Perceived Potential Value of Student Multiple-Choice Question-Construction in the Introductory Physics Laboratory

Abstract

In light of information-processing theory and constructivism, questioning has been suggested as a promising instructional technique to facilitate participants' cognitive elaboration, and as a valuable alternative to achieving meaningful learning by reinforcing higher-order thinking skills. Despite past studies provided some evidence supporting the beneficial effects of problem-posing on students' motivation, question-generation ability, analytical ability, creativity, comprehension, and attitudes toward the subject matter studied, etc. existing studies primarily involved posing open-ended questions or story problems. Analytically, with comparison with open-ended question-posing which only comprised of constructing a question, and its answer/solution, when faced with the tasks of constructing multiple-choice questions, students would have the added cognitive task of pondering three distractors that can effectively discriminate those who have learned and mastered the concepts, principles, or procedures from those who have not. Seeing that student multiple-choice question-construction instructional strategy has not yet been investigated in the research community, this study set out to examine the perceived potential value of its use in the introductory physics laboratory.

In this study, a multiple-choice question-construction instructional strategy was incorporated into a "Laboratory for Physics" course for a whole semester in the spring semester of 2003. 42 university freshmen from the department of civil engineering participated in the study. As a routine, students were required to construct and hand in 3 multiple-choice questions before the end of each lab session. At the last class session, a post-session self-report questionnaire, which consists of one open-ended question (what effects do you think multiple-choice question-construction instructional strategy have on your learning of physics?), and three 5-point Likert scales ("Satisfaction toward Past Learning Experience," "Learning Anxiety, and "Perceptions toward the Potentials of Question-Construction for the Support of Your Learning") was disseminated to be completed individually to assess students' perceptions and dispositions toward this instructional approach.

Analysis with one-group *t*-tests, using 3 as the expected mean, on data gathered from the scales found that students' satisfaction toward past learning experience (8

items), and perceptions toward the potential of question-construction for the support of their learning (11 items) were statistically significant at the 0.0005 level with t = 4.66 and t = 10.11, respectively. Learning anxiety (8 items) was not statistically significant, t = 1.26 ($p>.05$). The results supported the efficacy of multiple-choice question-construction for students' learning without elevating anxiety that might arise from the added cognitive tasks associated with the intervention. A constant comparison method was adopted to categorize responses provided by students to the open-ended question. Results indicated that the influences of multiple-choice question-construction were evident in several significant ways, which worked together, helped students' learning along the way. To help students become more active and intellectually engaged learners without relying on a high dosage of technology, which frequently requires major modifications of a traditional structure and additional financial inputs, multiple-choice question-construction is an instructional strategy with great potential that physics instructors might want to consider for implementation in their classroom. Topics for future studies were rendered at the end.