

Face-To-Face vs. Online Analysis of Student Performance: Lessons Learned from MOS Excel Certification Outcomes

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We compared/contrasted performance means for students receiving teaching instruction from two different learning modalities. We found no differences between the two groups by applying t-test and chi-square techniques. We also explored any performance difference between face-to-face and online students within five distinct categories of the Microsoft Office Specialist (MOS) Excel certification by using one way ANOVA test. We did not find mean performance differences within the various categories for face-to-face students. However, we did find mean performance differences for online students. We applied the Post Hoc Tukey Kramer technique to compare means differences in various categories for online students.

INTRODUCTION

Covid-19 had a profound impact on every sector of society including academia. All face-to-face instructions, in short notice, were switched to online format. Although online education is not new to universities, universities must acknowledge that Covid-19 initiated a major disruption and forced universities to find ways to be innovative with virtual learning (Abdullah et al., 2020). The online move forced universities to consider technological capabilities available to deliver classes in different modalities. Zoom, Microsoft and others offered their platforms and programs for classroom and meeting purposes.

Online or remote instructions vary from discipline to discipline. Qualitative disciplines are easier to teach in an online format. Quantitative or computing disciplines, on the other hand, are easier to deliver in a face-to-face format (Crain & Ragan, 2017). Computing concepts, MOS Excel certification courses are in particular, more effective when students are physically present in class (Ali & Fitzpatrick, 2019).

Our university is a regional, AACSB accredited business college. We offer MOS Excel certification courses both at the basic and expert level with the intent to prepare students with the necessary skills for marketability and employability. Excel skills are paramount and result in increased marketability for graduates (Formby et al., 2017).

The purpose of this paper is to find out whether any significant change occurred in the student performance as a result of the pandemic. Also, we wanted to investigate whether the change in modality has had any impact on the outcome of different sections of the certification test.

REVIEW OF LITERATURE

Computer skills have become an essential part of success both in academia and professional life. Today's job market requires computer skills, and the trend will be more robust in the coming years. Proficiency in Excel is imperative to be successful in today's marketplace (Bakir et al., 2019). A direct way to assess whether students are proficient in Excel is to have them complete the MOS Excel certification test. Passing the test, which is administered by Certipoint, implies that students are learning the necessary outcomes based on industry specifications. Before the Coronavirus pandemic, the certification course at our college was offered with traditional classroom instructions, using well-established instructional paradigm in which the teaching style and structure have been refined over several centuries. Face-to face modality has numerous benefits such as: dynamic instruction, a well-established modality, freedom from the internet's connectivity issues, access to auxiliary tools to maximize classroom performance, academic rigor, and instant feedback on instructor and class plausibility (Jasmine & Jefferson, 2019).

Advancement in technology allows academic institutions to offer flexible learning environments. Synchronous and asynchronous are two modes of communication that can be used for online classes. Although the format offers freedom to students, it demands a lot more discipline. Online students are required to consider new ways to prepare, organize, engage, and complete course requirements with higher levels of independence and self-direction (Martin et al., 2020).

Many studies have been completed that observe the outcome of face-to-face vs. online learning. The results are mixed, and there is no definitive conclusion about the effectiveness of a particular modality. Kemp & Grieve (2014) reported that students preferred to complete activities face-to-face rather than online but did not find any significant difference in their test performance in the two modalities. Johnson et al (2000) found in their study that the students in face-to-face courses hold positive perceptions about the instructor and course quality. Gegenfurtner & Ebner (2019) suggest that webinars are more effective than traditional face-to-face instructions. However, they also reported the effect was trivial in size.

Covid-19 has intensified the debate about the pros and cons of online learning. The pandemic changed the behavior of both teachers and students in their teaching/learning styles and assessment methods (Gherhes et al., 2021). The previous study highlights key information about online learning from students' perspectives. The study reports the strong level of desire by students to return to face-to-face modality. Some key positive aspects of online learning mentioned in the study are the ability to stay at home; a relaxed environment; and accessibility. Also, the study highlights the negatives of online learning such as lack of interaction with peers, lack of attention and involvement in class, anxiety, shyness, and fear of exposure.

As mentioned earlier, the purpose of this paper is to evaluate those two modes of instruction for a computing class. For this study, we selected the MOS Excel certification class because the results of the studies concluded that 56% of participants believed that the certification helped them to gain employment (Rebman et al., 2021).

In this paper, we first present the problem statement and research method. Next, we compare the statistical effectiveness of face-to-face instruction to online instruction in a MOS Excel certification class before the pandemic and during the pandemic. By comparing those two modalities, we present results before Covid-19 and during Covid-19 for the course. In addition, we addressed lessons learned, some limitations of the study and future work that can be undertaken.

STATEMENT OF THE PROBLEM

The purpose of this paper is to find if there are significant differences in the MOS Excel certification test for students getting instructions from two different modalities. Do students learning Excel face-to-face (before Covid-19) perform at least as well as students learning Excel online (during Covid-19) on the MOS Excel certification exam? All sections of the course were taught by the same professor and used the same materials and tests to ensure coherence with the research methodology. Another purpose of this study is to explore if there are any significant differences between the performance of face-to-face and online students in each of the five categories of the certification test: creating and managing worksheets and workbooks, managing data cells and ranges, creating tables, performing operations with formulas and functions, and creating charts and objects (Lambart, 2020).

