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MacEwan University

POSTER ABSTRACTS

Course-based Undergraduate Research Experience in a Senior Cell & Molecular Biology Laboratory Course

Laura Atkinson; Mount Royal University

Course-based undergraduate research experiences (CUREs) offer students the ability to experience research during their undergraduate studies. While independent studies projects have generally achieved this in the past, demand for undergraduate research positions exceeds their availability at most institutions leading to the rise in popularity of CUREs. This poster will explore the use of a CURE in a fourth year Cell & Molecular Biology laboratory course. In this course, students used a cell culture model to investigate an aspect of the morphological and biochemical alterations that occur during the process of myogenesis. Over the semester, students identified a specific research question, designed a series of experiments, collected and analyzed their data and presented their research in the form of a manuscript and presentation. Although set assessment dates aimed for completion of certain experiments, grading focused on students having gone through the scientific process and their ability to troubleshoot when experiments didn't work. This type of assessment challenged them to integrate fundamental background knowledge from their previous courses with critical thinking and advanced research methodology. Overall, CUREs are effective in exciting and engaging the students as well as providing them with a unique undergraduate research experience.

Acting out in the biochemistry classroom: the use of role-play to teach reciprocal regulation of a metabolic pathway

Nina Bernstein; MacEwan University

Reciprocal regulation of opposing pathways ensures efficient integration of metabolism and is a key concept in biochemistry. At MacEwan University, students are introduced to reciprocal regulation in BICM 200 (Introductory Biochemistry), most prominently in the regulation of glycogen metabolism by reversible phosphorylation. Many students find this non-linear concept difficult to grasp based on only images or simple animation. I have introduced a novel way to teach reciprocal regulation, having students participate in an analogy role-play. Students are assigned roles of individual molecular components (glycogen synthase, glycogen phosphorylase, kinases, phosphatases and hormones). As our "molecular players" act out the process, the rest of the class is invited to direct them. Based on student participation and feedback, the role-play exercise is effective at engaging students and enhancing their understanding of reciprocal regulation in metabolism.

Semi-pro: Novice students engage in more expert-like reading practices and understand more of what they are reading when they read research papers with Figure Facts

Jaclyn Dee, Warren Code, Bridgette Clarkston; University of British Columbia

Relative to professional academics, undergraduates tend to undervalue the figures and research methods published in scientific journal articles. We investigated the efficacy of a data-centric reading template known as 'Figure Facts' in helping students understand the contents of research papers, and in encouraging them to

read papers more like experts, who focus on analyzing data and research methods when reading the primary scientific literature. Developed by Round and Campbell (2013) for a neuroscience seminar course, Figure Facts is a table that asks students to write brief statements describing the data shown in individual figures in a paper, and the corresponding experimental techniques that were employed to obtain those data. Using a crossover design with random assignment to two activity types, we compared reading strategies and comprehension of three scientific papers between students who either completed Figure Facts or wrote a structured summary of each assigned paper. Students self-reported reading behaviors via an online survey. We posed four multiple-choice questions in the class following each assignment to assess students' understanding of each paper. We found that more students reported interpreting graphs on their own and spending more time on the Results and Methods sections of papers, and less time on Abstracts when they did Figure Facts. In addition, we discovered that Figure Facts enhanced students' understanding of experiments and findings in the assigned papers. We concluded that Figure Facts helped students grasp the contents of research papers more firmly and lead them to adopt more expert-like reading habits.

Alex Farmer - abstract coming soon

The impact of a second midterm on students' learning outcomes

Jamie Grunwald, Kelly Keus, Neil Haave; University of Alberta, Augustana

The purpose of our study was twofold: to consider whether a second midterm improved students' learning outcomes and to consider whether students were differentially impacted based on achievement level. Tests have the potential to produce better long-term retention of material via the testing effect than additional re-exposure and the effects can be increased with increased test frequency. However, the relationship between frequency and learning outcomes is not linear: after initial improvements, student learning diminishes as test frequency increases. We hypothesized that students receiving two midterms would have better learning outcomes than students receiving one midterm, and we predicted that lower-achieving students would disproportionately benefit from two midterms. Our study had a 2 (midterm: one or two) x2 (achievement level: high or low) x2 (course level: 100-level or 300-level) between-subjects design using difference scores (i.e., final exam score minus the first midterm exam score) as our dependent measure. We found that students enrolled in a 100-level course were positively impacted by a second midterm while those in a 300-level course were not. Compared to those who wrote only one midterm exam, students in the 100-level course who received a second midterm exam performed less poorly on their final exam relative to their first midterm exam. A second midterm exam thereby rescued students from a significantly poorer final exam result. However, a second midterm exam did not differentially improve the final exam scores relative to the midterm exam scores for low-achieving students

What is the relationship between students' mindset, study habits and learning gain?

