Project title: Exploring the Role of Rubrics in Assessment of Student Learning – Research, Development, and Implementation

1. Introduction and Motivation

Rubrics are well-known in all spheres of education today, K-12 through to postbaccalaureate. They are an important part of assessment and have garnered much focus owing to the benefits they offer to both students and teachers. Although I have used rubrics in my assessments before, I believe that I still do not possess a very good understanding of what constitutes a good rubric and how exactly they help in improving the assessment process. The goal of this project is to understand the role of rubrics in assessing student learning based on extensive research, explore existing best practices for developing effective rubrics, and then use the knowledge to design a suitable rubric for a "pilot" implementation in a Business Analytics course that I teach in Summer 2021 or Fall 2021. According to the literature, a rigorous and well-designed rubric that is aligned with the student learning goals is key to valid and actionable assessment results. This project will thus help me investigate if the rubric I will develop based on research and guided by best practices is able to improve assessment outcomes and improve student learning in the course as compared with previous semesters where such a rubric was not employed to evaluate student work.

2. Background Research

The background research on rubrics and their design presented in this section is based on my own literature review as well as guided by a workshop through the Faculty Development Center (FDC) that I had attended in early Spring 2021 (offered by Dr. Leslie Bruce).

2.1 What are rubrics and their benefits?

Rubrics have been defined in several ways, one of them says: "*A rubric is a multi-purpose scoring guide for assessing student products and performances.*" It is a grading tool that specifies levels of competence for a set of pre-defined criteria (which are typically set by the instructor). Rubrics have several benefits, both to teachers and students (Wolf & Stevens, 2007). Some benefits for teachers include faster more consistent, and objective grading as well as the opportunity to provide more feedback and guidance for improvement and better student performance and learning outcomes. These in turn help improve pedagogy, contribute to sound and actionable assessment, and are an important source of information for program improvement. Students, on the other hand, can benefit from clear expectations set forth upfront by the instructor regarding the different grading criteria and easier-to-follow and implement specific feedback provided by the instructor that allows for growth in the area. Rubrics thus work in a number of different ways to advance the goals of an educational program. Not only do rubrics contribute to student learning, but they also have great potential for non-traditional, first generation, and minority students, according to the literature (Andrade & Ying, 2005).

Rubrics can be broadly classified into two categories – (i) Analytic, and (ii) Holistic. An *analytic* rubric presents a description of each level of achievement for each criterion and provides a separate score for each criterion. A *holistic* rubric, on the other hand, presents a description of each of achievement and provides a single score based on an overall impression of a student's performance on a task. While an analytic rubric is more detailed and facilitates more consistent grading and student-specific feedback, it is more time consuming for the instructor and is thus less efficient for large class

sizes. A rubric can also be *task-specific*, meaning that it is customized for a particular course assignment, or *generic*, meaning that it can be adapted for multiple assignments and even for multiple courses. A rubric can also have different formats – grid or paragraph. This shows that rubrics are quite diverse and can be adapted to the needs of a specific instructor, course, or assignment, and is widely applicable to different learning goals such as critical thinking, communication skills, teamwork, among others.

2.2 Key features of a rubric

Writing an effective rubric can be challenging but taking the time to create one shows the students what is required to achieve a good grade on an assignment is important. Rubrics should be student focused and aligned with course and/or program learning goals and objectives so that the outcomes can be directly related to the relevant assessment task and inform subsequent course/program improvements. The key features of a rubric consist of:

- *Grading criteria* – should be aligned with relevant learning outcomes, goals, or objectives and stated clearly so that students and instructors know exactly what the expectations are
- *Performance descriptors or performance levels or levels of competence* – these are meant to inform students how to distinguish between "good" and "bad" work. They should be informative, concisely worded, and clearly reflect gradations of quality that should be based on the degree to which a criterion has been met. Some examples of performance levels are Excellent, Good, Fair or Advanced, Basic, Below Basic.
- *Feedback* – a space to provide specific and constructive feedback to students.

Some other characteristics of a good rubric include <u>continuity</u> (ensures that the difference in quality across the performance levels are similar and consistent), <u>reliability</u> (ensures consistent grading across raters or instructors, often called "inter-rater reliability"), and <u>validity</u> (ensures that the rubric is appropriate for the task or assignment that it is used to score and does what it is meant for).

