Teaching and educational notes

Teaching good Excel design and skills: A three spreadsheet assignment project

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A R T I C L E   I N F O

A B S T R A C T

Over sixty percent of AIS courses cover Excel because it is an important tool for accounting students to learn and master. Although spreadsheet programs like Excel provide powerful analytical tools for business, in practice, they are often created and used by people with minimal programming experience. Consequently, users can often develop spreadsheets containing critical errors, which, in turn, can cause significant losses for their businesses. Errors can be reduced, however, by learning and employing good spreadsheet design techniques. Good spreadsheet design also makes it easier to update and continue to use a spreadsheet over time. This paper describes a method for teaching spreadsheet design where students complete three spreadsheet assignments in an iterative and repetitive process. By the time students have completed these assignments, they will have acquired good spreadsheet design skills and improved their basic Excel skills.

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1. Introduction and project approach

General agreement exists in the accounting profession that accounting graduates should possess good spreadsheet skills. Substantial evidence exists, however, that spreadsheets created in practice often contain errors, and several studies show that good design would minimize these errors. According to one survey, over 60 percent of Accounting Information Systems (AIS) courses taught cover spreadsheets and include spreadsheet assignments and projects (Premuroso & Herron, 2012). Consequently, AIS seems to be a good place to teach spreadsheet design to accounting majors. This paper illustrates a way to teach good spreadsheet design and basic spreadsheet skills with a project that includes three spreadsheet assignments. The project starts with a simple spreadsheet assignment that illustrates the basics of good design along with some definitions required for basic programing. It ends with a more complex spreadsheet designed to support a decision.[1] There are various foci and learning objectives that can be associated with this project such as systems development and design principles; input, processing, and output controls; and auditability issues.

Spreadsheets are used throughout organizations for various purposes. In a survey of Tuck Business School Alumni, 77% of the respondents thought that spreadsheets were "very important" to "critical" in their job (Madahar, 2011). They also felt that although they had extensive experience with spreadsheets, they only had limited expertise. It did not appear from the responses that experience had significantly increased their expertise; therefore, training might be useful in increasing their expertise because more than half had not been formally trained to use or design spreadsheets (Madahar, 2011). Surveys

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[1] The purpose of these assignments is to teach good design, not Excel skills. It is the opinion of the author that students are more likely to pick up advanced Excel skills, rather than good design (i.e., the use of complex formulas) on their own.

of companies have overwhelmingly shown that spreadsheets are used in financial reporting and therefore accountants would be the primary preparers and users of such spreadsheets (Panko, 2006). Therefore, by focusing on design in Excel instruction for accounting students, faculty can provide expertise not just experience.

Students should learn good spreadsheet design because currently, many individuals with little knowledge of programming create and ultimately utilize spreadsheets with critical errors that are relied on as part the decision-making process. For example, one spreadsheet error contributed to a six-billion-dollar loss at JP Morgan and was cited and discussed in an internal report that summarized an investigation into the loss:

> "During the review process, additional operational issues became apparent. For example, the model operated through a series of Excel spreadsheets, which had to be completed manually, by a process of copying and pasting data from one spreadsheet to another."
>
> [Report of JPMorgan Chase & Co. Management Task Force Regarding 2012 CIO Losses, 2013, p. 124]

This is not the only example of a critical error involving spreadsheets. For example, after a great deal of research in the area of examining and documenting spreadsheet errors, overwhelming evidence exists that significant quantitative errors occur (Panko & Aurigemma, 2010). Good spreadsheet design has been found to be helpful in minimizing and eliminating errors in spreadsheets (Janvrin & Morrison, 2000a, 2000b; Kreie, Cronan, Pendley, & Renwick, 2000). To design is to provide, "a basic scheme or pattern that affects and controls function or development" (http://www.thefreedictionary.com/design, 2013). Therefore, good spreadsheet design should provide a scheme or pattern that controls for errors and provides for functional information.
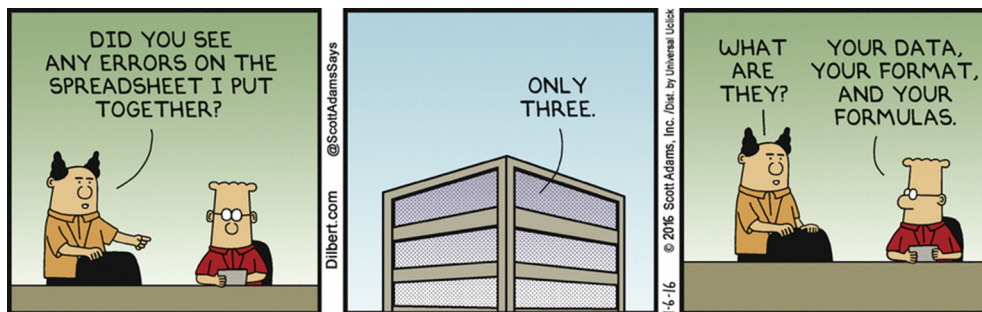
The primary learning objectives of the project are to: introduce students to the reality that errors in spreadsheets are common; demonstrate that good design principles will help minimize those errors; show that good design ultimately makes easily understood and modifiable spreadsheets, and most importantly, learn how to minimize calculation errors by utilizing good design principles. These objectives may be expanded depending on where in the curriculum these objectives are covered. The only prerequisites for the project are for the student to be able to create basic spreadsheets in Excel and to have a basic understanding of fundamental business topics, such as those taught in introductory business classes.

