Student-Centered One-Health Modules:
Digital Science Curriculum to Address Complex Interdisciplinary Issues

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Introduction

As the world continues to respond to the pandemic, Americans' lack of scientific knowledge makes deciphering fact from fiction difficult (Funk& Goo, 2015; Segers, 2020). The Pew Research Center consistently finds that U.S. students lag behind other countries in science, regardless of the test used (Desilver, 2017). Further, science is not among the most liked subjects in school despite its critical role in society (Jones, 2022).

This five–year project is part of a National Institutes of Health - Science Education Partnership (NIH-SEPA) grant (https://nihsepa.org) which has developed student-centered online modules to explore complex, real-world, One-Health topics that are focused on topics of interest to students. The One-Health modules provide rural middle school teachers with student-centered instructional strategies and resources for teaching life science through the integration of human, animal, and environmental health. The project focuses on rural schools which have large, educationally underserved populations, fewer teaching resources due to under-funding, and difficulty in recruiting highly trained science teachers (ERS, 2020). This project also addresses student motivation by incorporating relevant problem-based learning, a technologically appealing format, and by using a student-centered design.

How It Works

The project addresses both student motivation and teacher preparedness via three primary aims.

Aim 1. Develop and assess student-centered One Health modules using an online platform that students can access on mobile devices, tablets, and computers. Our Curriculum Development Team collaborated with software developers to create bilingual curriculum modules that incorporate authentic One Health case studies and motivational study aids. All curricula adhere to Next Generation Science Standards (NGSS). This approach engages students in curricular activities as individuals and groups, leading to classroom experiments, discussions, and presentations.

Aim 2. Structure the hosting website to accommodate the modules and enable resources to be accessible for teachers. The site currently serves a world-wide teacher audience (57,857 downloads each year by 2,201 teachers in 50 states). Restructuring/reorganization of the website has improved search features, enabling teachers to efficiently locate and utilize materials.

Aim 3. Provide professional development for teachers to strengthen their understanding of the significance of One Health topics and how they connect to science standards and aid teachers in implementing curricular resources within their classes.

Results to Date

To date, seven modules have been fully developed on the following One Health topics: Cell Biology, Stress, Infectious Diseases, Ecology, Clinical Trials, Genetics, and Zoonotic Disease.

Each module includes a motivating tool kit of cohesively integrated learning activities. The learner can select the order in which many of the activities are completed. Each module has pre and post tests and integrated learning activities including: Essential Knowledge-slide show of standards-based academic content; Backpack Adventures-science fiction story about a time-traveling group of middle-school students based on each module's theme; Meet the Scientist-short biography of a research pioneer in the topic area; Scientist Video Presentation-video on the topic from a scientist; Real Science Review-published research report that is rewritten at middle-school grade level. Students apply the scientific method to conduct a simulated peer review; Make a Note of That-note-taking templates aligned with academic content; Practice-mnemonic advice and engaging digital games to reinforce learning of essential knowledge. In addition, the Essential Knowledge, Backpack Adventures and pre and posttest sections have been translated to Spanish.

The modules are built as Sharable Content Object Reference Model (SCORM) packages and hosted through a university based LMS (Moodle). Teachers can see student progress, time spent in modules, and pre and post test scores. The project team is also able to use this information to determine engagement with the module and determine differences in pre and post test scores.

Approximately 100 teachers have participated in either in-person or online workshops as well as asynchronous micro-credentials allowing teachers to explore the modules. We currently have district approval for classroom use of curriculum from five Texas school districts and 185 teachers have registered to use the curriculum. During summer 2022, graduate and professional students partnered with teachers during remediation and enrichment programs to facilitate the use of the One Health curriculum. Data received to this point of 64 and 63 pretests and 24 and 22 posttests from the Cell Biology and Genetics modules (respectively) indicate gains in learning outcomes of .9 and 14.6 percentage points.

The "Summer Learning Experiences" hosted for middle and high school students engaged students in a One Health case study and enabled students to engage in problem-based learning.

Future Plans

Over the next year, we will ensure fidelity of the curriculum through pre and post-test data and compare students engaged with the modules to similar students who did not use the modules. Those wanting to implement a similar program are encouraged to engage with stakeholders and engage an interdisciplinary team of researchers. The One Health curriculum is publicly available, is relevant to agriculture education classes, and can promote collaboration among agriculture leaders and science professionals. As noted by Hall, et al. (2022), early career teachers indicate use of resources at a higher frequency. Thus, these teachers may find the modules useful.

Costs

As a NIH-SEPA funded project, access to the modules is free for teachers to implement. Mobile devices or computers with internet access are needed. Significant staff and faculty engagement as well as technical support (server space and LMS) was necessary to create and share the modules.

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