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Rubric Reboot: Assessing Student Learning Objectives

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The instructional team of the interdisciplinary senior design program at the University of Tennessee, Knoxville has been struggling with a mismatch between instructors' implicit goals for student learning and the rubrics used to assess students. The instructional team is revising course assessment rubrics to correspond with a set of student learning objectives. Learning objectives will be developed as smaller-scale, measurable student behaviors that demonstrate meeting the high-level course outcomes. The new rubrics are expected to make assessment more reliable between graders and more useful to students to direct their learning.

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Program Background

The University of Tennessee Honors Interdisciplinary Senior Design (ISD) program is a two-semester course where students from all engineering and business disciplines work in teams to complete sponsored, business-relevant projects with the help of faculty mentors and client liaisons. The program is in its third year and currently has 50 students (30% business majors) working on 8 teams. Course deliverables include a functional prototype, 3 reports (preliminary design, system level design, and final design), client presentations, a poster, and an infomercial video. The team plans to double student enrollment. The course fulfills university general education requirements for written and oral communication. An instructor and two graduate teaching assistants work on the course for a total of three graders. Rubrics were added to ISD assignments to provide consistent evaluation of student work across multiple graders.

Rubrics for Assessment and Learning

Analytic rubrics are an assessment tool that combine multiple criteria for student work with performance levels for each criterion. These two components make analytic rubrics distinct from other assessment tools like checklists, holistic review, or rating scales[1,2]. Beyond an assessment tool, rubrics can also improve student learning when criteria are descriptive. Descriptions of quality work, rather than quantity, help students use rubric feedback to direct their next steps[1]. Rubrics have been added to other capstone design courses in efforts to give students clearer feedback that leads to greater learning[3]. Rubrics have also been used to increase feedback consistency on capstone design reports[3,4].

While rubrics can have positive impacts on student performance, this is not always the case; rubrics must be validated to ensure they work as intended[5]. Rubrics are most useful for evaluating students when rubric criteria are rooted in student learning objectives[1,6]. Good rubrics must also be reliable—they must be used in the same way to assess each student's work by each evaluator[7]. Rubrics fall short when they are overly vague in their assessment criteria[8] or when they include criteria that are not relevant to the learning being assessed, for example work habits[9].

Product-focused Rubrics in ISD

Initially, ISD rubrics were created so multiple graders could consistently evaluate assignments, so these rubrics were focused on a grader's perspective. Rubric categories were unique to the expectations for each assignment. The assessment criteria were not made with student learning in mind. Because of this, some rubric criteria were not related to student learning goals and some learning goals were not represented in rubric criteria.

The rubric used to evaluate the system level design report, written at the end of the first semester, exemplifies this problem. Criteria from the rubric are template usage (10%), required content (20%), depth of content (10%), clarity of purpose (5%), organization (5%), analysis and discussion (15%), terminology (5%), grammar (10%), figures and tables (10%), and references (10%). Each criterion included a brief description and was evaluated as fully met, acceptable, needs improvement or unsatisfactory.

After using these product-focused rubrics for two years, it became clear that a better set of rubrics was needed for assessment and for student learning. The system level design report rubric showcases two major issues typical of ISD rubrics. First, overlapping, unclear categories allow for graders to differ in how they evaluate a piece of work.

The second difficulty exemplified by the system level design report rubric is that the purpose of the report is not clear from the rubric criteria – students are not given an idea of why their design work is important. Other rubrics also focused on discrete details like expectations for formatting at the expense of transferable goals for student learning.

Student Learning Objectives

To improve ISD rubrics, the instructional team will create a set of discrete student learning objectives for the course based on existing course outcomes. Student learning outcomes are a high-level view of knowledge and skills that students have at the end of the course. Student learning objectives are discrete, measurable student behaviors or skills. Learning objectives can help instructors create activities and assessments that focus on relevant student learning[10].

Learning outcomes of this course include the 7 student outcomes of ABET criterion 3[11]; and that students will recognize and use the discipline-specific tools of engineers and business people. These high-level course outcomes are too broad to evaluate directly. Discrete course learning objectives will bridge the gap between these high-level outcomes and the assignments students complete during the course. A list of the 8 student learning outcomes and the learning objectives scaffolded within them can be found at tiny.utk.edu/CDC2022RubricReboot.

Path to Student-focused Rubrics

Program rubrics will be rewritten to align with the new set of student learning objectives. The following learning objective-based criteria will be included in the system level design report: exective summary, value proposition, documentation, solution selection, test plan, risk communication, discipline-specific tools, iteration, and style guidelines. The rubric will also include a checklist to quickly assess adherence to formatting and grammar expectations. A description of each rubric criterion is available at tiny.utk.edu/CDC2022RubricReboot.

Now that the team has identified rubric criteria, the next step will be to define quality standards for each objective based on student work collected over the last three years. Sample assignments will be provided to students which exemplify performance at each level.

These rubric changes are designed to shift the course focus from assessing student work products to assessing student skills. The new rubrics are expected to help students succeed in meeting learning objectives for the course because expectations will be clearer to them. These changes will also make the connections between each assignment and overall program goals explicit.

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