The incremental approach using three spreadsheet assignments provides a way to teach good spreadsheet design and basic spreadsheet skills with minimal effort and classroom time. The approach starts with providing the students exposure to and practice with the basics of good design using a simple spreadsheet, which illustrates design concepts along with some definitions required for basic programing and ends with a more complex assignment designed to support a management decision. This hands-on approach is both repetitive and iterative. Students must use the global principles of good spreadsheet design and adapt them to each spreadsheet as the requirements change. Students discover, as they interact with each spreadsheet, that they can easily make changes to assumptions (e.g., estimating growth rates in sales) and avoid common errors that often remain hidden in the results (e.g., entering fixed numbers into calculations).

2. Implementation guidance

This project, consisting of three separate spreadsheet assignments, can be implemented by utilizing: (1) one to one and one-half 75-min class meetings and (2) two 15 min sessions in subsequent classes. In the next sections, I describe the steps shown in Fig. 1 for implementing the project.[2]

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[2] More detailed project implementation guidance is located in Appendix A.
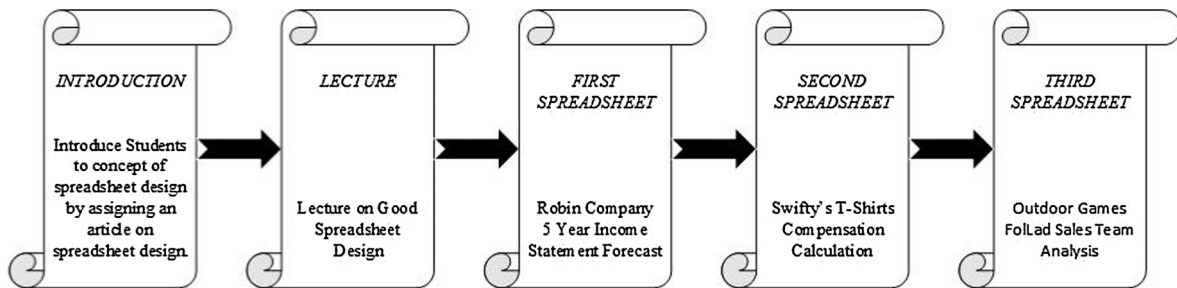
Fig. 1. Sequence for project implementation.

2.1. Project

Since operationalizing principles of good design can be difficult for students, I require students to use a standard design[3] and to read Kreie and Pendley's (1998) Journal of Accountancy article, "Spreadsheet safety: Designing the perfect file." Using a standard design makes it easier for the students because they don't have to develop their own design and, for the professor because it is easier to grade uniform spreadsheets.

The first learning objective of the project is to help students understand that errors in spreadsheets are common. During class and before the lecture on good design principles, I ask them to use the internet to find examples of spreadsheet errors in the press. Within a couple of minutes, students are sharing examples of how much errors in spreadsheets have cost businesses. I also ask them to notice how many hits their search has found. Invariably, they are shocked to see the number. This sets the stage for the lecture that focuses on two main points: basic principles of good spreadsheet design and the steps involved in developing a system (in this case a spreadsheet). In a slide presentation called, "Big Ideas –Spreadsheet Design" appearing in Appendix B, I embed clicker questions focusing on key principles of good design from the Kreie and Pendley's (1998) article. The purpose is to get the students to think more like a software designer/programmer than a user. During the lecture, I ask questions (the students answer these with their clickers which allows me to expand on issues that they may have missed or not quite understood from reading the article) and present the most common themes inherent in good spreadsheet design. Common principles of good spreadsheet design include: (1) separating data and formula cells (calculations); (2) not hard coding data and/or variables into formulas; (3) identifying variables and naming them; (4) using and understanding the difference between absolute and relative cell references; (5) not skipping rows and columns within a data range; and (6) providing documentation. I discuss each of the principles below.

The first principle, separating data and formula cells, is important because data in a spreadsheet can change from period to period. Putting data in a place where calculations are unlikely to be affected is important both for the integrity of the calculations and for reducing errors due to overwriting. Therefore, I have students put data on a separate worksheet from the calculations and then reference the data in the calculations.

The second principle is that spreadsheets should not have fixed values or variables "hard coded" into formulas. Following this principle, if a variable/value changes, then it only must be changed in one place, and that place should be obvious, not buried within a cell formula. For example, instead of putting = 0.10 * A1 into a cell, a user should put the 0.10 in a cell and use the cell reference. This is called a variable and a variable should be created whenever numbers act as a constant in a formula. Variables should also be put on a separate worksheet and labeled appropriately.

