# The project for simulation to enhance business skills

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**ABSTRACT**

Some students struggle with Excel and Access skills, especially in a business environment. What follows are the results of these skills being taught at a medium-sized Midwest University. While the number of Excel and Access projects provided to the student has been increased to provide greater breadth, students are still wrestling with the depth that some of the projects present. Additionally, students have a difficult time when it comes to advanced skillsets in Excel including data tables and statistical forecasting.

Four classes were used for this research. Two classes used simulation training for Excel and Access projects. Two other classes did not use simulation training. The classes using simulation are being conducted so that the student must do one of the simulation projects in the classroom. It is hypothesized that the simulation classes will not only have a better overall average/project but will have a better midterm and final grade for the Microsoft Excel and Microsoft Access projects.

While the students in the simulation classes did earn a higher grade on three of the most difficult projects when compared to the non-simulation classes, the midterm composite grade was about 8% higher for the non-simulation class. The simulation class did score higher on the Access midterm by over 9%. This is significant if non-equal variances were assumed.

Keywords: Simulation, Excel Skills, Access Skills, Business Skills

## INTRODUCTION

Simulation has been used in many occupations for a very long time. Aviation uses simulation to enhance a pilot's skill level in areas like emergency procedure training, crew coordination, aircraft modification, and even basic piloting skills (Reweti, Gilbey, & Jeffrey, 2017). While the skills are indeed enhanced, one must consider the lives that are saved through this practice. Additionally, it is much cheaper to power a simulator than to fly the actual aircraft. Medical personnel use simulation to practice intricate surgical procedures, simulate in-patient care, and even patient billing, thus reducing error that may indeed cost a patient's life (Jahanshir, et al., 2017).

Besides aviation and medical care, it is proposed that simulation can be both effective and efficient in education. While money and lives saved in aviation and medicine is paramount, personnel learn their trade better. With this same model in mind, one can conceive that education, specifically, technical skills in spreadsheet and database analysis will benefit (Manyukova & Nikonova, 2017). Additionally, it is important that faculty be well-versed in both technology understanding as well as being able to integrate this into the classroom (Coco, Jackson, Thomas, & Chen, 2017).

In a medium-sized, Midwestern university, four Principle of Management Information Systems class were used for this project, consisting of 30-35 students per class. These classes include *conceptual* Information Systems material that focus on networking, security, competitive advantage and systems development, as well as *practical* Excel and Access skills. The conceptual material is basically online and is used as homework. Students watch instructor-led videos that guides them through the textbook chapters.

For the practical Excel and Access skills, the students begin with either a simulation activity or an instructor led activity that demonstrates the skills needed to complete each project. For the simulation activity, the students do not need software; just a web browser. They enter the site and steps are provided on part of the screen and they can practice the skills annotated. When they have completed the "training" an evaluation exercise is provided and after a few attempts, the student's grade is recorded.

For the traditional non-simulation class, the instructor will demonstrate a project and then have the students either follow along step-by-step, or watch the instructor complete the project and take notes. Immediately afterwards, the students will attempt the same project for keystroke familiarity and having the instructor present to answer questions. For the simulation class, the instructor does nothing but walk around the room and explain any issues that may arise. This integration enhances the instructional process for the next generation classroom (Barneva, Kanev, Kapralos, Jenkin, & Brimkov, 2017).

For the after-training Excel (spreadsheet) and Access (database) skills, the students are provided a self-grading engine that allows them to download a starter Excel or Access file and based on instructions provided, manipulate the file and then upload the completed file. The engine grades the file and provides them with steps missed. Typically, the student will be provided two more chances to correct their mistakes. After the last attempt, the grade is recorded. For the midterm and final exams though, the students are only given one attempt.

One concern with the current generation of college student is that based on their knowledge of smartphones, the Internet, and gaming, students have a perception that they are more talented in computer skills than they are (Grant, Malloy, & Murphy, 2009). In the last eight years this assumed literacy has increased only slightly (Michalak, Rysavy, & Wessel, 2017).

