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# Teaching Spreadsheet Documentation Skills using Practitioner based Workshops

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## Abstract

*Proper documentation of spreadsheets and other forms of digital analysis is a common problem for business students entering professional practices. For example, when a spreadsheet is constructed and poorly documented as to assumptions and related descriptions the ability of others to effectively use the spreadsheet is eroded. This is particularly true when spreadsheets are prepared at the staff level, where such staff may subsequently leave the organization and others are left to rely on the document for important purposes (e.g., audits). Part of this problem could be alleviated by helping students first develop awareness of why poor documentation is a problem and then to develop habits and skills thereby enabling proper levels of documentation. This note describes an innovative approach used in an undergraduate accounting classroom. The innovation involves the use of workshops relying on certain types of co-presenters to facilitate student awareness to aid students in their preparation of Excel based analyses. While a short review of the relevant literature helps frame the issue, there is little published on best practices in teaching the documentation topic. The author explains the structure of the workshop (within the context of the class assignment) and provides the specific documentation elements emphasized. Evidence is provided as to the effectiveness of the approach. Thoughts and resources to enable replication are also supplied*

## Keywords
Spreadsheet, Excel, workshop, business student, quality control

## Cover Page Footnote
NA

## Introduction

In the realm of financial analysis, newly hired staff often undertake roles that require a near constant interface with a firm's information systems. This may involve interaction with large Enterprise Resource Planning systems, or more commonly, drawing data from such systems to perform independent analysis more often captured in electronic spreadsheets. These spreadsheets often aggregate into larger digital workbooks for different projects.

Teaching proper spreadsheet documentation skills is particularly important at the university level because i), it is expected by those firms hiring staff, ii), it is often overlooked in the rush to teach "hard" spreadsheet skills such as Pivot tables, and iii), it provides educators an opportunity to teach good habits relevant to long term career pathways in the financial field.

In practice, this process can be fraught with risk. For example, in the field of Accounting, where spreadsheets are used extensively, there are high levels of quality control issues [1]. This has led to increasing standards around internal controls to mitigate spreadsheet errors and risks. The higher bar that has been set around spreadsheet controls is driven [2] by increased regulatory compliance regulation (e.g., Sarbanes-Oxley, or SOX, regulations in the wake of the Enron failure) as well as increased use of financial data storage and transmission for analytical purposes (e.g., eXtensible Business Reporting Language, or "XBRL", increasing mandated in the filing of public company financial statements). Yet these problems persist.

While a significant problem associated with these efforts is the challenge of quality control, an equally important problem is staff failing to properly document their work product. One reason for these problems is that the growth of the information age has led business end users to prepare elaborate models and analysis outside the overview of the IT department [3]. Partly due to this, spreadsheets are poorly designed and documented. Not enough emphasis is provided by educators on developing appropriate levels of awareness and skills among their students [4]. Others [5] find that while a majority of accounting professors incorporate Excel into their courses evidencing the importance of the topic, the perception of the faculty is that the students do not become proficient.

There are a number of papers focused on the Quality Control ("QC") aspect of spreadsheets. For example, some studies [6] emphasize the importance of design thinking as a precursor to good QC. In particular, one study [7] emphasizes that educators need to raise student awareness for the propensity of such errors and to teach appropriate strategies. Other studies [1] have a "check list" approach to common errors.

While there is more literature on quality control practices, the emphasis on proper documentation is less evident. One paper [8] distinguishes the concept of documentation as providing a road map, or audit trail, to the subsequent user. This can be particularly important when such work product is provided by staff in the financial services field for certain types of analysis that may

not be audited until three to five years later. Given this time lapse, the staff level preparer may no longer be present at the firm. While some researchers [9] and [10] provide insights on what elements of a properly documented digital analysis should be present, little guidance exists in the educational literature on the best way to teach these skills and awareness levels.

As educators, one often sets out to teach the specifics skills needed to use specific technologies. Typically, the teaching modalities are lecture, case studies and defined problem sets where students engage with data to complete some type of analysis that they may be called to perform in the workplace. The educator may be well versed in the technology platform from an academic perspective, but less versed in the importance of proper documentation in practice. While educators may believe this is the responsibility of the hiring firms, the firms often believe that this is best taught during the university years and reinforced in practice [5].