2.2.1 Best practices in rubric design and development

Due to the diversity of rubrics, it is often advised that an instructor experiment with different rubric types (for example, analytic vs. holistic), styles, and formats to determine which works best. Once the instructor selects a particular rubric type, specificity, and format, they will need to develop the key features as outlined above. Some best practices that guide rubric design, development, and implementation are the outlined below:

- Use of clear and concise wording in the rubric is important so that everyone can understand the different components clearly. It should avoid vague and ambiguous language.
- Rubrics should not be created based on personal demands but rather on discipline standards and program requirements.
- <u>The validity and reliability of any rubric must be established prior to implementing it</u> – this can be done by testing it out on a smaller (but similar) assignment by the instructor himself or herself, have colleagues and other instructors review it and test it out as well, and obtain feedback from others and perform any necessary revisions and adjustments according to that.
- It may often be a good idea to start with an existing rubric and then adapt and edit it to fit the needs of a particular instructor/course/program/assessment.
- One best practice to ensure that the rubric serves as a useful learning and assessment tool is to <u>review the rubric with students early in the assignment's timeframe</u>. Students can also be encouraged to evaluate their own work after completion using the rubric and give themselves scores. They can also be asked, if possible, to review each other's work using the rubric and

give them scores. This has been known to lead to a deeper understanding of the rubric by students that in turn can lead to better student performance and scores eventually. Further, many students often do not refer to the rubric at all before or during the assignment, so engaging students with the rubric beforehand addresses that challenge as well.

2.3 Role of rubrics in assessment and student learning

Rubrics contribute to student learning and program improvement in a number of ways, both directly and indirectly. First of all, rubrics help students understand expectation in terms of performance for a particular assignment and hence are able to complete it more successfully, thus leading to better effort, better understanding of the course materials, and grades. Often instructors allow students to self-evaluate their work using the rubric before submitting the assignment or use it to review and provide feedback to classmates. This is also known to lead to a deeper understanding of the rubrics and hence better performance and grades.

From a teacher's perspective, rubrics aid in valid, consistent, and objective evaluation of assignments, thus leading to accurate and fair assessment outcomes that can in turn inform data-driven improvement in courses and programs. In case of multiple raters, rubrics also ensure more consistent grading across them since they consider the same detailed performance criteria.

Rubrics are also known to have the potential to advance the learning outcomes of underrepresented students, such as, students of color, first generation students, and students from non-traditional backgrounds (for example, non-native English speakers, international students). By making the rubric as detailed and clear as possible, students with different backgrounds are more easily able to understand the expectations regarding student performance. Verbal guidelines and advice provided by the instructor during class can sometimes be misunderstood or be difficult to understand for students coming from different cultural backgrounds or those that are not as fluent in the English language as native speakers. This leads to better performance on the related assignment and hence overall better learning outcomes for these underserved students. Colleges and universities today across the country are devoting a large number of resources to increase graduation rates for underrepresented students (and also overall) and close the achievement gap of these students with more traditional students. Rubrics thus prove to be an easy-to-implement measure to achieve this goal, and the more these are employed, the more improvement in student outcomes will be achieved. This benefit and impact of rubrics is not well-known; however, it has been established in literature across a variety of disciplines and types of assignments (Andrade & Ying, 2005; Delpit, 1988).

All of these thus clearly point to the fact that rubrics have various benefits for both students and faculty members as well as impact on student learning and outcomes. While well-designed rubrics make the assessment process more valid and reliable, their real value thus lies in advancing the teaching and learning process. More faculty members should hence be encouraged and motivated to use them more frequently in their courses and programs, as applicable.

2.4 Limitations of rubrics

While faculty members and students have both been aware of the value of assessment rubrics, they are not being as widely accepted and used in higher education contexts. A serious concern with rubrics is that creating one is time-consuming, especially writing the performance descriptions at each level and being able to maintain that continuity while distinguishing among each level. Rubrics also need to be designed well with great caution by drawing upon the professional knowledge of the instructor while ensuring that they are not biased by a particular instructor's personality or experiences or background. A poorly designed rubric, on the other hand, will not only be not helpful in improving student learning and performance but may also adversely affect student outcomes by diminishing the learning process. Some people also argue that rubrics may act as a constraint, preventing students

from showing creativity outside of the details outlined by the instructor. They may also sometimes provide students with a false notion that there is a universal standard for a certain type of assignment (say, writing) and they are not encouraged or motivated to think outside of their premises because they believe that such things are unimportant or irrelevant. So, it is challenging for an instructor to develop and design a rubric that is "ideal" in a particular assignment setting, whose scope is not too narrow or too broad, while at the same time is able to accomplish the underlying goal tied to the course learning objectives.

