Science Teachers' Pedagogical Content Knowledge and Integrated Approach

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Abstract. The integrated approach refers to the stages of pupils’ psychological development. Unfortunately, the competences which are designed into the curriculum is not appropriate with the child development. This Manuscript presents PCK (pedagogical content knowledge) of teachers who teach science content utilizing an integrated approach. The data has been collected by using CoRe, PaP-eR, and interviews from six elementary teachers who teach science. The paper informs that high and stable teacher PCKs have an impact on how teachers present integrated teaching. Because it is influenced by the selection of important content that must be submitted to the students, the depth of the content, the reasons for choosing the teaching procedures and some other things. So for teachers to be able to integrate teaching, they should have a balanced PCK.

1. Introduction

Pedagogical content knowledge is a conceptualization of specialized content area knowledge required for effective teaching [1]. Shulman defines and describes his knowledge of PCK as 'a unique amalgam of unique teachers' content and pedagogy, a form of professional understanding of their own. Shulman argues that PCK includes the most useful representational forms, analogies, illustrations, examples, explanations, demonstrations, the strongest pedagogical techniques, and knowledge of what makes the concept. However, the early conceptualization of Shulman PCK can lead to the blending of knowledge types with the quality of knowledge, suggesting that there is no weak PCK. Professional teachers prefer quality in teaching, paying great attention to the quality of learning and the quality of cognitive outcomes received by their students. So needed a good planning in teaching science to students in class. Pedagogical content knowledge is a comprehensive knowledge that brings together two pieces of knowledge: content knowledge and pedagogic knowledge in one unity that leads to better knowledge for students [2] [3].

In general, elementary teachers often have little or no training in school subjects like science and technology. Not surprisingly, some studies show that they often have difficulty while teaching these subjects [4]. With regard to the ability of teachers to teach in the classroom, developing relevant knowledge is more effective for measuring using PCK [5]. But in science learning in elementary schools has a specificity in teaching because science teaching uses the integrated approach. Integrated teaching can be a powerful tool for reintegrating the curriculum and illuminating the
isolated, reductional nature of teaching around the discipline rather than experience. It requires a lot of hard work, initial design, plus substantial restructuring of teacher relationships and class schedules [6].

In this paper we presented teachers' PCK with and their ability to integrate science lessons with other subjects in a series of integrated approaches. Subjects that accompany the subject of this science are selected Civics that have a specificity in learning, while the theme chosen is the theme is often taught in the class of the theme of "entertainment".

2. Experimental Method
This PaP-eR is based on an investigation involving six elementary teachers who teach in third grade. Teachers teach in elementary school for 9 to 12 years in Pekanbaru. All teachers are female. The theme of integrated teaching in this research is entertainment with subject science and civics. Instruments used are CoRe and PaP-eR [7], and open interviews relate to teachers' ability to integrate science and civics. Teacher representation content (CoRe) is collected as part of a learning plan while pedagogical experiences (PaP-eR) are gathered after teaching activities. The interview was done after the teacher finished teaching. The data obtained are analyzed with the rubrics already available, presented with graphs and tables.

3. Result and Discussion
Changes in the nature of objects, because of burning, warming, and in touch with the open environment are topics related to the object and its nature. In a large scope the teacher's understanding of this content is the nature of the object and its nature and the constituent elements. It takes a teacher's ability to represent the content appropriately so that learning activities on this material do not occur misconceptions to students [8], so that there is an element of pedagogy.

Ideally integrated teaching can be taught by teachers starting from designing curriculum, teaching methods, and assessments around selected themes. The representation of a teacher's content demonstrates a teacher's collective ability to teach in classroom [9]. Its can be numerated by appraisal using the CoRe instrument [7] [10]. The following is a representation of teacher content teaching science by using integrated approach.

