Turkish Online Journal of Distance Education-TOJDE January 2004 ISSN 1302-6488
Volume:5 Number:1

Spreadsheet Applications: Prototyping an Innovative Blended Course

Assist. Prof. Dr. J. Howard BAKER
Computer Information Systems
University of Louisiana Monroe, U.S.A.

ABSTRACT

After teaching the advanced spreadsheet course at a major university in Louisiana as a traditional classroom course for a number of years, it was decided to create a prototype-blended course, with a considerable portion offered via distance education. This research, which uses a prototyping methodology, is exploratory in nature. Prototyping can show that a design works, as well as where the design can be improved or enhanced. The traditional spreadsheet course had been taught in a highly structured fashion, with all students working on the same material at the same time. Students took exams at a specific time. With the change to a blended format, new teaching options and technologies opened up. This paper describes ongoing research for a new blended course using prototyping as the research methodology. Expected results from the new course include student skill level at the advanced level, improved student evaluations, and a decline in student withdrawals.

Introduction

After teaching the advanced spreadsheet course as a traditional classroom course for a number of years at a major university in Louisiana, it was decided to prototype a blended course, with a considerable portion of the course offered via distance education. A blended course is taught partly as a traditional classroom course and partly as a distance course.

The traditional three-semester hour advanced spreadsheet course has been required of all accounting majors for a number of years, and is often taken by Computer Information Systems majors and minors as an elective course. Students majoring in other disciplines such as math, finance, and computer science also enroll in the course as a general or business elective.

The prerequisite course is a three semester hour course covering basic computer literacy and the Microsoft Office suite. It is expected that students taking the advanced spreadsheet course have already achieved a mastery of Excel roughly equivalent to that of the Microsoft Office Specialist (MOS) Core level exam.

With the change of the course to a blended format, new teaching options and technologies open up. For instance, students will be allowed to schedule private sittings for exams rather than having to take exams in an assigned class period. Training assignments via the Web will now be done at the student's convenience, so long as they are completed by a cutoff date. Students may use on-line assessment tools to evaluate their progress at any time.

Research Methodology

The research described in this paper is ongoing research for a new blended course to be implemented in the spring 2004 semester. Prototyping is the research methodology employed. A prototype is created to demonstrate the feasibility of a design. Typically prototyping is used where the design is exploratory and innovative in nature. The learning is experiential in nature. A prototype enables a developer to test for a 'proof of concept'. Prototyping using innovative technologies is a popular research methodology in engineering, and prototyping has been used for software research and development in computer science and information systems for years (Lumbantobing 1990). Prototyping a course appears to be an appropriate methodology for exploring the use of new and innovative technologies in education as well. Instructional design shares much in common with computer science, particularly the sub-area called systems design (Wilson et al., 1993).

The steps in prototyping are well documented. They are:

1. **Concept definition**
2. **Implementation of a skeletal system**
3. **User evaluation and concept refinement**
4. **Implementation of refined requirements**
5. **User evaluation and concept refinement**
6. **Implementation of refined requirements**

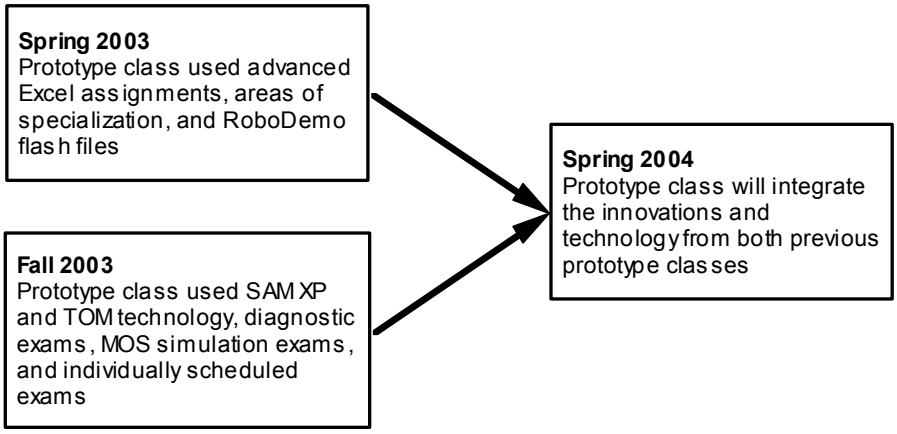
Prototyping involves the early development of a small-scale prototype used to test out certain key features of the design. Prototyping is most useful for large-scale projects. It is posited that prototyping can be relevant to all kinds of training development projects, but its value is most apparent in the design of computer-based systems (Wilson et al., 1993).

