Analytic Rubrics for Decision Making

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INTRODUCTION

Rubrics have been used in education for many years as tools for assessing student performance. In assessing student performance, Beyreli & Ari (2009) cited Weigle, (2002), who noted that analytic rubrics assess the performance as the sum of itemized tasks, while holistic scoring assesses student performance with a single score for the entire work. Weigle's research focused on the development and validation of rubrics designed to assess student performance on problem solving assignments. In the current study, rubrics were developed for both quantitative problems and qualitative problems. Rubrics developed for assessing student performance on conditional probability (quantitative) problems in an introductory statistics course were validated in study I. A rubric developed for assessing student performance discussing and analyzing specific situations related to legal issues (qualitative) presented in an undergraduate business law course was validated in study II.

Shipman, Roa, Hooten, & Wang (2012) provide positive and negative qualities of rubrics, focusing on the analytic rubric for problem solving. Like the rubrics in the Shipman et al study, the rubrics developed and validated in both of the current studies were all analytic in nature. Each rubric assigned scores based on several items required in the analysis and completion of the assigned problem, with the total score being the sum of the points scored for each item or task within the problem solution.

In order to validate that the rubrics are adequate for their intended use, the correlation between multiple raters using the rubrics to assess student performance are calculated. Strong inter-rater correlation indicates reliability of the assessment tool (Saxton, Belanger, & Becker, 2012). Reliability of the assessment tool is considered validation of the tool.

BACKGROUND

There have been numerous ways presented to improve the learning process in decision sciences, including the use of games and classroom activities (Chow, Woodford, & Maes, 2012), and applications of continuous improvement concepts in the development of online courses (Aggarwal, & Lynn, 2012). Rubrics are another tool used for improving the learning process. Cohen, Mason, Singh, and Yerushalmi (2008) had physics students use rubrics as self-diagnostic tools to determine their prior knowledge of the material introduced, and their post learning level of understanding. By completing the information requested in the rubric, students provided information based on their own perception of their understanding, while also providing the researchers with a consistent vehicle for collecting the information.

Yerushalmi, Mason, Cohen, & Singh (2009) used rubrics to increase student learning in physics. They concluded that students found the rubric as a useful learning tool, supporting the findings of their earlier research. Allen and Knight (2009) presented a method of collaboratively develop-

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ing and validating a rubric suitable for assessing performance to be both "academically-sound and employer –relevant." Collaboratively designing the rubric with input from academics and professionals, the resulting rubric assesses the learning and performance of students based on outcome criteria from both.

Beyreli and Ari (2009) used analytic rubrics broken into three sections and 10 properties to assess student writing performance. They used six raters and determined that the consistency/reliability of the raters was sufficient across the ten properties assessed. Thaler, Kazemi, & Huscher (2009) developed and validated rubrics for assessing student learning outcomes within their department. The inter-rater reliability and validity coefficients were statistically significant, supporting their position to encourage educators to develop, evaluate and apply rubrics in assessing student learning. May, O'Neill, and Sharma (2008) presented a case where business school professors worked with business professionals to refine an oral presentation rubric. They showed that including inter-rater agreement in the development of the rubric can improve the overall performance of the rubric. Additionally, the results of the study revealed a clear need for rater training.

Lunney and Sammarco (2009) successfully used a scoring rubric to evaluate student discussion responses in online nursing courses. They found suitable inter-rater reliability with overall correlation of inter-rater scoring to be satisfactory. Similarly, Oakleaf (2009) found that with suitable training, librarians can be trained to be moderately consistent raters using rubrics to assess information literacy.

Reddy & Andrade (2010) found through a study of research using rubrics that based on rater reliability, rubrics can be used to achieve a "relatively common interpretation of student performance." Stellmack, Konheim-Kalkstein, Manor, Massey, and Schmitz (2009) found that using a well constructed rubric for scoring student writing can provide suitable inter-rater reliability, including correlation to a subjective holistic scoring performed by another assessor, but warn that because of unavoidable subjectivity in assessing student writing, the use of a well developed rubric does not guarantee high reliability.

MAIN FOCUS

The experimental methods used in parts I and II of study I was quasi-experimental with students randomly assigned to solve either a conditional probability problem in a probabilistic format or in a natural frequency format. Study II was conducted as part of a normal classroom assessment exam, where participants were asked to discuss and analyze a particular situation in the form of an essay. Both studies were conducted within the classroom environment.

Methods

The scoring for each participant in study I was based on the level of correctness in their solution to the target problem. A scoring rubric for the probability solution target problem and a scoring rubric for the frequency format solution target problem were used to provide consistency in scoring. Two scoring rubrics are used because the solution method for the frequency format is different than the solution method for the probability format. By creating and applying two separate rubrics, the solution methods can be more distinctly identified for performance criteria and completion levels. The scoring rubrics were tested for reliability by having three different instructors evaluate the same sample (n=30) of problems and assigning points according to the rubrics. Consistency in the scoring validated the reliability of the rubric across multiple assessors.

The scoring rubrics consisted of six performance criteria or steps that assessed each participant's solution. The performance criteria for the probability based solution rubric were: (a) Identified conditions of problem; (b) Identified events in each condition; (c) Identified event probabilities given; (d) Identified conditional probabilities given; (e) Incorporated data/infor-