

Improving assessment processes in Higher Education: Student and teacher perceptions of the effectiveness of a rubric embedded in a LMS

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Students and teachers play different roles and thus have different perceptions about the effectiveness of assessment including structure, feedback, consistency, fairness and efficiency. In an undergraduate Business Information Systems course, a rubric was designed and semi-automated through a learning management system (LMS) to provide formative feedback. Action research with a qualitative approach was undertaken by the teacher. A questionnaire was administered to the 55 students to gather their perceptions of the effectiveness of the process. Students reported benefits of clearly being able to see what they needed to do, what they had achieved, and what they needed to do to improve. The majority (95%) recommended further use of the rubric process. From the teacher's perspective, a key benefit was an estimated 40% reduction in marking time and improved student satisfaction with feedback. An insight from the student feedback and teacher reflection was that there is a balance between providing clear detailed structure versus challenging students with freedom to deal with the ambiguity of open ended issues. The study provides practical insights for further roll-out of assurance of learning initiatives based on rubrics embedded in LMSs, and contributes a model for further research into student and teacher perceptions of assessment effectiveness.

Introduction

Assessment is a central activity in teaching and learning. Teachers spend long hours in setting assignments and preparing marking guides, followed by repetitive marking, the provision of feedback and the relief of finishing, only to be followed by another cycle. Students too experience many hours completing assignments followed by the receipt of their marks and feedback. There is a constant drive in educational design to create and implement assessment processes that balance effectiveness and efficiency.

Learning management systems (LMSs) are increasingly providing digital technologies that have the potential to assist assessment through semi-automation of many repetitive processes. As technology becomes more pervasive there are increasing opportunities to take advantage of economies of scale, widespread availability, and customization of generic functions (Dreher, Reiners, & Dreher, 2011). Another driver for increased use of LMSs for assessment purposes is quality assurance for accreditation (AACSB International, 2013). Quality assurance requires managed and documented teaching and learning processes, with feedback cycles for continuous improvement.

Rubrics have a long history of use in educational assessment (Dirlam & Byrne, 1978), and researchers have shown the added benefits of computerization using either personal computing software (Mitri, 2005; Czaplewski, 2009) or dedicated assessment systems (Anglin, Anglin, Schumann, & Kaliski, 2008). However, the embedding of rubrics in large scale LMSs (e.g., Blackboard, Sakai, and Moodle) is more recent. Anecdotally, the use of rubrics among tertiary colleagues is neither widespread nor systematic. This could be due to the lack of training of academics, the dominance of marking guides which are not rubric-based, and the traditional freedom to apply assessment techniques without standardization or moderation from external sources. The context of this study is thus different to previous studies of rubrics alone, or stand-alone computerized rubrics, because it involves the beginning of systematic use of rubrics via a LMS in a tertiary setting. Researchers of assessment and feedback systems have noted that, "Continuing research is required to track the development of new and updated systems..." (Burrows & Shortis, 2011, p. 1151) including the effectiveness and efficiency of rubrics in LMSs (Anglin et al., 2008).

In December 2011, the university in this study migrated the existing Blackboard learning management system to Blackboard 9.1 (<http://www.blackboard.com/>), and one of the assessment tools included was Blackboard Rubrics. Additionally, the Business faculty was seeking accreditation with the Association to Advance Collegiate Schools of Business (AACSB International, 2013) and one key requirement was assurance of learning. The faculty had settled on the use of generic rubrics for measuring graduate capabilities including applied discipline knowledge, critical thinking and written communication (von Konsky, Watkins, Atkinson, & Broadley, 2012). The first author, who was also the Teaching and Learning Coordinator in the faculty of Information Systems within the Curtin Business School, had been using a detailed marking guide in a course he coordinated with rubric type criteria and levels for several years. The piloting of the rubric assessment using a LMS in this course would provide feedback for wider systematic implementation into many courses in future semesters.

The combination of a need for efficient, effective formative assessment; the need to perform these assessments in an increasingly online environment; and the increased demand for program level tracking of learning outcomes, all provided impetus for an action research study into improving assessment processes through automating and embedding a rubric in a LMS.

The overall research question was chosen to be broad to allow concepts in the design and use of an old technique (rubrics) in the transition to a newer medium (a LMS), to emerge: What are student and teacher perceptions of the effectiveness of an assessment process using a rubric embedded in a LMS?

Effectiveness is explored through the research model developed in the next section. The student perceptions are explored via an open-ended questionnaire administered to current students, and via student evaluation data collected over five years. The teacher perceptions are explored via reflection by the teacher and feedback from sessional teaching staff.

Research model

The research model developed for the study (see Figure 1), emphasizes the different student and teacher perspectives (So & Lee, 2011) on assessment effectiveness and focuses on key characteristics including structure, feedback, consistency, fairness and efficiency. This includes and expands the dimensions of efficiency and effectiveness used by Anglin et al. (2008), where the former was measured by the time taken for the teacher to mark, and the latter was measured by student perceptions of feedback. The research model is intended to illustrate that there is some tension and balance between the two perspectives of teachers and students. For example, students may demand more feedback but the teacher may resist because the students are not acting upon feedback already provided (Sadler, 2010). Another example of tension and balance is that a teacher may try to improve marking efficiency by reducing assessment criteria, but in doing so decrease student learning of required knowledge and skills.