Often creating a production prototype is not a trivial matter. "Delivering an effective prototype is a demanding exercise" (Boar, 1984). To begin the prototyping effort, various technical and teaching innovations of the desired blended course were first used and tested individually in separate courses over a period of a year.

Evolutionary Development of the Course

In the spring of 2003 a prototype classroom-based course implemented advanced Excel assignments for the first time, requiring students to select an advanced area of specialization. The course utilized instructor created flash files extensively. In the fall of 2003 a distance education prototype course was taught to gain practical experience with an Internet-based testing and training system called SAM XP and TOM (SAM stands for Skills Assessment Manager and TOM stands for Training Online Manager). In addition, the course explored the use of diagnostic exams, Microsoft Office Specialist simulation exams, and individually scheduled exams. Figure 1 shows a diagram of prototype evolution.

Figure 1. Prototype evolution.



Through this evolutionary prototyping process a great deal of learning has taken place prior to integrating all the innovations into a single course. For instance, in the course taught during the fall of 2003 it was discovered which skill set modules in SAM XP and TOM were inadequate to train and test students to the advanced level. One particular topic with weaknesses was the training and testing of the VLOOKUP and HLOOKUP functions. Almost without exception students found this portion of SAM XP and TOM to be inadequate. As a result of this specific experiential learning, additional training resources have been developed for the spring 2004 course to complement SAM XP and TOM.

Prototype Evaluation

Once a prototype is created, it is then used and evaluated. The central issue of the evaluation effort is the determination of a successful design via meeting predefined goals. The goals of the prototype advanced spreadsheet blended course to be implemented in spring 2004 will be the combined goals set for both the spring 2003 and fall 2003 courses. The spring 2004 predefined goals are:

1. **The new technology employed must be easy to use by both students and the instructor.**
2. **The new technology must be inexpensive to implement.**
3. **The instructor must be able to monitor student progress online and provide rapid one-on-one mentoring as needed.**
4. **The skill and knowledge level achieved by the students must reach the advanced level, as demonstrated by objective testing and assessment.**
5. **Course and instructor evaluations must not decline.**
6. **The student must have considerable schedule flexibility in meeting course objectives.**
7. **The student drop rate must not increase.**

The evaluation of these goals will take place during and at the end of the spring 2004 course. Evaluation will be via student surveys, Microsoft Office Specialist exam test results, multiple choice exam results, and other means as deemed profitable.

Blended Course Description

The advanced spreadsheet course is described in the university catalog as an intensive hands-on coverage of business spreadsheet models, including spreadsheet

design, file-building techniques, graphics, and spreadsheet automation with macros. Spreadsheet automation actually goes beyond the recording of macros to creating custom functions in Visual Basic for Applications (VBA).

In order for students to progress to the advanced material they must first demonstrate proficiency at the MOS Core level of competence. A more detailed description of the Core level proficiency requirements is presented later in this paper.

Course coverage of Excel goes well beyond the requirements of the Expert level MOS exam. Each student is expected to master Excel to the Expert level by passing the actual MOS Expert level exam or a commercially available simulated MOS exam obtained by the university. This demonstration of proficiency must be achieved before completing the additional advanced material. The advanced material includes creating advanced decision support worksheets, converting and analyzing a list using PivotTables and PivotCharts, advanced charting, troubleshooting formulas, and the use of advanced functions. A more detailed description of the advanced proficiency requirements is presented later in this paper.

After working cases and completing on-line tutorials to demonstrate proficiency in these advanced areas, a student selects one advanced area of specialization. In order to receive credit for completing an area of specialization a student must create an original comprehensive case, including necessary starter and solution files, and take an exam in the area of specialization. A more detailed description of the advanced area of specialization requirements is presented later in this paper.

Core Level Proficiency

After the first two weeks of in-class orientation, every student will be given a comprehensive hands-on diagnostic exam on Excel 2002. The exam will be administered in class via the Internet. It is a simulated Core level MOS exam using Course Technology's SAM XP and TOM Internet-based testing and training system. SAM stands for Skills Assessment Manager and TOM stands for Training Online Manager. TOM is designed to prepare a student for certification as a Microsoft Office Specialist. Training can be delivered online via the Web or from CD. All online student training activities and exam results are recorded on a Course Technology database via the Internet. This information is available to the instructor via the Internet as soon as a student completes an activity or exam.

