Using Rubrics Assessment Tools in Construction Management Curriculum

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This paper introduces the reader to the value of using a rubric system to assess the learning of construction management students. One of the most important questions confronting new educators is, what is the best way an instructor can enhance students' learning while also improving course curriculum and the instructor's teaching skills? While the efforts students expend vary widely from student to student, the grading criteria an instructor chooses will focus on the course plans, deliverables, and the instructor's expectations for student performance. Developing a formal rubric system that specifies instructors' expectations of student performance, as well as what they expect students to take away from a particular event, provides a clear and objective way to evaluate students' efforts. The approach described within uses proven pedagogical methods and tools to develop a series of standardized rubric assessment measures appropriate for use in senior-level construction management courses.

Key Words: Assessment Tools, Curriculum, Pedagogy, Rubric, Student Assessment Strategies

Introduction

To evaluate student competency, instructors first need to develop learning objectives for each course taught. It is suggested that instructors use Bloom's taxonomy as their guide in developing course-learning objectives. Bloom's taxonomy recognizes the cognitive domain in classifying educational objectives and student learning behaviors. According to Allyn and Bacon (Pearson 1984) the major idea of the taxonomy is that what educators want students to know (encompassed in statements of educational objectives) can be arranged in a hierarchy from less complex to more complex. Once the course instructional objectives are developed, the next step is to organize the curriculum material and determine the subject matter that will be taught via lectures, coursework, and reading materials.

According to Joseph Bergin (The Pedagogical Patterns Project 2008) "The intent [of pedagogical patterns] is to capture the essence of the practice in a compact form that can be easily communicated to those who need the knowledge. Presenting this information in a coherent and accessible form can mean the difference between every new instructor needing to relearn what is known by senior faculty and easy transference of knowledge of teaching within the community."

At California Polytechnic State University (Cal Poly), instructors teaching a senior-level construction business management seminar successfully developed a formal outcomes assessment matrix that enables them to track course curriculum and teaching methods with the desired outcome of better ensuring that learning objectives are being met. Once instructors established the course of study and the direction they would take to move the class forward, they then determined overall expectations, by reviewing course-learning objectives, notes, handouts, and materials gathered on assessment strategies. One such handout used for developing rubric assessment tools was a chart that organized these key strategies into four quadrants. This matrix provided instructors with an objective system for developing a teaching approach that addressed the following principles: Formative, Summative, Informal, and Formal. This matrix can be examined in Appendix A at the back of this paper.

Student Assessment Principles: Formative, Summative, Informal, and Formal

In the formative quadrant of student assessment strategies, an instructor develops processes and procedures where students are assessed early on and very often. Students are given multiple opportunities to understand and master the subject matter. If they do not comprehend the material at first, the instructor needs to repeat the lessons until they do understand. If students do not grasp the meaning of the subject matter, instructors need to know why. This formative method of assessment is systematic in nature and supports learning and instruction.

The summative quadrant of student assessment deals with the final products. Has a final course product, such as a research paper, class project, portfolio, or thesis, been assigned? Quizzes and exams fall into the summative process of student assessment. In this particular seminar, students must complete a midterm and a final exam along with comprehensive lab activities that contribute to students' final project goals. The final course activity is to develop and present a business plan for a fictitious construction company students create on the first day of class.

Of the four assessment principles, the informal assessment tools used throughout the course proved to be the most valuable. Junior and senior-level students tend to focus more on analysis and synthesis to evaluate the competency of course instruction (Jackson, 2006). For this reason, engagement of and responses from senior-level students can be very pleasurable from an instructors' point of view. To informally assess student performance, the instructor used 3" x 5" index cards for maintaining a running tab of checks and balances. On the first day of class, instructors passed out the index cards and asked students to list their course expectations and what they hoped to get out of the class. Their responses helped instructors determine whether or not they were on the right track and if another topic of instruction should be incorporated into the curriculum. Periodically, instructors checked in with students during the quarter or semester and asked them what was and wasn't working. Because students have an attention span of around 15 to 20 minutes (Middendorf and Kalish, 1996) and university classes are scheduled for approximately 50 to 75 minutes or more, instructors must do something to maintain students' attention throughout the period.