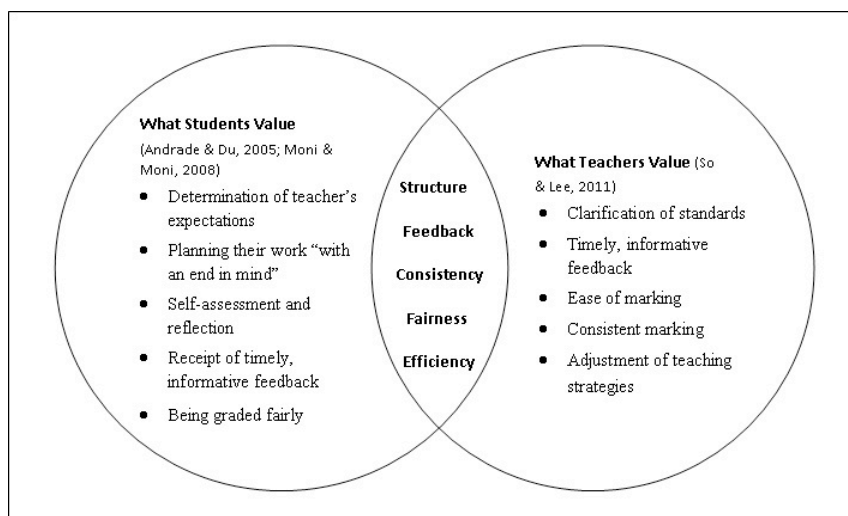


Figure 1. Research model showing the tension and balance between student and teacher perspectives of assessment.

Each of the characteristics of structure, feedback, consistency, fairness and efficiency are elaborated as follows in the context of an assessment rubric.

Structure

A rubric structure is usually presented in the form of a matrix, where the criteria and the levels of performance associated with each criterion indicates the explicit task and learning requirements.

From a student's perspective, the rubric clarifies the teacher's key categories of emphasis, guiding the student towards the final product. The criteria and their weighting indicate the required content and the focus. The levels of performance and the associated descriptors provide further detail of what is required to meet and exceed expectations. A student can thus use the structure of the rubric as a reference point to set the structure of their assignment during the planning process.

From the teacher's perspective, the structure and detail of the rubric allows the teacher to communicate to students which criteria to focus on and to motivate them to aspire to higher levels of performance. The learning is more directed and focused than without such a guide. The rubric can be used during the process of students undertaking an assignment, and then to assess the final product. If the rubric is well constructed, then the structure should also aid the provision of feedback and the efficiency of assessment. These aspects illustrate the "interdependent relationship of assessment and teaching and learning" (Wolf, Connelly, & Komara, 2008, p. 21)

Feedback

By providing formative feedback, at a detailed level of criterion and achievement, students can be given specific guidance on how to improve their next assignment. Researchers have noted the challenge of providing useful feedback in an environment of short semesters, large classes and modularization of the curriculum (Hepplestone, Holden, Irwin, Parkin, & Thorpe, 2011). With the use of a rubric, the descriptors based on each level of achievement can be used during a self-assessment process, to act as a checklist prior to assignment submission (Andrade, 2007). If used as a self-reflection and self-determination tool, such feedback encourages students to identify their strengths and weaknesses for different types of assessment. Increased feedback will eventually help them to recognize their aptitude, understand what to pay attention to, and work on the other skills they are lacking in, thus improving their overall learning capability (Price, Handley, Millar, & O'Donovan, 2010).

Through "a comprehensive set of carefully worded and constructed comments and feedback" (Czaplewski, 2009, p. 29), teachers can actively engage their students in picking up self-directed learning skills such as how to "start with the end in mind", the importance of understanding criteria, and making judgments on the quality of their work. Teachers also have the opportunity to choose and re-use feedback comments from a bank of comments built up through repeated assessment cycles. However, teachers have to be careful not to lose the customized individual touch in the process of automation.

Consistency and fairness

Making the rubric available early to students in the assessment process allows time for them to consider and reflect upon what is required based on factors such as time given, resources and their aptitude. The weighting of criteria and the levels of achievement allow students to plan their workload appropriately. So, at the time of assessment, and in the receipt of feedback, there should not be too many surprises.

The transparency of an assessment tool is important to perceptions of fairness. If the rubric is well designed then it should be easy for the marker to distinguish performance and to justify and explain results (Shirran, 2006). Where a student feels they have not been marked fairly it should be possible to show examples of higher and lower performance to justify a given mark. Additionally, the automation of the mark calculation should ensure consistency and thus perceptions of fairness across the cohort.

A rubric, when serving as a marking tool, can boost the validity and accuracy of grading (Brown, Glasswell, & Harland, 2004). Quality control can be difficult to maintain within large cohorts where multiple markers are expected to be consistent with their marking. A rubric can also be of benefit where a

single marker, making an assessment over a period of time, may be influenced by fatigue and mood. From the management point of view, the moderation time saved through the use of a rubric in maintaining consistency, can also contribute to quality assurance associated with university accreditation processes (Wolf & Goodwin, 2007).

Efficiency

From a student perspective, having a clear focus on what is required helps to direct work time, allocate resources and reduce confusion. Knowing that some criteria are basic requirements whereas others represent more challenging, explorative activities helps students to aim for levels of performance that are commensurate with their abilities. A high performing student can aim for the descriptors associated with high achievement, whereas a student content with a pass can modify their work activities appropriately. A learning management system can be used to allow early and universal access to the rubrics whilst students plan and implement their assignment completion. It can also provide efficiency through electronic submission. As soon as an assignment has been marked, both the mark and the feedback can be made available to individual students online.

From a teacher perspective there are potential time savings in reducing the time taken to explain assignment requirements, as the rubric can be used as a communication tool throughout the assessment process (Kryder, 2003). A learning management system (e.g., Blackboard 9.1) takes care of student submission tracking and processing including basics such as student name, identifier, uploaded files, and the time of submission. Furthermore, calculations are automated ensuring speed and accuracy. Distributions of results with summary statistics are available for general feedback to students, and for examination and auditing by other stakeholders.

Having discussed the characteristics of the research model, attention is now turned to the research methodology designed to address the research question.

