DAMOP15-2015-000089

Abstract for an Invited Paper
for the DAMOP15 Meeting of
the American Physical Society

Teaching and Learning Physics Expertise

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I will discuss what has been learned about the nature of expertise and how it is learned. Expertise is largely about asking the right questions and making the right decisions (both conscious and unconscious) at the right time. This includes knowing and using all the relevant information, and recognizing the limitations of those decisions. Expertise is acquired by the learner explicitly practicing, with guiding feedback, the necessary decisions and knowledge organization and application, and reflecting on decisions. Measures of expert decision making clearly reflect the degree to which different teaching methods provide the learner with the necessary explicit practice and feedback. I will start with describing the most general features of expertise, then specific elements of physics expertise, and finally the example of quite detailed components of expertise in DAMOP experimental physics. This will set the stage for the other talks in this session which will discuss examples of applying these concepts about the acquisition of expertise to a variety of specific physics courses and showing their effectiveness. This talk will make it clear why subject expertise is a necessary (though not sufficient) condition to be an effective teacher.