

## Chapter 15

# Developing an Online Simulation to Teach Enzyme Kinetics to Undergraduate Biochemistry Students: An Academic and Educational Designer Perspective

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### ABSTRACT

*One approach used in teaching scientific principles is laboratory practical classes. However, it can be challenging to teach concepts prior to their introduction in lectures. Academic teaching staff that wish to use alternative approaches to bridge this gap and, in turn, enhance student learning, often require help from their local Educational Developers (EDs). This chapter outlines the process of identifying a problem and then developing, implementing, and evaluating an online interactive simulation to teach enzyme kinetics to undergraduate students at the University of South Australia (UniSA). The challenges faced by the academic and ED in developing the simulation are covered. By the end of the chapter, the reader (academic or ED) will have a better appreciation of the challenges faced in developing a new teaching approach as well as the strategies that can be used to address these challenges.*

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## INTRODUCTION

Experimental sciences, by their nature, are grounded in a laboratory setting. As a result, academics devote much time instructing undergraduate science students in laboratory-based learning. Typical tasks include teaching students how to use standard laboratory equipment, which is then used to demonstrate fundamental concepts of the respective discipline. Such teaching is aligned with the delivery of course content through didactic lectures and tutorials. However, due to timetabling constraints and large class sizes, it is not uncommon for some students to undertake a laboratory practical without yet having been taught the underlying principles. This was the case for second-year undergraduate Biochemistry students at the University of South Australia (UniSA). The practical Enzyme Kinetics was delivered several weeks before the lecture content due to the rotation system of laboratory practicals and the logical order in which lecture topics are delivered. As a result, some students found the practical challenging, and based on their performance in the written practical report, they did not sufficiently learn all the key concepts. Additionally, it was observed that this practical was found to be intrinsically demanding for students, even with assistance from lecture material and laboratory technicians.

To address these two issues, the authors sought an alternative approach, not constrained by laboratory availability or lecture timetabling. With digital technologies now an integral part of university teaching, it was logical to explore the creation of an online resource that would enable, extend and even enhance student learning (Henderson et al., 2017). After several discussions over the best way to achieve this, the authors developed an online interactive simulation that would provide students with the required background information about enzyme kinetics and deliver additional support for the written practical report. The simulation was purposely designed to take the students through the exact steps they would perform in the laboratory class, assisting with data manipulation, calculations, and providing a quiz section for a self-guided review of their understanding. As Horton (2012) explains, in a true simulation, the learner decides and acts and can practice multiple times. Using a web-based resource allowed students to review the content multiple times to absorb and understand concepts. Thus, students had unlimited opportunities to use the simulation both before and after the practical session. Being able to access the simulation anytime gave the students the opportunity to feel empowered and in control of their learning (Smith, 2008).

This chapter describes and discusses this innovation in relation to the Scholarship of Teaching and Learning (SoTL), from the perspective of the academic and the educational designer (ED). The academic has taught Biochemistry at UniSA for 21 years. His doctoral training was in the fields of cell biology and biochemistry, specializing in Immunology. His teaching has evolved through a combination of carefully observing learning issues and implementing and assessing alternative strategies. In response to disappointing student performance in the Enzyme Kinetics practical, he sought another approach to teaching (Costabile, 2014). The ED has been an educational designer for 12 years with particular expertise in online simulations. She was instrumental in the creation of a fictitious simulated city called Horizon that has been a key teaching platform in the Nursing and Midwifery programs for the last five years. She has also built online modules covering topics from Social Media to Aboriginal Cultural Insights and Understanding, which are currently used by students University-wide. The ED has also been a part-time teaching academic for several years, teaching *Children's Literature* and *Global Experience: Professional Development*, which has given her insight into the practical applications of the principles of flexible and empowering pedagogy in an online environment.

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