The Effects of "Collaborative Discovery Learning with an Association Scheme" on the Acquisition of Scientific Literacy

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Introduction

This study introduces an instructional program designed to promote scientific literacy. To promote scientific literacy, one focus of science education is scientific discovery learning. However, its effectiveness is dubious, because students face some difficulties in dealing with the discovery processes, especially coordinating hypotheses with evidence (e.g., Kuhn, 2002). Students do not attempt to associate their hypotheses with the evidence. And even if they do, they are so strongly biased that they retain their current hypotheses and ignore or distort the evidence. Taking this into account, the following two supports are necessary. The first is to introduce students to an *association scheme*, which promotes the students' intention to associate their hypotheses with the evidence. The second is to place the students in a collaborative discovery situation. In a collaborative discovery situation, the meta-cognitive reviewing of each other's discovery process could reduce irrational data processing when any evidence contradicts a student's current hypotheses. Based on the above, the purpose of this study is to propose a program "*collaborative discovery learning with an association scheme*," to promote scientific literacy.

Method

Eighth-grade students (n=139) were individually assigned to one of four conditions: *collaborative discovery learning with an association scheme* and three traditional programs *student-led discovery learning*, *teacher-led discovery learning*, and *teacher-led discovery learning with explicit preconceptions*. In the collaborative discovery learning with an association scheme, the students were encouraged to work together and ask questions that were expected to provide them an association scheme. The questions to be asked are "Which evidence supported their current hypotheses?" and "What would be concluded from the evidence?" After the programs were conducted, two types of tests were carried out: a *comprehension of scientific concepts test* and a *scientific thinking skill test*.

Results and Conclusions

Analysis of the data from the tests with one-way ANOVAs indicated a significant condition effect (ps<.05). Further analysis with Scheffe multicomparison tests revealed that the collaborative discovery learning with an association scheme was more effective than the other conditions (see Table 1).

Table 1. The means and standard deviations of the comprehension test and the skill test

	Collaboration + Association scheme	Teacher-led	Student-led	Teacher-led + Preconception
Comprehension	9.89(1.14)	9.00(1.37)	8.70(1.14)	7.80(0.56)
Skill	3.38(0.45)	2.65(1.03)	2.79(0.44)	1.94(0.96)

In conclusion, the collaborative discovery learning with an association scheme was effective for acquiring scientific literacy. However, these results disagree with the findings of Okada & Simon (1997), according to which, merely placing students in a collaborative discovery situation could promote making a scientific discovery. One possible explanation for this difference is that the students in the present study were eighth-graders, while those in the study of Okada & Simon (1997) were undergraduates. This could mean that it is important to teach the association scheme to students with low science achievements.

References

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