Method

Approach

Action research (Lewin, 1947), was chosen as a suitable methodology within a qualitative approach (Miles & Huberman, 1994) where a variety of data are triangulated to make plausible inferences. Action research is characterized by an iterative cycle that includes diagnosing, action planning, action taking, evaluating and specifying learning (Susman & Evered, 1978). Furthermore its characteristics include existence of a real problem situation, collaboration between researcher and practitioner, application of theory to analyse the problem, and the way in which the participants' competency was increased (Narayanaswamy & Grover, 2007). The problem situation was "improving assessment processes" for the students and the teacher. The first researcher was also the practitioner, the teacher of the class. The theory was the research model used to analyse and structure the problem. The participants were the teacher and students, whose teaching and learning competencies were to be improved.

Action research is recognised as a research methodology that enhances transfer of learning because its iterative cycle includes: research on relevant issues, collaboration, action, and reflection (Cady & Caster, 2000; Caffarella, 2002; Creswell, 2008; Kolb, 1984; Waddell, Cummings, & Worley, 2004). The iterative design of the rubric and its implementation are described as part of the action research.

Rubric design

The rubric (see Appendix and Figure 2) evolved over four years of teaching. In the formative years, a set of criteria were developed to reflect the learning outcomes and the required syllabus. These were edited, filtered, refined and detailed based on student performance and feedback, teacher reflection and feedback from peers. The number of criteria had fluctuated up to a high of 14 but in recent semesters was reduced to ten to sharpen the focus, thus decreasing the marking time and reducing student workload. Whilst the detail of the rubric varied the basic structure was maintained over the years. Graduate capabilities from generic rubrics defined by faculty in the Business School, including applied discipline knowledge, critical thinking, and written communication, were also merged into the descriptions.

The levels of achievement were influenced by two aspects. First, assurance of learning activities required the use of three levels: below expectations, meets expectations and exceeds expectation. Second, the university uses a 100 mark grading system with five levels: fail (0-49), pass (50-59), credit (60-69), distinction (70-79) and high distinction (80-100). So the rubric was designed to incorporate three assurance of learning levels, five university grading levels, and the calculation of an overall mark out of 100.

The original marking guides were based on a Microsoft Word document with an embedded Excel table calculation. With the availability of Blackboard 9.1, an embedded semi-automated rubric was implemented for the first assignment of the course Business Software Tools 200 in April 2012. A partial view of the complete rubric (Appendix) is shown in Figure 2. One of the ten criteria is displayed on the left hand side. Five levels of achievement are shown across the rubric. The view is after a teacher has marked an assignment and includes the mark for the criterion and some feedback for the student. For example, in Figure 2, the student has received a mark of 55 (pass) for the criterion 8, "Lessons Learnt", and the feedback to the student is to include discussion of "Decision Support". This view is available to both teacher and student via Blackboard.

Points Range	Feedback
0 - 49	criticon not addressed in report (0=not done) or (25=very poor, 45=poor) The conclusions (or solutions) are unclear. They are not logically supported by the evidence and the process of analysis. Assumptions are not described.
50 - 59	One of the three is not covered adequately. The conclusions (or solutions) are clear and relevant. They are generally supported by the evidence and the process of analysis. Some assumptions are described. Feedback: Decision support?
60 - 69	adequate coverage of the three (a paragraph on each), clear and reasonably expressed
70 - 79	depth coverage of the three, clear and well expressed. The conclusions (or solutions) are comprehensive, relevant, significant and organised. They are logically supported by the evidence and the process of analysis. Assumptions are comprehensively described.
80 - 100	plus extra insights, references, and excellent expression

Figure 2. Rubric detail from Blackboard 9.1 for a marked criterion.

Implementation

The implementation of the rubric into the assessment process began with the design of an assignment worth 25% of the total assessment. The assignment was designed to address the learning outcome:

At the end of the unit, the student should be able to develop a spreadsheet model (financial, statistical, forecasting and simulation) to solve a business problem.

The assessment was designed to be formative in that the feedback would be used to improve learning outcomes for a second assignment of similar structure. A final examination would then give a summative total result.

The assignment instructions and the associated marking guide were released to students at the beginning of the semester, six weeks before the due date. The marking guide included screen prints of the Blackboard based rubric similar to that shown in the Appendix. In the course of the lectures and laboratories, the assignment, the criteria, and the levels were repeatedly referred to. When the assignment became due, students were instructed to submit their reports and spreadsheet workbooks electronically through Blackboard. Additionally, to help the marker, students were requested to submit a hardcopy of their report in class.

After the due date, the marker (the first author) accessed Blackboard and began marking each student's assignment. The marker opened up the Excel based workbooks and whilst checking some items in the workbook, read the hardcopy report. The Blackboard rubric was opened, and as each of the ten criteria were assessed, a level was given as a point score between 0 and 100. Feedback comments were given in the rubric. After the rubric had been completed, some overall feedback comments were given. This process was repeated for each of the 55 students until all assignments had been marked. About five assignments were marked each day. The elapsed time for marking all assignments was three weeks which is the university's maximum recommended time for completion of feedback.

The hardcopy reports were returned to individual students in the laboratories. The marker then spent 5-10 minutes with each student going over the individual feedback including checking the overall comments and the rubrics online. Whilst time-consuming, this was felt to be a very important process in having some interaction with individual students and reinforcing the written feedback.

Data collection

The participants were the enrolled students in the course Business Software Tools 200 which is taught as part of a Bachelor of Commerce degree with a major in Information Systems. In first semester 2012 these included 55 students attending the main Bentley campus of Curtin University. A cyclic approach was proposed whereby, following observation and feedback from the first assessment, improvements would be incorporated for the following assessment which was a different task but had similar marking criteria.

To collect student perceptions of the assessment process, the main instrument was a written questionnaire. This consisted of six open ended questions (Table 1). This approach was adopted to allow students to be open in proposing issues rather than being directed by the concepts of the research model.

