Classification of cultural capital to view profile of pedagogical content knowledge mathematics teachers in gayo highlands

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Abstract. Teachers with a variety of cultural capital backgrounds must be able to deliver content of material and be able to integrate the content knowledge taught into knowledge about the curriculum, the use of learning strategies and models, as well as an understanding of the characteristics of students’ abilities individually and in groups. Various teacher abilities are known as Pedagogical Content Knowledge (PCK). This study was conducted to determine the PCK profile of Mathematics teachers from the identification of cultural capital in the Gayo Highland state senior high schools. This research was conducted in 5 state Senior High Schools in Gayo Highland. The population in this study were all high school mathematics teachers in Gayo Highland. While the sample in this study were 10 Mathematics teachers from state senior high school in Gayo Highland who were selected using cluster sampling. The method used in this research is quantitative method with descriptive analysis through survey design. Teachers' PCK scores were obtained with Content Representation (CoRe) instruments and triangulation data with student questionnaires and school principal supervision sheets. The results showed that the Mathematics teachers' PCK profile from the cultural capital classification in the Gayo Highlands High School was at the level of the growing PCK.

1. Introduction
Teaching is a physical activity conducted in a classroom that involves teachers as instructors and students to be taught. Teaching is not only limited to the process of delivering information from teachers to students. Teaching also requires expertise and intuition so that activities that occur are very complex which involve many activities and actions taken. Constructivism sees teaching activities is as an activity that allows students to build their own knowledge with the participation of teachers as instructors in building the knowledge, finding clarity, giving meaning to bring critical attitudes of students as the learners in drawing conclusions. Teaching in this context means helping someone to think correctly by letting him find his own thoughts [1,2].

Article 1 subsection 1 of Law No. 14 of 2005 concerning on the Teachers and Lecturers states that teachers are professional educators with the main task of educating, teaching, guiding, directing, training, assessing, and evaluating students in early childhood education, formal education, basic education and secondary education [3]. In order to be able to carry out this task, the teacher must have a number of prerequisites including academic qualifications, competencies, educator certificates,
physical and spiritual health, so that they have the ability to realize the national education goals [4,5]. During learning the teacher should be able to accommodate all students' thinking skills, because the ability to think of one student with another can be different. The ability to think of students can not only be described from cognitive abilities alone. Affective and psychomotor abilities also contribute meaningfully. Zulmaulida said that someone who thinks critically can be seen from how and what results are obtained when solving problems and that is not only seen from the cognitive abilities he showed [6,7].

Seeing the seriousness and meaningfulness of teaching correctly, teachers should have knowledge and skills about how to teach the material and also instill the meaning of what is taught. The teacher must be able to convey more than just the content of the material being taught, the teacher who is expected to also be able to integrate content knowledge taught into the knowledge about the curriculum, learning, and strategies as well as an understanding of the characteristics of students' abilities [8]. This combination of knowledge will ultimately help the teacher manages the learning situation according to the needs of individual students and groups. This knowledge can cause the application of appropriate learning models in order to include the various characteristics of individual abilities of the students. These knowledge are expressed with the knowledge of pedagogical content or Pedagogical Content Knowledge (PCK) [9].

Based on preliminary studies, Mathematics learning in the Middle Aceh District High School was still found inappropriate application of the learning model for some materials. This is likely due to the Mathematics teacher's PCK have not reached a high leveleyet. So that the mastery of students towards Mathematics material is still disappointing. Since strong knowledge of content (concepts) from a teacher will have a positive influence on decision making related to changes in teaching strategies [10,11]. Achievement of teacher PCK that has not been maximized is also influenced by the role of cultural capital that exists in it. Cultural capital which is essentially an intellectual qualification obtained from formal education such as the ability to present themselves in public, and a variety of knowledge and certain skills of the results of formal education including certificates (educators) and undergraduate degrees [12]. Based on this background, it is necessary to know the teacher's PCK so that it can obtain an overview of the quality and flexibility of mastering their content. PCK's results from mapping through cultural capital qualifications are expected to be the basis for improving teacher professionalism and training in the future.

2. Method
The method used in this study is a quantitative method with descriptive analysis. Rationalization of the selection of this design is economic factor and length of time in presenting the data [13]. Data collection in this study was carried out with the following techniques: 1) Questionnaire, in the form of a CoRe instrument sheet which will be filled by the teacher, 2) Observation sheet, in the form of a school principal's supervision sheet for teachers that have been carried out in the current school year, 3) Questionnaire, to find out the educational background, training, and experience of the teacher, 4) Questionnaire, to find out the students' response toward the learning. Then triangulation of data sourced from the contents of the teacher in the CoRe sheet was conducted, percentage data from student questionnaires, and percentage data from the principal's supervision sheet. Triangulation is a combination of several data collection techniques that have been conducted which aim to test the credibility of data from various data sources. Sugiyono said triangulation does not aim to find the truth of a phenomenon, but rather to improve the researchers' understanding of what has been found [13,15,16].