This leads to the third principle, to name cells where variables are located. For example, instead of using a cell reference such as B2, a user can name the cell that contains 0.10 as "Interest_Rate." The name can then be used in the previous formula as follows:=Interest_Rate * A1. When users name a cell in Excel, that name and cell become an absolute reference, which means whenever that name is used, it will always refer to that exact cell. Additionally, as users view formulas, the name is more meaningful than a cell reference, and this can be helpful in spotting errors.[4]

The fourth principle, absolute and relative cell references, is the one that I find students have the most difficulty with because it involves differences in the way Excel copies cell references. In a relative cell address, which is the default, Excel assumes that the user wants the cell addresses copied relative to the cell that it is being copied to. For example, if I copy the formula = A1 + B1 from C1 to C2, the formula that appears in C2 will be = A2 + B2 not = A1 + B1. This makes Excel exceedingly powerful for duplicating formulas down rows or across columns but it can also lead to errors if students do not understand how this works.

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[3] Many ways exist to design a spreadsheet that incorporates good design and, as such, any methodology that incorporates good design can be used with these assignments.

[4] Although naming cells may seem restrictive or unnecessary work, it is especially important in very complex spreadsheets where there may be twenty or more variables used. The ability to quickly see which variable is used in which formula makes mistakes less likely and improves the auditability of the spreadsheet.

Table 1
Steps to creating a spreadsheet.

1. Determine what the output or reports will look like
2. Determine what inputs (data or assumptions) will be needed to create the output
3. Determine the processes/calculations necessary to convert the inputs into the outputs
4. Design the structure by determining how many worksheets will need be needed
5. Input or copy the inputs into the appropriate worksheets
6. Create the calculations sheet or sheets by using cell references to input (data or assumptions)
7. Create the output by using cell references from the input and calculation sheets
8. Create documentation by filling in the identification sheet and descriptions
9. Go through the generic spreadsheet checklist
10. Test the spreadsheet by recalculating some of the results

The fifth principle, not skipping rows or data within a data range, relates to the fact that Excel is designed so that it expects 'like' calculations or data sets to be congruent or in adjacent cells and columns. Thus, it is never a good idea to skip rows and columns within a group of data or calculations. I find this a common issue with students, who defend the practice explaining that it makes the worksheet look neater. I tell them this defeats the purpose of Excel. The software was designed for treating any data and/or calculations in congruent rows and columns as belonging together (i.e., a range). Therefore, it is better for them to widen the columns or rows if they feel they need more space.

Finally, 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.

To create a spreadsheet is to develop a system or application for solving a problem or performing an activity using software. The process should be no different than developing any piece of software. Good development requires a common iterative process of: (1) defining the system (i.e., what is the purpose?); (2) determining the requirements (i.e., what is needed for the system in terms of output?); (3) designing the system; (4) creating the system; and (5) testing the system. Once the lecture is completed, the students are provided with a list of ten specific steps for creating a spreadsheet (see Table 1). As explained in the next section, we work together to apply the ten steps to the first spreadsheet assignment, Robin Company Income Statement Forecast. The best way to complete steps 1–4 is on paper before launching Excel on the computer.

2.2. First spreadsheet assignment

The first spreadsheet assignment is completed in class directly after the lecture on good spreadsheet design. The students should have access to a computer so that the students can be working on the assignment step by step with the instructor. The spreadsheet assignment is a simple income statement forecast for Robin Company. The required output is a five-year

Fig. 2. Illustration of step 1 to creating a spreadsheet.

Fig. 3. Illustration of steps 2 and 3 of creating a spreadsheet.

Fig. 4. Example of board during steps 2 and 3 of creating a spreadsheet.

income statement forecast using four variables: first year income, ratio of expenses to revenues, income growth rate, and tax rate. The main objective in this assignment is to introduce the students to basic design and some fundamental terminology used in programming. Assignment directions are given to students (see Appendix C).

With their computer's off, students are asked to sketch out what they think the output for the assignment would look like, i.e. a five-year income statement (Step 1, Table 1). They are told not to worry about the exact numbers yet, just the skeleton financial statement. Their solution might look something like the illustration in Fig. 2.

Step 2 is to identify the assignment variables (input/assumptions). The input variables would be those constants used in developing the output required of the task. The assignment contains four primary inputs: first year income; ratio of expenses to revenues; income growth rate; and the tax rate. These are considered variables since they are constants in the computation of the outputs and they are estimates which might likely change under different assumptions and scenarios. I ask the students to imagine that they are being asked to do this projection by their boss and once the results are provided, the boss may decide to change several of the original assumptions to analyze the sensitivity of those assumptions on the results. If they "hard code" the variables into the calculation, they will have difficulty changing the variables within the formulas, and, thus, may make mistakes because the calculations are not readily visible while creating or editing the spreadsheet.

