

Learning research skills in undergraduate exercise physiology

G.D. Wadley, K.F. Howlett, A.P. Russell and R.J. Snow, Centre for Physical Activity and Nutrition Research, School of Exercise and Nutrition Sciences, Deakin University, Burwood, VIC 3125, Australia.

The need for research based learning to be the standard for educating undergraduates was championed by The Boyer Commission on Educating Undergraduates in the Research University (1998) almost 20 years ago. Furthermore, the design, execution, interpretation and reporting of experimental studies form the basis of knowledge in all scientific disciplines, including exercise physiology and metabolism. HSE303 Exercise Metabolism is a 3rd year undergraduate unit grounded in physiological principles in the Bachelor of Exercise and Sports Science degree at Deakin University. For the reasons outlined above, the teaching and learning of research skills in HSE303 comprise one of the unit learning outcomes “developing a research question, conducting a scientific research study and producing a journal quality paper”.

The laboratory experience in this unit provides students with an introduction to this process. In teams of 4-5, students undertake human exercise experiments on topics supplied by the teaching team. Importantly, the learning experience is authentic, since the experiments are adequately powered for many of the primary outcome measures. Students are expected to review important background literature, undertake experimental work, collect data and analyse these data using appropriate statistical tests. This work then culminates in submission of a written report in the format of a journal paper for the Journal of Applied Physiology.

The laboratory research projects are structured iteratively, so students initially complete a simple project focussed on data collection and analysis, with the interpretation and presentation being a written abstract, followed by detailed feedback. Advanced research projects then involve student input into research design and hypothesis development via an oral presentation that includes peer feedback; with the interpretation and presentation of the project being a journal manuscript.

Each research project is assessed electronically using an analytical rubric with five levels of performance for each criteria. The assessed criteria are based on the sections of a research manuscript that include introduction, methods, results, discussion and conclusion. The performance of students in each assessment criteria during 2014 were investigated using the criteria score frequency using the learning management system Desire2Learn (Kitchener, ON, Canada, <http://www.brightspace.com/>). For both research projects, the majority of students frequently scored highest in the criteria of formatting and presentation, followed by descriptive aspects of the manuscript such as methods and results. The criteria that students more frequently scored in the lower levels of performance were related to the interpretation and discussion of findings.

In summary, the assessed learning outcomes from this unit suggest these undergraduate students are adept at many of the lower level cognitive skills (Anderson & Krathwohl, 2001) involved in the description of the research process and outcomes. However the students display a lower level of performance with regards to interpretation and evaluation of physiological data. Therefore, future strategies in the implementation of the unit need to focus on teaching and learning tasks that improve skills around interpretation and evaluation of physiological data.

Anderson LW, Krathwohl DR (eds) (2001) In *A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives* New York: Longman.

The Boyer Commission on Educating Undergraduates in the Research University (1998) *Reinventing undergraduate education: A blueprint for America's research universities*. Available for electronic download at <http://eric.ed.gov/?id=ED424840>.