Constructing Adaptive Educational Tools in Parasitology

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ABSTRACT

Technology's influence on learning is extensive, and it is important to be able to present educational material through improved modes while technology continues to advance. The formulation of educational modules through a scenario based learning environment (SaBLE) provides the opportunity for students to engage with medical laboratory science course content in a digital structure that will continue to support their learning. SaBLE is a web-based tool that allows instructors to create learning modules by constructing pages that can be customized with questions for the students to answer. This includes fill-in-the-blank, multiple choice, and multiple-select, and matching questions. SaBLE has the ability to create pathway randomization, which allows students to experience a different outcome depending on the answer they provide for a given question. Parasitology questions were developed in alignment with parasitology course learning objectives, with focuses on parasite identification and specimen processing.With the development of this module, it can be administered to students and aid in assessing improvement in content comprehension and academic performance. Further developments of these modules can provide support in other challenging concepts, such as antibody identification in immunohematology and endocrine pathways in clinical chemistry.

BACKGROUND

Learning styles among students have been shaped by the conventional learning methods, such as direct textbook studying and rote memorization, along with those based in technology. By constructing educational tools that can foster the use of metacognitive learning, students can enhance their learning and the ability to regulate their thinking. The use of adaptive technology is becoming increasingly popular in science education courses, and its implementation in medical laboratory science education is no exception.

Through the twentieth century, the behaviorist, cognitivist, and constructivist learning theories were developed by psychologists to understand and explain human behavior from an epistemological point of view. The various learning theories provide a lens to better understand an educational model and system. The role of science in learning theory became widely used in the nineteenth century, where it was argued that truth should be able to be scientifically verifiable.

Adaptive electronic learning tools have been developed and implemented at other institutions across the United States and the rest of the world, most frequently in basic science courses, such as general chemistry and biology. The use of these tools has shown increased engagement, confidence, and understanding of course content, yielding higher grades. In professional student learning, the use of digital tools has been shown to improve clinical and critical reasoning skills that allow students to better approach clinical problems. The development of SaBLE is utilized to accomplish adequate acquisition of these skills in the medical laboratory science curriculum. Utilizing SaBLE to apply course concepts with simulated clinical scenarios allows students to contextualize their learning and simultaneously acquire transferable skills, akin to those applied in a wet laboratory environment. With previous applications of SaBLE in hematology, questions that were answered correctly both significantly and positively predicted student performance. It is believed that this tool can be further implemented in other medical laboratory science courses, such as parasitology. This study aims to demonstrate the improvement in retention of learning outcomes by students through the use of SaBLE parasitology modules, compared to traditional learning methods.

METHODS

We utilized a game tutoring system, known as Scenario-Based Learning Environment (SaBLE), to create learning modules for students in a parasitology course. SaBLE is a web-based tool that allows instructors to create learning modules by constructing pages that can be customized with questions for the students to answer. This includes fill-in-the-blank, multiple choice, and multiple-select, and matching questions. SaBLE has the ability to create pathway randomization, which allows students to experience a different outcome depending on the answer they provide for a given question. It also has the ability to present feedback to students after answering questions, depending on the response. Parasitology questions were developed in alignment with parasitology course learning objectives, with focuses on parasite identification and specimen processing. Common helminth parasites were presented to students with information about life cycles, key features, unique identifiers, and clinical information.

DISCUSSION

The formation of the online collaborative learning theory, or collaborativism, argues that technology can advance human agency in learning, by providing interaction with knowledge rather than presenting it. The formulation of educational modules through SaBLE supports the ability for students to engage with the course content in a digital structure that will continue to support their learning. The implementation of these modules aids in supplementing student learning and presenting topics that may not be experienced due to omission of a wet laboratory course that would typically present them. However, by the construction of modules with gamification elements, like earning points and awards, learners can have significantly increased motivation, course completion, and interest in the topics than with traditional learning alone.

Figure 1. Node Graph of Page Pathway in SaBLE

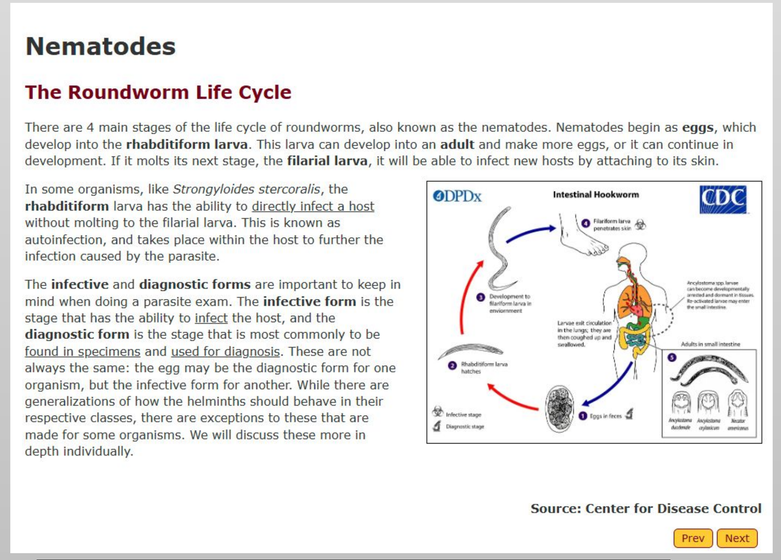

Figure 2. Example Page of SaBLE Nematode Content

CONCLUSION

With the development of this module, it can be administered to students and aid in assessing improvement in content comprehension and academic performance. It also provides a space for students to move through the content at their own pace, and in the space of their choosing, due to its online accessibility. A limitation to the use of SaBLE as an educational tool is the lack of artificial intelligence (AI) within the capabilities of the modules. With the popularity it has amassed due to its ability to scan and transmit information more efficiently than other modes, AI is a top competitor to SaBLE in tools that students will turn to when approaching difficult educational concepts. SaBLE is not meant to take over traditional teaching methods for lower yield MLS topics, but to strengthen student performance in difficult concepts and those that lack a corresponding wet laboratory experience. This includes the creation of challenge modules, which present the introductory information as a case study, as well as the utilization of pre-module and post-module surveys to obtain student perceptions and effectiveness of the modules. Future SaBLE developments can provide support for other challenging concepts, such as antibody identification in immunohematology and endocrine pathways in clinical chemistry.

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