Malin Hansen; Red Deer College

A student's mindset has been defined as a student's perception of his or her ability to improve on a certain skill or ability to learn a certain concept. A student with a fixed mindset believes that his or her ability is fixed and that improving on a certain skill is very difficult. A student with a growth mindset, on the other hand, believes that his or her ability can be developed and improved through deliberate practice. As a result, it is likely that students' mindsets affect their study habits and consequently their learning gain. A self-reflective survey was completed as part of an in-class individual post-midterm reflective activity. The survey included Likert-scale statements that explored students' mindset and study habits. A total "mindset score" was calculated based on

eight statements. Students with a growth mindset (a mindset score >60%) were more likely to report that they would change their study habits if receiving a poor result than students with a fixed mindset (79% vs. 52%). In addition, students who reported that they were likely to change their study habits were more likely to improve their grade from midterm 1 to 2 (43% vs. 14%, p-value = 0.006). These students also experienced higher overall learning gain throughout the course (13% vs. 8%, p-value = 0.04). A better understanding of how students' mindset affects their study habits and learning allows educators to design learning activities that aims to shift students' mindset. Implementation of such activities could have a drastic effect on the success of many undergraduate students.

Course-Based Undergraduate Research Experience using a K-562 cell line

Kimberley Harcombe, Melissa Hills, Nina Bernstein; MacEwan University

Course-Based Undergraduate Research Experiences (CURE) are recognized as providing critical experiential learning opportunities for students. Essential elements that define a CURE include working on projects that do not have a predetermined outcome, collaborative work, and the opportunity to build technical skills through iteration. CUREs have been shown to develop a deeper understanding of the scientific process, improve technical skills, and build confidence and resilience in a scientific setting. We have developed a fourth-year research-based laboratory course, grounded in the CURE model, based on primary scientific literature showing that certain chemicals can induce the immortal Chronic Myelogenous Leukemia (CML) cell line K562 to revert to a differentiated, mortal state. In this course, students work independently to propose and test potential chemical inducers of K562, employing a variety of molecular and cellular biology techniques to measure cell differentiation. The sharing of lab materials, equipment, and experiences develops skills necessary for work in a collaborative research environment. Scientific literacy and writing skills are developed through completion of a detailed research proposal, supported by primary literature, and a final report in the style of a journal article manuscript. Skills relevant to authentic research are emphasized through documentation of experiments in a formal laboratory notebook, analysis of data, research design and troubleshooting, and deployment of a breadth of laboratory skills. A survey of students recently enrolled in the course was used to examine its effectiveness in contributing to student learning and skills development, guided by the outcomes predicted in the CURE model.

Can a short meiosis animation support student learning?

Melissa Hills, Kathy Davies, Carolyn Ives; MacEwan University

Undergraduate understanding of meiosis can be utilized as a test case to evaluate learning tools in biology. Video is frequently used to support learning in and out of the classroom. We developed a short, engaging meiosis animation to supplement regular instruction. In addition to evaluating whether the animation improved student understanding of meiosis, this research assessed whether students perceived the animation to be useful to their learning. Two similar study designs were used: in the first "Controlled" design, students viewed the animation in class; in the second "Self-Directed" design, students received animation access online to view independently. In the Self-Directed study design, only 27% of students with access to the animation watched it. Neither study design found an improvement in test scores following classroom instruction, regardless of whether students also watched the animation. These results suggest that most students in this study were not interested in utilizing animation outside of the classroom as a learning tool. Our results may support previous research that suggests students are not engaged in mastering challenging concepts without a clear incentive.

The correlation between marks on multiple choice and written questions on first year evolution and diversity exams

Kevin Judge, Mrinal Das; MacEwan University

Undergraduate educators are faced with a challenge: how to adequately assess student learning while balancing all the other demands on our time. This is especially the case with the large number of students in introductory classes. For exam testing, one solution to this tradeoff is the use of multiple choice questions (MCQs) for the majority of an exam due to the ease of grading, despite the problems associated with this format. Instructors in MacEwan's first year evolution and diversity class (BIOL-108: Organisms in Their Environment) use a majority of MCQs on exams, but the proportion varies both with instructor and over time. Within the past few years, we made a decision to increase the proportion of multiple choice questions on final exams in response to pressures to submit final grades at the end of term. This decision was based on a strong positive correlation between scores on MCQs and written questions, although the analysis was limited in scope and sophistication. We readdress this correlation with a larger dataset (more years and more instructors) and ask more nuanced questions, for example, about the strength of the correlation both across the distribution of student grades as well as over time.

