Prepare Students for Course Activities with Online Decision Trees

By Sarah McLean

I remember being stressed for undergraduate science laboratories, unsure whether I understood the protocol sufficiently and worried that I was going to "mess up" in the lab. With this in mind I thought about what I could do to help ease my students' anxiety in a new third year laboratory course I was developing. The answer was an online decision tree that guided students through laboratory procedures, which I named LaboraTREEs. Students would do the module before coming to lab, making mistakes online where they were not in sight of others.

I took a "Choose Your Own Adventure" approach to helping students prepare for laboratory sessions. Students were presented with the same scientific problem and protocol that they would encounter in the laboratory. Throughout the simulation, students encountered many "branching points" where they would have to choose between a few options for how to proceed with the experiment. Their selection in the branching point could lead to a few different options: they would proceed to the next step (if the answer was correct), they could be lead to a quick review tutorial (often in video format), or they could continue to another step- even if their selection was incorrect.

I allowed students to move forward even if their choice was incorrect because it matched the laboratory experience. Frequently during experiments you do not know if your experiment worked or did not work until the very end. Therefore, I wanted to include this aspect in the simulation for my students, to mimic what "real" science was like, and to model some of the problem-solving skills that are essential to be successful in science. If the students chose a "wrong" path, they would find that their experiment did not work, and would be given a short explanation as to why. The idea was that when students went into the laboratory environment, the LaboraTREEs gave them some previous experience with the laboratory technique, so that they had a better understanding of the importance of certain steps, and thus would make fewer mistakes and feel better prepared.

Development of LaboraTREEs

I designed LaboraTREEs by first reflecting on the common mistakes that students make in a lab. These mistakes formed the foundation of the branching points. For example, in one LaboraTREE, students performed a calculation that would be necessary to determine the volume of a reagent to add. This was a crucial step in the actual wet laboratory, and could significantly affect the outcome of the experiment. If students performed the calculation incorrectly, they would be immediately redirected to a video tutorial that went over how to

complete the calculation. I then mapped out the entire decision tree so that I had a good overview of what the simulation would look like.

Next, I worked with an instructional designer, who helped to bring the LaboraTREEs to life using Adobe Captivate. Adobe Captivate allows branching options, and can also allow you to track students' progress through SCORM. Both of these features were essential to the development of the LaboraTREEs, as I wanted to ensure that students completed these simulations prior to the laboratory. Captivate is by no means the only option for creating branching tutorials. Articulate Storyline is a very powerful system used for training in the private sector, as is iSpring. Your instructional design crew will undoubtedly have expertise in one of these systems and will help you create the module. An even simpler option is to use PowerPoint's ability to send users to different slides based on their input. See this tutorial on how to create branching scenarios with PowerPoint: https://youtu.be/YXGD-z5s5a8.

I created the short review tutorials by simply creating an mp4 file in "Explain Everything" on my iPad, which the instructional designer then embedded in the simulation. Finally, I embedded images for the various pieces of equipment and reagents that were identical to what we would use in the lab. Overall, the idea was to make the LaboraTREEs as close to the actual wet lab experiment as possible.

Implementation of LaboraTREEs

I introduced the students to the idea of the LaboraTREEs on the first day of class. I told them that these were developed to help them apply the theoretical knowledge that they would need in the lab. Importantly, I stressed that I was not concerned with how well they performed on the LaboraTREEs, I simply wanted them to complete them *before* the lab. In fact, I encouraged them to complete them many times, and try different ways of "messing up". Again, this all led back to the initial rationale for the LaboraTREEs, which was to give the students a safe place to make mistakes. I embedded the LaboraTREEs on our course website through our learning management system, to make it easy for students to access.

So how did students receive the LaboraTREEs? I received positive feedback on the simple, quick, and interactive nature of the design. Students liked that they were able to complete it multiple times, and that it was visually engaging. They also commented that they appreciated the short video tutorials that helped them if they made a mistake. One drawback to this approach is the technology itself. I found that certain web browsers supported the simulations better than others, and needed to do some troubleshooting in order to find the best option for my students. But instructional designers were able to help with browser compatibility issues.

Decision trees can be useful for teaching students procedures in a wide range of subjects besides the sciences. Education courses can use them to teach how to address different classroom situations, and any course involving fieldwork can use them to teach procedures before students get into the field. Consider branching scenario options for teaching procedures in your courses. I am confident that your students will thank you.

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