## RESEARCH DESIGN

For this research project, two classes used the traditional method of having an instructor explain the procedures and two other classes taught by another instructor used the simulation method. The data descriptions for the professor and class are noted in Appendices 1 and 2. The simulation method allows the student to attempt the step and if incorrect, it will guide them through the proper keystrokes to accomplish each step. Each project is composed of 12-15 steps. The Excel projects and their attributes under review are:

- Project 2 – If/Then, Vlookup, Cell format, Average
- Project 3 – Charting
- Project 4 – Data tables, Structured References, Total Row, Sorting
- Project 5 – Subtotals, Grouping, PivotTables, PivotCharts
- Project 6 – Range names, Solver (very short project)
- Project 7 – Nested logical functions, If/Then, Database, Index, Match

* It should be noted that Excel begins at Project 2 as Project 1 is just a review of skills learned in a previous prerequisite class.

The Access projects and their attributes under review are:

- Project 1 – Table design, Filtering, and Sorting
- Project 2 – Importing different file types, Relationships, Basic Queries
- Project 3 – Calculated fields, Total rows, Advanced Queries, Expression Fields
- Project 4 – Forms, Reports, Advanced Queries

The hypothesis for this research project is that based on prior uses of simulation, students in the two classes that use simulation will learn more about each project and be able to score better on each project and better on the midterm and final exams. The null hypothesis was that the students would not score better in both the individual projects and the midterm and final exam projects in the simulation class when compared to the traditional class. All projects used in both classes, traditional and simulation, both weekly projects and midterm/final projects were identical. It should be noted that the midterm exam is a composite of attributes learned in Excel Projects 2-4 above. The final exam is a composite of the four Access projects listed above. The descriptive statistics collected are the mean, standard deviation, and standard error mean. The statistical instrument used for analysis was SPSS, version 22. Additionally, Levene's test for equality of variances and a t-test for equality of means was conducted also using SPSS.

## FINDINGS

There were fifty-five total students presented with the simulation exercises. Seventeen were female and thirty-four were male. There were 51 students that were not presented with the simulation exercises. Sixteen students were female and 39 were male from this group.

Table 1 list the mean scores for each of the professor's classes. Professor 1 used the simulation in their class. Professor two did not use a simulation exercise before the exact same in-class quiz.

Table 1

| Quiz | Professor | N | Mean | Std. Deviation |
|---|---|---|---|---|
| Excel 2 | 1 simulation | 51 | 87.7712 | 16.12017 |
| | 2 | 45 | 80.2756 | 17.99777 |
| Excel 3* | 1 simulation | 51 | 90.0412 | 7.35762 |
| | 2 | 53 | 85.4868 | 9.83768 |
| Excel 4 | 1 simulation | 51 | 88.6536 | 10.55040 |
| | 2 | 53 | 83.6340 | 17.05338 |
| Excel 5 | 1 simulation | 51 | 80.3203 | 23.63331 |
| | 2 | 48 | 85.5792 | 11.18102 |
| Excel 6 | 1 simulation | 51 | 87.8186 | 16.58661 |
| | 2 | 43 | 79.3698 | 26.78836 |
| Excel 7 | 1 simulation | 51 | 69.9150 | 30.97697 |
| | 2 | 44 | 73.6023 | 29.66994 |
| Access 1 | 1 simulation | 51 | 85.7908 | 20.07818 |
| | 2 | 43 | 88.0930 | 11.82575 |
| Access 2 | 1 simulation | 51 | 85.5098 | 30.73806 |
| | 2 | 46 | 93.6848 | 5.24019 |
| Access 3 | 1 simulation | 51 | 74.1732 | 27.44190 |
| | 2 | 45 | 80.3511 | 11.69224 |
| Access 4 | 1 simulation | 51 | 71.8562 | 31.23831 |
| | 2 | 45 | 82.0111 | 13.00240 |
| Excel Midterm | 1 simulation | 51 | 84.2608 | 16.65385 |
| | 2 | 52 | 78.0038 | 13.74657 |
| Access* Midterm | 1 simulation | 51 | 84.2412 | 26.99344 |
| | 2 | 48 | 92.2417 | 8.03230 |

*Significantly different at the p=.05 level

Some students did not take the individual exams. This is the reason why the total number of students is not the same for each quiz.