Promoting a culture of learning through a learning philosophy assignment

Kelly Keus, Neil Haave; Augustana Campus, University of Alberta

Creating respect for deep learning often requires professors to educate students on what effective learning looks like. We developed a learning philosophy assignment (LP) which encourages students' metacognition which is known to promote student learning outcomes. The LP asks students to consider what, why, and how they learn, but also how their current learning connects to their greater life goals. We investigated whether the LP improved specific learning outcomes (i.e., exam performance) and/or general learning outcomes (i.e., intellectual development). Students' intellectual development was measured at the beginning and end of term using the Learning Environment Preferences (LEP) Survey which returns a cognitive complexity index indicating their level of intellectual development on the Perry Scheme. Prior to the midterm exam, students completed a first draft of the LP. Students were then given feedback after the MT exam to develop their LPs which specifically asked students to consider whether their learning strategies were effective and what alternative strategies should be considered. Prior to the final exam, students completed a second draft of their LP that responded to this feedback. The LP appeared to prevent a decrease in intellectual development and improve exam performance of first-year students, but the effect is inconsistent. Certain cohorts demonstrated improvements in intellectual development (i.e., Fall 2015), others showed improvements in exam performance (i.e., Fall 2016), while some showed no improvements on either measure (Fall 2017). However, our qualitative analysis indicated that all students were engaged in metacognition of their learning.

There is no I in Team: Coaching in structured teams to foster positive collaboration

Jody Rintoul; Augustana Campus, University of Alberta

Science, like most fields, is highly collaborative. In order to gain experience working collaboratively, a lot of instructors in the sciences promote teamwork in their labs. Unfortunately, many of us do not coach the students effectively on working in teams (at least in my experience), and so uncomfortable group dynamics occasionally arise. As an attempt to reduce the stress and anxiety associated with teamwork, I have implemented two approaches to encourage effective teamwork in my introductory biology lab: 1) students are assigned to a four person team early in the semester and continue throughout the semester to work in a pair with each person in that team; this culminates in a team project with all four team members; and 2) coaching

students on articulating expectations and accountability measures in a “team alliance” for their team project. Compared to previous years, I have observed that there have been fewer issues within the teams and the peer evaluations show this as well. Overall, I suggest that we need to take the time to coach our students on how to be team players if we expect them to work collaboratively in the biology lab environment and in other science disciplines too.

Buck Tradition: Reenvisioning writing in labs

Carla Starchuk; University of Alberta

The majority of students identify that their future careers will include common scientific communication tasks. Despite this, one of the most common student lab complaints is that they do not plan to be scientists and therefore they do not need to know how to write lab reports. This poster discusses the outcomes of an endeavor to make writing more meaningful to our students’ diverse futures while remaining authentic to science. The students are asked to choose two out of four possible writing assignments to complete. The assignments have different formats and are stylistically distinct from each other but all are types of written communications that can be expected from disciplines requiring a scientific background. The assignments all maintain many of the core elements of lab reports but with differing emphasis. Giving students autonomy to choose assignments that align the writing format with their predicted future helps students see how both the content and the practice of writing is transferable across disciplines and applicable to their intended career paths.

Using the online platform Kahoot for more than just review; survey students to encourage goal setting, reflect on learning, and provide teaching feedback.

Amy Tessier; MacEwan University

On Day One in the lab, my students participate in an online Kahoot survey designed to get them thinking about their reason for being in my class, what they expect to learn, and if they think their current approach to studying is effective. Throughout the term, the students are asked to engage in weekly review quizzes using Kahoot, where additional questions are added to encourage students to reflect on their learning accomplishments. At the end of term the Kahoot survey is used to get feedback regarding the various methods used throughout the term, such as the Kahoot quizzes, powerpoints, support questions, and pre-lab discussions. The Kahoot platform generates reports of the surveys and quizzes, which can then be analyzed to provide insight into student attitudes, and what additions or changes in teaching method could improve student motivation and learning.