Next, the students should sketch out what they think the calculations would be for the first-year forecasted income statement using the format they developed in Step 1. For example, the revenue for the first year would require a formula that is equal to the first-year revenue variable. An illustration of a common solution is shown in Fig. 3.

I provide hints to those students that appear to be struggling. When the students seem to be on the right track, we work through the solution on the whiteboard. While working through the formulas, we use generic variable names for each

Fig. 5. Identification sheet for Robin Company Income Statement Forecast.

Fig. 6. Variables or assumptions sheet for Robin Company Income Statement Forecast.

assumption or variable (Step 2 of Table 1) and then come up with the calculation formula for each item on that is required for the output (Step 3 of Table 1). An example of the whiteboard appears in Fig. 4.

We find that while working on the formulas that we need a new variable to represent the first year of the forecast since we may want to use the spreadsheet more than once. After we come up with a good solution (which may take 30–40 min), we discuss how the workbook should be organized (Step 4), per the design in the article they read. Typically, we end up with four worksheets: (1) Identification and Description (Fig. 5); (2) Variables/Assumptions (input) (Fig. 6); (3) Income Statement Calculation (Fig. 7); and (4) Income Statement Forecast (output) (Fig. 8 and Fig. 9). The students can then launch Excel and start designing the spreadsheet using the guidelines and solutions that we developed (Steps 5–8 of Table 1). As they work on the spreadsheet, I walk around and make sure that each of them is headed in the right direction.

After students complete the spreadsheet with all four worksheets, they check their work against the spreadsheet design checklist[5] that is provided to them (Step 9 of Table 1). They can make changes and then we go over the spreadsheet solution. I

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[5] Appendix C contains a student-ready only copy of this checklist.

Fig. 7. Financial forecast calculation for Robin Company Income Statement Forecast.

Fig. 8. Financial report of Robin Company Income Statement Forecast (showing formulas).

answer questions and they turn in their work. I do not formally grade this assignment; all students present in class that day get full credit because we did the work together. Typically, the first spreadsheet assignment is completed in one class meeting. If not, I complete it at the beginning of the next class meeting and follow it with the second spreadsheet assignment.

2.3. Second spreadsheet assignment

The second spreadsheet assignment is called Swifty's T-Shirts Compensation Calculation. Swifty's T-Shirts requires students to create a spreadsheet that will calculate total compensation for salespeople. Approximately fifteen minutes of class time is used to introduce the assignment. Students are handed the assignment instructions and asked to read through it making notes as needed. The class and I discuss how this assignment might be different from the first assignment. They are told that they are preparing this for a secretary who will use the spreadsheet each month to prepare the compensation report. Swifty's salesperson compensation has four components: salary, standard commission, priority commission, and acquisition of new customers. Calculating compensation requires historical data (monthly salary, total sales dollars for both types of items each salesperson has sold for the current month, and the number of new customers acquired by each salesperson in the current month) and commission rates (one for each type of sale and for each new customer acquired). The assignment adds additional design issues in that there are two types of inputs required: (1) the commission rates that need to be easily changed from month to month (variables) and (2) the current salary and sales data that needs to be imported into the spreadsheet each month (fixed/historical data). This additional complication requires students to insert an extra

worksheet for the monthly sales data into the spreadsheet and to be thoughtful to make the design easy for someone to change each month.

We discuss what the output should look like. They are asked to follow the same steps that we followed on the first assignment, so that they should start thinking about the design by using the output requirement (Compensation Report). The Compensation Report should show each salesperson and their total compensation. They are told to check their spreadsheet against the spreadsheet design checklist. Appendix D includes a copy of the student handout for this assignment.

Each student completes the spreadsheet outside of class with a one-week due date. Help is available, but students are told they should first try to figure it out on their own. Some students struggle, but many can complete the assignment on their own. This assignment is then graded using a detailed rubric based on the spreadsheet design checklist.[6] The rubric is in an Excel spreadsheet[7] so grading only requires putting a 1 or 0 in the cell next to each criterion. The spreadsheet then calculates the total score keeping grading time to a minimum. After the first several workbooks it takes only a few minutes to grade each one.[8] The students are given feedback on the assignment via the completed rubric.

2.4. Third spreadsheet assignment

Approximately one week later, I spend another 15 min in class to show Swifty's T-Shirts solution and answer any student questions. Once all the questions have been answered, I hand out the instructions for the third spreadsheet assignment and spend a few minutes describing it and asking for questions. The assignment, Outdoor Games FolLad Sales Team Analysis, involves calculating outcomes based on given criteria that serve as the basis for a management decision. Students are asked to build a sales team for a new product using specific criteria put forth by management. They are given sales data for each salesperson and the criteria to be used for the new team. A copy of the student handout appears in Appendix E.

