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Using Swirl to make TRUBLE (Teaching with R in Undergraduate Biology Less Excruciating)

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Extended Abstract

Data science, programming, and analysis skills are in high demand from students and employers. Integrating these skills with biology has been proven to have better learning outcomes for students. Although R is one of the most recommended statistical software packages in biology, it is very difficult to incorporate into an undergraduate classroom or laboratory setting. How can we make Teaching with R in Undergraduate Biology Less Excruciating (TRUBLE)? R with Swirl is a platform for learning and teaching R in the Rstudio console. Swirl lessons provide a step-by-step guide through programming basics, scaffolding for tricky programming functions, and positive reinforcement! Using Swirl lessons allow students to gain basic skills within R at their own pace, and frees the instructor to focus on other areas of content. And if an instructor is so inclined, R with Swirl can also be used to create custom Swirl lessons tailored to an individual lab or objective. These resources apply regardless of your background experience with R. Swirl lessons are accessible from the greenest of beginners to more advanced topics. Even if you have no experience with R, you can use the resources from this workshop to navigate to some Swirl lessons that will help you start learning. If you already have some experience, but want more material on how to implement ready-made lessons to supplement instruction on R or create your own tailored lessons for a lab, you can skip ahead through some of the slides to get right to our main learning objective: learning to format a table and import that table into R (.csv file). In this hands-on workshop, participants installed Swirl and, depending on prior experience with R, either 1) started with the basics of programming in R or 2) completed an available Swirl lesson on importing data. We also covered strategies to implement and assess these lessons. I have modified the workshop slides to include: 1) an introduction to the importance of data science skills and how to sell it to your students, 2) why use Swirl with R to teach, 3) a walkthrough of downloading R and R studio, 4) a walkthrough of navigating to Swirl lessons for those new to R, 5) a walkthrough to install and navigate to the specific lesson 'Importing Data' for those already familiar with R, 6) example student instructions, an example for assessment, and implementation notes for the lesson 'Importing Data', and 7) more ready-made lessons and documentation to help make your own using Swirlify. These slides can be found in the link to supplemental materials.

Keywords: teaching R, classroom technology, computer-based lab, data analysis, statistics

Link to Supplemental Materials: **https://doi.org/10.37590/able.v41.sup34**

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Mission, Review Process & Disclaimer

The Association for Biology Laboratory Education (ABLE) was founded in 1979 to promote information exchange among university and college educators actively concerned with teaching biology in a laboratory setting. The focus of ABLE is to improve the undergraduate biology laboratory experience by promoting the development and dissemination of interesting, innovative, and reliable laboratory exercises. For more information about ABLE, please visit **http://www.ableweb.org/.**

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