Mastery of Content Representation (CoRes) Related TPACK High School Biology Teacher

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Abstract. The purpose of this study was to determine the mastery of Content Representation (CoRes) teachers related to the integration of technology and pedagogy in teaching Biology (TPACK). This research uses a descriptive method. The data were taken using instruments CoRes as the primary data and semi-structured interviews as supporting data. The subjects were biology teacher in class X MIA from four schools in Bandung. Teachers raised CoRes was analyzed using a scoring rubric CoRes with coding 1 - 3 then categorized into a group of upper, middle, or lower. The results showed that the two teachers in the lower category. This results means that the control of teachers in defining the essential concept in the CoRes has not been detailed and specific. Meanwhile, two other teachers were in the middle category. This means that the ability of teachers to determine the essential concepts in the CoRes are still inadequate so that still needs to be improved.

1. Introduction
Teachers today are growing according to its function to foster students to achieve educational goals [1]. In the era of globalization, not only the students who are required to have a lot of skill and compete in the technological progress that is increasingly sophisticated. Teachers also need to update their knowledge and skills, both in the fields of technology and science [2]. The rapid development of technology today makes many researchers feel that the technology should become an important part of the learning process, as was done by Koehler and Mishra that add technology into PCK concept introduced by Shulman becoming TPACK [3][4]. They assume that good teaching is teaching not only use components of content and pedagogy alone, but there must be a technology component in it. So that teachers is required to have seven essential components derived from TPACK components, namely TK, PK, CK, TPK, TCK, PCK, TPACK.

With the demands of procurement of component technology and pedagogy in learning, teachers often end up ignoring the importance of the content because it is too focused on the selection or the use of technology and pedagogy. As revealed by Shulman in research Van Driell, Verloop, and De Vos that teachers should not ignore the content in the learning process [5]. The use of technology and pedagogy basically is a tool that can be selected teachers to facilitate the delivery of concepts to students. That is why these components become crucial in the learning process and should be considered by the teacher. Another problem in the classroom is that many of the teachers are not in agreement with the educational background [6]. So that teachers will have difficulty in delivering the
right content to the students, even the teachers could be transferred her misconception to students that will raise the conceptual difficulties students [7].

Teachers are expected to select the content to be taught to students, mapping the core material that must be learned by students, where the additional material, and the material is not the time studied by the students [8]. Teachers are also expected to identify misconceptions or errors that may occur in the understanding of their students, as well as overcome the difficulties students in learning concepts to be taught. It certainly can be realized if the teacher has a good knowledge of the content, so it will have a positive influence on the teachers themselves and will have an impact on effective teaching [9]. Besides, the ability of teachers to identify the content to be taught influenced by curriculum factors, knowledge of the subject to be taught, and assessment standards to be used by the teacher [10]. Many studies of CoRes has been done, one of which is used to improve teacher PCK [11]. Research on CoRes also been done on the Concept of Human and Environment which reveals that PCK experienced teachers are in the medium category and prospective teachers in the high category [12]. Based on the explanation above, this study aims to see mastery Content Representation (CoRes) related teacher TPACK in learning biology.

2. Experimental Method

This study is a descriptive study which will give an idea of knowledge Content Representation (CoRes) teacher related TPACK on learning Biology. Researchers did not give the treatment of research subjects and only retrieve data without any changes. The subjects were four teachers biology class X MIA from four different schools in Bandung. Data collected through the document CoRes developed by Loughran [13]. CoRes consisted of 10 questions, namely: (1) What do you intend to the students to learn about this material? (2) Why is it important for students to master these concepts? (3) Related to the concepts to be taught, what concept that need to be explained and untimely known by students? (4) What are difficulties in teaching these concepts? (5) What is error of understanding or students misconceptions that is common in the concept? (6) What factors are likely to influence the teaching of the concept to the students? (7) What is local potential anything that can be used to help convey the concept? (8) What are the procedures or the order of teaching the concept? (9) How do you know the students already understand or not the concepts they are studying? (10) What are source learn that you used in this material?. These CoRes were analyzed using a scoring rubric CoRes with coding 1-3 developed from Hadiyanti [12] then categorized based on the number of coding score into the category of upper, middle, or lower. (See Table 1).

| Number of coding score | Categories  |
|------------------------|-------------|
| 24-30                  | Upper       |
| 17-23                  | Middle      |
| 10-16                  | Lower       |

3. Result and Discussion

Data used in this study is the result that obtained from CoRes document which developed by Loughran [13] and filled by participants before learning. All answers from the teacher at CoRes documents described below.

