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The effectiveness of learning with guided lecture worksheets designed based on students' learning difficulties

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Guided lecture worksheets have been used in the introductory physics courses for first-year science students at Mahidol University. A set of worksheets was regularly distributed to students before starting each lesson and used as a teaching tool during each lecture. This was done throughout the course. In this study, we have developed worksheets for teaching electrostatics in large-class lectures. We began by researching students' understanding in the year 2011 using pre- and post-tests, and interviewing them in order to identify their difficulties occurred when they learned with the worksheets (called 'earlier worksheets'). We found that the earlier worksheets still could not well-address the learning difficulties for a large number of students. The average normalized gain was 0.45±0.22. Therefore, in 2012 we brought the student learning problems found in the year 2011 to develop the lecture worksheets (called 'new worksheets') and used them in the class. We found that there was the higher learning improvement with the average normalized gain of 0.61±0.20. To ensure that worksheets reconstructed yield a good effectiveness on learning electrostatics, we again used them in the year 2013. The average normalized gain was 0.55±0.20 which was quite steady. Amongst the three years devoted to the study, we can conclude that the development of worksheets based on students' particular learning difficulties can make the difference of student learning outcomes.

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