

An Automated Grading Spreadsheet for Reports or Presentations

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S Supporting Information

ABSTRACT: An Excel workbook is described that automates and simplifies the use of any grading rubric for written reports or oral presentations. The accompanying workbook can be modified to include a user's specific rubric and grading scheme.

KEYWORDS: First-Year Undergraduate/General, Second-Year Undergraduate, Upper-Division Undergraduate, Communication/Writing, Testing/Assessment

■ BACKGROUND AND INTRODUCTION

The use of rubrics for grading is widespread in chemistry. Faculty use rubrics¹ to grade exams, homework, oral presentations, papers, and laboratory reports. In general, using rubrics is reported to standardize grading among different graders, to make grading faster, and to provide useful feedback for students. Rubrics developed^{2,3} for scientific writing in biology courses were tested and found to be highly reliable among both trained and untrained raters. Others reported⁴ anecdotally that rubrics made grading in an engineering course more efficient and that the grading was more consistent among graduate student teaching assistants.

Rubrics may divide an assignment into different components that are based on sections of the report or paper, such as abstract or discussion.⁵ Alternatively, the evaluated components may be based on characteristics such as relevance⁶ or evidence-based reasoning.⁷ For each component there is a corresponding set of levels with some description. The levels range from excellent (mastery) to poor (unacceptable, developmental) or even absent.

Yuan and Recker⁸ identified three key aspects of a rubric: the content of the rubric (including whether the rubric includes quality dimensions, a rating scale, and a scoring guide), the development process used to create the rubric (what testing was done and the number of revisions reported), and the utility of a rubric (specific to a course, topic, or Web site and automated or not). The authors also emphasize the importance of support for rubric users.

Many years ago we began using rubrics to grade reports for the physical chemistry laboratory course. The intent of the rubrics was to provide students with additional feedback in addition to simplifying and standardizing grading among teaching assistants. The initial rubrics did not assign point values to the levels for each component of the report. Instead, the instructor or the teaching assistants assigned a score for each component. Grading remained inconsistent, and the grades were often very low. It was not unusual for students who had written five- to ten-page reports to receive grades well below 50%. In addition, the number of students taking the physical chemistry laboratory course increased, further intensifying the grading demand on the instructor and teaching assistants. For these reasons, a spreadsheet-based automated rubric was developed that may be used to tally and assign a numerical grade to a report.

A few automated rubrics have been described. One Web site⁹ lists steps to create an analytic rubric spreadsheet from a database; the spreadsheet and database must be made by the user. Another Web site¹⁰ describes a course management system that allows subscribers of this system to create rubrics that are automatically insert a grade into their gradebook. Vista et al.¹¹ describe a semiautomated rubric and text-scoring system used for peer-review of higher level writing assignments in MOOC's.

This technical report describes an Excel-based workbook that may be fully customized by an instructor to automate the mechanical scoring reports or presentations for any course. The example rubric is designed for the physical chemistry laboratory course at this institution. Users will likely want to modify the rubric to fit their needs.

■ OVERVIEW

The workbook includes five important features, which are listed in [Box 1](#). Each feature is described in more detail below.

Box 1. Features Included in the Workbook

1. An editable rubric
2. A macro that creates an individual, labeled worksheet for each student on the class roll
3. Drop-down menus to select the level for each report component
4. The total grade with an option for a late penalty
5. A class roll with names and grades that may be uploaded to a course management system

The workbook and an Instructor's Guide are included in the [Supporting Information](#). The workbook must be macro-enabled; the file extension is *xlsm*. It opens with three worksheets labeled "Rubric", "Roll", and "Student". Microsoft Excel 2010 was used to create the workbook. An Excel 97–2003 version of the workbook is also included in the [Supporting Information](#).

Editable Rubric

The actual rubric is located on a separate worksheet labeled "Rubric". As written, the rubric has six levels for each

a	Abstract content: statement of experiment summarizing: system studied, methodology used, important numerical results, and relation to literature.		#N/A	9	#N/A
b	Abstract content: statement of experiment summarizing: system studied, methodology used, important numerical results, and relation to literature.		#N/A	9	#N/A
c	Abstract content: statement of experiment summarizing: system studied, methodology used, important numerical results, and relation to literature.	Three or more elements missing, incoherent, or incorrect.	50	9	4.5

Figure 1. Drop-down menus. (a) Initial appearance of the “student” spreadsheet; (b) drop-down menu for the “Abstract content” Report Component; (c) final appearance after the level is selected. The level selected (Unacceptable) corresponds to 50%, or 4.5/9 points for this Report Component.

component: Absent, Unacceptable, Basic, Competent, Proficient, Distinguished. The levels are listed in a row on the spreadsheet. Levels may be removed by deleting a column, or more levels may be added by inserting a column. For example, “Unacceptable” could be deleted from the current set of levels, or “Poor” might be added after a column is inserted. Levels may be renamed by typing in the new name (e.g., change “Distinguished” to “Excellent”). Each level is assigned a point value: 0, 50, 65, 80, 90, and 100 for Absent through Distinguished. The point values can be changed.

