A Direct Method for Teaching and Measuring Engineering Professional Skills

Methods for Efficient and Reliable Scoring of Discussion Transcripts

A Validity Study for the National Science Foundation’s Research in Evaluation of Engineering and Science Education (REESE)

INTRODUCTION

Proficiency in teamwork, effective communication, knowledge of impact on society, recognition of life-long learning, and knowledge of contemporary issues are often referred to as Professional Skills. These skills are critical for success in the multidisciplinary, intercultural team interactions that characterize engineering careers in the 21st century. Engineering programs across the nation have struggled to define, teach, and measure these skills since their introduction as accreditation criteria in 2000. To address the need by engineering programs nationwide to define, teach, and measure these skills, in 2006 the Washington State University (WSU) College of Engineering and Architecture partnered with an assessment specialist to create an innovative, direct method called the Engineering Professional Skills Assessment (EPSA) for teaching and measuring these professional skills simultaneously. No direct method for teaching and measuring these skills simultaneously has existed in the literature prior to the EPSA protocol.

EPSA METHOD

The EPSA method is a discussion-based performance task designed to elicit students’ knowledge and application of professional skills.

Medium sized groups (5-7 typically) of students are presented with a complex, real-world scenario that includes multi-faceted, multidisciplinary engineering issues. The students are then asked to determine the most important issues and to discuss stakeholders, impacts, unknowns, and possible solutions.

Faculty raters and assessment specialists assess student group discussions using an analytical rubric to measure the quality of the students’ performance in demonstrating engineering professional skills.

This method can be used at the course level for developing and measuring student performance and at the program level for evaluating curricular efficacy.

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PROJECT OBJECTIVES

1) Construct a framework to guide production of scenarios and task prompts that equally elicit student consideration of all professional skills.
2) Develop a manual that provides specifications for training and task implementation, scoring, and reporting.
3) Validate scenarios, task kernels, and rubric usage across disciplines and institutions.
4) Provide methods for the efficient and reliable scoring of the transcripts of the student discussions.
5) Document results for engineering education community and disseminate EPSA learning outcomes, administration protocols, and scoring know-how to classroom practitioners.

RESEARCH QUESTIONS

This research project is driven by the following three research questions:

1) To what extent does the EPSA method equitably elicit student consideration of professional skills when implemented in different course types and at different points in a curriculum?
2) Do the EPSA rubric scores reliably provide information about students’ professional skills proficiency levels?
3) What is the correlation between the EPSA rubric’s scores and scores from other established instruments that measure the same or similar skills?

RESEARCH METHODOLOGY

Framework: Descriptive case-study methodology will allow the researchers to understand and examine the contexts in which parallel performance tasks are deployed.

Design: Purposeful multi-site sampling will be implemented in three distinct sites and four distinct course-type settings.

Instrument: Instruments with established validity will be used for data triangulation with the EPSA rubric to establish the criterion validity of the EPSA Rubric.

CONTRIBUTIONS

Findings from the EPSA and focus group sessions may be combined with other assessment measures to give engineering programs a more complete picture of student mastery of professional skills.

This direct method of developing and assessing professional skills simultaneously can be used in engineering programs to continuously improve the global professional competencies of future engineers.