Finally, some critics argue that rubrics tend to give students a perception of simple, objective and precise grading that can potentially be debunked as inconsistencies can occur due to the natural differences in the perceptions and understandings of different types of student work (particularly true for assessing work that is in the borderlines of two performance levels for one or more criteria). It is true that it is easy for a student to understand where the instructor deducted points when utilizing grading rubrics and also for the instructor to provide explanation to the student if asked; however, the purpose of the rubric may not be fully realized without detailed feedback provided by the instructor at the time of grading. This in turn requires much time on the part of the instructor during the grading process which can also be sometimes wrongly perceived as being simple and clear-cut and quick once a rubric is available. Similarly, testing and validating the rubric and establishing its reliability (when using multiple graders) can also be a time-intensive process and undertaking.

Thus, in conclusion, a rubric is a valuable grading and learning tool, and if designed and implemented properly, holds the promise of significantly improving student learning outcomes. However, as with any tool, there are challenges and concerns associated with them, and therefore a substantial amount of effort is often required for creating and implementing a rubric. Hence some researchers suggest using rubrics only for the most complex assignments so that their worth can be fully utilized.

3. Rubric development and implementation

Based on materials obtained from a FDC workshop on designing and applying rubrics and other references (AACU website and their rubric templates, for instance), I designed a rubric to grade a course team project that involves analyzing a business case with real data using advanced statistical and data mining methods, interpreting the results and findings, and recommending effective business decisions in the context of the given business problem. It is much more detailed than rubrics I have previously used, so I hope that it will be clearer and more beneficial for the students in my classes that before. A copy of the rubric is attached in Appendix B.

The rubric will be first pilot tested in one of my classes during the summer (undergraduate course) and preliminary data analyzed to assess impact on student learning and performance. It will then be revised and fine-tuned, if needed, based on the experience, thus establishing its validity and reliability with respect to the assessment task on hand. Next, it will be further applied to two of my graduate courses in Fall 2021, both of which include a comprehensive group project in the area of Data Science/Business Analytics. A survey has also been developed to obtain students' perceptions about the usefulness of the rubric in completing the assignment (project) and how it improved their learning. It will also serve as an "indirect assessment" tool and will be administered in the courses where the rubric will be employed. The survey also collects some background and demographic information about the students so that the data can be analyzed by different groups and impact on underrepresented groups can be studied. A copy of the survey is attached in Appendix A.

All results will be compared with course grades from the same courses taught in earlier semesters to fully assess the impact of the rubric in a pre-post design setting.

4. Data collection, analyses, and results

4.1 Pilot implementation
A pilot implementation of the rubric occurred in one of my summer courses in 2021. Although the written assignment for this course was slightly different than that in my intended graduate courses, it still had the overall structure of a quantitative/analytical project and hence I was able to obtain some insights (based on student feedback and comments) that helped me incorporate small adjustments to the rubric before the final implementation in Fall 2021. Overall, the rubric was perceived by students as helpful in understanding the expectations associated with the assignment and completing it successfully. [I did not administer the survey in the pilot classes but gathered some student feedback informally since the main goal was to validate the rubric.] The copy of the attached rubric in Appendix B is the final "validated" one.

4.2 Final implementation and project data analysis
I implemented this rubric in two of my graduate courses in Fall 2021, which I will refer to as "Course A" and "Course B" respectively. For both courses, the written assignment (case study project) constituted 20% of the final course grade. As part of this group activity, students have to analyze a dataset from a business application using appropriate advanced statistical and data mining techniques, present the findings, interpret the results, and make final conclusions and recommendations for effective business decision-making. For Course A, students are provided with a dataset while for Course B, students in each group are responsible for finding their own data (resources provided to guide students in making this selection).

Average student grades (in percentage form) on the written assignment and average final grades (also in percentage form) are shown in Table 1. It also includes average student project grades and final grades from my Fall 2020 classes (where a much simpler rubric was used) for comparison purposes. As we see, the project grades improved slightly with the introduction of the new rubric although grades in both Fall 2020 and Fall 2021 were quite high (given that these are graduate courses). The differences were not statistically significant as evidently shown by the p-values included in Table 1. It should also be noted that the course enrollments were low in both semesters, hence the hypothesis tests have low statistical power and results cannot be generalized to larger student populations.