This assignment is less structured, and, thus, includes additional challenges such as using conditional formulas and creating a graph. The objective is to come up with metrics for each salesperson based on their overall sales and their sales of a new product (a folding ladder game called FolLad) for which the new sales team is being formed. They are given a set of data for two years for each salesperson. This data includes sales to new customers, sales of FolLad, and each salesperson's quota. I typically provide this data to them via an Excel file.[9] The assignment requires the students to calculate two metrics for each salesperson by: (1) taking each salesperson's sales to new customers and (2) dividing it by their sales quota and FolLad sales and dividing it by their sales quota. These two metrics are deemed to be important for identifying the best salespeople for the new sales team. The criteria given by management should then be applied using the metrics. (This can be done using conditional IF statements and AND statements and will require much more from the students in terms of critical thinking). In addition, students must provide a graph for the analysis to support the decision-making process which should be based on good graphical design as described in Fulkerson, Pittman, and Frownfelter-Lohrke (1999). They also write up a short explanation to describe their analysis and provide a recommendation.

I provide very little help on this assignment. Most students will need to ask a couple of questions to complete this assignment and questions are answered only if students are specific and/or after they have given the problem some thought. It is important that students think through the problem and can apply the design principles. I remind them to check their spreadsheets against the spreadsheet design checklist before they turn in their completed assignment. They are again provided with a graded rubric as feedback.

3. Classroom use and efficacy

I used this methodology to teaching spreadsheet in the first course of a two-course systems sequence taken by accounting majors since 2010. This project is typically started during a discussion of application software (in the third week of a fifteen-week semester) and before introducing databases. This project, in total, accounts for approximately 4 percent of the student's grade. This project could be used in one of many courses: Accounting Information Systems, Auditing, IT Auditing, or an introductory Management Information Systems course. It may also be used in conjunction with the coverage of the systems development lifecycle (SDLC). Many time constraints exist with all the other topics to cover in these classes, so this paper illustrates a way to teach good spreadsheet design and basic spreadsheet skills with three spreadsheet assignments that will take minimal class time.

These assignments are not easy for students. They require analytical thinking and are not plug and play. It is difficult to measure whether all students master good design, but I rely on the grading of the assignments to tell me whether they are making progress towards good design. In a typical semester, the grades of the second and third spreadsheets average 13/15 and 19/20, respectively. It has been my experience that undergraduate students in their junior year rarely appreciate the need for spreadsheet skills; it is only after they do internships or start full time jobs after graduation that they are grateful for the skills they acquired. Often, I have students come by my office one or two semesters after taking the course and com-

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[6] The solutions and rubrics are available from the author upon request.
[7] The Excel file rubric is available from the author upon request.
[8] I have had success giving this grading to a graduate student.
[9] The Excel file, which creates random data, is available upon request.

	2013	2014	2015	2016	2017	Total	Average
Robin Company Income Statement Forecast							
Income Statement Forecast							
Five Years							
Revenue	$ 2,000.00	$ 2,200.00	$ 2,420.00	$ 2,662.00	$ 2,928.20	$ 12,210.20	$ 2,442.04
Expenses	1,000.00	1,100.00	1,210.00	1,331.00	1,464.10	6,105.10	1,221.02
Profit	1,000.00	1,100.00	1,210.00	1,331.00	1,464.10	6,105.10	1,221.02
Taxes	350.00	385.00	423.50	465.85	512.44	2,136.79	427.36
Profit after taxes	$ 650.00	$ 715.00	$ 786.50	$ 865.15	$ 951.67	$ 3,968.32	$ 793.66

Financial Parameters (Assumptions) Used:

First Year Revenue	$ 2,000.00
Annual Revenue Growth	10%
Ratio of Expenses to Rev	50%
Tax Rate	35%

Fig. 9. Print preview of the Robin Company Income Statement Forecast report.

pleting the assignments to thank me for giving them the opportunity to learn the skills used in these assignments. Here are some examples of student feedback from excerpts of emails sent to me by my students.

How naive was I in thinking that I could avoid basic Excel skills once I left your class? The truth is, having those skills is essential in the business workplace (Not that you already didn't know). I am finding that truth to be more evident every day I step foot in the office and I want to thank you for providing me with that introduction and pushing me to learn these skills.

This class has certainly improved my skills in Excel and Access. I actually got really excited when I knew how to calculate financial formulas in excel at work.

So, 7 of my friends and I are doing Jan Term in London and traveling the two weeks prior. We booked hotels, hostels, trains, planes, etc. As you can imagine, there are lots of costs involved and it was difficult to divide up who owes who money. So..guess what? I used Excel! I made a worksheet for every girl corresponding to the locations, who they owe, and what amount. We had some changes in prices so I adjusted the corresponding cell and everything corrected itself automatically-the girls were really impressed…haha all because of AIS! I thought you would appreciate hearing that your students actually do apply what we learn in the classroom!

In addition, I have received feedback from colleagues who require students to use Excel in their courses. An example is the finance professor who told me that he can always tell when a student has had my class because his/her Excel spreadsheets are so much better than the average student.

