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The Influence of Argumentation Strategy on Student's Web-Based Argumentation in Different Scientific Concepts

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Abstract : Argumentation is an essential aspect of scientific thinking which has been widely concerned in recent reform of science education. The purpose of the present studies was to explore the influences of two variables termed 'the argumentation strategy' and 'the kind of science concept' on student's web-based argumentation. The first variable was divided into either monological (which refers to individual's internal discourse and inner chain reasoning) or dialectical (which refers to dialogue interaction between/among people). The other one was also divided into either descriptive (i.e., macro-level concept, such as phenomenon can be observed and tested directly) or theoretical (i.e., micro-level concept which is abstract, and cannot be tested directly in nature). The present study applied the quasi-experimental design in which 138 7th grade students were invited and then assigned to either monological group (N=70) or dialectical group (N=68) randomly. An argumentation learning program called 'the PWAL' was developed to improve their scientific argumentation abilities, such as arguing from multiple perspectives and based on scientific evidence. There were two versions of PWAL created. For the individual version, students can propose argument only through knowledge recall and self-reflecting process. On the other hand, the students were allowed to construct arguments through peers' communication in the collaborative version. The PWAL involved three descriptive science concept-based topics (unit 1, 3 and 5) and three theoretical concept-based topics (unit 2, 4 and 6). Three kinds of scaffoldings were embedded into the PWAL: a) argument template, which was used for constructing evidence-based argument; b) the model of the Toulmin's TAP, which shows the structure and elements of a sound argument; c) the discussion block, which enabled the students to review what had been proposed during the argumentation. Both quantitative and qualitative data were collected and analyzed. An analytical framework for coding students' arguments proposed in the PWAL was constructed. The results showed that the argumentation approach has a significant effect on argumentation only in theoretical topics ($f(1, 136)=48.2$, $p < .001$, $\eta 2=2.62$). The post-hoc analysis showed the students in the collaborative group perform significantly better than the students in the individual group (mean difference=2.27). However, there is no significant difference between the two groups regarding their argumentation in descriptive topics. Secondly, the students made significant progress in the PWAL from the earlier descriptive or theoretical topic to the later one. The results enabled us to conclude that the PWAL was effective for students' argumentation. And the students' peers' interaction was essential for students to argue scientifically especially for the theoretical topic. The follow-up qualitative analysis showed student tended to generate arguments through critical dialogue interactions in the theoretical topic which promoted them to use more critiques and to evaluate and co-construct each other's arguments. More explanations regarding the students' web-based argumentation and the suggestions for the development of web-based science learning were proposed in our discussions.

Keywords : argumentation, collaborative learning, scientific concepts, web-based learning
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