Excel project three was significantly different at the p = .05 level. Excel projects two, four and six were not significant but did show a higher average score for those students doing the simulation exercises. This was also the case for the Excel midterm.

Additional statistics were run to determine if there were any significant differences between males and females in the two professor's courses.

Table 2 shows the scores between males and females for the two professors.

Table 2.

| Sex | | Professor | N | Mean | Std. Deviation |
|---|---|---|---|---|---|
| Female | Excel 2 | 1 | 17 | 89.1765 | 14.92626 |
| | | 2 | 14 | 74.6071 | 22.47735 |
| | Excel 3 | 1 | 17 | 91.4618 | 5.65408 |
| | | 2 | 16 | 87.5938 | 11.93077 |
| | Excel 4 | 1 | 17 | 88.3922 | 11.44749 |
| | | 2 | 16 | 82.2000 | 20.28625 |
| | Excel 5 | 1 | 17 | 83.8824 | 18.05199 |
| | | 2 | 14 | 86.2500 | 9.88151 |
| | Excel 6 | 1 | 17 | 83.7598 | 24.09059 |
| | | 2 | 14 | 79.3357 | 26.26055 |
| | Excel 7 | 1 | 17 | 67.7255 | 36.10522 |
| | | 2 | 14 | 68.0500 | 37.78752 |
| | Access 1 | 1 | 17 | 89.0196 | 9.61298 |
| | | 2 | 13 | 82.3077 | 15.89751 |
| | Access 2 | 1 | 17 | 82.3333 | 32.65178 |
| | | 2 | 12 | 93.3750 | 4.88562 |
| | Access 3 | 1 | 17 | 79.6863 | 24.70796 |
| | | 2 | 13 | 82.0000 | 12.74526 |
| | Access 4 | 1 | 17 | 79.6078 | 23.03838 |
| | | 2 | 12 | 86.1250 | 12.37138 |
| | Excel Midterm | 1 | 17 | 83.9647 | 22.88411 |
| | | 2 | 15 | 72.6733 | 10.88816 |
| | Access Midterm | 1 | 17 | 81.1235 | 31.19400 |
| | | 2 | 14 | 90.9714 | 7.19695 |
| Male | Excel 2 | 1 | 34 | 87.0686 | 16.85765 |
| | | 2 | 31 | 82.8355 | 15.30955 |
| | Excel 3* | 1 | 34 | 89.3309 | 8.05995 |
| | | 2 | 37 | 84.5757 | 8.81235 |
| | Excel 4 | 1 | 34 | 88.7843 | 10.25003 |
| | | 2 | 37 | 84.2541 | 15.72543 |
| | Excel 5 | 1 | 34 | 78.5392 | 26.04723 |
| | | 2 | 34 | 85.3029 | 11.80325 |
| | Excel 6 | 1 | 34 | 89.8480 | 11.07822 |

| | | | | | |
|---|---|---|---|---|---|
| | | 2 | 29 | 79.3862 | 27.49991 |
| | Excel 7 | 1 | 34 | 71.0098 | 28.60335 |
| | | 2 | 30 | 76.1933 | 25.36457 |
| | Access 1 | 1 | 34 | 84.1765 | 23.62092 |
| | | 2 | 30 | 90.6000 | 8.74386 |
| | Access 2 | 1 | 34 | 87.0980 | 30.11387 |
| | | 2 | 34 | 93.7941 | 5.42597 |
| | Access 3 | 1 | 34 | 71.4167 | 28.66215 |
| | | 2 | 32 | 79.6813 | 11.38217 |
| | Access 4 | 1 | 34 | 67.9804 | 34.27478 |
| | | 2 | 33 | 80.5152 | 13.08415 |
| | Excel | 1 | 34 | 84.4088 | 12.89396 |
| | Midterm | 2 | 37 | 80.1649 | 14.31651 |
| | Access | 1 | 34 | 85.8000 | 24.99418 |
| | Midterm | 2 | 34 | 92.7647 | 8.39751 |

*Significantly different at the p=.05 level

It should be noted that the sample size for females is extremely low for both professors. Any conclusion drawn should be suspect due to the low sample size.