It is through the student's experience of the project that the learning objectives are achieved. Specifically, students are introduced to the reality that errors in spreadsheets are common when they are asked to search for examples in the press where spreadsheet errors have occurred during the introductory lecture that is presented at the beginning of the project. They learn through the article and the lecture about good spreadsheet design and that good design principles will help minimize those errors. The iteration of completing three different spreadsheet assignments allows them to experience that good

design ultimately makes easily understood and modifiable spreadsheets. Most importantly, by utilizing good design principles to build the spreadsheets, they learn how to minimize calculation errors.

4. Summary

The three-spreadsheet assignment project detailed above can be implemented with minimal class time and provides students with the basics of good spreadsheet design and additional training using Excel. The literature has shown that training in good spreadsheet design helps to minimize errors (Janvrin & Morrison, 2000a, 2000b; Kreie et al., 2000) that are so prevalent in spreadsheets (Panko & Aurigemma, 2010). Because most AIS classes include Excel assignments, it would seem important to include good design principles as part of Excel instruction.

Appendix A. Project implementation guidance
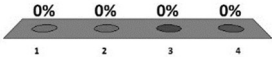
	When (How?)	Purpose	Materials included and/or available from author	Comments
1	Homework	Introduce students to concept of spreadsheet design by assigning an article on spreadsheet design		I use (Kreie & Pendley, 1998)
2	First class (15 min)	Lecture on Good Spreadsheet Design	PowerPoint slides illustrations are included in Appendix B	
3	First class[a] (50–75 min)	First assignment, Robin Company-5 Year Income Statement Forecast	Assignment, Spreadsheet Design Checklist, Solution (Appendix C)	This entire spreadsheet is completed in-class
4	Second class (10–15 min)	Introduce second spreadsheet assignment: Swifty's T-shirts Compensation Calculation. Explain the additional challenge in this assignment, includes historical/fixed data as well as variables for input	Assignment, Solution, Grading Rubric (Appendix D)	Students do this one on their own but I do provide time in class for asking questions, not longer than 5 min or so at the beginning of class
5	Third class[b] (10–15 min) and Homework	Show solution for second assignment, answer questions, introduce third spreadsheet assignment which is Outdoor Games FolLad Sales Team Analysis. This assignment is less structured which adds complexity, they must use conditional statements, create a graph and write a short report	Assignment, Solution, Grading Rubric (Appendix E)	Assign an article on preparing good graphics. I use Preparing Financial Graphics: Principles to make your presentations more effective (Fulkerson et al., 1999) but there are many others out there

[a] Depending on the number of students, professors may need slightly more than one class to accomplish this step.
[b] This class is typically a week after the second class to allow time for the students to complete the spreadsheet and turn it in.

Appendix B

Big idea: Spreadsheet design PowerPoint slides[10]

(continued on next page)

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[10] The author is happy to share the PowerPoint file for these slides upon request.

A1
or
$A1
or
A$1
or
A1

Know the difference and use absolute versus relative formulas

Makes formula and use of cells easier to understand

Name cells

Use sheets to arrange the contents of your workbooks logically and clearly

Organize Your Worksheets

A sheet has the following named cells:
B3 is named Current, C3 is named Last Month, D3 is named Average for Year. Which formula below calculates the difference between the current value and last month's value?

1. =Current - LastMonth
2. Current - Last Month
3. =B3(Current) - D3(LastMonth)
4. =(Current + LastMonth) /2

0%   0%   0%   0%
1   2   3   4
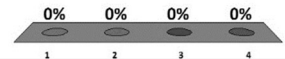
You should test your sheet's calculations using _____.
a. values that are easy to calculate with
b. realistic values
c. extreme values like very small, very large, and zero
d. realistic values that you know answers for

1. a, b, c, d
2. a, c, d
3. b and c
4. a and d

0%   0%   0%   0%
1   2   3   4
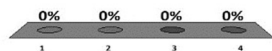
Appendix C

Student handout: Spreadsheet assignment 1

In the first assignment, you will create a spreadsheet using "Good Design Principles." Specifically, you should rely on the model shown in the article "Spreadsheet Safety: Designing the Perfect File" by Kreie and Pendley (1998). The spreadsheet is a

simple income statement forecast. The main objective of this assignment is to introduce you to the basic design that you will be using and some fundamental terminology used in programming. Once you have completed the spreadsheet, you should check it against the Spreadsheet Design Checklist.

Robin Company Income Statement Forecast:

The spreadsheet to be created will be a five-year income statement forecast for Robin Company.

The parameters for the forecast are:

First year Revenue	$2000
Annual revenue growth	10%
Ratio of expenses to revenue	50%
Tax rate	35%

The output should contain detail of Revenue, Expenses, Profit, Taxes and Profit after Taxes for each year. It should also contain a Total and an Average for all years.

A check figure is $793.66, which is the average of all five years of profit after taxes.

