Chapter 15

Using a Live Simulation to Teach Human Anatomy and the Diagnostic Process to High School Students

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ABSTRACT

This chapter describes and defines role-play simulations. Reviews of two undergraduate role-play studies highlight the advantages and benefits of using simulations. Few secondary students participate in science or STEM role-plays during their high school careers. This chapter portrays the CyberSurgeons live simulation where teams of students use critical thinking skills and scientific knowledge to solve emergency medical problems. During their virtual mission students become part of an emergency medical team aboard a National Institutes of Health (NIH) mercy ship traveling up the Amazon River. Authors describe CyberSurgeons' learning goals, design features, mission day experiences, and the summative evaluation. Findings from the summative evaluation indicate that the CyberSurgeons program provides an authentic context for high school students to apply their knowledge of biology, physiology, and the diagnostic process to analyze data and make decisions as professionals in the biomedical field. Recommendations and future research considerations close this chapter.

INTRODUCTION

This chapter aligns with Strand 2, Pedagogical Concepts and Related Practice, and identifies pedagogical aspects of learning in the *CyberSurgeons* live, role-based, clinical simulation for high school students. The chapter describes the pedagogical concepts and related best practices for the online simulation learning goals and design/development, simulation mission preparation, mission day, literature review, summative evaluation results, and recommendations for research about role-playing simulations.

Innovative ways that teach students about real-world applications of anatomy and physiology, biology, and health professions in a cost-effective, authentic manner are needed to prepare high school students for biomedical careers. Immersing students in didactic content while providing limited hands-on experience can teach content but does not inform high school students about the complexities of clinical diagnosis and treatment involved in the biomedical workplace. To advance the research literature about the use of role-playing simulations in high school science classrooms, this chapter provides a literature review about the use of role-based simulations in secondary classrooms. The review highlights two role-play studies conducted at the undergraduate level (one medical student and one interdisciplinary health) to describe the benefits and advantages of using simulations. The next section of the chapter focuses on multiple aspects of the *CyberSurgeons* live-simulation experience including learning goals and design/development, simulation design features, facilitator's programming features, simulation mission preparation, simulation/mission day, the summative evaluation, and potential conditions that may negatively impact *CyberSurgeons*. This chapter closes with recommendations, future research directions, and the conclusion. After reviewing this chapter, readers will be able to

1. Define a role-play simulation.
2. Discuss the benefits and advantages of using role-play simulations in secondary science classrooms.
3. Understand the development and design features of the *CyberSurgeons* live simulation.
4. Review the summative evaluation results for *CyberSurgeons* and realize the challenges for evaluation of online, role-playing simulations in secondary science classrooms.
5. Identify opportunities for introducing science simulations into high school curriculum.

BACKGROUND

What Is a Role-Play Simulation?

A role-play simulation is a form of experiential learning that provides students with an active opportunity to practice and apply new content and skills in a real situation (Shaw, 2012). Good simulations must contain high levels of integration of the material in addition to interactivity between the facilitator/teacher and the student (Wheeler, 2006). High levels of interactivity result in more advanced levels of learning using Bloom's (Bloom & Krathwohl, 1956) taxonomy criteria (Wheeler, 2006). Studies show that role-playing simulations are an effective instructional method to give students the opportunity to engage in higher-level learning (Silvia, 2010). During a role-play simulation, students transition from a passive learning style that is more common in traditional lecture to a more active style. It is important to clarify the students' responsibility in role-playing simulations. In this chapter no consideration is given in situations where students play parts in scientific phenomena such as electrons in an electrical circuit, molecules from food in digestion (Aubusson, Fogwill, Barr, & Perkovic, 1997), or human chromosomes in mitosis and meiosis (Chinnici, Yue, & Torres, 2004). The simulation scenarios discussed in the literature review pertain to situations where students analyze and synthesize data in order to complete the tasks designed for their role play.

During role play, students develop their problem-solving skills by taking on different roles and confronting unstructured problems in scenarios involving the content and given roles. Clapper (2010) discussed the pedagogical advantages of using role-play simulations as "returning to teaching for understanding" (p. 39). Classroom simulations provide an opportunity for students to problem solve, think critically, and make deci-

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