

Explanatory approach for analyzing online problem-solving activities in science teachers' CoP with epistemic tools

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Abstract. The aim of this study is to describe an explanatory approach for analyzing logical structures of science teachers' inference process with epistemic tools. The epistemic tools used in this study were the following concepts of epistemology: Inference to the Best Explanation (IBE), Explaining to the Best Inference (EBI), testimony, and theories of scientific explanations. The online problem-solving activities in science teachers' Community of Practice (CoP) were analyzed. The result shows their professional competence to do scientific investigation in CoP. The logical structure of science teachers' problem-solving activities also suggests some ideas to design students' exploring activities in class.

1 Asynchronous online activities in science teachers' CoP

Problem-solving activities in a group of science teachers was considered in terms of Community of Practice (CoP)¹ in the author's previous study². Science teachers of the group were like-minded individuals belonging to a variety of schools. They met regularly face-to-face at its monthly meeting after school or on a day off to discuss topics of common interests. They also exchanged information by group e-mails and Internet discussion boards. They acquired new knowledge through the process. The structural properties of their computer-mediated asynchronous communication by e-mail system were analyzed by using social network analysis technique. The analysis result of e-mail traffic revealed the role of each member in the CoP.

Science teachers of the CoP also used an internet discussion board system. They shared various types of data file and discussed scientific topics asynchronously on the internet discussion board. In this study, their online problem-solving activities on the internet discussion board were analyzed in an explanatory approach. Several epistemic tools were used to analyze the logical structure of the problem-solving activities.

2 Epistemic tools: IBE, EBI, testimony, and theories of scientific explanation

In this study, the concepts of epistemology were used as epistemic tools to analyze the logical structure of science teachers' discussion on the internet discussion board.

The Inference to the Best Explanation (IBE)³ is a common method by which we gain knowledge of scientific hypotheses and theories. We use IBE to compare various explanations and infer that the best one is true. The general structure of IBE⁴:

F_1, F_2, \dots, F_n are facts in need of explanation.

Hypothesis H explains the F_i .

No available competing hypotheses would explain the F_i as well as H does.

Therefore, H is true.

Explaining to the Best Inference (EBI)⁵ emphasizes the process of explaining. The activity of explaining and looking for explanations leads to true explanations. The process of explaining is sometimes beneficial even if one does not arrive at the correct explanation. Key social evidence provided to science teachers during their problem-solving activities was considered as the concept of epistemology "testimony." There are many competing theories of the nature of scientific explanation⁶. In this study, we chose one of the theories as appropriate, that would be useful for our analysis.

3 Result

Analysis revealed that the epistemic tools were applicable to science teachers' online problem-solving activities in CoP. Figure 1 shows an example of the logical structure of science teachers' discussion on the internet bulletin board.

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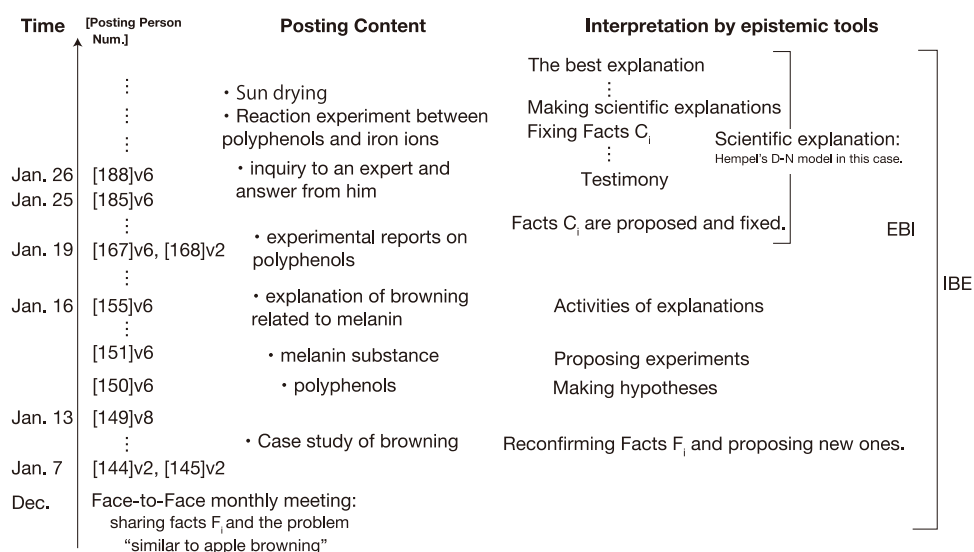


Fig. 1 The logical structure of science teachers' problem-solving activities on internet discussion board.