fields. In the learning process will produce knowledge of the subject or content learned will be better understood by students. The character in this STEM learning approach is how students recognize a concept in a problem. So by conducting an experiment for example, students can recognize a concept found in the experiment. STEM learning is suitable to be applied in education from an early age so students can already combine themselves with knowledge and skills.

In this learning requires a teacher who presents content and pedagogy in an integrated manner so that learning also runs well. Furthermore, this learning must also adjust to thematic learning because it is in accordance with basic school education that has implemented thematic learning. Therefore, a good learning planning framework is needed within the PCK (Pedagogical Content Knowledge) framework (Shulman, 1986).

PCK is the teacher's knowledge about the presentation of content in teaching and the use of specific strategies appropriate for student understanding to be achieved. PCK is based on the statement that proper teaching is not just about delivering knowledge but on the quality of the content delivered and the application of the content that has been taught.

PCK provides the idea that in teaching students not only convey knowledge but also in the application of knowledge through skills. PCK is a form of teacher professional knowledge that is organized differently from the teacher's content knowledge.

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In exploring teacher PCK, the COR (Representation of Content) and PaP-eR (Repertoire of Pedagogical and Professional Experience) documents are needed. (Mulhall, 2012; Bertram, 2014). By analyzing the CoRes and PaP-eRs documents the effectiveness of classroom learning activities will show whether they are in line with the objectives to be achieved in learning. In this study, the focus of this research is to look at the implementation of learning content and follow-up on the use of technology taught by the teacher. So the focus of this research is to look at the PCK of teachers in terms of the PaP-eRs document they produce.

PaP-eRs are one way to capture the holistic and complexity of PCK, more than is possible in CoRe. PaP-eRs have the ability to represent the whole narrative, and function to explain in the text what people know in their actions as teachers (Bertram, 2014). PaP-eRs are narratives related to teacher PCK implementation that focus on the content of the material taught by the teacher. PaP-eRs are intended as a reflection or improvement of PCK that has been applied by teachers in the learning process in the classroom. PaP-eRs also illustrate the reason for the teacher in taking certain actions or steps in implementing the teaching concept. The PaP-eRs document that is filled out by the teacher is useful to find out how the teacher's mastery in understanding the use of PCK during learning. Some of them come from basic teaching skills (Kafyulilo, Fisser, & Voogt, 2016). Of course, filling in the PaP-eRs document will produce a different opinion for each teacher. Documents filled out by the teacher will produce factual descriptions of learning activities in the classroom as a reflection of the teacher's professionalism after teaching. So that the teacher's knowledge of the content being taught will be obtained, how to teach content, student responses to content teaching, and actions taken by the teacher during the learning process.

The term STEM was first launched by the US National Science Foundation in the 1990s under the name SMET, but the term was not agreed upon by some parties which was later changed to the theme of the education reform movement in four disciplines to grow the workforce. In the field of STEM, and to develop citizens who master the science of STEM (STEM literature), and enhance the global competitiveness of the United States (The approach of the four fields of science is a field of collaboration that matches the problems that occur in the real world (Torlakson. T, 2014)

STEM is an integration of four scientific disciplines namely science, technology, engineering, and mathematics in an interdisciplinary approach and is applied based on real world context and problem based learning. The four STEM disciplines can be explained as follows: (a) Science, which is natural science, represents natural laws relating to physics, chemistry, and biology and medicine or the application of facts, principles, concepts, and convection related to scientific disciplines. (B) Technology (technology), which is a skill or system used in managing society, organization, knowledge or can be defined as a product of the essence of science and engineering. (c) Engineering (engineering), namely engineering knowledge by utilizing concepts from science and mathematics and technological tools to solve problems. (d) Mathematics (mathematics), which is knowledge that links between quantity, space, and numbers that require logical arguments. The four fields of science can make knowledge more meaningful if it is integrated in the learning process. The purpose of STEM is designed to improve the ability of people in science and technology to be able to compete globally (Torlakson. T, 2014)

STEM education must include: (a) integration of technology and engineering into science and mathematics; (B) prioritize scientific inquiry and engineering design, including mathematics and science instruction; (c) a collaborative approach to learning, connecting students and educators with STEM; (d) provide a global and multi-perspective perspective; (e) combining strategies such as project-based learning, providing formal and informal learning experiences; and (f) incorporating appropriate technology to enhance learning.