There were no significant differences between the females in each class. However, Excel projects two, three, four, and six did show average scores for females in the simulation exposed class to be higher than the non simulation class. This was also the case for Access project one and the Excel midterm. The only significant difference between the males was for the Excel 3 quiz. However, Excel projects two, three, four, six and the Excel midterm did show higher scores for the males exposed to simulation than the males not using simulation. There was no significant difference found between males and females within the same class.

The group statistics are annotated in Appendix 3. For Project 3, Excel, the mean for the simulation class is 90.04 and the mean for the traditional class is 85.49.

For the database projects, there was no significant difference in the individual projects; however, the Final Exam grade was different as noted in Appendix 4. The individual projects though were typically 10-15 points higher than the Excel projects in both classes.

## DISCUSSION

Simulation, whether in aviation or medicine, typically familiarizes one with concepts, analogies, or instances where transformation learning can take place. For aviation, the student may be able to memorize the steps with an emergency procedure that could result in restarting a flamed-out engine. For medicine, the student may be able to memorize a series of steps for the successful removal of a gall bladder. Therefore, it would make sense that the university student would see a series of steps performed by the computer and then be able to transfer this

knowledge into successful completions of the individual project and the composite project that was used for the midterm and final exams.

The simulation used in this study was not without its faults. Students sometimes had to click through the steps several times before the computer would accept their keystrokes. Additionally, the computer would at times, grade the student's attempts incorrectly, even when they performed the correct keystrokes. This happened on more than one occasion. But when the professor threatened to cancel the simulation and return to the traditional method the students, almost in unison, pleaded to continue. It seemed that they preferred this method of learning than having to watch and listen to the professor. This could be caused by their age group and use of technology to do their thinking. When queried, both simulation classes, said that they liked being "forced" to type the steps.

While the only significant difference between the two classes was for Excel project three. Exposing students to simulation seems to have a positive effect for Excel projects two three, four, and the Excel Midterm. Simulation does not seem to have an impact for improving their Access database scores. This may be due to the ease of the Access projects where doing a simulation may have reduced their retention of the material.

Similar results were found when comparing females and males when exposed to simulation. While not significant females exposed to simulation did have a higher midterm score for Excel projects two, three, four, six and the Excel midterms. They did not have higher midterm scores for Access database project or the Access midterm except for Access project 1. Males also seemed to do better when exposed to simulation for Excel projects two, three, four, six, and the Excel midterm. Males exposed to simulation did not do better on any of the Access database projects or Access midterm. Again, this may be due to the ease of the projects where doing a simulation may have reduced their retention of the material.

## CONCLUSION AND FUTHER RESEARCH

This class taught at this university is a service-class that is required by every business major. Business faculty from the multiple disciplines have requested that extensive Excel skills be taught as they will require students to have a working knowledge of Excel. Albeit, the Information Systems department puts an equal amount of emphasis on Access because of the job market appears to use database skills. Smith & Mader, 2017 posit that it is imperative students be allowed to collect and manipulate data.

The skills though are both volatile and short-lived. Additionally, based on the ubiquity of the Internet, these projects find their way to the Internet, so some students have been known to download them, see the formulas/functions associated and simply copy/paste. Detection software has been developed to minimize this, but it still happens. Thus, class changes occur often, and different techniques are employed to reduce student cheating and increase learning. Future research should be conducted with online classes to determine if simulation training combined with a lack of physical instructor presence has an impact on learning Excel and Access skills.

There were enough problems using the simulation that the professor using it decided to continue its use. It is obvious that learning was short term so another method for subsequent semesters has been planned. Students will take a project in class that that has explicit instructions. The instructor will again explain each project. On the second class day the student

will conduct a more difficult project. Minimal instructor time will be given. Homework will consist of a project that has formulas and functions that are incorrect. The students will be required to "fix" these mistakes and submit for a grade. Students need to be able to find and address spreadsheet errors (Schneider, Becker, & Berg, 2017).