Table 1
Written questionnaire used to collect student perceptions

Questions
What were the best things about the assessment process you experienced?
What things about the assessment process could be improved or modified?
Would you recommend it be used in the future? Yes/No
Why is this your recommendation?
What did you learn for future assignments based on the feedback you received?
How does the assessment process experienced in this unit compare with others you have experienced?

The questionnaire was made available to students after they had received their assignment feedback. In addition to the questionnaire, the first researcher was the teacher of the course and interacted with the participants in the course of the teaching semester. This included initial and ongoing discussion of the marking criteria and achievement levels with students, and one-to-one meetings in the laboratory to discuss the assignment feedback whilst viewing it through the LMS. These activities were not formally recorded but are actions that would have influenced the perceptions of the students and the teacher.

The questionnaire responses were read and summarized (thematically and quantitatively as appropriate) across the six questions (Miles & Huberman, 1994). These formed the basis for the findings discussed in the next section. The questionnaire was administered both online and via hardcopy. The latter proved to have a more successful response as it was done when the marker returned the hardcopy report to the individual students. Of the 55 students, 20 responded, a 36% response rate.

In addition to the research questionnaire, a standard student evaluation of the course and the teaching (known internally as eVALUate) which is administered by the University was examined for quantitative and qualitative items pertaining to assessment and feedback. This was available for each semester that the subject had been taught since 2008 and so provided data pre and post the use of the rubric in a LMS.

From the teacher's perspective, a key interest was in the potential to save time, so as each assignment was marked the time taken in minutes was measured. The start time was when the student's work was accessed through Blackboard Grade Center. The end time was when the marks and feedback had been completed. The teacher kept a record of strengths and weaknesses of the rubric use in Blackboard, and in 2013 obtained some feedback from a local tutor and an offshore lecturer who began using the rubrics.

Findings

The findings are discussed using the categories from the research model, that is, structure, feedback, consistency, fairness and efficiency. Representative and evocative comments are quoted from the student questionnaire responses.

Structure

Clarity of purpose, detail, and expectations were consistent themes amongst the students' responses referring to the assessment process and the use of the rubric.

Makes marking clear. We know what are our goals.
The marking guide is helpful for students to achieve a good result as they know what to aim for.
Was easy to understand what is expected from the student.

There were also some criticisms and suggestions for improvement.

Less ambiguity. Clearer requirements and relevant depth. More focus on students' logic and applying problem solving.
The structure of the assignment task was defined – hard to customize.
More freedom in the assignment task would be the only other inclusion.

The comments regarding customization and freedom are interesting in that they illustrate the balance between too little and too much structure in the assignment task. Some students in a cohort will want more structure to make it clearer and easier to complete assignments, whereas others may prefer more challenge and opportunity for creativity. One solution is to provide a variety of criteria including more structured tasks at the lower achievement level and include more open-ended challenging tasks for the higher achievers. The criteria and achievement levels would thus reflect the movement from basic competency to more advanced expertise.

Feedback

There were many responses regarding feedback, reflecting student's concerns for how to improve.

I learnt how to improve the section you didn't do well in your first assignment.
Areas that required improvement were outlined clearly.
Good marking rubric. Makes it clear what is required in the assignment and how we did in the results and what can be improved.

The last comment makes the connection between clear goals, summative feedback (on the current assignment) and formative feedback for the next assignment. The fact that similar criteria were to be used for the second assignment enabled a clear and immediate incentive for students to be attentive to feedback so they could lift their achievement levels on the next assignment.

More generally, at an organizational level the move to using generic rubrics could provide some consistency and reinforcement of particular learning objectives such as discipline knowledge, written communication and critical thinking. In the longer term there would appear to be clear benefits to having a consistent approach to assessment e.g., standardized criteria and achievement levels, across a curriculum so that student learning is focused and cumulative. For example if students continue to meet the referencing criterion (criterion 9 in Figure 2), in many of the 24 modules of a degree, with consistent feedback, they should be considerably more skilled at graduation than at the start of their degree. Furthermore, expanding this benefit to a higher level, the use of rubrics could scaffold and facilitate students' metacognitive processes by shaping their learning behaviour (Andrade & Du, 2005; Reynolds-Keefer, 2010). When students get into the routine habit of applying the rubric into their work, this process provides a mental framework, guiding them to think how they could possibly identify and associate explicit concepts they have learnt to be applied into an authentic assessment and become self-regulated learners.

An additional type of feedback for the teacher, provided by the LMS, was a rubric evaluation report. This report provided a breakdown of the grade distribution into the ten criteria. This information could be used by the teacher to determine criteria that were being done well or poorly by the cohort overall. An example, provided in Figure 3, shows a summary for the critical thinking criterion – where 9% of the 55 students were below expectations. This was a 'challenge' question that students struggled with compared

to the more structured text book cases. In preparation for the final examination, or for future runs of the course, the teacher could use this evaluation to direct students to particular learning activities and to adjust teaching tactics. Based on this particular report, from first semester, the teacher developed a 10 minute video on the topic of the challenge question to support students in the second semester.

The rubric evaluation report can also be used within assurance of learning processes as unit level data and for aggregation into course level data for checking attainment of graduate capabilities such as critical thinking. This process is being undertaken in 2013 based on previous developments. (von Konsky et al., 2012)

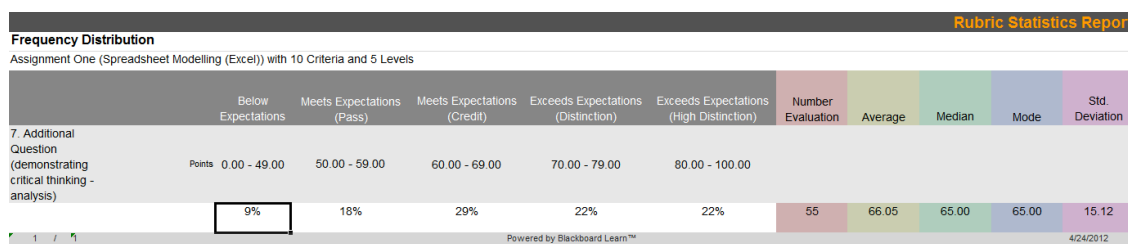


Figure 3. The rubric evaluation report from Blackboard 9.1 showing that 9% of the 55 students were below expectations on a critical thinking criterion.