One focus of attention in education is the problem of disasters that often occur recently in Indonesia. Disasters have an impact on humans and the environment. Disaster risk is caused by the lack of proper disaster management, environmental impacts, and human activities.

Disaster mitigation can be done as early as possible by elementary school students by introducing the concept of disaster first. Education can provide students' knowledge and skills in dealing with natural disasters. Disaster mitigation education is an important requirement for students to reduce the impact of natural disasters both now and in the future. At present disaster education materials are still little studied in schools in Indonesia (Rizaldy, 2018). With the knowledge of disaster mitigation, students will get used to finding solutions to the problems of natural disasters they face. Students will produce outputs on disaster mitigation in the form of products that can be used in disaster mitigation.

## 2. Methodology

This manuscript reports a portion of research on primary school teacher disaster mitigation designs. Data was collected from eight elementary school teachers who teach in primary schools in flood-affected areas. Teachers are tested using the PaP-eRs instrument which is compiled based on basic teaching skills (Putra, 2017). The PaP-eRs indicators compiled based on basic teaching skills are as follows.

PaP-eRs indicator

**Table 1.** The PaP-eRs Indicators

1. Identify and utilize students' initial knowledge
2. Determine the right conditions for students to start new learning
3. Increase student attention and discipline
4. Using certain techniques to respond to student diversity
5. Using questioning and probing techniques
6. Choosing the right methods and strategies according to the conditions of students' knowledge
7. Guiding students to understand
8. Review students' new knowledge
9. Select and use media / learning sources
10. Choose the right technique to evaluate
11. Advanced learning

The PaP-eRs document is then categorized as not appearing, starting to appear and already appearing. Furthermore, researchers make conclusions about the findings obtained.

## 3. Result and Discussion

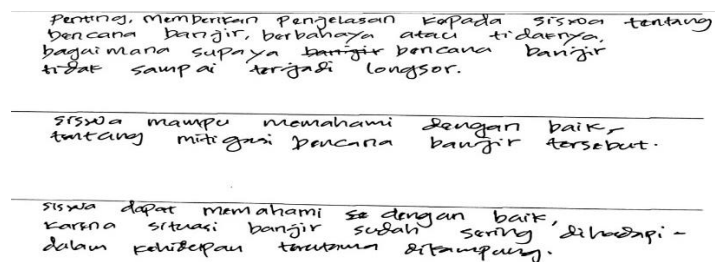
The teacher is a determinant of learning activities, because with appropriate learning activities teachers can run effectively. One effort that can be done by teachers is to improve the quality of planning not only in written form but also in the form of mindset planning. One effort to see the mindset of learning in teachers is to see the PCK the teacher has when going to teach in class. The following is the mindset of the teachers regarding disaster mitigation.

### 3.1. Identification and utilization of students' initial knowledge

When planning, teachers consider knowledge about this aspect in determining learning approaches or determining learning activities and activities, so that teachers can teach topics appropriately to students in the classroom in specific teaching and learning situations (Loughran, Berry, & Mulhall, 2006; Anwar, 2014).

Two teachers pointed out that PCK has emerged by answering questions and has applied in learning that identifying students' initial knowledge is an important step by providing an explanation of the effects of floods and how to overcome them, so students can understand well how disaster mitigation is because students are accustomed to experiencing flood conditions in their area so that students' initial knowledge is very influential in learning activities by understanding the concept of disaster mitigation.

Three teachers indicated that PCK began to emerge by answering questions identifying students' initial knowledge by giving an explanation of the dangers of flooding but the teacher did not finish answering because it only explained that students understood the material well and were enthusiastic without explaining how students understood it well and the effect of students' initial knowledge on activities learn.