Figure 1. Presented PCK teachers who plan integrated learning on the "entertainment theme". Four teachers demonstrate the dominance of the ability to manage learning in the form of teaching skills (pedagogy) rather than content representation. Teaching in the lower classes requires skills in managing learning (pedagogy) higher than the content. Because, the content is superficial and still easy to observe by students. In addition, low-grade science lessons are more emphasized in phenomena that appear to be students (i.e. hand function etc.) [6]. Therefore, even though teachers do not teach deeply about science content, it is important to understand science appropriately. Some studies indicate that the quality of teaching is very important for student learning, for example, classroom management and classroom interaction, teaching characteristics have greater influence and the school environment has a similar effect on students' cognitive competence [11] [12]. The understanding of pedagogy in classroom management as described above is more widely gained from the experience of teachers in teaching [13] [14] [15], than experienced teachers certainly have better teaching skills and generate better understanding of students [11] [12].
Teaching skills appear when teachers respond to PaP-eR, and answers to teacher interviews. Teachers with high CoRe, have a stronger reason when asked about how they connect the material to the theme (Table 1). Because it is influenced by the selection of important content that must be submitted to the students, the depth of the content, the reasons for choosing the teaching procedures and some other things. Integrated teaching is based on the idea that people acquire knowledge when learning in a coherent "whole" context and when they can relate what they learn to the real world. Integrated teaching seeks to place the teaching of cognitive skills such as reading, math, science, and writing in the context of real-life experience subjects that are specific enough to be practical, and broad enough to enable creative exploration.

From the interviews conducted there is one teacher who still understands the subject of science as a learning that is separate from other subject civic (Level 1). The teacher presents a divided thinking about science and other learning without considering the theme. Besides this the teacher is more inclined to teach the content of science in a separate way just caught on the subject that is put on the theme being taught (No Integration) [16]. This teacher is more inclined to teach the content of science in a separate way just caught on the subject that is put on the theme being taught and teachers' PCK is low.

Furthermore, we find teachers who can generally provide an overview of integrate science and civics. The basic understanding that the integration of two subjects is very likely to occur and integration is described as sequential and the domain may not have in-depth content (Level 2). Integration is described as a thematic teaching where subject areas are organized around topics or themes (Beginning Integration) [16]. In the initial integration, teachers have recognized the integration of science with other lessons that may reasonably be difficult to realize. However, because the teacher understands the content of science well, it allows teachers to connect science with another subject. Teachers’ PCK at this level are low and unbalanced between content and pedagogy.

Next, we found teacher responses that reflect an understanding of the integration of the Civic-science as a one-way process. There is an explicit focus on a single domain, with the second domain being used to support or facilitate the primary domain (Level 3). The introduction of relationships between domains signifies the understanding of integration that arises, but the relationship is tentative (Emerging Integration) [16]. Teachers at this level begin to build confidence in the integration of learning practices between the two subjects that are difficult to unite. They can discuss the shared attributes (e.g., civics function more on the value contained not in the content learning process) this indicates that the teacher already understands the subject matter that is not taught only one direction, but two ways. At this level the teacher's PCK is medium and balanced.

Finally, we find teachers who implicitly understand integration as a reciprocal relationship. There is a relationship between two domains although their contents in both domains may not be discussed in

![Figure 1. PCK (CoRe & PaP-eR) science teachers with integrated approach](image-url)
depth but are strongly interconnected (Level 4). At this level, teacher’s responds indicate that teachers have developed strategies based on their personal experience in applying science and civic teaching by integrated teaching (fundamental integration) [16]. Teachers at this level, have the belief that teaching science and civic with integrated teaching. This belief is shown by a high and balanced teacher PCK.

**Table 1.** Level teachers to integrate science subjects in a integrated approach with CoRe and PaP-eRs science teachers

| Level  | CoRe  | PaP-eRs | Teachers | Teachers respond                                      |
|--------|-------|---------|----------|------------------------------------------------------|
| Level 1| 0.50  | 0.64    | G.2      | Novice: rule-based and inflexible, Separate content domains (no integration) |
| Level 2| 0.69  | 0.88    | G.4      | Advanced beginner: global, Basic understanding; ‘knowing that’ (Beginning Integration) |
|        | 0.58  | 0.67    | G.1      |                                                       |
| Level 3| 0.78  | 0.79    | G.6      | Competent performer: organized plan                   |
|        | 0.72  | 0.70    | G.3      | Unidirectional (Emerging Integration)                 |
| Level 4| 0.86  | 0.85    | G.5      | Proficient performer: analytic decision making       |
|        |       |         |          | Reciprocal processes; ‘knowing how’ (fundamental integration) |

From Table 1. Describes the ability of teachers to integrate science and Civics learning in the theme of "entertainment". CoRe and PaPer values indicate conformity with the level of science-science integration capability. This indicates that the balanced teacher PCK both from the side of the content representation as well as their repertoire Experience is more stable in relating the subject of science and Civics in this theme.

4. Conclusion

From the description above it appears that teachers with PCK teachers give shape to the ability to teach science with thematic approach. The effect is due to the teacher's valuable and stable teacher pattern. PCK teachers as a means to connect domains, so they are very easy to choose teaching with thematic approach.

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