Teaching Undergraduate Business Students Data Analytics: Differences Between Male & Female F2F-WEB Students

J. Kirk Atkinson
Western Kentucky University

Utilizing two class sections at a midwestern, public university, undergraduate students received instruction in basic data analytics concepts using SimNet® preparatory assignments with Microsoft Excel®, additional instructional materials, and analytics projects were assigned. Performance on each of the three analytics projects was measured against performance on the preparatory Excel assignments by sex with the intent to prepare students for basic analytics projects. The results of a Pearson correlation indicated for face-to-face female learners there was no correlation observed between the first five SimNet projects. There was a statistically significant correlation between SimNet projects 1-5 and analytics project 2. For face-to-face male learners, correlations observed were between the first and second analytics projects and the first and third analytics projects. For female Web learners analytics project, 1 was correlated to SimNet projects 6 - 9 and to analytics project 2. SimNet projects 6 - 9 were correlated to analytics project 2. For male online students, a statistically significant correlation was observed between numerous projects.

Keywords: analytics, undergraduates, spreadsheets

INTRODUCTION & LITERATURE REVIEW

There is extensive research on differences between males and females, as well as face-to-face vs online learners. The Covid-19 pandemic dramatically impacted both teaching methods as well as student learning preferences (Tang et al., 2021). College instructors with few options were forced to use delivery methods that were not always comfortable for them. Additionally, some topics, like nursing and physical therapy may not be compatible with online learning models. Students, whether they performed well in an online-only environment or not, found themselves isolated, relegated to asynchronous learning videos or synchronous tools like Zoom® or Microsoft Teams® (Salim et al., 2022; Zhang et al., 2022).

Atkinson, Thrasher, and Coleman compared business and non-business students' significant differences between the two groups, but also between business-related students by discipline (2011). While this work did not assess learning modalities, it may be important to note that teaching among cross-disciplinary groups may be impacted by students' ability to understand spreadsheet skills as opposed to analytics concepts. Other research suggests that traditional online learning models are insufficient to achieve the goal of student learning. Pak, Lee, and Lee (2022) suggest that a learning support system be developed that consists of three components; 1) an online development environment module, 2) a learning monitoring module, and 3) a learning support module. While this work focused on programming and engineering practices, these principles are not dissimilar to data analytics.

This research focused on the differences between learning data analytics principles between males and females in both learning modalities. The Principles of Management Information Systems course was selected primarily because of the current instruction of spreadsheets, and it is a required business core course in the curriculum. While the course is targeted at the second year students, it is common to find students nearing graduation. This study assesses the effectiveness of using foundational spreadsheet projects to prepare undergraduate students for data analytic concepts when limited to spreadsheets as the primary tool.

For this research, effectiveness will be defined by this question:

R1 *– Is there a significant difference between face-to-face and WEB-based undergraduate business students when using spreadsheets to prepare them for introductory-level data analytics projects?*

METHODOLOGY

This study assesses the effectiveness by using principles of management information systems course at a 4-year, public university located in the southeastern United States. There are both male and female students in both the face-to-face and WEB-based course sections. This course uses as the focal point the introduction of data analytics concepts using Microsoft Excel® as the software tool. The same instructor taught two face-to-face sections and one online section. Students were selected using convenience sampling as members of the course sections were affected. The total number of students that participated in the combined course sections was 90.

Microsoft Excel® was the tool selected because of its popularity in the industry. Four analytics projects were defined by the instructor and involved the construction of a model to solve basic business problems. This model construction was followed using built-in, what-if analysis, and add-in tools. Examples are Frontline Solver®, one and two-variable data tables, and pivot tables. The concepts of each targeted skill were demonstrated in class, and where necessary, provided as on-demand video tutorials. All projects provided a visual representation of the expected outcomes in a form that preserved project integrity. Each of the three analytics projects was assigned after the completion of pre-selected McGraw-Hill SimNet® spreadsheet assignments. This study did not attempt to validate or score the value of selected projects and in no way is the McGraw tool being assessed. There are numerous projects and simulations available, it was at the instructor's sole discretion as to which text and which projects were selected. Each project was selected based on the instructor's knowledge of the technical skills required to complete each analytics assignment. Projects one through five provided context and understanding for the first analytics assignment which involved constructing a dynamic spreadsheet model. An entire lecture session discussed and demonstrated examples of spreadsheet models. A separate recorded instructional video was provided to the online students. Upon completion of the basic model, additional Excel project assignments continued to build on the skills needed for each successive analytics project. There was a total of three analytics projects including the initial model construction assignment.

Analytics project 1 included the business model that was closely monitored and any recommended corrections made before proceeding. This project included the use of what-if tools, Goal Seek, Scenario Manager, one-variable and two-variable data tables, some basic charts, and finally a pivot table. This project was assigned after the first five SimNet project assignments.

