Training science teachers in using guided inquiry-based learning to develop experimental design skills in laboratories

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Abstract. It is well accepted that the purpose of physics laboratory classes is to not only help students gain an understanding of physics concepts, but to also help them develop their scientific laboratory skills. One such skill is the ability to undertake science inquiry to design an experiment to investigate a research question, thereby enhancing students' higher order thinking skills. Engaging in science inquiry and experimental design consists of five sub-skills. These include identifying the variables to be measured, developing an experimental procedure, selecting equipment and materials, minimizing possible errors, and making links to known physics concepts. The aim of this study was to train teachers to enhance their students' experimental design skills through inquiry based learning. A training program was conducted, in which 22 teachers participated. These teachers had over 5 years' experience in teaching science and physics. The concept of heat capacity was chosen, as it was of interest to all the teachers in the group. The training also involved teachers using guided worksheets, which were designed to help them assist their students in developing each of the five sub-skills using a guided inquiry approach. It is expected that such an approach will allow students to solve problems that they had encountered previously. From observations of teacher practices and analysis of teacher worksheets completed in the training course, we found that most teachers spent most time on linking physics knowledge to solve the problem. Many teachers had misconceptions about heat transfer and closed system. Only 6 teachers could design and conduct their experiment to solve the problem correctly. However, all of them could reflect that the need for designing experiments that can enhance students' experimental design skills and the five sub-skills.