FACTORS UNDERPINNING STUDENT PERCEPTIONS OF LABORATORY EXPERIENCES

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KEYWORDS: student perceptions, laboratory learning, ASELL

Background

Survey data gathered as part of the Advancing Science by Enhancing Learning in the Laboratory (ASELL) project and its predecessors have been used previously to draw correlations between student perceptions of different aspects of laboratory-based activities and their perceived overall learning experience (Barrie, Bucat, Buntine, Burke da Silva, Crisp, George, Jamie, Kable, Lim, Pyke, Read, Sharma, & Yeung, 2015). However, typical past analyses have involved the application of scoring techniques to ordered categorical response data, conflating student dependent and student independent contributions to student responses. Rasch modeling techniques provide an opportunity to control for the biases of individual students, revealing the more sample independent correlations in student perceptions which can be used to inform teaching practice. Particularly, the Linear Logistic Test Model (Fischer, 1995) is capable of expressing sample independent measures for each survey item as a linear combination of more basic factors of the experience.

Aims

The aim of this research was to derive a Linear Logistic Test Model for the ASELL Student Learning Experience (ASLE) survey, expressing "overall learning experience" as a linear combination of more basic factors of the learning experience.

Methods

A data set of 128,881 individual data points provided by over 9000 students in response to the ASLE survey, gathered from 29 practical activities run from 2011 to 2015 was input into a Rasch model, extracting student independent measures of quality for each experiment. These student independent measures were subjected to factor analysis, subsequently converting the results into a Linder Logistic Test Model of the ASLE survey data. Number of factors extracted was determined by balancing the parsimony of the model with the proportion of observed data variance explained, using the corrected Akaike Information Criterion (Burnham & Anderson, 2004).

Results

The final Linear Logistic Test Model reveals six major identifiable contributors to the laboratory learning experience. In descending order of impact on responses, these factors are the perceived connection to lecture theory, the quality of instructional material provided, understanding of theory through collaboration with others, the development of data interpretation skills, independent learning and the reliance on or appreciation for the demonstrator. A large component of "overall learning experience" appears to be due to aspects not addressed by ASLE survey items. The model yields equations for facets of the laboratory learning experience targeted by the ASLE survey, such as the equation for "overall learning experience" below (Equation 1).

$$\delta_{14 \, (overall \; learning \; experience)} \;=\; \begin{bmatrix} -2 \\ 2 \\ 0 \\ 1 \\ 1 \\ 2 \\ 5 \end{bmatrix} \cdot \begin{bmatrix} \eta_{theory \; focus} \\ \eta_{instructions} \\ \eta_{collaborative \; understanding} \\ \eta_{data \; interpretation} \\ \eta_{independent \; learning} \\ \eta_{demonstrators} \\ \eta_{unexplained \; overall} \end{bmatrix} \qquad (1)$$

Similar equations are also obtained for other items of the survey, revealing models for fostering aspects of the experience such as student interest, increased understanding and development of technical skills.

Conclusions

Equations comprising the Linear logistic Test Model have a range of pedagogical implications for the structure of laboratory learning activities. Notably, increased understanding appears to be irrelevant to perceived "overall learning experience", raising questions as to the consequential validity of using student response data to drive design of learning activities. A general theme of conflict between student preferences and attainment of learning objectives is recognized.

References

Barrie, S. C., R. B. Bucat, M. A. Buntine, K. Burke da Silva, G. T. Crisp, A. V. George, I. M. Jamie, S. H. Kable, K. F. Lim, S. M. Pyke, J. R. Read, M. D. Sharma & A. Yeung (2015). Development, Evaluation and Use of a Student Experience Survey in Undergraduate Science Laboratories: The Advancing Science by Enhancing Learning in the Laboratory Student Laboratory Learning Experience Survey. *International Journal of Science Education, 37*(11), 1795-1814.

Burnham, K. P. & Anderson, D. R. (2004). Multimodel Inference: Understanding AIC and BIC in Model Selection. *Sociological Methods & Research, 33*(2), 261-304.

Fischer, G. H. (1995). The linear logistic test model. *Rasch models* (pp. 131-155): Springer.