Following Middendorf and Kalish's research, instructors made a point of stopping about every 15 to 20 minutes during a lecture to ask questions about what was just discussed and to engage the class in dialogue. After the lecture, the instructor asked students what points were unclear, what did they not understand, what they now knew as a result of digesting the material, and what else they would like to know about this particular topic. This process enabled educators to better connect students with the course material being presented and engage them in their own education. This method is also considered a form of active learning. According to Victorino (2009) active learning can be defined as a learning environment that allows "students to talk, listen, read, write, and reflect as they approach course content through problem solving exercises, informal small groups, simulations, case studies, role playing, and other activities. All of which require students to apply what they are learning."

Another effective informal assessment tool used in this seminar again involved distributing blank index cards, this time asking students to jot down two or three quiz or exam questions. This tool proved to be most useful in this particular course for composing the midterm exam. Of the 30 questions posed on the midterm, 17 were derived from the students' suggestions. Although the student-generated questions were rewritten and presented differently, students were tested on concepts and subject matter they expressed as being important to their learning. The average exam score was 90 percent. Most of the material in this course was presented in a new format, and the exams were newly prepared. No comparisons were made to evaluate performance on this quarter's exam in relation to the exam given the previous quarter.

The fourth quadrant of the assessment matrix addressed more formal aspects of teaching, including exams, tests, research papers, lab reports, projects, and student performance. In this case, instructors concentrated their rubric development research most heavily on the formal aspects of teaching. The seminar was organized to include lecture topics on specific subjects pertaining to aspects of managing a construction company. Classroom learning was then reinforced with lab-based activities on each specific topic. Once the course pedagogy was created, the material was further refined into daily lecture topics, reading assignments, lab assignments, and case studies. After composing the course assignment document, a formal rubric for each class assignment was created.

Student assessment tools combined the four principles – formative, summative, informal, and formal – with various processes and procedures relating to specific tasks and activities. A basic set of generic pedagogical tasks was assumed at this stage of curriculum development. Not all of the following steps are necessarily explicit in all

teaching and learning activities. Regardless of which assessment principle was being used, instructors repeatedly checked in with students to evaluate their progress and learning outcomes.

Understanding Rubrics

Used as an assessment tool to improve instruction, a rubric is a set of scoring guidelines for evaluating student work. Rubrics answer questions such as: By what criteria should performance be evaluated? What specific factors will be considered for measuring performance success? What does the range in the quality of performance look like? How does an instructor fairly, validly, and consistently determine what score should be given and what that score means? How should different levels of quality be described and distinguished from one another? (Herter and MacElroy, 2008)

Rubrics can be created in different ways, varying from simple to complex. However, all rubrics contain three common features (Dodge and Pickett, 2000):

- a focus on measuring a stated objective (performance, behavior, or quality);
- the use of a range to rate performance; and
- the inclusion of specific performance characteristics, which are tiered to indicate the degree to which a standard has been met.

Many experts believe that rubric assessment tools improve students' end products and, therefore, increase learning. In evaluating papers or projects, teachers know from their own experience and their mastery of the material what constitutes a good final product and why. When students receive a rubric assessment tool at the onset of a course, seminar, or project, they better understand how they will be evaluated, which then enables them to prepare and perform accordingly. Developing a rubric and making it available as a tool for students' use provides students with a foundation for improving the quality of their work and increasing their knowledge.

Among the many advantages they offer, rubrics (Goodrich, 1997)**:**

- improve student performance by clearly showing students what is expected and how their work will be evaluated;
- help students better evaluate the quality of their own work;
- contribute to more objective and consistent assessment;
- compel instructors to be specific in describing their evaluation criteria;
- reduce the amount of time teachers spend evaluating student work;
- promote student awareness about criteria they can use to assess peer performance;
- provide useful feedback to teachers regarding the effectiveness of their instruction;
- provide students with more informative feedback about their strengths and areas needing improvement;
- accommodate heterogeneous classes by identifying a range of quality levels;
- are easy to use and easy to explain.

Implementing Rubrics into Course Instruction

How does an instructor use this information to develop effective rubric tools? To put into use the rubrics characteristics described above, the instructor broke down each course assignment into two parts: the assignment's basic function and the instructor's expectations for student performance. For the standard daily reading assignment, for example, the objective was to reduce the instructor's time spent grading student work, by developing a grading rubric that clearly identified formal expectations and that could be shared with students. Because many students will do only what they believe is necessary and important to pass any given course, the instructor developed a rubric for the daily reading assignments. These assignments were based on specific chapters in the adopted textbook with a focus on major concepts related to that week's lecture topic. The basic objective for the reading activity was for students to answer fundamental questions that would stimulate a degree of understanding of the subject matter and that would promote class dialogue. For this particular assignment, a conscious decision was made to grade what was

turned in, rather than grading the entire effort and content. A dead body rubric was developed. According to Wilhelm (2008), a dead body rubric helps accelerate the grading process and decrease effort spent. The main emphasis of a dead body rubric is that the course work becomes a dead point, students will not be asked to revise their work. The critical aspect of using a dead body rubric is that the grading be honest, precise, and well organized. (See Appendix A for examples of a dead body rubric developed for this particular grading process.)