The “Rubric” worksheet includes descriptions of what is required at each level for each report component. This particular rubric was developed for physical chemistry laboratory reports, so it focuses on making figures and tables and formatting equations in addition to the content and style of the sections of the report. The text may be changed by entering the desired text in the worksheet. Components may be removed or added by deleting or inserting rows in the worksheet. Detailed instructions for deleting or adding Report Components are included in the Instructor’s Guide.

Automated Worksheet Copying and Renaming

A macro (RenameSheet) that copies and renames a separate worksheet (initially labeled Student) is included with this workbook. Macros must be enabled when opening the workbook. Before running the macro, the instructor copies the names on the class roll into the Roll worksheet. The macro is invoked by typing “Ctrl+Shift+R” or by choosing View, Macros, RenameSheet, Run. As an example, if 10 students are in a class, 10 copies of the “Student” worksheet are made, and each worksheet will have a student’s name on the tab. In a class with the students “Curie, Marie”, “Boltzmann, Ludwig”, and “Planck, Max”, the first three worksheets (after the Roll worksheet) would be renamed “Curie, Marie”, “Boltzmann, Ludwig”, and “Planck, Max”, and the names would also be copied into top left cell of each student-named worksheet. This macro accurately completes the copying and renaming process in less than a minute, even for large classes.

Drop-down Menus

The “Student” worksheet in the workbook has drop-down menus referencing the rubric. Selecting an item from the

drop-down menu automatically inserts the point value for that item. Keyboard shortcuts may be used with the drop-down menus if desired (ALT + DOWN ARROW, followed by the UP or DOWN ARROW). The first column in this sheet lists the Report Components copied from Rubric worksheet. For each Report Component, there is a drop-down menu in the adjacent column. The drop-down menu has the level descriptions for each component. Once a level has been selected, the third column displays the corresponding numerical value. For example, under Abstract Content, choosing “Three or more elements missing, incoherent, or incorrect.” corresponds to “Unacceptable”, so a “50” appears in the third column. The next adjacent column gives the Points/component; for this example, Abstract Content is worth 9 points (out of 100). This report would get 4.5/9 points for the Abstract content. Figure 1 illustrates one of the drop-down menus.

Total Grade

The Student worksheet also tallies the total grade for a report. After selecting the appropriate level using the drop-down menus, the worksheet automatically computes and totals the points for that component to add to the full report grade (see Figure 1c). Optional late penalties may be assessed using another drop-down menu. The late penalties may be changed. By default, no penalty is assigned, and no points are deducted. Instructors can easily change the point values for different parts of a report (for example, the four points assigned to the title page could be changed to two points).

Class Roll with Names and Grades

The students’ grades and names will be displayed on the Roll worksheet once the instructor has completed assigning grades for each student. To upload the grades to a course management system such as Blackboard, LONCAPA, or Moodle, the instructor will need to copy and paste the listed names and grades as values into a new worksheet. Most grade uploads for course management systems require a comma-delimited (csv) file. Detailed instructions for this feature are described in the Instructor’s Guide. This feature and the RenameSheet macro reduce time spent by the instructor on the more mundane but necessary aspects of grading.

It is also possible to modify the workbook to summarize all the students' report component scores onto one worksheet. Instructions on how to modify the workbook are included in the Instructor's Guide. This modification should be made only after altering the rubric to suit the instructor's needs. Making this modification allows the instructor to see patterns in grading. For example, student scores for writing the abstract might be high, while scores for making figures might be low. The instructor might also discern patterns in grading by teaching assistants.

CONCLUSION

The elements of this workbook automate the use of a rubric for a classroom assignment. Instructors run the RenameSheet macro, apply the rubric to each student's assignment, copy and paste the class roll with grades to a new worksheet, upload grades to the CMS, and print (if desired) each student's rubric to return with the graded assignment. Applying Yuan and Recker's criteria⁸ for evaluating rubrics, the spreadsheet-based rubric described in this report includes quality dimensions, a rating scale, and a scoring guide, and it has high utility because it can be modified and is automated. The rubric reliability has not been rigorously tested. In our experience, we have found that using the automated rubric also helps make grading more consistent from one grader to the next. Faculty from three other institutions have used the workbook for grading, and they report that the workbook is very helpful because it is fast, provides useful feedback to students, and can be altered to suit their grading needs.¹²

ASSOCIATED CONTENT

Supporting Information

The Supporting Information is available on the ACS Publications website at DOI: 10.1021/acs.jchemed.5b00553.