After creating and checking that you have correctly programmed all formulas, change the parameters for the forecast to

First year Revenue	$3000
Annual revenue growth	5%
Ratio of expenses to revenue	55%
Tax rate	40%

When you change the parameters, you should see your forecast change accordingly. Manually calculate what your new five-year average profit is, and make sure that your spreadsheet matches that answer.

Spreadsheet design checklist:

IDENTIFICATION PAGE
Sheet has all required information (Title, Developer, Date, File Name, Contents)
Table of Contents is descriptive and understandable (Sheet Names match tabs)
Table of Contents is descriptive and understandable (Description is specific & detailed)
All Tabs are visible

DESCRIPTION
Description sheet is present (if necessary)
The description of the spreadsheet is complete and understandable

VARIABLE SHEET
The correct variables are listed on the sheet
The cells are named and the names are meaningful

DATA SHEET (If required)
There is only data on the data sheet
The data has not been manipulated from its original source

CALCULATION SHEET
The calculations are correct
There is no data or hard coded variables on the calculations sheet (only cell references)
The calculations are clear and understandable (They have been broken down into easy to understand parts)
Functions such as SUM, AVG, etc. are used where appropriate

REPORT
The report shows the correct information (there is enough information and no extraneous information)
There are no calculations or data on the report sheet (all should be cell references/names)
The report is properly formatted (with underlines, correct cell formats)
The report has a clear and complete title
The report will fit on pages in a neat and concise manner (when using print preview)
The report shows underlying assumptions/variables used
The report has appropriate header/footer (identifying information, date, page numbers)

OVERALL
There are no spelling errors
All manipulations of the spreadsheet are performed from the assumption and or data sheets

Appendix D

Student handout: Spreadsheet assignment 2[11]

The second spreadsheet adds some complexity in that it includes data as well as variables. This spreadsheet requires you to create a workbook that will calculate total compensation for individual salespersons. The compensation computation includes: salary, commission on low-margin items, commission on high-margin items, and commission for new customers. Remember to start with the output (Compensation Report) when designing. In addition, you will need an extra sheet for the sales data, so this Excel workbook, when complete, will consist of five or six separate worksheets (1) A identification/description sheet (there could be separate identification and description sheets); (2) a sales data sheet; (3) a sales commissions sheet; (4) a calculation sheet; and (5) the report on the total amount owed in compensation to each salesperson in final printable format.

Swifty's T-Shirts Salesperson Compensation Report

Swifty's T-Shirts supplies personalized shirts to businesses. The sales staff are paid via salary and commission. The commission is based on three rates: a percentage commission on lower margin items (known as "standard commission"), a percentage commission on higher margin items (known as "priority commission"), and a bonus for each new customer.

The commission rates are set by the Vice President of Marketing, Mr. Sam Sneed. Mr. Sneed likes to adjust the commission rates to provide appropriate incentives for sales. When there are many higher margin items that are overstocked, Sam increases the "high-margin commission" temporarily to try to reduce the excess inventory. Similarly, if he feels that the sales staff has not found enough new customers, he may raise the bonus for new customers. When adjustments to the commission structure are made, they are effective at the beginning of the next calendar month.

Swifty's T-Shirts uses an accounting software package to handle its order processing and billing. That software can be used to produce a monthly summary of sales of low-margin items and high-margin items for each salesperson. Each salesperson submits a list of new customers they have attracted that month, which is verified from the accounting data to determine the count of new customers.

Mr. Sneed has requested that you create a workbook that will calculate the total amount of compensation owed to each salesperson for the month. He asks that the spreadsheet be designed to allow for adjustments to the commission rates. He would like to be able to allow his secretary to do the actual data entry each month. The secretary is a novice spreadsheet user.

The monthly data has been downloaded into the table below from the accounting system. The data will be delivered in this format every month. The workbook should be designed so that the new data can update the old data and calculate commissions for the month based on the new data and any changes in the commission rates. Current values for the commission rates and bonus rates are also shown. Your spreadsheet should treat the commission and bonus rate information as parameters (assumptions/variables). That is, all uses of a given rate should reference a single cell that can be easily identified and modified by the user. Your calculations should display detailed information about commissions earned by component and by salesperson, as well as summary information for each salesperson and the total compensation to be paid.

Commission Rates:

High-Margin Items Commission   4%
Low-Margin Items Commission   3%
New Customer Commission $150/customer

Salesperson	Salary	Sales of high-margin items	Sales of low- margin items	New customers
Zicarelli, Joan	475	48,701	29,575	10
Harrington, Diane	320	41,951	31,942	2
Lockamy, Bill	400	30,748	33,152	9
Belski, Archie	345	57,465	32,701	5
Lohrke, Robin	455	42,629	30,135	7
Frownfelter, Sam	490	40,728	36,996	6
Long, Sebastian	420	35,410	30,960	8
Affenbach, Yolonda	540	44,839	33,654	4
Scalise, Matise	520	47,661	21,214	6
Rahn, Stella	345	38,129	21,252	3
York, Robin	585	55,466	32,526	10
Garrett, Susan	420	41,948	26,842	0
Powell, Bo	330	58,603	31,778	5
Rogers, Fred	455	58,021	26,908	9

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[11] This assignment was adapted from an assignment in Morgan (1999).

