

Threshold Concepts in Physics: too many to count

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There is an ongoing search for threshold concepts in academic disciplines. If identified correctly, these conceptual gateways could provide valuable tools for course design and curriculum renewal. Students who get to understand a threshold concept obtain “a transformed internal view of subject matter” (Meyer and Land, 2005). Students, who fail to grasp it, find their learning paths blocked.

Physics is a discipline hard to grasp for many students. By teaching theoretical courses to 2nd and 3rd year undergraduates, I noticed year after year the same stumbling blocks. Spending more time on some subjects didn't seem to improve students' understanding, reflected in poor final exam marks. 86 one-to-one interviews with 2nd and 3rd year undergraduate students were carried out between 2009 and 2013 at the Department of Physics, University of Toronto. At the same time, 5 Teaching Assistants teaching those classes were interviewed every year. The interview form was drafted using the main ideas of Threshold Concepts theory.

The study revealed 8 dominant threshold concepts taken from Theoretical Physics classes. We shall discuss not only the results but also the interview methodology which we found difficult and ambiguous.

We also surveyed students from two laboratory courses, in 2010-2013. We looked at difficulties students have in understanding the experimental error analysis. We obtained data that supported other authors' findings (Wilson et. al., 2010) regarding *the measurement uncertainty* as a threshold concept.