One particular study [11] includes a reference to documentation as one of six themes in good spreadsheet design and quality. The author states: *creators of spreadsheets should always document an explanation of what the spreadsheet does, where the input came from, what assumptions were made, as well as why and how the calculations were determined. Spreadsheets are powerful because they can be used more than once with different data and variables. Because of this, spreadsheets take on a life of their own and do not always stay with the creator, or they are used intermittently by the creator, so documentation becomes important to remembering how the spreadsheet works.*

This passage is helpful in providing some broad themes as to how to accomplish good documentation habits, but students often need more specific guidance and "show me" instruction. The latter part of the passage provides a broad rationale for why documentation is needed. Again, students need specific examples and reasoning sets for the awareness to "stick."

The question this note seeks to address is how best to incorporate proper documentation awareness and skills into undergraduate business students who use information technology as part of their courses. The author has experimented with this question over the seven years he has been teaching at a large university. Post workshop examples of how the author has used this approach in spreadsheet related assignments include:

- Allocating a portion of case based grading rubrics to include a weight for proper documentation elements as well as evidence of quality control checks (e.g., twenty percent of the case grade in sophomore level managerial accounting classes where the associated syllabus requires three team based case study submissions per semester);
- Quiz and exam short answer questions asking students to identify elements of a poorly documented spreadsheet provided as a "strawman" sample (typically undertaken in a second midterm per the related syllabus); and
- Point deductions for poorly documented spreadsheet, and similar exhibits, submitted by students as part of homework assignment that are identified as "supplemental" in the syllabus relative to less challenging chapter homework assignments (e.g., in senior level accounting information system classes).

This note provides a description of a process that this professor has found effective (and evidence of the effectiveness) as well as suggestions for replication.

## Assignment and innovation

Drawing on a course that has been taught by the author each semester over the past seven years, Managerial Accounting, the author set out to test the awareness levels of the students not only in regard to their specific level of Excel skills but also their knowledge of both basic quality control and documentation techniques. This course is typically taken in the sophomore year and is required of all business students.

Excel was selected as this is the most common software platform system used by business students. The author has also experimented with this topic in systems course he teaches for accounting students. The systems course, in particular, requires students to interact with relational databases, using queries to draw down subsets of data for spreadsheet analysis. Students then import their spreadsheet findings back into reporting systems such as Tableau for data visualization display. While the focus is on skill (and confidence) building, the author (based on his extensive years as a practice leader at a Big Four firm) is highly aware of the problems that a lack of awareness around poor spreadsheet documentation can cause. As a result, he set out to test how best to instruct on the topic of proper documentation.

To test the workshop approach in the Managerial Accounting course, the author first set out to survey the baseline level of Excel skills in general as well as the extent that students were aware of the need for proper documentation. This was done at the start the semester for these two courses in the Fall semester of 2016. The results of the survey of the two sections can generally be described as follows:

On a four-point Likert scale (with 1 = "no experience", 2 = "some experience, 3 = "proficient" and 4 = "very strong") the median self-rated score on overall Excel proficiency was 2.4 for the sophomore class and 2.8 for the Senior Accounting Systems class. Generally, students were more familiar with basic skills (e.g., formatting, functions, graphing, data entry), less familiar with higher level skills (e.g., pivot tables and lookups) and largely unfamiliar with statistical techniques on Excel (e.g., correlation, regression, and macros). A short Excel diagnostic quiz was also given, the week following the survey, to complement the self-assessment. As part of the pre-course survey, students were also asked to identify up to five examples of good documentation habits. A review of the results indicated that perhaps 20 to 30 percent of the students could provide one meaningful example of what would constitute a good documentation habit or skill. Most students were more familiar with the concept of QC but not documentation, but even so, there was still a shortfall of good examples.

Sample surveys and complete findings are available from the author.

With this baseline underscoring the need, the instructor set out to take the two sections of the Managerial Accounting course he taught in the fall of 2016 and introduce an intervention (or innovation) in the form of a workshop with three components: building specific Excel skills (e.g., formulas, pivot tables, regression), quality control principles and proper documentation techniques and awareness.