SimNet projects six through nine were completed before the final two analytics projects described below. Analytics project 2 includes four [4] Solver problems.

Analytics project 3 introduced the use of a larger dataset. A 7,000-row dataset was provided. The students were assigned to create several pivot tables and associated pivot charts. Because there were no statistically significant outcomes, no further discussion of the final analytics project is warranted. There were 90 scores used, with descriptive statistics that define the sample of the study.

A Pearson correlation was run against the Excel preparatory SimNet® activities and the associated Analytics Projects, Excel projects 1 through 5 against the first analytics projects, and Excel projects 6 through 9 for the second and third analytics projects. An ANOVA was performed using mean scores to

determine the significance between the Excel preparatory assignments and the analytics projects versus the student's final course performance.

FIGURE 1
FREQUENCIES

Delivery Format	N		
Face-to-face student	56		
WEB students	35		
Males	47		
Female	43		
Chose not to identify	1		
Course Task	Means		
	Face-to-Face	WEB	
Modeling project	84.4	76.6	
Analytics project 1	73.6	78.5	
Analytics project 2	93.4	74.1	

RESULTS

The data analytics project scores of students from all three (3) sections were analyzed by performing the Pearson Correlation. The outcomes of analytics project scores for assignments 1 through 5 were compared to the overall student performance in the course and to the performance during the preparatory McGraw-Hill SimNet® spreadsheet activities related to the skillsets required.

For face-to-face female learners, there was no correlation observed between the first five SimNet projects [hereafter SimNet 1] and the first analytics project. There was a correlation (.689) between the first five SimNet assignments and the second set of SimNet projects (.777), as well as a correlation between SimNet 1 and analytics project 2. For face-to-face male learners, the only correlations observed were between the first and second analytics projects (.508), and again between the first and third analytics projects (.734).

For female Web learners, SimNet 1 was correlated to SimNet projects 6 through 9 [hereafter SimNet 2] (.577). In addition, analytics project 1 was correlated to SimNet 2 (.724) and analytics project 2 (.958). SimNet 2 was correlated to analytics project 2 (.833).

For male online students, SimNet 1 is correlated to analytics project 1 (.821), SimNet 2 (.921), and again to analytics project 2 (.730). Analytics project 1 is correlated to SimNet 2 (.866) and analytics project 2 (.893). SimNet 2 is correlated to analytics project 2 (.797) Correlation is significant at the 0.01 level (2-tailed).

Table 1 depicts the results of an ANOVA including the Excel activities and all three analytics projects. There is no analysis between Excel cases 1-5 and Analytics Project 3 and no analysis between Excel cases 6-9 and Analytics Project 1. In the latter case, the project assignment was after the preparatory cases.

TABLE 1
SPREADSHEET PREPARATORY CASES AND ANALYTICS PROJECTS

		F	Sig.
Excel cases 1 - 5	Analytics Project 1	1.699	0.046**
	Analytics Project 2	5.986	0.000**
Excel cases 6 - 9	Analytics Project 2	7.096	0.000**
	Analytics Project 3	1.597	0.159

**. Correlation is significant at the 0.01 level (2-tailed).

Only the final analytics project indicated no significance as it relates to the final student performance. All other preparatory Excel cases and analytics projects were significant.

DISCUSSION

As data analytics continues to rise in popularity among college students, more institutions are integrating it across their curricula. This is demonstrated by the inclusion of analytics components in the Certified Public Accountant [CPA] examination, but also to appease AACSB standards (Hines & Tapis, 2022).

Henry and Venkatraman (2015) establish that AACSB-accredited business schools integrate data analytics skills throughout every discipline. The interdisciplinary nature of data analytics initiated a push for students from outside the business school to select courses as electives.

The results indicated that there is a strong, and statistically significant correlation between the Excel preparatory activities and the first two analytics projects. As mentioned, the final analytics project was not statistically significant or correlated to preparatory assignments. This finding affirms earlier work by Tazici (2020) that project-based learning is an effective methodology for undergraduate learning in the area of descriptive and predictive analytics. Interestingly, the online learners performed more consistently than their F2F counterparts, but on average achieved lower scores.

Earlier work (Atkinson et al., 2021) established that spreadsheet preparatory assignments were useful in teaching analytics skills. This research focused on statistically significant differences between face-to-face and in-person male and female learners.

Limitations

This research exhibits limitations: only two [2] sections were selected and taught by the same instructor. Additionally, convenience samples were used as opposed to random sampling techniques. It is also noteworthy that because male and female learners are identified that those learners that do not identify in traditional gender roles may have differences in styles that are yet undiscovered.

Conclusions

This research sufficiently concludes that continued work in spreadsheet skills as they relate to data analytics is beneficial to undergraduate students. The future direction would need to include additional instructors and perhaps repeated at other institutions. Performing a comparison between various instructors and across institutions of higher learning may assist in recommendations for improvements in the methodology and types of project activities.

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