3.1. What do you intend to the students to learn about this material?

Concepts which students need to learn is the essential concepts that are important to know to develop their understanding of this topic [13]. Total concept or big idea raised by the teacher was never determined, but is generally 5-8 teacher raises important concept [13]. Based on the responses of teachers in the document CoRes about Kingdom Animalia, MI 8 raises important concept, RI 5
important concept. As for the material Kingdom Plantae, CI raises 13 important concept. But from the results of interviews conducted, all the teachers said that the essential concept to be taught to students of this topic is only about general characteristics, classification, and role. The exact number of essential concepts that emerged from the interviews could not be determined. Differences in the number of important concepts raised by the teachers influenced by the curriculum, time allocation, and teaching experience [12] [14].

3.2. Why is it important for students to master these concepts?

Two of the three teachers who teach the material Kingdom Animalia say that this concept is important for students so that they can distinguish animals from the different phylum. Students can also identify the animals in the surrounding environment better. In other words that consideration of the teacher to teach this concept is based on curriculum and benefit in student's daily life. However, one teacher can not express the importance of the concepts taught and said that this concept is already listed in the book and have to be taught. This is because teacher consideration in choosing concept is just textbooks.

As for the teachers who teach the Kingdom Plantae argued important concept is that the students should be able to distinguish the types of plants from different families and classes, as well as can identify plants in the neighborhood. A successful teacher is a teacher who can convey the concepts and relate them with student’s daily life and create the meaningful learning [13].

3.3. Related to the concepts to be taught, what concept that need to be explained and untimely known by students?

Almost all teachers have difficulties and confusion in answering this question. All the teachers have not been able to determine the limits of the concept. Clearly, even MI said that all concepts must be explained. RI and CI said that the scientific names of animals and plants as well as families or orders of animals and plants do not need to be explained in detail to the students. Teachers should know well the limits content to be delivered to students because not all concepts known by teachers must be taught.

3.4. What are difficulties in teaching these concepts?

Almost all of the teachers said that the limitations of the technology or media used in learning are the main problem in the learning process. Teachers also have difficulty in choosing learning strategy and model. Teachers certainly have its difficulties in learning [12], the difficulties were written by MI is allocation of a limited time, while very much a concept that should be taught. RI and CI says it’s hard to teach scholarly language of animals and plants. While EI said it is hard to bring real specimens to class to be introduced to the students.

3.5. What are error of understanding or students misconceptions that is common in the concept?

Teacher's ability to identify errors of understanding or misconceptions of students affected by the teaching experience and knowledge of the content being taught [13]. This is evident from the answers of teachers who teach the kingdom Animalia, which their students often think that animals of the phylum sponges are dying because of similar objects such as rocks, and snakes are invertebrate animals. Teachers expressed misconceptions is the result of a previous learning process and not through individual tests or interviews. Therefore, researchers use the term error of understanding not misconceptions because of misconceptions is a mistake in the learning process of science should be determined through specific testing [12].
3.6. What factors are likely to influence the teaching of the concept to the students?

All the teachers say the same thing about the factors that may affect the pursuit of the concept to students namely strategies, approaches, methods, and models chosen by the teachers. From the interviews conducted, the teacher also said that their understanding of the content being also taught significantly affect the teaching of the concept. MI, RI, and the CI as different teachers say that teaching experience is still less could affect how to teach these concepts. EI as an experienced teacher said that old age had made many of the concepts to be forgotten and should read the material back. EI also said that the conditions of the students and the learning environment is also very influential.

3.7. What is local potential that can be used to help convey the concept?

Exploiting local potential is indispensable in the learning process, the goal is students can more easily understand the concept of an example, which can be seen directly. Exploiting local potential will also be vital for the preservation of local wealth. Moreover, teachers can improve the quality of learning by utilizing and maximizing the potential of locally owned learning [15]. But in the learning process, especially the concept of kingdom Animalia invertebrate, no one of the teacher can exploit local potential. This is because most of the examples of invertebrates from the sea, while in the district Malangbong not has local potential from the sea. Whereas for example other invertebrates like Insecta widespread in any area, but the teacher does not utilize it. As for the material kingdom Plantae, CI also said that there is no typical Bandung plants that could be introduced to the students. CI only use the plants around the school but are not a common vegetation of the area though there are Garut orange (Malangbong entered district Garut) and Pelung chicken which is typical of plants and animals from West Java.

Some things that may affect the utilization of local potential is teachers’ understanding of the natural resources owned by the region and the potential availability of locally owned area is associated with content. Because not all of the content in Biology owned by an area. Therefore, the ability of teachers to identify the content and connect with local potential is needed to create a more meaningful learning process.