The study was conducted in 5 state high schools in Gayo Highland by taking locations in Central Aceh. The population in this study were all high school mathematics teachers in the Gayo Highland located in Central Aceh. While the sample in this study were 10 Mathematics teachers from high schools who were selected by using cluster sampling.
3. Result and Discussion

The results of the questionnaire distribution to 10 teachers as the samples in this study who were scattered in Central Aceh Regency whose PCK at the growing level as many as 8 samples and 2 samples were at the pre-PCK level. No single sample reached the PCK maturity level.

CoRe instruments were analyzed using scoring based on 8 (eight) components adopted from Loughran. Analysis is done by scoring on each component described by the teacher. The score is given between 1-4 for each component described by the teacher. This Scoring criteria can be seen in Table 1. which is described based on the CoRe Casting Rubric in Table 1.

| Table 1. CoRe Component Criteria |
|----------------------------------|
| Skor | Criteria          |
| 25-32 | Maturing PCK     |
| 16-24 | Growing PCK      |
| 8-15  | Pra PCK          |

The results of the evaluation of the principal and the distribution of questionnaires to students and the value of CoRe are shown in Table 2 below.

| Table 2. Triangulasi |
|----------------------|
| No | Sampel | Principal Supervision | Student Questionnaire | CoRe |
|----|--------|------------------------|-----------------------|------|
| 1  | G1     | 87                     | 88                    | 17   |
| 2  | G2     | 100                    | 86                    | 19   |
| 3  | G3     | 85                     | 86                    | 23   |
| 4  | G4     | 88                     | 86                    | 15   |
| 5  | G5     | 97                     | 90                    | 20   |
| 6  | G6     | 100                    | 91                    | 21   |
| 7  | G7     | 92                     | 92                    | 22   |
| 8  | G8     | 74                     | 86                    | 15   |
| 9  | G9     | 90                     | 90                    | 17   |
| 10 | G10    | 97                     | 90                    | 20   |

The results obtained based on the recapitulation in the table above shows that the PCK score of the mathematics teacher has not reached the PCK maturity level. This result is strengthened by the results of the principal's school supervision and student questionnaire. The results of supervision carried out by the school principal were only two teachers who obtained perfect scores on the implementation of learning with the note that there were improvements in the use of more interactive media. The shortcomings seen by school principals in the other eight teachers revolved around the use of media that had not been maximized. Broadly speaking, the lack of use of media is also obtained from the results of student questionnaires. The results of the calculation of the CoRe instrument contents are shown in Table 3.

| Table 3. Accumulation of CoRe Score |
|-------------------------------------|
| No | Aspect | Total CoRe Score |
|----|--------|------------------|
|    | Objectives | Concept | Pedagogy | Evaluation |               |
| G1 | 5      | 5       | 5       | 2          | 17             |
| G2 | 4      | 6       | 6       | 3          | 19             |
| G3 | 6      | 9       | 5       | 3          | 23             |
The results in the CoRe sheet obtained information that on the aspect of goal, the most of teachers obtained a score of 5 out of a total score of 8 if the CoRe was filled properly. This showed that the teacher has begun to set goals to achieve the competencies of the concepts taught in accordance with those specified in the curriculum accurately. This can be seen from several things:

a. Already able to apply operational verbs in the learning objectives to achieve competencies according to the demands of Basic Competencies (KD).

b. Start to determine the dimensions of knowledge according to the competencies regulated in the curriculum, namely factual, conceptual, procedural, and metacognitive knowledge in accordance with the 2013 curriculum implementation policy at the high school level.

c. Can bring out important values from the chosen concept and its relation to the next concept and the daily life of students.

3.2 Teachers’ PCK profile determined from concept aspects at the CoRe instruments

In the concept aspect, it can be seen that the concept of three-dimensional space raised has referred to and related to the core concepts of the various interrelations between length, distance, and the location of various components in the three dimensional space. From the results of the CoRe instrument on the concept aspect, it was obtained a score of 6.7 out of 12 maximum score, but the teachers' ability to determine the breadth and depth of the material was good enough. Errors that are often done by the teacher in identifying and anticipating misconceptions of students. So that when they fill in the CoRe instrument, they tended not to write down student misconception points in detail. Though the ability to predict the potential of student learning difficulties with content is an important aspect of mathematics PCK [17]. The teachers' ability to convey concepts becomes a strong foundation in mathematics learning, especially the three dimensional space as a basic concept in learning space geometry. Applying the right concepts for students will build a variety of other mathematical abilities, including spatial abilities. Teacher participation in learning geometry at school is needed to train and develop students' mathematical spatial abilities [18].

3.3 Teacher’s PCK profile determined from pedagogical aspects at the CoRe instruments

The pedagogical aspect, in this study, referred to the ability of the teacher to adjust the learning strategy to the characteristics of the concepts in the material and the competencies to be achieved. After filling in the CoRe instrument it turned out that the average teacher score for pedagogical aspects was 4.5 out of a maximum score of 8. This result showed that the teacher had considered the use of media and the limitations in the use of the required facilities. The lack of learning done by the teacher is not considering the time allocation and conditions of diverse student abilities.

