Communicating Understanding of Statistical Concepts

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This paper explores student commentary on computer output of basic statistical analysis as a means of communicating understanding of concepts. In fundamental statistical education at university, students can be confounded by an onslaught of terminology, equations and processes. Many fail to reach the point where they can present rational comments on their findings. As this 'rational comment' provides us with evidence of their assimilation of statistical knowledge, as educators it behooves us to seek measures to address this shortfall in their learning.

This study forms a part of an implementation in an on-going action research project on assessment. The project aims to identify strategies which promote assessment that facilitates learning. The taxonomy of learning proposed by Bloom (1974) and his associates and revised by Anderson and his associates (2001), has been used to align teaching and assessment in this subject. This alignment has been transparent in practice with all student tasks and assessment containing the explicit objectives.

Epistemology and social constructivist learning theory pervade the instructional framework for the fundamental statistics subject under evaluation. In order to foster 'deep learning', it has been designed around collaborative and experiential learning exercises and assessment. Tasks engaged students in active exploration of 'real data' using technology in laboratory classes and structured to support the theoretical concepts expounded in lectures. (Biggs, 2003; DeMulder and Eby, 1999; Kolb, 1984) Students worked from a laboratory manual which contained space for their responses, comments and output. The manual formed the principal reference resource for study for the final exam. Student (60-70%) evaluations have rated the classes, manual and tasks as extremely important to their understanding of statistics.

Assignments mirrored laboratory tasks and were structured for teams of two collaborators. Each question comprised of two parts (one for each partner) and although partners were encouraged to collaborate, each responded to different questions. The questions were formed as either parallel (same theoretical context but different data) or complementary (one partner completing theoretically based questions and one completing practical questions for the same theoretical background). These perspectives were reversed for another question.

Technology was used for basic analysis and calculation, and interpretive responses were to be substantiated by their output. Earlier observations (in a previous implementation of the action research cycle) had identified student reticence to complete assessment questions which required them to 'comment upon', 'explain' or 'interpret'. Some responses had been facile, with little or no support from the output. Many could correctly identify appropriate measures, but could not structure a logical comment incorporating these.

In an attempt to provide a systematic framework for such responses by e, detailed 'marking guides' which identified requisite knowledge were structured as 'advance organisers'. (Ivie, 1998) These were included with the initial assessment tasks, but for subsequent tasks the guides were made less specific, with students encouraged to refer to previous feedback. Tracking later assessment does show improvement in similar questions with most students reporting 'confidence' in their ability to handle them. Final student evaluations for example, indicated that they strongly believed in their ability to conduct and comment upon exploration and analysis of data sets, and relationships between two variables (both topics taught early in the course). This has also been supported by teacher evaluations of student learning and reflected in student performances in these topics in the final exam. Continuous feedback however also appears to have played a role in this, as topics encountered late in the subject show less competence in interpretive responses.

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