AN ATTEMPT TO QUANTIFY PEDAGOGICAL CONTENT KNOWLEDGE FOR JAPANESE HIGH SCHOOL PHYSICS TEACHERS

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A CASE STUDY OF HOW TO HANDLE THE ELECTRIC CURRENT CONCEPT

For quality science education, it is essential to fully grasp the concept of Pedagogical Content Knowledge (PCK) proposed by Shulman (1987). Therefore, there is a need to develop teachers' PCK in science education. In prior research, CoRes (Content Representations) and PaP-eRs (Pedagogical and Professional-experience Repertoires) (Magnusson et al., 1999) have been used as a framework to elicit from teachers the PCK components: orientations toward science teaching, knowledge of students' understanding of science, knowledge of science curriculum, knowledge of instructional strategies, and knowledge of assessment in science. The CoRes consist of eight questions designed to elicit the science teacher's understanding of specific aspects of PCK, such as an overview of key ideas, points of confusion. The PaP-eRs is a useful framework for showing the deeper aspects of science teachers' PCK, for example, in this study it consists of CoRes-based interview transcripts. However, these studies represent teachers' PCK qualitatively and remain case studies. Therefore, the study we are presenting, aims to represent PCK quantitatively based on previous studies. The context of the investigation is how electric current is handled in the first hour of an electricity unit in high school.

METHOD

Beginning in May 2022, we preliminarily surveyed and analyzed four teachers who teach physics in high schools. Interviews were conducted with teachers based on the CoRes and PaP-eRs frameworks. Interview transcripts are categorized by PCK components. The number of utterances that appeared in each category was then recorded and represented as a radar chart.

RESULTS

An example of one teacher's radar chart of the items with the highest number of utterances as 1 is shown in Figure 1. Each item represents knowledge of students' understanding of science, knowledge of science curriculum, knowledge of instructional strategies, and knowledge of assessment in science. Since the first hour is assumed, the number of occurrences of knowledge of assessment in science may be low. It should be noted that this figure does not represent teacher qualifications, as the actual context and understanding of the students they teach in their learning varies among the teachers surveyed. In the current analysis, we only consider the number of utterances. Therefore, we would like to consider the need for weighting in future research. Although the number of surveys is limited at this time, we will increase the number of surveys and present a more detailed study.

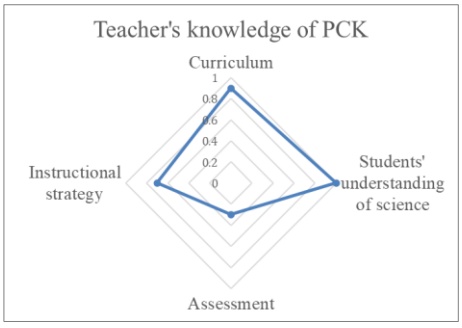

Figure 1. Radar chart diagram of PCK

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