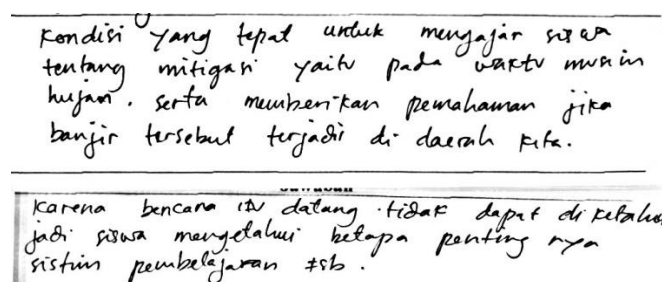


**Figure 1.** Identification and utilization of students' initial knowledge

Three teachers indicated that PCK did not emerge by answering questions about how to provide initial knowledge to students only by informing the danger of flooding, then being able to understand students well, and not being able to explain how students' understanding of material well and not being able to explain the effect of students' initial knowledge on learning activities, only students can understand the importance of preserving nature.

### 3.2. Time Determine the right conditions for students to start new learning

Two teachers have appeared PCK by answering questions and have determined the right conditions for students to learn about the concept of flood disaster mitigation is when students are in the rainy season or the rainy season while learning this concept, so students experience it themselves and understand that the coming disaster is not predictable and students have prepared disaster mitigation before or after the flood.



**Figure 2** Time Determine the right conditions for students to start new learning

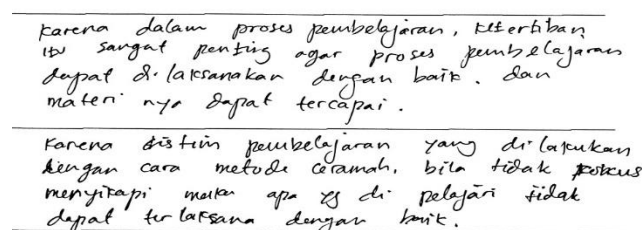
A teacher shows that the answer is incomplete and PCK starts to emerge by determining the right conditions to start teaching the concept of flood disaster mitigation is to start early, because students must know the signs of flooding and anticipate it, this answer is incomplete because the teacher only explains the condition of students which is too general beginning without explaining the situation conditions or students' knowledge about flood disaster mitigation.

Five teachers answered this problem is incomplete and has not yet arisen because the teacher answers the question doubtfully that the right conditions for students to start learning the concept of disaster mitigation are when students are in good condition but cannot describe what conditions students must be. The teacher explains that students must learn about disaster mitigation because students must know the signs of flooding and anticipate them.

### 3.3 Increase student attention and discipline

Four teachers answer the full question that efforts to focus attention and discipline students are important to make the learning process run smoothly and the material delivered can be achieved. The teacher has applied this concentration method by using the lecture method in the delivery of learning material. This effort is very important so students can focus on the reception of the material delivered by the teacher and the learning process properly.

A teacher answers incomplete but has begun to make this effort because efforts to focus student attention are important for teachers to get good results but the teacher does not describe the specific activities carried out as a form of attention that is focused and disciplining students.



**Figure 3** Increase student attention and discipline

Three teachers have not answered the question completely, the teacher only answered that the focus on students' attention and discipline is important but does not explain why this is important and does not explain and has not done activities such as what is done in an effort to discipline students, the teacher only explains that this effort is for learning running smoothly.

### 3.4 Using certain techniques to respond to student diversity

A teacher answers questions fully and has applied question and answer techniques to see various levels of student understanding. These questions and answers are carried out to determine the extent of student understanding of the results if students who understand will easily answer and understand the material while weak students need more attention from the teacher.

maka akan dilakukan tanya jawab sesuai dengan pemahaman yg siswa miliki

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karena siswa yang pintar ia akan mudah memahami materi yang di berikan .. sedang kan siswa yang lemah mereka memerlukan perhatian yg lebih .

**Figure 4.** using certain techniques to respond to student diversity

Four teachers have used techniques to respond to student diversity by conducting tutoring, this tutoring is done because students must understand the material being taught, but the teacher does not explain what type of tutoring is done to see differences in the level of student understanding.

Three teachers have not applied the technique to respond to student diversity, because the teacher has not explained what kind of technique will be done if there is a different understanding by students. The teacher explains that things done to respond to student diversity are carried out so that student grades are achieved as expected

### 3.5 Using questioning and probing techniques

Two students have raised PCK and applied pushing and investigating techniques when teaching disaster mitigation materials to encourage students' thinking skills, the teacher used pushing and investigating techniques so that students could ask questions and answers in a loud and directed voice such as when students were asked to do role plays.