On the first day of class and during the first few weeks, the instructor made expectations and grading rubrics very clear to the students. The first few assignments were handed back to students with a rubric stapled to the front. Once, after a Thursday class, a student approached the instructor about a reading assignment of four chapters, which was due the following Tuesday. The student explained that this was a lot of work, especially in addition to other homework required that weekend. The student then asked if it was necessary to do the reading assignment. The instructor answered that if students wanted to receive points for the assignment, then, yes, they needed to complete the work. Another student listening to the conversation said to the classmate, "If you do the reading assignment and answer all the questions and meet the requirements, you'll get 10 points. If you don't meet one of the requirements, you'll get 7 points. If you don't meet two or three of the requirements, you'll get 5 points, and if you don't complete the assignment, you'll get 0 points." That information, based upon the reading assignment rubric, concluded the discussion, leaving it up to the first student to decide how much of the reading assignment they would do.

At this point, the instructor conducted an informal student survey to gather students' assessments about introducing rubrics into the curriculum. The successful use of rubrics hinges largely upon regularly checking in with students to informally assess their understanding, thereby completing the learning assessment cycle. This informal assessment addresses questions such as, how is the instructor doing in conveying the material? How is the student doing in comprehending the material? Are the rubrics helpful? Do students think it's good to have a formalized rubric?

Student Survey Outcomes

Table 1

Rubric Student Survey

1. Before taking this class, had you ever heard of a rubric?
2. Are any of your other construction management professors using rubrics to grade or assess assignments?
    - If so, for what types of assignments are they using rubrics?
3. Are any of your non-construction management professors using rubrics to grade or assess assignments?
    - If so, for what types of assignments are they using rubrics?
4. How do you feel about your professor using a rubric for grading? Example:
    - Is it a good thing?
    - Does it help set expectations?
    - Do you not care, etc?
5. Do you want to see a copy of the rubric handed back with each assignment?
6. Would you like your professor to provide students with access to every rubric for each assignment, such as posting the rubric on a blackboard?

The above student survey was e-mailed to the entire class, with the request that students complete the survey by a specific date. Only two completed surveys were returned, and those were from architecture majors with minors in construction management. The instructor sent out another e-mail, this time indicating that 5 points would be awarded to students who turned in a completed survey. Students were also told that the instructor was writing a paper on informal and formal rubrics and stressed how important it is for university professors to research, write, and publish papers. Sixteen of the 32 students enrolled in the course responded. Of the 16 students who responded, only 5 had never heard of a rubric before; 11 students indicated they had professors who used rubrics in the classroom. Of the 11 students who were familiar with rubrics, 4 said that one of their construction management professors has used a rubric, and 2 said that rubrics were used in a general elective English course. The remaining 5 students indicated they had heard about rubrics and knew what they were, but they did not have experience with any

other professors who used rubrics as an assessment tool. The students who knew what a rubric was said that their professors used rubrics to assess presentations, papers, lab activity work, movie analysis projects, and term projects.

The students agreed that it was to their benefit for instructors to establish a standardized rubric grading system, so that students will know what is expected of them and how the teacher will grade their efforts. Students also said they would like to see a copy of the rubric put on blackboard, but they felt it wasn't necessary for the teacher to hand out a rubric with each assignment. Students offered the following additional comments:

- "I like to see what I'm being graded on, and it's fair to everyone in the class if the teacher grades consistently throughout the class."
- "[The rubric] helps to set expectations and allows us to complete the assignments in full."
- "If the rubric is comprehensive and fair, then I think it is the ideal way to grade. I like to know what the professor wants, and rubrics provide this [information] explicitly."
- "I dislike [the rubric] because it usually is organized in the professor's way and technique on writing, and it doesn't give me the freedom to express my way or allow me to organize my thoughts how I would like to present them."