Evidence of improvement in student perceptions of feedback was available from the university's routine data collection of student evaluations known internally as eVALUate. The responses (Table 2) have been collected since 2008, but in particular, show an improvement during 2012, when the rubric was implemented in the LMS. The unit summary report (USR) results in semester one and two of 2012 (85 and 100) are an improvement of (8 and 23) percentage points from the average prior to implementation (77). The teaching evaluation report (TER) results for 2012 (93 and 100) are an improvement of (12 and 19) percentage points from the historical average (81). Whilst the small sample numbers do not support statistical significance, the trend is positive and triangulates with the positive qualitative comments from the research questionnaire and the student evaluation. Furthermore, the university reports that feedback is the lowest rated item in university eVALUate scores, with a long term average of 78 percentage points, hence any reported improvements are important.

Table 2
Student evaluation data from 2008-2012 on assessment feedback showing improvement to 100% satisfaction after implementation of the rubric in the LMS

Assessment related questions in eVALUate for the unit	Before LMS	After rubric implementation in LMS	
	Average 2008 - 2011	2012 Semester 1	2012 Semester 2
Unit summary report (USR)			
"Feedback on my work in this unit helps me to achieve the learning outcomes"	77%	85%	100%
Number enrolled	47	55	35
Response rate	40%	47%	26%
Teaching evaluation report (TER)			
"Provides useful feedback"	81%	93%	100%
Number enrolled	47	55	35
Response rate	20%	25%	17%

Consistency and fairness

There was only one comment from students regarding consistency and fairness. A possible interpretation is that the students didn't have any problem with these items. None of the 55 students questioned their results for the first assignment. This was despite several students failing. The one relevant comment was:

It would have been nice to have it marked quicker but this was not bad because the marks were accurate.

It is noted that the second assignment, using a similar assessment process had two students question their results via email but after a response from the marker defending the existing result, there were no further questions.

From the teacher's perspective, consistency and fairness were improved by making the rubric available early to the students and referring to it repeatedly when discussing assignment requirements in lectures and computer laboratories. The criteria of the rubric were then explicitly requested in the assignment report so that made it easier to compare students' performance because the assignment had been broken down into 10 criteria and five levels. When discussing the feedback with students in the computer laboratory it was easy to refer to the specific criterion and level.

There was only one marker in this course in 2012 who was also the only teacher, so the possible inconsistencies brought about by having multiple markers and teachers was not an issue. Previous runs of the course had multiple markers and it was necessary to spend time with marked examples to improve consistency. In 2013 an offshore and a local tutor used the rubrics in the LMS and a moderation process using examples and double marking was employed to improve consistency in the rubric use.

One small issue of fairness presented itself when, after completing the marking, a student questioned the feedback regarding the referencing criterion. The marker acknowledged the error, but rather than remark for minor adjustments, asked students to incorporate the learning for the second assignment. This was accepted without further debate.

Efficiency

The key benefit for the teacher was an estimated 40% reduction in marking time using the rubric in the LMS compared to using the rubric via Microsoft Word and Excel. This reduction is similar in magnitude to those reported by Anglin et al. (2008) (50% - 70%) when comparing computer-assisted rubric grading with hand grading or hand grading using rubrics. It is noted that the Anglin et al. (2008) study used a task which only required one to two minutes to mark compared to this study which uses an assignment marking task more representative of the complexity of an undergraduate business assignment in an Australian context. The comparison in the current study was based on a conservative (i.e., low) estimated average of 30 minutes per assignment for similar assignments in the past teaching of the course. The first author has marked many similar assignments previously and has used the 30 minute estimate as a guide to pay for sessional staff engaged in marking. The assessment process in the past had used a marking rubric that was semi-automated using Microsoft Word and Excel templates. The calculation was automated but there were numerous manual overheads including entry of the student name and number, scrolling of the files, transfer of criteria marks, and attachment of files.

The Blackboard rubric, which was embedded in the LMS, helped to streamline these processes, reducing the time taken from an estimated average of 30 minutes to an actual average of 18 minutes with standard deviation 4.3 minutes; a 40% saving of 12 minutes per paper. Note that the sample size of 50 rather than 55 was because 5 assignments were not timed accurately.

During marking it was noted that there was a constant overhead of opening up the three files (Excel workbooks) submitted by each student. This was taking up to a minute through the web applications. It was noted that where students had submitted zipped files this overhead was reduced to about thirty seconds. Aside from the elapsed time, there was also the frustration associated with the mind being ready to assess while waiting for a machine process to be completed.

Another tactic employed to speed up marking was having students submit a hardcopy of their report in addition to the softcopies of the Excel workbooks. This enabled the marker to be always reading and assessing in parallel rather than waiting for the online report to be opened up. It was also faster to read the hardcopy compared to online because the reports were about 20 pages long and thus required considerable scrolling online.

Improvements to the assessment process

In addition to the research model categories discussed above, students were asked to suggest improvements to the process. Some examples follow.

Instead of showing what mark I got, it would be great if the assessment provided an additional help link or topic I should be aware of for the next assignment.

From a learning and teaching perspective this is a good suggestion. It was partially implemented with the feedback for the English expression criterion. Here a link to Communication Skills Centre resources was provided. Additionally, students who did poorly at the critical thinking analysis criterion were directed to the lecture resources. Whilst it is useful for students to have some guidance, there is also some onus on the student to make use of resources provided. Perhaps in a future assignment with similar criteria, students could be requested to document what they had done to respond to earlier feedback.