Likewise with the lack of diverse, learning models that are not mentioned in the CoRe instrument. Such as Problem Based Learning (PBL), jigsaw, and inquiry that match the three dimensional space space characters. This is due to the lack of teacher competency in choosing learning models that are in accordance with the material.
3.4 Teachers' PCK profile determined from evaluation aspects of CoRe instruments
In the evaluation aspect, the teacher got an average score of 2.7 from the maximum score 4. The teacher has used written tests in evaluating and some other forms of tests. The instrument developed has considered each concept, for example by using forms of essay and multiple choice questions. The teacher also used the principle of authentic assessment but has not been creative in developing other test instruments.

3.5 Effect of mathematics teachers' PCK development on three dimension space material in central aceh district senior high school
The factors that influence the teacher's PCK consist of four aspects that influence the CoRe instrument. These four aspects consist of aspects of objectives, concepts, pedagogy, and evaluation. Seeing the influence of these four aspects is obtained from the coefficient of determination of the following SPSS output in Tabel 4.

| Table 4. Koefisien Determination from The Objectives Aspect |
|------------------------------------------------------------|
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|-------|---|----------|------------------|--------------------------|
| 1     | .588¹ | .346 | .264 | 2.408 |

The objective aspect affected 34.6% of the development of the mathematics teacher's PCK 65.4% of the remainder was influenced by various other factors.

| Table 5. Koefisien Determination from Concept Aspect |
|----------------------------------------------------|
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|-------|---|----------|------------------|--------------------------|
| 1     | .888¹ | .788 | .762 | 1.370 |

The conceptual aspect affected 78.8% of the development of the mathematics teacher's PCK. The remaining 21.2% was influenced by various other factors.

| Table 6. Koefisien Determination from Pedagogical Aspect |
|----------------------------------------------------------|
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|-------|---|----------|------------------|--------------------------|
| 1     | .588¹ | .346 | .264 | 2.408 |

The pedagogical aspect affected 34.6% of the development of the mathematics teacher's PCK. The remaining 65.4% was influenced by various other factors.

| Table 7. Koefisien Determination from Evaluation Aspect |
|---------------------------------------------------------|
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|-------|---|----------|------------------|--------------------------|
| 1     | .221¹ | .049 | -.070 | 2.903 |

The evaluation aspect affected 4.9% of the development of the mathematics teacher's PCK. The remaining 95.1% was influenced by various other factors. Seen after the analysis was carried out, it was found that the concept aspect gave the greatest influence on the development of the mathematics teacher's PCK in Central Aceh.

3.6 Cultural capital classification that affects in the development of mathematics teachers' PCK in the three dimension space material in Central Aceh District senior high school
Based on the teacher's cultural capital data in the following Table 8, it can be seen that the high school mathematics teacher in Central Aceh District who was sampled in this study had a minimum
undergraduate (S1) educational background with a working period ranging from 5 to 15. The sample teachers were ranked from III / a to IV / b with experience in getting uneven education and training. Some have received training 1-2 times / year, but there are still those who have never attended education and training at all.

| No. | Nickname | Education | worked time | Rank/Grade | Training Award | Participate In Training   |
|-----|----------|-----------|-------------|------------|----------------|---------------------------|
| 1   | G1       | S1        | 15          | IV         | 3              | 1-2 times in/years        |
| 2   | G2       | S1        | 12          | III        | 4              | One time/three years      |
| 3   | G3       | S1        | 12          | III        | 3              | One time/three years      |
| 4   | G4       | S1        | 10          | III        | 1              | One time/three years      |
| 5   | G5       | S1        | 14          | IV         | 2              | 1-2 times in/years        |
| 6   | G6       | S1        | 12          | III        | 3              | 1-2 times in/years        |
| 7   | G7       | S1        | 12          | III        | 3              | One time/two years        |
| 8   | G8       | S1        | 5           | III        | 0              | Never                     |
| 9   | G9       | S1        | 12          | IV         | 3              | One time/three years      |
| 10  | G10      | S1        | 7           | III        | 2              | 1-2 times in/years        |

The experience of participating in education and training also supports the development of teachers' PCK [19,20,17]. Data showed that teachers who have never or rarely attended education and training one time/three years tend to have a lower PCK score. Even at the pre-PCK level. Because teachers who actively participate in education and training will record a fun learning process that is exemplified or demonstrated by mentors (lecturers, tutors, or instructors) that we follow during college or other educational and training programs. This result showed the cultural capital of each teacher can map his PCK profile.

4. Conclusion
Based on the results of data collection and analysis in this study, the researchers took some discussion and conclusions as follow. Mathematics Teachers' PCK profile on the three-dimensional space material in the Central Aceh District senior High School is at the PCK growing level of 8 people, and the remaining 2 people are at the pre-PCK level. Among the cultural capital there are supporting factors for the development of teacher PCK, such as teaching experiences and teacher participation in education and training programs. It is necessary to develop a teacher education and training program that focuses on aspects of the concept or deepening of teaching material, considering the concept aspect is the factor that has the greatest influence on the teacher's PCK profile. A more effective supervision pattern should be developed so that various cultural capital possessed can be one of the factors mapping the teacher's PCK profile.

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