The purpose of the diagnostic exam is to determine the student's level of competence with Excel 2002. After taking the exam in SAM XP, students are provided with an online detailed report of all questions missed on the diagnostic exam so they can correct deficiencies through TOM training. The SAM XP report contains a hyperlink from each missed question directly to the corresponding training module.

There are seven skill sets which are examined in the diagnostic exam:

1. **Working with cells and cell data**
2. **Managing workbooks**
3. **Formatting and printing worksheets**
4. **Modifying workbooks**
5. **Creating and revising formulas**
6. **Creating and modifying graphics**
7. **Workgroup collaboration**

In order to progress in the course, students must demonstrate proficiency at the Core level within the first four weeks of class. Passing the MOS Core level exam or a simulated MOS Core level exam can do this either. Upon demonstrating proficiency at the Core level, the student progresses to the MOS Expert level and advanced Excel material.

Advanced Level Proficiency

Advanced level proficiency in the course is demonstrated by the following:

1. **Completing the online SAM XP and TOM Expert level skill set training**
2. **Completing seven advanced Excel tutorials**
3. **Completing seven advanced cases–one per advanced tutorial**
4. **Passing the Expert level MOS exam or simulated Expert level MOS exam**

There are nine Expert level SAM XP and TOM skill sets to complete. They are listed in Table 1.

Table 1. Expert level SAM XP and TOM skill sets.

Importing and exporting data
Managing workbooks
Formatting numbers
Working with ranges
Customizing Excel
Auditing worksheets
Summarizing data
Analyzing data
Workgroup collaboration

Each skill set training module is composed of numerous skill set tutorials. Each skill set tutorial is composed of four learning activities. They are:

1. **Prepare–provides theoretical instruction regarding a skill**
2. **Observe–demonstrates how to perform the skill**
3. **Practice–allows the student to complete the skill with help**
4. **Apply–allows the student to demonstrate the skill without help**

In addition to the SAM XP and TOM skill set training, each student must complete seven advanced tutorials. The seven advanced tutorials and their subtopics are listed in Table 2.

Table 2. Advanced tutorial topics and subtopics.

I. Using Excel as a decision support tool
1. What-If analysis
2. Scenario analysis
3. Regression analysis
II. Using Excel as a list management tool

1. Using Excel's Find and Replace
2. Converting World Wide Web tables to lists
3. Data scrubbing
4. Using MS Word with Excel to parse text
5. Using advanced PivotTable and PivotChart features
III. Using Excel charts to make decisions
1. Changing chart options
2. Modifying source data ranges
3. Changing a chart type or sub-type
IV. Using Excel for advanced charting
1. Three-dimensional charts
2. Pie charts
3. Doughnut charts
4. 100% stacked charts
5. XY (Scatter) charts
6. Line charts
7. Ribbon charts
8. Radar charts
9. Surface charts
10. Stock charts
V. Troubleshooting formulas and using advanced functions
1. Workbook, formatting, and formula errors
2. Financial functions
3. Database functions
4. Date and time functions
5. Statistical functions
6. Math and trigonometry functions
7. Engineering functions
8. Lookup and reference functions
9. Information functions
10. Text functions
VI. Visual Basic for Applications using Excel
1. Working with existing macros
2. Using the macro recorder
3. VBA terminology
4. Subs and functions
5. Documenting VBA code
6. Deleting macros and modules
7. Creating a digital signature
8. Signing a macro
9. Trusted sources
VII. Creating custom functions
1. Creating global functions
2. Events
3. Object browser
4. Creating a custom function with no arguments
5. Using a function stored in another workbook
6. Cleaning up the XLStart Folder
7. Comparing IF, VLOOKUP, and custom functions
8. Creating a custom function using IF statements
9. Debugging code

Since these advanced tutorials are not part of SAM XP and TOM, flash files have been developed using RoboDemo from eHelp (a Macromedia company) to allow students to observe how to perform the various advanced skills and solve example cases. Testing for the advanced tutorials is done online using an Internet testing system called QuizLab. QuizLab is integrated with MyGradeBook, which is a Web-based grade book system used with the course. (See Web References below for URLs.) A randomly generated password is assigned to each student at the beginning of the semester. That single password is used for logging on to SAM XP and TOM, QuizLab, and MyGradeBook.