An Excel 97–2003 version of the automated rubric, an Excel 2010 version of the automated rubric, and an instructor's guide for using the workbook (ZIP)

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Notes

The authors declare no competing financial interest.

REFERENCES

- (1) Moskal, B. M. Scoring rubrics: what, when and how? *Practical Assessment, Research & Evaluation*, **2000**, *7*. <http://pareonline.net/getvn.asp?v=7&n=3> (accessed October 8, 2015).
- (2) Crowell Timmerman, B. E.; Strickland, D. C.; Johnson, R. L.; Payne, J. R. Development of a 'universal' rubric for assessing undergraduates' scientific reasoning skills using scientific writing. *Assessment & Evaluation in Higher Education* **2011**, *36*, 509–547 <http://web.a.ebscohost.com/ehost/pdfviewer/pdfviewer?sid=8bd6a8b0-5944-4fda-8186-ea349c9d82ea%40sessionmgr4003&vid=4&hid=4106> (accessed October 5, 2015).
- (3) Bird, F. L.; Yucel, R. Improving marking reliability of scientific writing with the Developing Understanding of Assessment for Learning programme. *Assessment & Evaluation in Higher Education* **2013**, *38*, 536–553 <http://web.a.ebscohost.com/ehost/pdfviewer/pdfviewer?sid=8bd6a8b0-5944-4fda-8186-ea349c9d82ea%40sessionmgr4003&vid=8&hid=4106> (accessed October 5, 2015).

- (4) Watai, L. L.; Francis, S. A.; Brodersen, A. J. A Qualitative and Systematic Assessment Methodology for Course Outcomes from Formal Laboratory Work Products in Electrical Engineering; *Frontiers In Education Conference - Global Engineering: Knowledge Without Borders, Opportunities Without Passports*, 2007. FIE '07. 37th Annual, **2007**; p F2C-21. <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=4418104> (accessed October 16, 2015)10.1109/FIE.2007.4418104

- (5) Gragson, D. E.; Hagen John, P. Developing Technical Writing Skills in the Physical Chemistry Laboratory: A Progressive Approach Employing Peer Review. *J. Chem. Educ.* **2010**, *87*, 62–65 <http://pubs.acs.org/doi/pdf/10.1021/ed800015t> (accessed October 16, 2015).

- (6) Oliver-Hoyo, M. T. Designing a Written Assignment To Promote the Use of Critical Thinking Skills in an Introductory Chemistry Course. *J. Chem. Educ.* **2003**, *80*, 899–903 <http://pubs.acs.org/doi/pdf/10.1021/ed080p899> (accessed October 16, 2015).

- (7) Van Bramer, S. E.; Bastin, L. D.; Loyd, D. Using a Progressive Paper To Develop Students' Writing Skills. *J. Chem. Educ.* **2013**, *90*, 745–750 <http://pubs.acs.org/doi/pdf/10.1021/ed300312q> (accessed October 16, 2015).

- (8) Yuan, M.; Recker, M. Not All Rubrics Are Equal: A Review of Rubrics for Evaluating the Quality of Open Educational Resources. *Int. Rev. Res. Open Distrib. Learn.* **2015**, *16*, 16–38.

- (9) How to Score a Rubric on a Computer Using Any Decent Database. <http://stone.web.brevard.k12.fl.us/html/d.b.rubric.html> (accessed October 8 2015).

- (10) RCampus. <https://www.rcampus.com/index.cfm?nocache=1444329704875> (accessed October 8, 2015).

- (11) Vista, A.; Care, E.; Griffin, P. A new approach towards marking large-scale complex assessments: Developing a distributed marking system that uses an automatically scaffolding and rubric-targeted interface for guided peer-review. *Assessing Writing* **2015**, *24*, 1–15 http://ac.els-cdn.com/S1075293514000543/1-s2.0-S1075293514000543-main.pdf?_tid=efaa341c-78f1-11e5-8454-000000000000&acdnat=1445541801187be360ba695ffff6de37f9c3f57c21 (accessed October 16, 2015).

- (12) Grushow, A. Department of Chemistry, Rider University, Lawrence Township, NJ; Reeves, M. Department of Chemistry, Tuskegee University, Tuskegee, AL; Whitnell, R. Department of Chemistry, Guilford College, Greensboro, NC. Personal communication, February 2015.