SYM-34-03

THE DEVELOPMENT OF UNDERGRADUATE SCIENCE STUDENTS' SCIENTIFIC ARGUMENT SKILLS IN ORAL PRESENTATIONS

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The Science Threshold Learning Outcomes (TLOs) developed recently as part of the Learning and Teaching Academic Standards project, reinforce that the ability to develop evidence-based, well-reasoned arguments and to clearly communicate those arguments in a variety of communication modes, are key graduate attributes (Jones, Yates & Kelder, 2011). However, in practice, specific measurement of these skills is limited, particularly in oral presentations. This study describes the initial literature-based development of a rubric for the evaluation of scientific argument in oral presentations (Toulmin, 1958; Sampson, Grooms & Walker, 2009), and the reiterative, data-driven process of refinement of that rubric. The rubric reflects the established framework for the scientific argument, by including criteria for claim, evidence and reasoning, and evaluates these three components across standards that represent the variation within a mid-level undergraduate cohort. Using this rubric, we evaluated the ability of undergraduate science students to communicate scientific arguments in an oral presentation task in which they presented data acquired from an inquiry-based practical (Bugarcic, Zimbardi, Macaranas & Thorn, 2012). Students demonstrated the ability to make claims, supply evidence and articulate reasoning that linked claims with supporting evidence. However, the standard of these elements was varied, and the structure of students' arguments was not always complete. Using an action-research approach, these initial findings were used to develop student guidelines and alter the curriculum in a subsequent iteration of the course. This intervention resulted in students presenting more complete and higher quality arguments. Overall, this study reports on the development of the rubric and describes the design and impact of an evidence-driven teaching intervention that enhances students' scientific argument development in oral presentations.

SYM-34-04

DEVELOPING STUDENTS' SCIENTIFIC WRITING SKILLS THROUGH EMBEDDED WRITING ACTIVITIES IN BIOSCIENCE UNDERGRADUATE LABORATORY AND HONOURS COURSES

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Scientific writing skills are important for a science career, yet specific training can be difficult to integrate effectively into a University program. To challenge science students to improve their writing we incorporated writing activities into undergraduate biological science laboratory courses and into Honours courses, and designed appropriate feedback mechanisms. The outcome is that students experience cycles of writing, receiving feedback and making improvements, which continue until both student and assessor are satisfied with the outcomes. This proactive approach encourages students to change their attitude towards scientific writing, which in turn promotes critical thinking and independent learning. Embedding the writing activities into existing courses enables the students to see the relevance of the writing training and students enthusiastically embraced the iterative feedback processes. We probed student opinions regarding scientific writing and their perceived value of the writing exercises by anonymous pre- and post-course surveys using a combination of closed and open questions. The courses were also evaluated through the University's standard course experience surveys. Confidence towards scientific writing and performing simple writing tasks significantly improved after experiencing the writing activities. Independent assessors evaluated the standard of students' written reports that originated from the same laboratory course held in years before and after writing activities were incorporated into the curriculum. The assessors reported a significant improvement in scientific writing quality that correlated with the increase in student confidence and attitudes towards writing.

SYM-34-05

BEYOND MEMORISING FACTS: DEVELOPING CRITICAL THINKING AND SCIENTIFIC REASONING SKILLS IN BIOLOGY UNDERGRADUATES

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In 2012 we introduced two new second-year biology courses aimed at developing a number of generic skills expected in a biologist including, but not limited to, critical evaluation of the scientific literature, science writing and communication, critical thinking, experimental design and statistical analysis. Whilst the courses we describe here were designed specifically to focus on developing these skills, the teaching approach and assessment pieces could be integrated into existing courses. The course Big Questions in Biology presented a syllabus with a focus on the nature of science, using case studies to introduce fundamental scientific concepts and the relationship between biology and society. Assessment pieces in this course include a focus on improving writing skills in different contexts. The second course, Experimental Design and Analysis, focuses on improving student skills in the essential aspects of research from experimental design through to application of statistical tests, evaluation and analysis of data and presentation of outcomes. We embedded these learning outcomes in a biology context, making the course interesting and relevant for biologists. Curriculum design of both courses and experiences of the 'Second year biology' student will be presented.

SYM-35-01

LIVE FAST, DIE YOUNG? PLANT TRAITS ASSOCIATED WITH RECOVERY FROM DROUGHT-INDUCED XYLEM EMBOLISM ACROSS CONTRASTING BIOMES

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Background/Aims Drought intensity may increase in future climates in many regions, causing xylem embolism, which may accumulate to lethal levels, if not refilled. Plant species with traits that allow refilling of xylem embolism may avoid drought-induced mortality. Interestingly, many species exhibit significant night-time sap flux, which has been hypothesized to contribute to refilling of xylem embolism. This study relates recovery from drought-induced xylem embolism to night-time water flux. Here, I droughted 8 woody plant species (spanning tropical to semi-arid biomes) and measured xylem vulnerability curves and subsequent recovery from embolism following re-watering. I calculated a xylem recovery index (XRI; percent loss of conductivity (PLC) during drought relative to PLC twelve hours following re-watering) to quantify hydraulic recovery following drought. I tested whether (1) xylem recovery was linked with delayed time to mortality, (2) xylem recovery was linked with nocturnal stomatal conductance, and (3) whether elevated CO_2 increases time to death and Xylem Recovery Index. Whole-plant and leaf traits that influence xylem recovery, including stomatal conductance, transpiration, turgor loss point, photosynthesis, both instantaneous (A/Gs) and integrated water use efficiency (C13 estimated using carbon isotopes), nonstructural carbohydrate content, parenchyma starch content, specific leaf area, and wood density are discussed. Results Counter-intuitively, species with the highest recovery from embolism also had fastest time to mortality. Also counter-intuitively, night-time stomatal conductance was positively related to xylem recovery. The strongest driver of xylem recovery was ray parenchyma starch, and plant species clustered by biome. Elevated CO2 increased leaf temperature, branch diameter and branch conductivity and decreased stomatal conductance, leading to no overall impact on time to death or xylem recovery. Hydraulic strategies used by plants across various biomes to recover from xylem embolism, and how these vary across biomes to avoid drought-mortality are described. These results will enable us to (1) predict which species will be resilient to drought-induced mortality, and (2) prioritise which whole-plant and leaf traits are most important to include in vegetation models.