Give some example of how an assignment should look. The criterion "additional question" should have some guide.

An advanced rubric could include snippet examples of the type of work expected. These could be based on previous assignments. Furthermore, there could be examples of the achievement levels – below expectations, meets expectations, and exceeds expectations. Again the teacher would need to strike a balance between training a student to do exactly what you ask for, and educating a student to exercise their own judgment. In 2013 semester one a 10 minute video was created showing an assignment exemplar and this was well frequented by students – 60 hits compared to 3 or 4 for recorded lectures.

As a counter to the desire for greater clarity and detail was the comment:

[The rubric] is quite detailed i.e. too much to apply – prefer to focus on particular areas as opposed to apply everything in the context.

So there are students who would prefer less detail, although they were in the minority.

An overwhelming majority (19 of 20, 95%) recommended use of the process in the future, which for the short term meant the second assignment. The single dissenter had an issue with the criteria used for assessment rather than the process, claiming that the criteria did not assess the process of logical model creation. This was a reasonable comment given that two of the three tasks were following structured steps from a text book.

A representative reason given for recommending the process be continued included the following:

I had a clear set of instructions on what was required in the assessment so therefore I could complete without questions or follow-up. The rubric outlined what was required for each mark/level type and this helped clear up any questions I may have had.

Teacher perceptions of strengths and issues of the rubric in the LMS

In 2013 semester one, two more staff, a local tutor and an offshore lecturer, was involved in the teaching of the unit, and the assignment assessment. A short questionnaire revealed that they both considered the rubrics useful, in particular the openness and transparency of the assessment for students and teachers. One noted that it aided moderation amongst colleagues because of the detailed breakdown into criteria. This lends some support to the use of rubrics for quality assurance purposes although an argument could be mounted that detailed marking guides would serve a similar purpose.

The tutor also noted that the strength of the rubric in providing detailed guidance to students, and promoting standardization, was also its weakness in that it could be stifling creativity and imagination. Whilst the standard of assignments had improved they were all very uniform. This issue is similar to what some students reported in their feedback, and strikes at the need to consider a balance between providing students with structure, yet allowing them to express creativity and imagination. A rubric could be adjusted to be more open, and specific criteria allocated to creativity, should that be the learning objective for a specific assessment.

In the course of the 2012 rubric implementation in Blackboard 9.1, the teacher kept a journal of strengths and issues which was used to inform the assurance of learning team on issues regarding the wider implementation to more courses. These are listed in Table 3 and have implications for the improvement of the current Blackboard Rubrics module when compared to other alternatives such as Turnitin GradeMark which is currently being trialled. It is noted that even when there are potentially superior assessment modules available from other vendors the enterprise and legacy requirements of LMSs often dictate improvement of existing systems, unless the modules integrate well into the existing LMS (Burrows & Shortis, 2011).

Table 3
Strengths and issues from the teacher's perspective of the rubric implementation in Blackboard 9.1

Strengths
The ease of assessing individual students where assignment files, student information, and marks are managed by the LMS.
The automatic calculation of the student final mark after checking the cells in the rubric.
The storage of the data for each student making it easy for tracking and checking during later enquiries.
The rubric evaluation report giving statistics of the distribution of student performance on each criterion of the assignment.
The ease of sharing marked examples with colleagues (onshore and offshore) for moderation.

Issues
The matrix structure of the Blackboard rubric forces the same number of achievement levels for each criterion. This doesn't allow the flexibility of differing achievement levels (more or less granularity) for different criteria, which is common with traditional marking guides where questions can have different mark granularity.
It was clumsy to weight criteria using the point range e.g. 50-59, option. The teacher either had to repeat criteria to imitate weighting or to go with the default of equal weighting. (This can be overcome using the percent range option although statistics [average, standard deviation] disappear in the rubric evaluation report.)
There were some irritating formatting issues in the feedback dialogue of the rubric where items such as quotation marks were presented as back-slashes by the system.
A system error caused 1000 points in the rubric to be automatically converted to 1,000 which then required manual removal of the comma to continue.
An easy to use print option could be used to improve the printing and distribution of student specific rubrics and generic rubrics either as hardcopies and/or pdf files.
The rubric doesn't allow direct annotation of student assignments.
The rubric evaluation report cannot be easily broken down into different student cohorts (e.g., local and offshore) to allow comparisons.
There is no easy way to deal with group assessment where rubrics are to be shared amongst group members.
An offshore tutor reported being bumped out of the system and having to re-input rubric marks. This is likely an internet connection issue.

A broader issue is the experience of teachers with rubrics, LMSs and assessment strategies. The teacher in this study had a long experience with rubrics and the LMS so was well placed to take advantage of the computerization. In comparison, many of the teachers who will be using the system in the future are much less experienced, particularly with the use of rubrics. Whilst the re-use of generic rubrics within the LMS can save time for new adopters there is still considerable adaptation and thinking required by teachers before they can implement the rubrics into their courses and their assessment strategy. Researchers have previously noted that the experiences, attitudes and beliefs of teachers shape their use of rubrics which in turn influences the impact on student learning. (So & Lee, 2011)

Conclusion

The embedding of the rubric within the LMS to support an assessment process appears to have been successful from both the student and teacher perspective.

Students have noted the feedback they have received as a guide to improve their next assignment. They have recommended the process be continued and they have compared the process favourably with experiences in other courses. Furthermore, their satisfaction with feedback has improved well above the university average.

