Adapting a Bacterial Unknowns Project to Online Learning: Using Microsoft PowerPoint To Create an Unknowns Identification Simulation

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KEYWORDS simulation, PowerPoint, microbiology, laboratory, identification, bacterial unknowns, unknowns project

INTRODUCTION

The identification of bacterial unknowns is a hallmark of in-person undergraduate microbiology classes (1). This project provides students with a meaningful experience that allows them to utilize skills, knowledge, and tools learned in their course and apply them to solve a scientific problem. In addition, this assignment provides instructors with a valuable assessment tool of their students’ ability to execute lab techniques and to interpret results. At the start of the project, students are given a bacterial culture and must reliably and correctly complete lab techniques and interpret results to identify the organism(s) they have been given. This assignment not only reinforces the material students have learned in the laboratory, but it also encourages students to take ownership of their educating, promoting engagement (2).

The COVID-19 pandemic forced colleges and universities in the United States to move to remote instruction during the spring 2020 term. In order to work within the confines of a new learning environment, Microsoft PowerPoint was used to develop an alternative bacterial unknowns simulation that is completed electronically. Virtual laboratory simulations have been shown to improve student performance and promote learning while providing instructors with a means to assess student knowledge (3, 4). We describe here the process by which Microsoft PowerPoint can be used to create unknowns simulations, including the formatting options set in PowerPoint that allow it to function as an interactive assignment and a description of the different kinds of slides used in the simulation.

PROCEDURE

Microsoft PowerPoint 2019 was chosen to develop this unknowns simulation. This program provides the ability to hyperlink to another slide within the presentation and the ability for the program to automatically open in a presentation format. Hyperlinking is achieved by placing hyperlinks within shapes on each slide to navigate between different slides, making the presentation interactive. Saving a simulation in PowerPoint in “show” format causes the presentations to automatically open into a full-screen presentation. This feature prohibits students from being able to make any changes to the simulation while also requiring them to move through the presentation using only hyperlinks. Direction for hyperlinking slides and setting up show mode can be found in Appendices SA and SB in the supplemental material (Text S1), respectively.

There are six different categories of slides that were used in this simulation. Examples of each slide type are shown in Appendix SC in the supplemental material.

Instruction slide

The instruction slide is the first slide in the simulation and provides a brief outline of how the simulation works. In addition, this slide contains a clickable hyperlink arrow that demonstrates how to navigate the simulation and moves students onto the next slide.

Introduction slide

The introduction slide is second and contains pictures of a pure culture and a Gram stain of the unknown bacterium. Students continue the simulation by choosing a Gram stain result, depicted in one of two clickable hyperlink boxes that direct students to upcoming landing slides.

Landing slides

Landing slides contain the different tests and medium options the students were introduced to during their laboratory course. Our simulation uses four different landing
slides: Gram-negative test/media, Gram-positive test/media, “other” test/media, and all tests/media. These slides act as navigation slides for the student; each test or media option contains a clickable box, which is hyperlinked to a corresponding results slide.

Results slides

Each test and medium option has a corresponding results slide that contains the name of the test, picture(s) of results, and hyperlinked boxes back to the landing slides. An option to return to any of the four different landing slides is available from all results slides. In addition, the option to move to the completion slides is available, should the student be finished with the simulation.

Completion slides

Completion slides are utilized to aid students in finishing the simulation. When students choose the hyperlinked box indicating they have completed their simulation, a completion slide provides the option to return to the introduction slide or to end the simulation. If ending the simulation is selected, students will be directed to a congratulations slide that allows them to exit the simulation. Students are not provided with the identity of their bacterial unknown through the simulation.

Mis-click slides

The “mis-click” slide was designed as an established mechanism to encourage students to complete the simulation correctly. This slide is placed in between every single slide in the simulation. If a student clicks anywhere on a slide that does not contain a hyperlink, they would be directed to this mis-click slide, which then redirects the student back to the introduction slide to restart the simulation.

IMPLEMENTATION AND ASSESSMENT

Students were assigned two bacterial unknowns and were provided with their PowerPoint files either through our LMS or email. Students were given a week to complete their assignment and allowed unlimited access to the simulation. Assessment was based on written lab reports, one for each identification, that included an introduction, methods and materials for each relevant test, a description of the results obtained, and a discussion section identifying their bacterial species and explaining the rationale behind their choice. Students were graded based on a rubric, gaining a variable number of points from each section.

CONCLUSIONS

In response to the continuing need for remote instruction, this simulation was created to provide students with an assessment of their ability to determine the necessary tests and correctly interpret results in order to identify unknown bacterial species. The use of an electronic bacterial unknowns simulation creates an assignment that is accessible and equitable to all students, regardless of their ability to attend in person microbiology lab courses due to institutional requirements, health concerns, or other disruptions.

SUPPLEMENTAL MATERIAL

Supplemental material is available online only.

TEXT S1, DOCX file, 18.1 MB.

ACKNOWLEDGMENTS

We acknowledge Savannah Shooter and Oakleigh Reeves for their help in troubleshooting early versions of this simulation. In addition, we thank photographer Kim Vardeman for providing images for the simulations.

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