Three case studies with embedded Excel components are used in the course. The student compositions of both sections were tested along with a number of variables (e.g., GPA, gender, attitudes about Excel, previous course work in computer courses, ….) and both sections of this course were found to be highly homogenous in terms of student attributes. The intervention, or innovation, was a two hour Excel workshop – involving co-presenters drawn from the local professional practice community. The workshop was given for only one of the course sections in the first case. Each section of the course has 40 students, who were randomly assigned to 10 groups of four students for purposes of completing the case assignment. The second section of students on the first case was not offered a workshop but rather were directed to pursue self-learning avenues such as internet searches (e.g., YouTube or Lynda.com) to acquire the necessary knowledge to complete the Excel portions of the case. Prior to the assignment, the general grading rubric was provided at the same time to both sections; students were told of the weights for the skill versus quality control and documentation components of the Excel requirements of the case. The latter two components comprised 25 percent of the case. A self-directed learning approach is often justified in an academic setting because this will be the resource that students will often need to rely on to educate themselves on technology needs once they are actually in the workplace. While self-directed learning may be quite effective (and efficient) for learning specific skills (e.g., pivot tables), this approach may be less effective for the softer skills (e.g., documentation).

The basic line of inquiry in the overall study was whether it is more effective to teach Excel in a workshop or self-directed learning mode; an ancillary area of interest was on the best way to teach documentation. The latter is the focus of this note.

The format of the workshop is important and, in essence, this is the innovation or insight embodied in this paper. At the evening workshops, two hours in length, students were offered (attendance was voluntary for the invited section) the opportunity to bring their laptops and to work along with the presenters. The focus was largely on skill-based problems. However, approximately 30 minutes of the workshop was carved out for quality control and documentation topics. Two specific attributes seemed to make this impactful (evidence-based findings to follow). First, the choice of presenters was important. The author, as the class professor, provided a general opening to the workshop, but the teaching was conducted by a Manager level representative of a local Big Four accounting firm as well as senior level teaching assistants who had the experience of two to three company internship placements.

Including presenters of this type appears beneficial in two ways. First, the teaching assistants provide not only a peer-to-peer learning perspective but also spoke to their experience as to how their company placements impacted their understanding of the importance of quality control and documentation. The teaching assistants were able to relate they had a general idea of quality control prior to their placements, but really did not have an awareness of the need of proper documentation nor understanding how to accomplish it.

The Big Four professional services representative in addition to providing skills' instruction, was also asked to address the documentation topics. He was able to hone in on the following key points:

- Managers review and have ownership responsibility for all spreadsheets on projects that they direct and they specifically look for good documentation patterns (this tells them something of the level of ownership of the staff preparing the work product – an attribute that is always discussed at first year performance reviews and is often a salient determinant of which staff get selected most often and for the more challenging projects);
- Why "documentation" is so important, particularly by relating a few "war stories" as to client situations where the staff person preparing the poorly documented spreadsheets in years past had moved on to graduate school yet the client was now being audited and the prior work needed to be understood;
- Explaining the practical dimension of how projects go over budget (that is, on projects where three or more staff members may be preparing different spreadsheets to be compiled into a common workbook the time cost of a high billing rate for a Manager to "fix" everything to a common format); and
- The challenge of version control and associated risks. An example of such a risk is staff habits of "leveraging" spreadsheets from each other for subsequent transactional data without properly understanding the necessary assumptions and data sources.

When not presenting in front of the workshop, the co-presenters "floated" among the students to provide "over the shoulder" troubleshooting of any issues they were having as they were working through the simulated Excel problems in the workshops.

Though not taking a significant amount of time on the documentation topic, the thought was that the combination of experiences of these two types of presenters could be quite impactful particularly around the notions of: awareness as to "documentation" and why it is important, the development of good documentation habits and the notion that good documentation skills promote personal brand. A list of the documentation habits taught as part of the workshop is provided in the appendix Exhibit A. The author has experimented with Excel workshops in previous semesters for the course, but those were wholly skilled focused and only occasionally involving teaching assistants and practitioners.

## Evidence on the effectiveness of the innovation

Two approaches were used to judge effectiveness: student perceptions from a post-course survey administered by the author and a comparison of the graded results for the Excel Documentation component of the case studies between the two sections. That is, the sections with and without the workshop opportunity in both cases (i.e., a crossover design).