Finally, students may suffer from creativity in using simulation programs. Runco, Acar, & Cayirdag, (2017) posit that students experience a creative gap between school and outside of school. The authors continue to say that they may be hindered by the structure and additional restructions at school.

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## APPENDICES

Appendix 1 – Professor Data Description

| Professor | | | | | |
|---|---|---|---|---|---|
| Professor | | Frequency | Percent | Valid Percent | Cumulative Percent |
| | 1-Traditional | 56 | 50.5 | 50.5 | 50.5 |
| | 2-Simulation | 55 | 49.5 | 49.5 | 100.0 |
| | Total | 111 | 100.0 | 100.0 | |

Appendix 2 – Class Data Description

| Class | | | | | |
|---|---|---|---|---|---|
| Class Type | | Frequency | Percent | Valid Percent | Cumulative Percent |
| | 1-Traditional | 30 | 27.0 | 27.0 | 27.0 |
| | 2-Simulation | 30 | 27.0 | 27.0 | 54.1 |
| | 3-Simulation | 25 | 22.5 | 22.5 | 76.6 |
| | 4-Traditional | 26 | 23.4 | 23.4 | 100.0 |
| | Total | 111 | 100.0 | 100.0 | |

Appendix 3 – Group Statistics

| | Levene's Test for Equality of Variances | | | |
|---|---|---|---|---|
| | t | df | Sig. (2-tailed) | Mean Difference |

| | | | | | |
|---|---|---|---|---|---|
| Excel 2 | Equal variances assumed | 2.153 | 94 | .034 | 7.49569 |
| | Equal variances not assumed | 2.138 | 89.066 | .035 | 7.49569 |
| Excel 3 | Equal variances assumed | 2.666 | 102 | .009 | 4.55438 |
| | Equal variances not assumed | 2.680 | 96.214 | .009 | 4.55438 |
| Excel 4 | Equal variances assumed | 1.797 | 102 | .075 | 5.01963 |
| | Equal variances not assumed | 1.813 | 87.240 | .073 | 5.01963 |
| Excel 5 | Equal variances assumed | -1.401 | 97 | .164 | -5.25891 |
| | Equal variances not assumed | -1.428 | 72.262 | .158 | -5.25891 |
| Excel 6 | Equal variances assumed | 1.868 | 92 | .065 | 8.44886 |
| | Equal variances not assumed | 1.798 | 67.607 | .077 | 8.44886 |
| Excel 7 | Equal variances assumed | -.590 | 93 | .557 | -3.68724 |
| | Equal variances not assumed | -.592 | 91.961 | .555 | -3.68724 |
| Access 1 | Equal variances assumed | -.661 | 92 | .510 | -2.30217 |
| | Equal variances not assumed | -.689 | 82.901 | .493 | -2.30217 |
| Access 2 | Equal variances assumed | -1.780 | 95 | .078 | -8.17498 |

| | | | | | |
|---|---|---|---|---|---|
| | Equal variances not assumed | -1.869 | 53.213 | .067 | -8.17498 |
| Access 3 | Equal variances assumed | -1.401 | 94 | .164 | -6.17791 |
| | Equal variances not assumed | -1.464 | 69.355 | .148 | -6.17791 |
| Access 4 | Equal variances assumed | -2.030 | 94 | .045 | -10.15490 |
| | Equal variances not assumed | -2.122 | 68.559 | .037 | -10.15490 |
| Excel Midterm | Equal variances assumed | 2.081 | 101 | .040 | 6.25694 |
| | Equal variances not assumed | 2.077 | 96.781 | .040 | 6.25694 |
| Access Midterm | Equal variances assumed | -1.972 | 97 | .051 | -8.00049 |
| | Equal variances not assumed | -2.024 | 59.292 | .048 | -8.00049 |

Appendix 4 – Final Exam, Access

| | Professor | N | Mean | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| Final Exam - Access | 1- Traditional | 51 | 85.75 | 24.19362 | 3.38778 |
| | 2- Simulation | 48 | 92.24 | 8.03230 | 1.15936 |