Cooperation of Faculty and Teachers for Improving Interactive Response System Questions

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In the last decade, interactive response systems (IRS) have been widely established in secondary and tertiary classrooms. The literature has reported the benefits of teaching with IRS, which includes promoting classroom interaction, retaining students' concentration, and informing teaching via monitoring learning progress. However, the design of high-quality questions is crucial in order to fulfill the expected pedagogical outcomes. Via the cooperation of a high school physics teacher and a university faculty member in science education, this study compares the quality of the existing and modified IRS questions.

The rationale of this study integrated the Conceptual Change Model (CCM) and social constructivism. The CCM suggests that learning science is a process of overcoming naïve intuitive concepts by encountering cognitive conflicts, while social constructivism underpins the role of teaching mediation to facilitate students to comprehend the meanings of scientific terminology and to distinguish the discrepancy between scientific and daily life usages.

Two groups of students answered both the original and modified tests, including 128 high school students and 112 university new entrants majoring in engineering. A two-tier multiple choice instrument was adopted to investigate the how and why of the students' answering of the IRS questions.

The quality of the modified version was found to be greatly improved in terms of revealing the students' learning pitfalls, covering complete variables and their causality, and reinforcing the demand of logical reasoning. Thus, the modified questions may encourage students to adopt more meaningful strategies and to enhance the sophistication of their scientific knowledge. Meanwhile, the students' responses in the modified version showed that "seeing is not learning", verifying the socialized nature of scientific knowledge proposed by social constructivism, and challenging the empirical epistemological assumption (prevalently held by many physics teachers). Finally, the factors and strategies of devising high-quality IRS questions in physics are summarized, and the implications of the existing teaching design are discussed.