Post-course survey results also evidence the relative effectiveness of the workshop approach relative to the documentation topic. Using a five-point Likert scale, an affirmative response (e.g., a score of 4 equals "Agree") was found to the survey question:

*The workshop provided me with an understanding of (and skills) relative to the importance of "documenting" my work?*

This result was significantly different from the neutral response (i.e., "3") and held for both those students who had previous exposure to Excel (in either a High School or freshman level computer science course) and those who had no previous classroom exposure. These results, including the test statistics, are displayed in Appendix Exhibit B. The qualitative responses to the question above as to why a certain score was selected were all favorable. A sampling of these anecdotal responses is presented in Appendix Exhibit C.

Exhibit B also compares the frequency distribution of the graded scores for the documentation component between the two course sections (i.e., one section with the opportunity for the workshop and the other relying on self-directed learning). A note in the exhibit details the grading rubric. As seen in the exhibit, for the first case, the class section (Section 14) with the workshop opportunity shows a better ability to capture a higher documentation grades. This difference is mitigated for the second case, as the other section (Section 11) is also afforded the workshop opportunity. For the second case, section 14 was directed to the self-learning approach (without the benefit of attendance at the second workshop) given the different Excel skills introduced in the second case.

Finally, relative to the College's typical course assessment survey, students noted the benefit of the Excel component on the cases. For example "Excel workshops were incredibly helpful personally and for the class" for the Comments field.

## Discussion and teaching suggestions

Teaching student users of software, particularly those students that are business vis-à-vis computer science oriented, proper documentation awareness and habits is important from a practical workplace perspective. Nonetheless, this is often overlooked in the classroom where a good foundation can otherwise be developed. The question becomes what is the "best," or most impactful, way to instruct on this topic. This note provides a suggested format involving a workshop around a typical case study that might be assigned requiring software usage. The innovation is not the workshop per se, but rather the inclusion of the topic of documentation and

more importantly the use of specific types of resources to teach the topic. The use of senior level teaching assistants who speak from a peer perspective. More importantly, is the involvement of mid-level practitioners who can articulate the need – particularly using situational examples that illustrate the logic of why documentation is crucial. Stories have a way of resonating with students, beyond "lecturing." Providing specific, or "checklist" type examples of specific documentation elements is also important to enable retention. The author has experimented with different types of workshops in the past for this course that was purely skill focused. The above approach yielded the desired results: consistent skill development AND better documentation performance.

Given the effort that goes into staging a workshop, a practical question for other professors interested in replicating the approach goes to whether they have the opportunity to involve co-presenter types as described in this note. Those teaching at institutions in urban areas will likely find such professional resources available. Typically, manager level individuals are happy to speak as such a workshop as it counts towards their performance review and professional development. For those not in these localities nor having teaching assistants available, the author to this study has completed one video tape using Storyline of one workshop and will be completing another in the Spring of 2018. Storyline is quite a helpful format as many students know certain Excel skills but not others. Storyline facilitates the ability of the student to hone in on the material they have less familiarity with and avoid investing time in what they already know. The videos capture certain skill tutorials and also include the QC and documentation components (again, indexed by Storyline to facilitate efficient retrieval). The author is happy to supply these Blackboard enabled digital assets gratis to interested parties.

The author did not apply this experiment to the Accounting Systems course as these types of case studies were not extensively used the same way in that course. However, the author has experimented with a role play exercise specifically geared to the documentation topic. The exercise provides the students with an example of a poorly document spreadsheet. The students are asked to assume the manager role in the role play with the understanding that the spreadsheet was prepared by a first-year staff two years ago. The staff member has departed to graduate school but the client is being audited, and the manager needs to be able to present the analysis that afternoon to the auditor. The students are then asked whether they should be concerned and what information do they need about how the spreadsheet was prepared (e.g., assumptions, data sources, …) that is not readily evident. Most students respond in the class discussion that they can see an empathetic perspective on the issue of documentation. While no formal evidence was gathered as to the effectiveness of this short exercise, it is yet another approach that creates awareness. The author is happy to also supply this short role play document to interested parties.

## Conclusion

The purpose of this note was to highlight the importance of documentation for students not having formal systems of computer science background. In practice, this is a meaningful problem

in the business community at the staff level. The remediation of the issue should be part of the educator's goal set.

This note provides one approach to creating student awareness and skills through not only a workshop format but with a design that emphasize the voices of both senior level teaching assistants and mid-level professionals in the business community as co-presenters. Suggestions are provided in this paper to enable replication by interested educators.