Conclusion

The practice this research supports is for instructors to develop formal rubrics that clearly specify their grading criteria for assessing each course assignment, and to continue building on this model. Establishing grading criteria and performance expectations and communicating these with students simplifies the grading process, reduces time spent on grading, and results in students better understanding the grades they receive. The time spent up front developing course curricula and a standardized rubric system is considerable. Nonetheless, in this study the time spent grading assignments was decreased when a dead body rubric was used as a student assessment tool. Additionally, the instructor using formal rubric tools for the first time found them inspiring and helpful when developing new course curriculum.

It is necessary for instructors to review the course learning objectives before proceeding to the outcomes assessment matrix and creating evaluation criteria for each lecture and assignment. The success of the rubric structure developed was further enhanced when expectations for student performance were broken down into specific categories, such as reading assignments, lab activities, and case studies, and the rubric was refined to include these outputs.

The instructor using the rubric for the first time found that developing this pedagogical assessment tool was the best effort put forth since becoming a university instructor. Students took very well to the structured assessment criteria and were motivated to do a higher quality work and turn in their assignments on time. The rubrics also provided the students with important lessons in reading and following directions, as they discovered when they lost points for not following the specified format for submitting an assignment. They knew before turning in their coursework what the instructor's expectations were.

Effective educators understand the importance of using a variety of assessment principles in the classroom. The grading rubrics used in this study clearly specified the instructor's expectations for student performance. The lecture formats were varied and included formal Power Point presentations and class dialogue as well as informal lectures that were combined with lots of class discussions. Students became engaged in their own education by having different groups facilitate the case study and reading assignment dialogue; this is what active learning is all about.

Rubrics serve as powerful communication tools for familiarizing students with an instructor's teaching style and for fostering students' understanding, from the first day of class, as to what the instructor's expectations are and how the class is going to be structured and conducted. The formative, summative, formal, and informal assessment aspects are key pedagogical tools for improving instruction of construction management curricula and strengthening communication with students, with the end products being effective and meaningful curricula, dynamic teaching, greater student engagement, and enhanced learning.

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Appendix A

Student Assessment Matrix: Formative, Summative, Informal, Formal

Formative	***Summative***
Process Oriented: Assess early and often	Final product
Supports revisions, rethinking, redoing	Papers, exams, projects
Drafts (multiple chances to get it right)	Standardized
Ongoing (lowers risk, encourages risk-taking)	Thesis
Supports learning and instruction, if systematic	Portfolio
Shapes instruction (if they don't get it maybe we can repeat/reteach it!)	
When they don't get it, we want to know why	
Quick starts and/or closings-routines	
Informal	***Formal***
What's working, what's not on a 3 x 5 Card	Tests
Muddiest point (3 x 5)	Exams
What I know, what I want to know (3 x 5)	Research Papers
Minute paper	Lab Reports
Students' notes/journals	Projects
Students write exam/quiz question	Programs
One question surveys: How many hours did you study to prepare for class? Did you do the reading? Why or why not? (3x5)	Performances
	Portfolios
Observations of class behaviors – glazed eyes, deep sighs-look and listen	Senior Projects
Connect students with the material and with one another-pair and share/small groups	
Confidence check or Fear factor	

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Appendix B

Example of Dead Body Rubrics Used in Class

Rubrics for Book-reading Assignments

1. Follows instructions and is turned in on time. Meets all requirements of the assignment = 10 Points
    - A computer-generated report is turned in on time
    - All questions are answered concisely, intelligently, and correctly
    - Name, date, book assignment activity title, and class information is printed on the document

2. Fails to meet one of the goals of the assignment = 7 Points
    - Fails to turn in a computer-generated report
    - Fails to answer questions concisely, intelligently and correctly
    - Fails to put name, date, book assignment activity title, and or class information printed on the document

3. Fails to meet two or three of the goals of the reading assignment = 5 Points

4. Fails to complete the assignment on time and/or fails to meet four or more of the goals of the assignment = 0 Points

Rubrics for Case Study Assignments

1. Follows directions and is turned in on time. Meets all requirements of the assignment = 10 Points
    - Turned in assignment on time
    - Formatted as a computer-generated document
    - Records all team members names on the deliverable
    - Records case study number and name, centered at the top of the document
    - Answers all questions assigned at the end of the case study
    - Completes all exercises assigned at the end of the case study

2. Fails to meet one of the goals of the lab activity assignment = 7 Points

3. Fails to meet two of the goals of the lab activity assignment = 5 Points

4. Fails to complete the assignment on time and/or fails to meet three or more of the goals of the assignment = 0 Points