

Levels of Students' Understandings of Electric Field Due to a Continuous Charged Distribution: A Case Study of a Uniformly Charged Insulating Rod

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Abstract : Electric field is an important fundamental concept in electrostatics. In high-school, generally Thai students have already learned about definition of electric field, electric field due to a point charge, and superposition of electric fields due to multiple-point charges. Those are the prerequisite basic knowledge students holding before entrancing universities. In the first-year university level, students will be quickly revised those basic knowledge and will be then introduced to a more complicated topic—electric field due to continuous charged distributions. We initially found that our freshman students, who were from the Faculty of Science and enrolled in the introductory physics course (SCPY 158), often seriously struggled with the basic physics concepts—superposition of electric fields and inverse square law and mathematics being relevant to this topic. These also then resulted on students' understanding of advanced topics within the course such as Gauss's law, electric potential difference, and capacitance. Therefore, it is very important to determine students' understanding of electric field due to continuous charged distributions. The open-ended question about sketching net electric field vectors from a uniformly charged insulating rod was administered to 260 freshman science students as pre- and post-tests. All of their responses were analyzed and classified into five levels of understandings. To get deep understanding of each level, 30 students were interviewed toward their individual responses. The pre-test result found was that about 90% of students had incorrect understanding. Even after completing the lectures, there were only 26.5% of them could provide correct responses. Up to 50% had confusions and irrelevant ideas. The result implies that teaching methods in Thai high schools may be problematic. In addition for our benefit, these students' alternative conceptions identified could be used as a guideline for developing the instructional method currently used in the course especially for teaching electrostatics.

Keywords : alternative conceptions, electric field of continuous charged distributions, inverse square law, levels of student understandings, superposition principle

Conference Title : ICE 2016 : International Conference on Education

Conference Location : Singapore, Singapore

Conference Dates : January 07-08, 2016