Whilst the teacher has seen a 40% reduction in marking time similar to Anglin et al. (2008), the provision of quality feedback has not been compromised. This reinforces and extends the results Anglin et al. (2008) observed but now in the context of a LMS with a substantive assessment and the potential to scale to many courses. As with all marking and feedback systems (Burrows & Shortis, 2011) the teacher and sessional staff have noted issues about the particular LMS implementation that could be improved.

The availability of the rubric and associated feedback online has supported communication and interaction with students about improving their learning, including the use of a rubric evaluation report as an analytical basis for future changes to teaching and learning (Baepler & Murdoch, 2010). However, it was noted that though a majority of students enjoyed the structure, detail and clarity of the rubric, some students preferred more freedom to deal with challenging questions. Hence, teachers need to be thoughtful about how structured the criteria and achievement levels should be.

Rubrics are widely used in K-12 education and are advocated by accreditation bodies like AACSB for assurance of learning processes in Higher Education. The AACSB alone has over 600 accredited institutions worldwide, including 11 Business Schools in Australia, so this represents a large potential user base (AACSB International, 2013). Combined with the diffusion of LMSs and assessment tools into the education sector, the findings on computer-based rubrics have broader implications to the wider context of educational assessment and quality assurance (see Tertiary Education Quality and Standards Agency, <http://www.teqsa.gov.au/>). The balance among efficiency and effectiveness is of interest to teachers, students, course coordinators, assessment specialists, LMS system adopters, academic managers and accreditation bodies.

The research model has provided a useful framework to consider the tension and balance between student and teacher perspectives, rather than a single perspective. The existing criteria identified are structure, feedback, consistency, fairness and efficiency. Future research can identify additional criteria and refine the existing criteria. A positivist study could measure the criteria and investigate the link between them and overall student satisfaction and/or performance. Expanding the research to other courses, students, and teachers, will improve the generalizability and transferability of findings.

The study was limited to the use of the LMS Blackboard 9.1 and Blackboard Rubrics. It would be useful to compare implementation with other LMSs, e.g., Moodle and Sakai, and/or assessment tools with rubrics, e.g., Turnitin GradeMark (Venable, Aitken, Chang, Dreher, Issa, von Konsky, & Wood, 2012). It is clear to the authors that the particular technology does structure and constrain the implementation and use by teachers and students, but this is yet to be researched. As of 2013, there is some trialling of GradeMark within the university as an alternative rubric-based assessment technology.

Furthermore, the familiarity of teachers and students with the technology is likely a moderating variable on the success of use (So & Lee, 2011). For example, the second semester implementation in this study

showed improved student satisfaction regarding feedback. However, as rubric use becomes widespread over time it will be less novel for the students and their increased expectations may result in lower satisfaction. So there is an opportunity for further longitudinal research.

The aim of the authors is to continue improving and researching the assessment processes with a view to diffusing evidence based practice to other faculty. This diffusion has begun with the sharing of the current rubric with other faculty and the further development and implementation of generic assessment rubrics for graduate capabilities such as written communication and critical thinking. Driven by assurance of learning requirements (von Kinsky et al., 2012), the rubric-based implementation in this study is being rolled out in 2013 and 2014 to most of the undergraduate and postgraduate courses in the faculty so there is a rich set of contexts for further research.

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Appendix. The complete rubric implemented in Blackboard 9.1



