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Maria Wallace
College of Saint Benedict/Saint John's University, mwallace001@csbsju.edu

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Evaluation of online lab platforms against best practices for an undergraduate neurobiology course

Maria Wallace and Jennifer Schaefer

College of St. Benedict/St. John’s University, Biology Department, Collegeville, MN 56321

Introduction

The COVID-10 pandemic has changed the way that traditional college courses, and especially laboratory courses, are taught.

Best practices for online education

Following best practices helps instructors to develop the most effective online instruction, increasing student learning and engagement. Many courses and laboratories have been forced to move online in the past 8 months as COVID mandated remote instruction. Many online neuroscience laboratory resources had already been developed due to the cost- and time-intensive nature of neurobiology laboratory techniques. Instructors can take advantage of these pre-existing online resources during the COVID pandemic.

Neurobiology course and project

The neurobiology course taught at CSB/SJU (Biology 320) offers a laboratory component for the first time in spring 2021. Online laboratory resources may continue to be utilized in parallel with hands-on investigations post-pandemic. This project researched best practices for online undergraduate science laboratory instruction and tested neurobiology online lab platforms against best practices and course goals.

Methods

| Literature review of best practices for online laboratory |
| List most relevant to BIOL 320 & annotate references |
| Review neurobiology course objectives and topics |
| Compile list of 9 online neuroscience lab resources |

Results

- **Best practices for online education:**
  - Collaboration among students (Freedman, 2020)
  - Use of simulations for modeling real-world scenarios / ability to repeat labs or lessons (Koski & Kortesky, 2018; Nossoni et al., 2018)
  - Incorporation of videos or demos to reinforce content (Fox et al., 2020; Chloé et al., 2019)
  - Ability to collect data & do analysis
  - Asynchronous course: Best for self-motivated students & weekly meetings to keep students on task and check for understanding (McCowan, 2020; fox et al., 2020)
  - Importance of feedback from the instructor for students to improve student performance (Peterson, 2020)
  - Learning via reading scientific literature to understand current research related to the course/topics (Chandra, 2020)

- **Labs removed for accessibility issues:**
  - NeuroSim5
  - Swimmy
  - UCLA- NSF modules
  - Electrophysiology of the neuron

- **Description of top labs: NeuroWiki & MetaNeuron**
  - Accessible from personal computers & easy-to-use: increases student understanding and facilitates student collaboration
  - Include many simulations for a topic/lesson and/or provides in-depth material for each topic
  - Allow data collection and data analysis
  - Include student exercises & instructor’s manuals, with videos & demonstrations of the simulations or concepts

Conclusion/ Discussion

The increasing demand for online instruction and remote science laboratories is due to the current pandemic but is likely to change the direction of education for the future. The top-rated online laboratories for neurobiology offer virtual simulations, data analysis, understanding of laboratory techniques, and coverage of numerous course topics. The CSB/SJU Neurobiology course is prepared for either remote or traditional learning via online laboratories that follow best practices for online instruction to promote student engagement and learning.