Courses	Project grade (%)	p-values	Final grade (%)	p-values
Course A (Fall 2020) $n = 12$	90%		92.2%	
Course A (Fall 2021) $n = 8$	94%	0.749	93%	0.944
Course B (Fall 2020) $n = 12$	85%		85.4%	
Course B (Fall 2021) $n = 13$	86.5%	0.912	88%	0.849

Table 1: Comparison of average grades across semesters with and without the rubric in Appendix B

Another goal of this research project was to assess the impact of the rubric on underrepresented students. Unfortunately, I had only two UR students in my courses both during this semester and in Fall 2020. Hence, I decided not to conduct this analysis as the results would not have been reliable or meaningful due to the very small sample sizes. But overall, all UR students performed well in the courses in both semesters.

4.3 Indirect assessment survey data analysis
Although the direct assessment results did not show significant improvement in student project grades and final course grades (that can partially be attributed to the low sample sizes), the survey data was expected to yield interesting insights as to how students perceived the benefit of the new rubric in completing the group project assignment.

However, only one student in each of my two Fall 2021 courses responded to the survey despite a few reminders[1]. Since both courses had low enrollment and students get very busy towards the end of the semester, this is not very surprising. I plan to implement this again in my future courses when hopefully the enrollment will be significantly higher so that we will be able to obtain some meaningful data for analysis.

5. Final conclusions, reflections, and future work
This project provided me with the opportunity to study and understand rubrics and their role in assessment better. I feel that I now possess the expertise to develop effective rubrics for my courses that include written assignments, mainly in the area of Business Analytics and Data Science.

The main challenge I faced during the implementation process was the small class sizes I had for the two courses in Fall 2021. Hence, the true impact of the new and revised rubric could not be assessed in an accurate and valid manner. Although there were some improvements in the overall project grades in Fall 2021 compared to those in Fall 2020, those increments were not statistically significant. Similarly, an adequate number of responses were not obtained on the survey that was meant to help us understand how students perceived the benefit of the rubric in completing their project successfully. Nevertheless, I believe that this rubric is definitely better in all respects than the previous simple rubric I was using for these courses given that the project constituted a significant portion of the final course grade in both courses.

In the future, I would like to keep implementing this rubric in my future courses so that I can combine all the data and have a reasonable sample size to conduct more in-depth research and obtain valid statistical inferences. I would also like to continue learning about rubrics for assessing different types of student learning outcomes such as teamwork, oral communication, and so on.

References:

1. Andrade, H., & Ying, D. (2005). Student Perspectives on Rubric-referenced Assessment. *Practical Assessment, Research & Evaluation*, 10(3), 1-11.
2. Delpit, L. (1988). The Silenced Dialogue: Power and Pedagogy in Educating Other People's Children. *Harvard Educational Review*, 58(3), 280-298.
3. Wolf, K., Stevens, E. (2007). The Role of Rubrics in Advancing and Assessing Student Learning, *The Journal of Effective Teaching*, 7(1): 3 – 14.

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[1] I suffered a medical emergency in Fall 2021 (middle of December) and was not able to follow up after that.

Appendix A: Indirect Assessment - Student Survey on Rubrics

Demographics and Background:
1. What is your class standing? [Not needed for graduate courses]
   a. Freshman
   b. Sophomore
   c. Junior
   d. Senior
   e. Post-baccalaureate

2. What is your gender?
   a. Male
   b. Female
   c. Other

3. What is your race/ethnicity?
   a. American native or Alaskan native
   b. Asian or Pacific Islander
   c. Black
   d. White
   e. Hispanic or Latinx
   f. Two or more races
   g. Unknown

4. Are you a first-generation college student?
   a. Yes
   b. No

5. Is English your first language?
   a. Yes
   b. No

6. What is your current cumulative GPA?

Perceptions about and use of the rubric:
7. How much of the rubric did you read before and while completing the assignment?
   a. All of it
   b. Most of it
   c. I just skimmed it briefly
   d. I never looked the rubric before/during the assignment

8. To what extent do you think the rubric helped you better understand the expectations of the instructor in terms of the assignment?
   a. Significantly
   b. To a moderate extent
   c. Slightly

d. Not at all

9. Do you feel that your performance on the assignment was better because of the rubric that was provided?
    a. Absolutely yes
    b. Somewhat yes
    c. Not sure/don't know
    d. Somewhat no
    e. Not at all