3.8. What are the procedures or the order of teaching the concept?

The procedure teaching is tailored to the teacher’s lesson plan, but the RI said that the teaching procedures used to focus more on the order of the material in the textbook. The method of teaching utilized by all teachers is the conventional method. Specifically on EI and CI adds the discussion method in learning. But overall learning implementation that teachers use still conventional methods.

When asked in an interview, the reason teachers are still using conventional methods because of limited facilities in schools so that there is no other choice than conventional methods. This indicates that the pedagogy of teachers is still less because it can not create meaningful learning on the grounds no technology can be utilized. Whereas the procedures taught by Mitchel and Mitchel is a tactic that selected teachers is a procedure to use, when, how, and why to increase the difference aspects of learning [13]. Although the actual procedure was chosen teaching can not guarantee to learn, but if used in the right way and the right time can influence the thinking of students and may be able to improve their understanding of learning better [13].

3.9. How do you know the students already understand or not the concepts they are studying?

All teachers choose an oral test to determine students who already understand or not the concept have learned at the end of each lesson. The oral test is done through questions and answers to students. However, CI teachers always do a written test in addition to the oral tests were performed. And all the teachers implement a written test end of each chapter of the concepts learned. This is consistent with
that expressed by Loughran [13] that the teacher should constantly monitor students' understanding and progress of both formal and informal.

3.10. What are learning resources that you used in this material?

In the learning process carried out, almost all teachers use learning resources in the form of the same textbooks used by students, in addition to using the internet as other supporting material. But CI teachers use the plants in the surrounding environment as a source of learning support. Based on the results of interviews conducted, the teacher said they rarely read journals / articles and textbooks to supplement the information. The reason is that it is easier to understand the content in the textbooks of students while journals and textbooks are tough to understand because of the discussion that is too deep.

Based on the answers to the teacher on the document CoRes, CoRes are then analyzed using a scoring rubric CoRes with coding 1-3 and categorized into a group of upper, middle, or lower. The results of the analysis of the coding of mastery Content Representation (CoRes) biology teacher presented in the table below.

| Teachers | Total score coding | Category |
|----------|--------------------|----------|
| MI       | 16                 | Lower    |
| RI       | 16                 | Lower    |
| CI       | 22                 | Middle   |
| EI       | 19                 | Middle   |

Table 2 shows that CoRes mastery of MI and RI are in the lower category while CI and EI are in the middle category. At the lower category, essential concepts that appear in the CoRes can not cover the essential concepts and details. Can not yet determine the important role of the concepts taught to students. Learning procedure is not described in detail and only refers to the textbook. Limitations of school facilities are the reason teachers still prefer the conventional method so that the learning procedure is also not specified in detail. In the middle category, teachers have started to cover the essential concepts and begin to be explained in detail. The determination of the essential concepts for students, not only based on the concept and curriculum structure but also consider the benefits in the daily lives of students. CI learning procedure refers to the RPP have been made and curriculum while EI refers to textbooks and curriculum. But learning methods have remained conventional and discussions. Has not been able to identify misconceptions students in detail and not exploit local potential to the fullest.

Based on the CoRes documents that have been analyzed and the results of interviews have been conducted shows that the control of teachers to the CoRes is still lacking. The lack of supporting facilities such technology in learning make teachers tend to retain the conventional method. In fact, 3 of 4 teachers are young and new teachers to learn about a wide range of strategies, methods, and models of learning, but do not apply them in the learning process to be carried out. All the teachers said that the characteristics of the concept of a determinant in choosing technology and pedagogy to be used. But CoRes results show that the lack of facilities technology makes the teacher choose conventional methods again and ultimately failed to create meaningful learning, or motivate students to learn more about the biology of [16].

4. Conclusion

Conclusion of this research shows that there are no teachers who are in the top category. Two teachers are in the lower category and the other two are in the middle category. This is because the new
teachers were first to answer the questions CoRes and have never been required to determine the essential concepts that should be taught to students. Besides the lack of support from the school to the progress of teachers in teaching and lack of evaluation of the performance of teachers often lack the mastery of teachers to CoRes. It is also shown that ability of teacher’s TPACK is still lacking.

Advice from researchers to the readers of this article is to conduct research on participants more with the school situation is more varied, ranging from limited to the school with complete facilities. The aim was to see whether the limited means of support also affects the ability to integrate content into technology and pedagogy. Readers can choosing different research areas to see the extent to which culture can influence the learning process. Another suggestion is to compare teachers who taught biology from biology education background and biology nature.

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