Four teachers answered incomplete so PCK began to appear. The teacher applies asking and probing techniques so that students are guided in disaster mitigation, but the teacher does not explain the technique clearly, the teacher only explains why promising and investigating techniques are important.

teknik bertanya pada saat mengajar bertujuan membantu siswa dan mengarahkan ke materi mitigasi untuk mendorong kemampuan berfikir siswa.

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- karena dengan teknik probing dan probing siswa dapat menjawab pertanyaan dengan suara nyaring. contohanya bertanya memainkan peran.

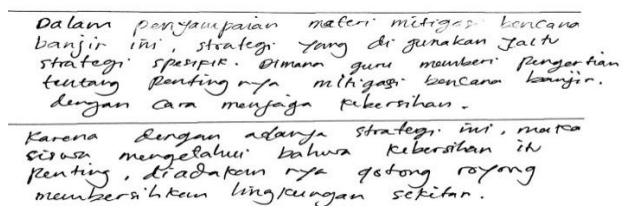
**Figure 5.** Using questioning and probing techniques

Two teachers have not yet appeared PCK and have not yet applied asking and asking questions because the teacher only explained that this technique was important so students were aware but did not explain the implementation of the techniques carried out in class and explained their reasons for asking for prompts and investigating clearly.

### 3.6 Choosing the right methods and strategies according to the conditions of students' knowledge

A teacher has appeared at PCK and implemented a special strategy to explain flood mitigation by maintaining cleanliness, as well as conducting mutual cooperation as a form of student understanding of the delivery of flood disaster mitigation materials so that students know how to reduce before flood disasters by maintaining environmental cleanliness.

Six teachers answered incomplete and PCK began to appear in the teacher's answer and provided a strategy for delivering disaster material by explaining an understanding of flood disaster mitigation so students knew the importance of maintaining cleanliness, but the teacher had not explained further about the strategy he did more clearly



Dalam penyampaian materi mitigasi bencana banjir ini, strategi yang digunakan yaitu strategi spesifik. Dimana guru memberi pengertian tentang penting nya mitigasi bencana banjir. dengan cara menjaga kebersihan.

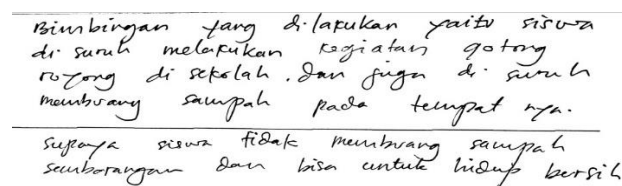
Karena dengan adanya strategi ini, maka siswa mengetahui bahwa kebersihan itu penting, diadakan nya gotong royong membersihkan lingkungan sekitar.

**Figure 6** Choosing the right methods and strategies according to the conditions of students' knowledge

A teacher has not yet appeared and implemented a specific strategy used in the delivery of disaster mitigation materials, the teacher only replied that he used a special strategy to facilitate student understanding but did not explain what strategy was done for students.

### 3.7 Guiding students to understand

Two teachers have applied guidance to students to understand flood disaster mitigation through the application, namely students are asked in groups to work together and are accustomed to throwing garbage in their places, through this application the teacher guides students to understand things that can be done before the flood occurs.



Bimbingan yang dilakukan yaitu siswa di suruh melakukan kegiatan gotong royong di sekolah. dan juga di suruh membuang sampah pada tempat nya.

supaya siswa tidak membuang sampah sembarangan dan bisa untuk hidup bersih.

**Figure 7** Guiding students to understand

Four teachers began to appear PCK and conduct tutoring such as group learning, tutoring so that students understand disaster mitigation material. But the teacher does not explain what group guidance is being guided to students, so the teacher's answers are incomplete in the implementation of the guidance. Two teachers have not made PCK with the teacher's answers guiding students with various methods, but it is not explained what methods are used to guide students to understand the concept of disaster mitigation and the teacher who does this guidance is important for children to act but act as what is expected not explained by the teacher.

### 3.8 Review students' new knowledge

Two teachers have raised the PCK and answered in full explaining that it is important to review knowledge about the concept of flood disaster mitigation so that students remember past learning and do not forget easily, and sharpen their thinking and understanding of the concept of disaster mitigation taught by the teacher.

Penting, untuk mengulangi pembelajaran yang telah lalu dan agar tidak mudah lupa.