Name Assignment One (Spreadsheet Modelling (Excel)) with 10 Criteria and 5 Levels					
Description A rubric structure adapted to the Spreadsheet Modelling (Excel) assignment for the unit Business Software Tools 200. It includes reference to graduate capabilities via the criteria (rows), e.g. applied discipline knowledge (20%), critical thinking (40%) and written communication (30%) (from the CBS BCom learning goal rubrics developed by the AOL team.) The levels of achievement (below, meets and exceeds expectations) include descriptors from the BCom learning goal rubrics.					
Rubric Detail					
Criteria	Levels of Achievement				
	Below Expectations	Meets Expectations (Pass)	Meets Expectations (Credit)	Exceeds Expectations (Distinction)	Exceeds Expectations (High Distinction)
1. Customisation (demonstrating individual scholarship and ethical behaviour)	0 to 49 points criterion not addressed in report (0=not done) or several steps not completed and reported. (25=very poor, 45=poor)	50 to 59 points most steps completed and reported (55=pass)	60 to 69 points nearly all steps completed and reported (65=credit)	70 to 79 points all steps completed and reported with good summary and presentation (75=distinction)	80 to 100 points all steps completed and reported with excellent summary and presentation (85=high distinction, 100=amazing)
2. Problem steps completed from text (Case Problem 1) (demonstrating applied discipline knowledge and skills - analyse data)	0 to 49 points criterion not addressed in report (0=not done) or several steps not completed and reported (25=very poor, 45=poor) Did not analyse data using prescribed methods to create usable information.	50 to 59 points most steps completed accurately and reported (55=pass) Can apply prescribed methods to analyse data and create useable information.	60 to 69 points nearly all steps completed accurately and reported (65=credit)	70 to 79 points all steps completed accurately and reported with good summary and presentation (75=distinction) Can select and apply appropriate methods to analyse data and create useful information.	80 to 100 points all steps completed accurately and reported with excellent summary and presentation (85=high distinction, 100=amazing)
3. Problem steps completed from text (Case Problem 2) (demonstrating applied discipline knowledge and skills - analyse data)	0 to 49 points criterion not addressed in report (0=not done) or several steps not completed and reported (25=very poor, 45=poor) Did not analyse data using prescribed methods to create usable information.	50 to 59 points most steps completed accurately and reported (55=pass) Can apply prescribed methods to analyse data and create useable information.	60 to 69 points nearly all steps completed accurately and reported (65=credit)	70 to 79 points all steps completed accurately and reported with good summary and presentation (75=distinction) Can select and apply appropriate methods to analyse data and create useful information.	80 to 100 points all steps completed accurately and reported with excellent summary and presentation (85=high distinction, 100=amazing)
4. Modelling process/method (refer to Read and Batson 6 stages here) (demonstrating critical thinking - issue)	0 to 49 points criterion not addressed in report (0=not done) or stages omitted and minimal or no application to the assignment context (25=very poor, 45=poor) The issue or problem to be considered critically is not clearly stated and described. There are significant omissions and/or errors.	50 to 59 points mentions all stages and minimal application to the assignment context (55=pass) The issue (or problem) to be considered critically is stated clearly and described with enough information for an adequate understanding.	60 to 69 points covers at least 3 stages adequately (must be examples applied to the assignment context) (65=credit)	70 to 79 points covers at least 4 stages with depth (must be examples applied to the assignment context) (75=distinction) The issue (or problem) to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for a full understanding.	80 to 100 points covers all six stages in depth (must be examples applied to the assignment context) (85=high distinction, 100=amazing)
5. Documentation on the model (e.g. documentation sheet, comments) (demonstrating written communication - context and purpose)	0 to 49 points criterion not addressed in report (0=not done) or (25=very poor, 45=poor) Did not demonstrate adequate consideration of context, audience, and purpose and a clear focus on the assigned task(s) (e.g., the task aligns with audience, purpose, and context)	50 to 59 points documentation sheet only Demonstrates adequate consideration of context, audience, and purpose and a clear focus on the assigned task(s) (e.g., the task aligns with audience, purpose, and context)	60 to 69 points documentation sheet, comments on cells	70 to 79 points plus widespread e.g. comments on many cells Demonstrates a thorough understanding of context, audience, and purpose that is responsive to the assigned task(s) and focuses all elements of the work.	80 to 100 points extras like model version, customised headers and footers for printing (see Read and Batson)
6. Extra features that have been implemented in the application to enhance the usability (e.g. effectiveness and efficiency) of the application including extra functions and improved interface design (demonstrating critical thinking - alternatives)	0 to 49 points criterion not addressed in report (0=not done) or (25=very poor, 45=poor) Alternatives are either not presented or there is inadequate evaluation of the relative merits or drawbacks of each alternative.	50 to 59 points a basic feature stated but minimal description Presents and evaluates alternatives in a way that demonstrates adequate understanding of the relative merits and drawbacks of each alternative.	60 to 69 points a basic feature with adequate description (text only)	70 to 79 points several (e.g. 2) features with depth description (text and annotated screens) Presents and evaluates alternatives in a way that demonstrates an in-depth understanding of the relative merits or drawbacks of each alternative.	80 to 100 points many (e.g. 3 or more) advanced features with depth description (text and annotated screens)
7. Additional Question (demonstrating critical thinking - analysis)	0 to 49 points The analysis is not coherent. Information, concepts and methods are lacking. The information analysed is gathered from very limited source(s) or only those provided.	50 to 59 points The analysis is generally adequate but is only based on sources provided.	60 to 69 points A coherent analysis is based on relevant information, concepts and methods. The information analysed is gathered from several, relevant source(s) beyond those provided.	70 to 79 points The analysis is generally comprehensive and mostly based on high quality sources.	80 to 100 points A comprehensive analysis is based on relevant information, concepts and methods The information analysed is gathered from many diverse, high quality source(s) beyond those provided.
8. Lessons Learnt (600 words maximum) on what you have learnt in the course of the assignment (about decision support, about the software, about the assignment...) (demonstrating critical thinking - conclusions)	0 to 49 points criterion not addressed in report (0=not done) or (25=very poor, 45=poor) The conclusions (or solutions) are unclear. They are not logically supported by the evidence and the process of analysis. Assumptions are not described.	50 to 59 points One of the three is not covered adequately The conclusions (or solutions) are clear and relevant They are generally supported by the evidence and the process of analysis. Some assumptions are described.	60 to 69 points adequate coverage of the three (a paragraph on each), clear and reasonably expressed	70 to 79 points depth coverage of the three, clear and well expressed The conclusions (or solutions) are comprehensive, relevant, significant and organised. They are logically supported by the evidence and the process of analysis. Assumptions are comprehensively described.	80 to 100 points plus extra insights, advanced features with depth description (text and annotated screens)
9. References (in-text, end-of-text, Curtin Library standard) (demonstrating written communication - sources and evidence)	0 to 49 points criterion not addressed in report (0=not done) Did not demonstrate consistent use of credible, relevant sources to support ideas that are situated within the discipline and genre of the writing.	50 to 59 points one reference (end-of-text) Demonstrates consistent use of credible, relevant sources to support ideas that are situated within the discipline and genre of the writing.	60 to 69 points two references e.g. Read and Batson; Excel 2010 (in-text, end-of-text, Curtin Library standard)	70 to 79 points three or four references (in-text, end-of-text (alpha ordered), Curtin Library standard) Demonstrates skilful use of high-quality, credible, relevant sources to develop ideas that are appropriate for the discipline and genre of the writing	80 to 100 points five or more references (in-text, end-of-text (alpha ordered, indented to highlight author) Curtin Library standard)
10. English expression (spelling, word usage, sentence construction, grammar, objective style – use “the author” not “I”, “my”) that aids understanding (demonstrating written communication - control of syntax and mechanics)	0 to 49 points errors (more than 4 or 5 on a page) and difficult to read document (25=very poor, 45=poor) Did not use language that conveys meaning to readers with sufficient clarity and includes numerous errors.	50 to 59 points some errors (4 or 5 on a page) but generally clear to read document Uses language that generally conveys meaning to readers with clarity, although writing may include some errors.	60 to 69 points some errors (3 or 4 on a page) but generally clear to read document	70 to 79 points few errors (1 or 2 on a page) and good to read document	80 to 100 points no errors (max 1 or 2 in whole document) and excellent to read document Uses language that skilfully communicates meaning to readers with clarity and fluency, and is virtually error-free