As referenced in the article, researchers [11] identify "documentation" as one element in good spreadsheet design. One study [8] specifically references the importance of spreadsheet documentation in the financial function related to audit trails and other studies [9] and [10] each provide insights as to what specific techniques good documentation entails. This paper adds to that literature by providing an evidenced based study on how the use of workshops, incorporating practitioners as co-presenters, provides an effective channel to teaching these skills.

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**Appendix Exhibit A**: Examples of Specific Documentation Habits/grading rubric criteria

- Preparer name/date; QC reviewer name and brief description of what level of review was undertaken/date
- Version Control ID/shared drive locator (if appropriate)
- Identification of the existence and location of corresponding cell formula map
- Use of footnotes in the table as appropriate, use of Notes at the bottom of the table as appropriate
- Use of color coded cells to highlight salient outcomes for the reader when the spreadsheet is dense
- Use of proper titles and subtitles, including units of measurements for rows and columns, as appropriate
- Complete source documentation, including input/output references to other tables
- List of assumptions (can be placed in notes)
- Consistent use of font sizes, table numbers, headings…so that all the exhibits follow a common protocol for all spreadsheets in a report or table.
- Use of "check" columns or cross tabs (at least on drafts) so that the reviewer has easy visual evidence that controls were used in the construction of the report
- Avoid unnecessary repetition of symbols (e.g., $) or use of decimal numbers when largely irrelevant
- Consider (as appropriate) indicating how this results of the spreadsheet should be used and/or what other analysis the document flows into (or is sourced from)

**Appendix Exhibit B**: Evidence of the effectiveness of the innovation: post-course student survey

*The course provided me with an understanding (and skills) relative to the importance of properly "documenting" my work (1 = strongly disagree, 5 = strongly agree):*

*Test Ho: mean response not equal to 3.0*

| Students attending the workshop: | mean | standard deviation | n (students) | test statistic [mean-3.0/(s/sqrt n)] | P <.005 |
|---|---|---|---|---|---|
| Having no prior excel training | 3.8 | 0.75 | 10 | 3.37 | * |
| With some level of prior excel training | 4.1 | 0.63 | 12 | 6.05 | * |

- ■ Students have a positive perception of the workshop facilitating documentation skills

## Case Study 1 – Documentation grading component distribution and frequency

| Points awarded | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| Section 14 (w/ work shop) | 1 | 0 | 1 | 3 | 3 | 2 |
| Section 11 (w/o wkshp) | 0 | 2 | 5 | 3 | 0 | 0 |

- ■ The section with the benefit of the workshop exhibited a higher frequency of group earning higher scores

## Case Study 2

| Points awarded | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| Section 11 (w/ wkshp) | 0 | 3 | 2 | 2 | 2 | 0 |
| Section 14 (w/o wkshp) | 0 | 1 | 4 | 2 | 2 | 1 |

- ■ By case study 2, both sections have had the workshop so little difference is seen in the frequency distributions

**Grading rubric:** points (grading rubric of 0 to a max of 5) awarded cumulatively for inclusion on the case excel exhibits any of the following documentation characteristics: notes with formula displays, identification of who prepared each worksheet, use of color, highlighting and borders, insertion of check or cross tab columns, and descriptive titles/subtitles/units of measurement.

**Appendix Exhibit C**: Qualitative (Anecdotal) Responses to the Question of how effective the Workshop format was to developing Documentation habits and skills

- *"The professional/industry usage of Excel was covered which is not stressed in CS 1100"*
- *"I thought the session was well taught and presented, especially in showing quality control and proper documentation. I had not been exposed to these topics being stressed before, while the other skills I had been exposed to"*
- *"The workshop helped me learn the importance of documentation in the real world"*
- *"Hearing these things from a person who has real experience in it was more persuasive to me"*
- *"I thought the workshop was the best way to learn Excel"*
- *"I enjoyed having a presentation as opposed to You Tube"*
- *"Also, QC is not something brought up in online Lynda videos, so that was especially helpful"*
- *"It's nice to have someone actually teach me skills in Excel. We can always look at videos and self-teaching but having someone teach me is more effective."*
- *"Personal guidance with tips and direction is better than research on your own and not knowing what is essential"*
- *"TA's were available to answer any questions. I also learned the importance of documentation in a professional setting. Attending with my group was also helpful as we were able to help each other."*