Karena untuk mengasimilasi pemikiran dan penambahannya dalam pembelajaran tersebut.

**Figure 8** Review students' new knowledge

Four teachers showed answers that PCK had just appeared and answered incomplete on the grounds that this review was important to do so students would remember lessons from the past, the teacher did not explain the reasons for the other comments more clearly.

Two teachers showed the results that PCK had not yet appeared by providing answers that it was important to review the development of students' knowledge about the concept of disaster mitigation on the grounds that students quickly became smart so the answers given by the teacher were incomplete. .

### 3.9 Select and use media / learning sources

Two teachers have raised PCK by applying the use of media / learning resources to teach the concept of disaster mitigation by displaying images of natural disasters that occur so students know that disasters can occur without predictable biases and see how important it is to learn about disaster mitigation so that disasters do not happened as the teacher pointed out in a media disaster.

Media yang di gunakan yaitu memperlihatkan kan gambar bencana alam yg terjadi

Supaya siswa tau, bahwa bencana itu bisa terjadi kapan saja, dan mereka tau pentingnya materi itu di ajar kan.

**Figure 9** Select and use media / learning sources

Five teachers have used media / resources to teach the concept of disaster mitigation with natural disaster media, but the teacher did not explain the specific form of media used, the teacher chose this media so that the answer is incomplete and the teacher uses this media because it is easy to find and understand in the material natural disaster mitigation.

A teacher answers by pointing out that PCK has not yet emerged with the answer that the media / resources used by teachers to teach the concept of disaster mitigation are media that are appropriate to the level of students, but the teacher does not explain what media / sources are used when teaching students, and this media is for the teacher as an explanation of the material, but the teacher also does not describe the explanation as what is in the media or the source chosen by the teacher.



### 3.10 Choose the right technique to evaluate

Six teachers answered questions that gave rise to the PCK of teachers by choosing techniques in evaluating the concept of flood disaster mitigation by testing the effectiveness of the postal media on flood disaster preparedness, which is considered in conducting an assessment is the activity of assessment. Students in class, student activity is a reaction to students' understanding of disaster mitigation materials.

melakukan uji tingkat keefektifan media  
poses, kesiap siagaan ~~dan~~ terhadap bencana  
banjir pada siswa SD.

yang menjadi pertimbangan yaitu keaktifan  
siswa

**Figure 10** choose the right technique to evaluate

A teacher answers questions that begin to improve PCK by choosing performance techniques to conduct assessments on the grounds that conducting this assessment is environmental, but the teacher does not explain the selected judgment.

A teacher answers questions that have not yet arisen by PCK by choosing an open assessment in assessing the concept of flood disaster mitigation understood by students and the consideration is the ability of students, but this explanation is incomplete because it does not explain the open assessment more clearly

### 3.11 Advanced learning

Two teachers answered questions that raised PCK by following up learning through activities carried out by students after understanding the concept of working together, the consideration of choosing this follow-up activity was the student's activity in understanding the concept of flood disaster mitigation.

berkerja sama dan bergotong royong dalam  
memahami konsep pembelajaran.

keaktifan siswa dalam memahami konsep  
pembelajaran.

**Figure 11** Advanced learning

Four teachers answered questions raising PCK by following up on learning through activities undertaken by students after understanding the concept of doing groups or independent activities carried out wherever students are, but the teacher did not explain group activities or independent learning as to what students would do.

Two teachers answered questions that did not improve PCK by following up on learning through activities carried out by students after understanding the concepts of mutual cooperation and self-care but did not answer and explain the considerations in choosing this follow-up activity.

In general, teacher representation (PCK-STEM) in teaching disaster mitigation is still relatively low. This means that teachers' teaching readiness does not have sufficient capacity. Like the findings of previous research on the contribution of learning in LPTK on PCK teachers is quite adequate although initially the representation of the concept of teachers was still low (Anwar, 2014)

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#### 4. Conclusion

Based on the analysis data, that the PCK-STEM of elementary school teachers tested using the PaP-eRs instrument is below the average ability expected in almost all assessment indicators. This means that if during this study teachers were asked to teach disaster mitigation with the STEM approach that was in accordance with basic teaching skills as expected, then efforts were needed to improve their teaching skills first.

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