

Chapter 19

Online Inquiry–Based Learning in Biology: An Experiment in the Use of Virtual Laboratories

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ABSTRACT

A number of experimental studies have been conducted to explore the relationship between inquiry-based learning and the use of online experiments carried out remotely or virtually. Researchers have studied the effect of these techniques in STEM-centered modules (science, technology, engineering, and mathematics) in recent years, as a way to better integrate educational technology to the school context, as well as providing the students with high-quality education. Within this scenario, a biology lecture on nervous impulses was presented following (1) the construction of an inquiry-based online course, as well as inquiry cycle, from which students had at their disposal a series of steps to research the subject, including testing practices through virtual laboratories; (2) application of the educational tool in biology classes; (3) identification the students' progression regarding the understanding of the content explored in the research phases and their perception regarding their learning and usefulness of the educational tool.

INTRODUCTION

Inquiry-based teaching frameworks are being strongly associated with the integration of educational technologies, especially as regards the promotion of Science Teaching, which is more responsible for the development of scientific and technological knowledge that drives the economy of a society (Gütl et al., 2012). Recent research indicates that Inquiry-Based Learning has gained its place in the planning of classes for the teaching of science, as well as in the development of scientific research, due to the emergence of recent techniques that allow those researches to be supported by Virtual Learning Environments in Education (VLEE) (Pedaste et al., 2015).

In addition, the practice of hands-on classes through the use of online experiments, combined with Inquiry-Based Learning, has been explored mainly within STEM centred modules (Science, Technology, Engineering and Mathematics) as a way of better integrating educational technology into the school context. Therefore, it can trigger a classroom built on inquiry (an experience closer to scientific knowledge), developing scientific research, experimentation and research skills, raising the quality of teaching and making learning more meaningful for students.

This study sought to analyse and represent the evolution of the understanding of the contents explored in an inquiry cycle through practical applications of online laboratories integrated to the Investigative Teaching Sequences (ITS), carried out on a VLEE Biology lecture on Nervous Impulses with High School students, as well as identify the perspectives presented by them in relation to their learning and usefulness of this education tool.

For the purpose of this study, it is important to clarify that SDI are online research spaces. This denomination was adopted by the Federal University of Santa Catarina's (UFSC) Remote Experimentation Laboratory team (RexLab), which includes the Mobile Remote Experimentation Workgroup (GT-MRE), of which this study is part. An SDI consists of several stages that induce the deepening of knowledge through the resolution of activities, studies and research in different media, and research in online laboratories, thus enabling the development of different skills and competences, not always explored by the traditional teaching, such as argumentation and critical skills. These activities are characterised as a sequence because they are strongly linked to one another and are investigative because they are all elaborated in an Inquiry-Based Learning (IBL) approach, a type of active learning methodology.

Moreover, the study presented here follows a quantitative approach of an applied research in order to make a comparison between the case-study analysis, carried out at the beginning of the investigative process and the final evaluation, in order to identify the students' progression in the understanding of the content explored in the investigation phases. Although this research is characterised as qualitative, it also aims to learn the students' perceptions obtained by the usefulness of developed tool, after participating in these applications (classes planned from the IBL perspective).

QUESTIONS, CHALLENGES AND TENDENCIES

In recent years, there has been an emphasis on developing curricula and programs geared towards teaching STEM modules, as these subjects are widely seen as a means to encourage innovation and boost national economies. Thus, Science, Technology, Engineering and Mathematics are extremely important areas for school education, as they develop the necessary skills to respond to advances in science and technology in today's society. Qualifications in these areas play a key role in a wide range of occupations of modern

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