

Epistemological Understandings Activated in Conceptual Problem Solving

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Abstract. This study aimed to investigate students' epistemological views activated in conceptual problem solving situations. The participants of the study were five tenth grade high school students. The data of the study were obtained with interviews and analyzed in perspective of the resource framework. The analysis of the data indicated that students activated several epistemological resources and those resources influenced their approaches to solving problems. The results also showed that students' framing of solving problems could hinder or facilitate the activation of productive epistemological resources.

1 Theoretical Framework

Epistemological understandings defined as individuals' understandings of the nature of knowledge, knowing and learning [1,2]. Studying students' epistemological understandings are vital as a great deal of research has revealed that students' epistemological understandings influence their approaches to learning and assessment activities [3,4].

There are different frameworks (e.g., epistemologies as developmental stages, epistemologies as beliefs, epistemologies as resources) for the form of students' epistemological understandings. In this study, the resource framework, and epistemological framing that is based on this framework are used to interpret students' responses to conceptual questions.

1.1 *The Resources Framework*

According to this framework, students' personal epistemologies can vary across different contexts. Students' epistemological understandings can be considered as resources similar to diSessa's [5] phenomenological primitives in intuitive physics. The activation of the epistemological resources relies on contexts. Therefore, a student can demonstrate different epistemological sophistications at different situations [6].

1.2 *Epistemological Framing*

Redish [7] defined framing as "the process of perceiving, interpreting, and activating a particular set of long-term memories for dealing with a situation" (p, 27). It is related to individuals' expectations of what is going on in the situations. Similarly, epistemological framing is related to individuals' expectations about knowledge construction or learning in a particular activity. Students use their previous similar experiences to make sense what is going on the activity. Epistemological framing affects students' actions in a particular learning or problem-solving situation [4, 8].

2 Method

2.1 Participants of the Study

The participants included five tenth grade students, three males and two females, in a public high school. Their ages ranged from 15 to 17. In order to create a heterogeneous group of students, they were selected based on their ninth grade physics GPA.

2.2 Data Collection and Analysis

Students were individually interviewed by the researcher. Students answered several conceptual questions regarding relative motion, projectile motion and Newton's laws of motion. They participated in three interview sessions lasting one-half to one hour.

3 Results and Conclusion

Results of the study indicated that students demonstrated various behaviors which were epistemologically oriented when they dealt with the conceptual questions. Those behaviors can be summarized as follows;

- Using technical language without understandings.
- Using different concepts interchangeably.
- Using different explanations for the same phenomenon.
- Scientific acceptable knowledge cannot be questioned.
- Physical principles and laws are applicable to only special contexts.
- Formula applications produce more reliable results.

The analysis of the data also provided information about students' framing of problem solving that might lead to the activation of above epistemological ideas. For example, that students framed the problems as formal language application activity rather than making sense activity might lead students to use technical terms without understandings. Moreover, students framed the questions regarding Newton's third law as formula application activity and applied $F = ma$ although they had a conceptual definition of the law. Those epistemological framings prevented students from activating productive epistemological resources and negatively influenced their performance. These results contributed to the findings of the current literature stressing the importance of promoting students' epistemological framing which leads to the activation of productive resources. Teachers should implicitly and explicitly address students' framing related to knowledge, knowing and learning.

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