Advanced Area of Specialization

During the last month of the course a student must select an advanced area of specialization. The area of specialization must be one of the seven advanced tutorial topics listed in Table 2. To complete an area of specialization a student must write an original comprehensive case similar to the seven advanced cases they are required to work. An example of such a student authored case is presented in Exhibit 1. Each student must create the necessary starter file(s) for the case and provide the solution file(s). Each student must also take and pass a multiple choice exam in their chosen area of specialization. The exam is a multiple choice exam administered via QuizLab.

Conclusions

The results of the evaluation process from the spring and fall 2003 courses have been positive. Student evaluations were higher in both courses and student drop rates were much lower than with the traditional course. Considerable learning has taken place as a result of teaching these two prototype courses. Based on the experiential learning gained, important changes and modifications have been planned for implementation in the spring 2004 prototype blended course.

References

Boar, B. (1984). Application Prototyping: A Requirements Definition Strategy for the 80s. John Wiley & Sons, New York, New York.

Lumbantobing, S. (1990) "The Design of a Prototype Decision Support System Using Fuzzy Set Theory for Development Planning." Ph.D. diss., George Washington University.

Wilson, B. et al. (1993). Cognitive Approaches to Instructional Design, Retrieved December 25, 2003 from http://carbon.cudenver.edu/~bwilson/training.html

Web References

RoboDemo from eHelp, a Macromedia company http://www.ehelp.com/products/robodemo/

SAM XP and TOM from Course Technology, a Thomson Publishing company http://samcentral.course.com/

MyGradeBook from teachervision.com, a division of Pearson Education http://www.mygradebook.com/

QuizLab from teachervision.com, a division of Pearson Education
http://www.quizlab.com/

Exhibit 1. Student authored case.

Advanced Topic: Visual Basic for Applications using Excel

As sales manager for a large car dealership, you have been asked to develop a new commission formula that rewards achievement. You have decided to create four commission percentages that, when applied to net sales, calculate earned sales commissions and dealership commissions. The dealership and sales commission will equal 20%. You have asked a VBA programmer to help you write the custom function, and now you want to change the percentages of the sales and dealership commissions.

To complete this task:

1. **Open the T6EC1 workbook located on the Tutorial.06\Cases folder on your Data Disk. Enable the macros in the workbook. The workbook consists of only four columns of information.**
2. **Review the formulas in column C and D. The custom Commissions function uses only one argument, the sales values in range B2:B8 to calculate the commission. It is not obvious what percentage was used to calculate the commission values in column C and D.**
3. **To display the percentage used to calculate the commissions, Insert a column between C and D and label it "Percentage" in cell D1 and F1, apply a bold format to cells D1 and F1, and widen both columns to display the entire label. Then, enter the formula =C2/B2 in cell D2 and =E2/B2 in cell F2.**
4. **Format the value in cells D2 and F2 as a percentage with no digits to the right of the decimal point, and then copy the formula in cell D2 through the range D3:D14 and the same for F2 through the range F3:F14. By entering this formula, you make it obvious that the higher the sales, the higher the commission rate. You decide to test the commission percentage threshold by entering different sales values for row 2 and 3.**
5. **In cell B2, enter 30000 and for B3, enter in 35000 to see how the commissions and associated percentages change. To know where the thresholds between the four commission percentages are for sure, however, you need to view the VBA code behind the Commission function and Dealership function.**
6. **Open the Visual Basic Editor, and display the code for the Module1 object. Enter a comment line before the Commission function statement with you name and the current date.**
7. **In the VBA statements, change the Commission rate level to 5%, 7%, 9%, and 11%. Also change the Dealership rate level to 15%, 13%, 11%, and 9%.**
8. **In the VBA statement, change the third level to go up to 44999.99 and the forth level to start at 45000. (Hint: Make sure you change the levels in both commission and dealership.)**
9. **Save and print the code in the Visual Basic Editor window.**
10. **Close the Visual Basic Editor window, and notice that none of the percentages recalculated in column D or E, even though different percentages are used with different ranges.**
11. **Copy the values in range B2:B14, and then paste them back into the same range. Notice that the percentages are recalculated in column D and F as soon as you pasted the values.**

12. **Print the T6EC1 worksheet with your name in the upper-left section of the header.**
13. **Save and close the workbook, and then exit Excel.**

Editor's note: This paper is peer reviewed by TOJDES's Editors