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Investigating student learning in upper-division laboratory courses on analog electronics¹

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There are many important learning goals associated with upper-division laboratory instruction; however, until recently, relatively little work has focused on assessing the impact of these laboratory-based courses on students. As part of an ongoing, in-depth investigation of student learning in upper-division laboratory courses on analog electronics, we have been examining the extent to which students enrolled in these courses develop a robust and functional understanding of both canonical electronics topics (e.g., diode, transistor, and op-amp circuits) and foundational circuits concepts (e.g., Kirchhoff's laws and voltage division). This focus on conceptual understanding is motivated in part by a large body of research revealing significant student difficulties with simple dc circuits at the introductory level and by expectations that students finish electronics courses with a level of understanding suitable for building common, practical circuits in a real-world environment. Recently, we have extended the scope of our investigation to include more laboratory-focused learning goals such as the development of (1) troubleshooting proficiency and (2) circuit chunking and design abilities. In this talk, I will highlight findings from written questions and interview tasks that have been designed to probe student understanding in sufficient depth to identify conceptual and reasoning difficulties. I will also use specific examples to illustrate the ways in which this research may inform instruction in upper-division laboratory courses on analog electronics.

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