10. Do you feel that your score on the assignment was better because of the rubric that was provided?
    a. Absolutely yes
    b. Somewhat yes
    c. Not sure/don't know
    d. Somewhat no
    e. Not at all

11. Do you feel that your ability to complete the assignment improved because of the rubric that was provided?
    a. Absolutely yes
    b. Somewhat yes
    c. Not sure/don't know
    d. Somewhat no
    e. Not at all

12. Were the instructor's comments and feedback on the assignment clear and useful?
    a. Yes
    b. No

13. Do you believe that rubrics add value to the assignment and help improve student learning, performance, and outcomes?
    a. Yes
    b. No
    c. Not sure/Don't know

14. Would you like to see more rubrics used for certain assignments like this one in other courses in CBE and CSUF?
    a. Yes
    b. No
    c. Not sure/Don't know

15. Any other comments about the rubric and how else it can be improved or can help students – please add.

Appendix B: Data Science courses (graduate)
Grading Rubric

Assignment: Data Science/Analytics Group Project (comprehensive)

Description: The students are required to analyze data using the appropriate statistical and/or data mining methods, interpret those results clearly, and communicate the findings in the context of the business problem. A dataset, along with a description of the Business case, is provided (or the students are required to find an appropriate dataset themselves from the resources provided in the course. After the analyses, students will write up a formal "business" report (with specific formatting – instructions provided) with the case and data descriptions, the statistical methods used and analyses performed, the results and the final conclusions, interpretations, and recommendations that will inform effective business decision-making. The rubric is meant to evaluate this written report.

Format: Grid
Specificity: Task specific (Data Science/Analytics Case study project)
Criteria: Analytic – aligned with the course-specific SLOs

Total Points: 25

References: AACU Rubrics/Leslie's WAC workshop materials

Criteria	Absent or Below Basic (below expectations) 0 – 1	Developing (below expectations) 1 - 2	Proficient (meets expectations) 3 - 4	Advanced (exceeds expectations) 5
Introduction & Background: Background, purpose, business problem description, identification of relevant variables, and an outline of the data mining/statistical methods to be applied to address the business problem.	Background description and purpose of the business problem are missing or not stated clearly and fully; description of the variables and the statistical methods are missing or fully incorrect	Background description and purpose of the business problem are included but the problem but lacks details or clarity; description of the variables and the statistical methods are included but have some errors or are vague	Background description and purpose of the business problem are well-defined and covers the scope; descriptions of the variables and the statistical methods are accurately and clearly outlined	Background description and purpose of the business problem are well-defined and includes additional information in the context of the data (not provided); descriptions of the variables and the statistical methods are accurately and clearly outlined and well-organized
Methodology: Application of the appropriate statistical or data mining methods, rationale for choice, and analyses	Incorrect statistical method used and incorrect analysis, or no methodology included in report.	Correct method used but some errors in intermediate steps of the analyses and calculations	Correct method used, correct steps followed, and correct final answers provided	Correct method and steps used, and all steps of the calculations explained clearly, along with correct answers

Decision-making: Interpretation of the results, conclusions, and final decision-making in the context of the business problem	Conclusion is incorrect and interpretation is incorrect or missing	Correct interpretation of results but the conclusions are not communicated properly in the business context	Correct interpretation of results and conclusions communicated clearly in the context of the business problem	Correct interpretation of results and conclusions explained clearly and fluently in detail in the context of the business problem using audience-appropriate language
Organization: Development, layout, flow and design	Points are not presented sequentially and are hard to follow; formatting instructions (layout) are not followed at all or for the most part; and design are or messy and lacks clarity	Points are sequential; the layout or formatting is adequate but not followed completely; design and flow are average but still lacks clarity and a professional look	Points are well-developed and presented, the formatting or layout follows instructions; and the design is clean and easy to read and follow	Points are very well-developed, and paper is organized according to the formatting instructions; the layout is clean, easy to follow; and the design is professional
Literacy: Paragraphs, grammar, punctuation, & word choice; Introduction & conclusion	Several incorrect spellings or typos; grammar and/or word usage errors are disruptive; does not include introduction and/or conclusion	Minor errors in spelling, grammar, punctuation, or word choice; few typos; introduction and/or conclusion are included but are not well-structured	Not more than 1 or 2 errors **overall** with respect to grammar, spelling, typo and punctuations; effective introduction and conclusion	No errors with respect to grammar, spelling, typo and punctuations; introduction and conclusion are well-developed, clear, and effective