Appendix D (*continued*)

Salesperson	Salary	Sales of high-margin items	Sales of low- margin items	New customers
McMullen, Harry	255	30,497	23,396	6
Marshall, Marshall	415	57,338	33,421	1
Hendon, Sarai	555	45,917	28,587	3
Harlow, Gene	255	56,603	2471	1

Make sure to check your workbook against the spreadsheet design checklist and test your spreadsheet before turning it in.

Appendix E

Student handout: Spreadsheet assignment 3[12]

Spreadsheet Assignment 3 involves calculating criteria on which to base a management decision. As such, it is a less structured task, and, thus, includes additional challenges such as using conditional formulas and creating a graph. It is important to think through the problem and apply the design principles that you have used to complete the first two projects. This Excel workbook, when complete, will contain six or seven worksheets: (1) An identification/description sheet (there could be separate identification and description sheets); (2) a sales data sheet; (3) a decision criteria sheet; (4) a calculation sheet; (5) the report which will include a list of salespersons, their scaled scores on new customers and the product, FOlLad (a folding ladder game), and whether they met the criteria and (6) the graph requested. Once you have finished compare your spreadsheet to the spreadsheet design checklist and test the spreadsheet.

Outdoor Games FolLad Sales Team Analysis

Outdoor Games is a manufacturer of outdoor recreational products. Outdoor Games has traditionally sold its games through retail stores located in the central and western United States. Outdoor Games has a sales staff of 28 salespersons who are assigned to one of four regional sales managers. The regional managers in turn report to Alexandra Smith the Vice President for Marketing. The sales staff at Outdoor Games has always been assigned on a geographical basis with each salesperson selling all products to customers in their territory.

Two years ago, Outdoor Games introduced a new product, a foldable ladder ball game called FolLad. This new product is quite successful, with sales reaching 15% of total company sales after two years. However, sales are being hampered by the current structure (geographical) of the sales staff.

Sales of the FolLad have been strongest in toy stores and outdoor equipment stores. Some of the sales staff have not been quick to recognize these new types of customers. Alexandra would like to establish a sales staff responsible for selling FolLad only. The initial sales force would have four individuals, one for each region. She also feels that the current territories could be restructured and that some territories could be consolidated. She has received approval from the CEO to make changes providing that the total number of sales staff is not increased and the new team for FolLad is chosen from the existing sales staff.

Salespersons who are considered "good" candidates for the new sales team will be invited to apply. Alexandra has asked you to prepare a spreadsheet for her that will identify these "good" candidates. There are two characteristics that are particularly important. First, the FolLad sales staff will need to seek out new customers, so the salespersons selected should have a history of seeking out new customers. Second, they should be enthusiastic about selling FolLad and should have a history of strong sales of FolLad. She also feels that sales quotas should be considered when evaluating each candidate. The quotas are felt to be good measures of the sales potentials of different territories, and often new salespersons are given the least promising territories. You should consider sales for the last two years in your analysis.

Alexandra would also like you to include a chart that will help her see the variability across these two measures among the salespeople. The chart should help her determine if there is enough variability in the two criteria to justify using them for the selection process.

The IT department was able to extract summary sales data from Outdoor Games database and place it in a spreadsheet for you. Your professor can provide you the spreadsheet. For each salesperson, the following items have been retrieved.

Column (Field) Name	Description
S_NAME	The salespersons name
REGION	The region to which the salesperson is presently assigned
QUOTA1	The sales quota for Year 1 in dollars
NCUST1	The salespersons sales to new customers for Year 1 in dollars
FolLad1	The salespersons sales of FolLad for Year 1 in dollars
QUOTA2	The sales quota for Year 2 in dollars
NCUST2	The salespersons sales to new customers for Year 2 in dollars
FolLad2	The salespersons sales of FolLad for Year 2 in dollars

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[12] This case was adapted from Morgan (1999).

You should prepare a spreadsheet using "Good Spreadsheet Design Principles." You can start with the spreadsheet file that includes the data. You should use the sum of the two years to derive two criteria by which to judge each salesperson. You should present in a report the two criteria for each salesperson: the rate of sales for new customers and the rate of sales for FolLad for the two years combined. In addition, you should have a third column that designates high sales, which should identify those candidates who have shown a strong performance on both criteria. Alexandra would like to start with a list of candidates who exceed 20% above the average of the salespeople in both categories. The report should be sorted from high to low on the rate of sales for FolLad column. The chart should show both criteria for all salespersons, be on a separate work-sheet, and be created based on good graphical guidelines. Read the article "Preparing Financial Graphics: Principles to Make Your Presentations more Effective" (Fulkerson et al., 1999), which describes these principles. Finally, include some recommendations to Ms. Smith based on your analysis.

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