Method

In this study, we observe the results of the MOS Excel certification test and compare the differences in the mean scores of face-to-face vs. online classes. Also, the final course grades of students were used as a comparative factor in assessing performance differences between the modalities. The study also looked at the mean scores of each Excel skills category within a modality. The reason for comparing mean scores of Excel skills categories within a modality was to find whether students' scores were statistically significantly different or not.

The strategy employed in this study was to test students in two different groups based on the modality of instruction in which they took the course. Lessons for the course were to build the necessary skills set by Certiport to pass the MOS Excel certification test.

Two sections of a data analysis course consisting of 74 total business students were used as samples for face-to-face modality taught in the fall semester of 2019 which was before the pandemic. For online instruction, two sections of the same course consisting of 71 total business students were used as samples taught in the fall semester of 2020 during the pandemic. All sections were taught by the same professor and used the same materials and testing procedure to ensure consistency with the research method. The lessons were created from the textbook; Microsoft Office Excel 365 Complete in Practice 2019 (Stewart & Nordell, 2020). Based on the aforementioned information, the following four hypotheses guided the study:

Hypothesis 1

H₀: There is no significant difference in the mean score of the Excel certification test between face-to-face and online students.

Hypothesis 2

H₀: There is no significant difference in grade distribution between face-to-face and online students.

Hypothesis 3

H₀: There is no significant difference in the mean score between categories on the Excel skills test for face-to-face students.

Hypothesis 4

H₀: There is no significant difference in the mean score between categories on the Excel skills test for online students.

Results

T-tests were to investigate the first hypothesis and to determine whether the mean difference between the two groups is statistically significant or not. The details of the test are given in Table 1:

Table 1. Statistic for two groups and t-test mean for the between-group difference.

	Face-to-Face group	Online group
Mean	787.60	746.50
Standard Deviation	152.89	183.63
Observations	74	71
df	136	
<i>t</i>	1.46	
p-value	0.15	
Test result	Fail to reject null hypothesis	

The null hypothesis of the equality of the means for face-to-face and online groups was not rejected at the 5% level of significance, showing that the difference in scores between the two groups is statistically insignificant. The face-to-face group's mean scores were higher compared with the online students. The conventional wisdom was that the face-to-face would perform better than the online group. However, we found no statistically significant difference between the two groups ($p > .05$).

The second hypothesis investigates whether a difference in grade distribution exists between face-to-face and online students. The grades were based on the Excel certification test scores with the following scales (shown in Table 2):

Table 2. Grade scales for face-to-face and online groups.

Grade	A	B	C	D	F
MOS Excel Score	$\geq 90\%$	$\geq 80\%$	$\geq 75\%$	$\geq 70\%$	$< 70\%$

A traditional chi-square method was used to test this hypothesis. The technique is useful for comparing grades for two modalities and to quantify statistically significant difference between the observed and expected grades proportions. In other words, we were interested in determining if the grades proportion of face-to-face students differs from online students. Table 3 below shows the mean proportion and standard deviation proportion for each modality. The numbers are provided to elucidate any differences between the modalities.

Table 3. Means and standard deviations for face-to-face and online groups.

	Face-to-Face	Online
Mean	72.0	67.7
Standard deviation	17.5	19.3

A chi-square analysis was performed using R to find if there was a statistical difference in grade distribution between face-to-face and online students. Table 4 below displays the grade distributions for face-to-face and online modalities. The difference in student performance was statistically insignificant, $\chi^2(4, 145) = 8.1703$, $p > 0.5$.

Table 4. Contingency table for student's grade performance (N =145).

Modality	A	B	C	D	F	Total
Face-to-face (pre-pandemic)	15	31	8	6	14	74
Face-to-face % within grade	51.72	63.26	53.33	27.27	46.66	51.03
Online (During Pandemic)	14	18	7	16	16	71
Online % within grade	48.27	36.73	46.66	72.72	53.33	48.96

$\chi^2 = 8.1703$, Critical value (χ_a^2) = 9.4877, d.f.=4

Between the two modalities, there are small differences in the proportion of students who obtained an A, C or F, whereas the differences are higher for grades B and D. However, there is a small percentage difference between grade total as a percent of modality. The difference in total percentage of grades is a better reflection of performance levels. For example, face-to-face learners earned 31 B (63.26% of total B's). However, when viewing the B grade against all learners in each modality, it can be seen that 31 of 74 face-to-face students (41.89%) scored B, compared to 18 of 71 (25.35%) online students.

The chi-square test statistic is $\chi^2 = 8.1703$, which is less than the critical value of $\chi_a^2 = 9.4877$. Also, the p-value of 0.0854 was greater than the significance level of 0.05. Thus, the results show that there is no statistically significant difference between the groups in terms of grade performance.

For hypotheses three and four, we used a one-way ANOVA test to find if there was a difference in the mean score between categories on the Excel skills test for face-to-face and online students. The ANOVA is an excellent tool for the hypotheses as it tests the differences between multiple means within a modality. When the results of the ANOVA test were statistically significant, Post hoc Tukey Kramer was conducted to determine where differences between means existed. Statistical significance was accepted at an alpha level of $p < 0.05$. Table 5 displays the mean and standard deviation of face-to-face and online groups for Excel skills test categories. The mean difference within a modality for face-to-face is 10.37 whereas the mean difference for online modality is 24.62. Tables 6 and 7 below show the results of one-way ANOVA for the last two hypotheses. As can be seen in Table 6 that $p > 0.05$, we fail to reject the null hypothesis and conclude that there are no significant differences in the mean scores between categories on the Excel skills test for face-to-face students. On the other hand, in Table 7 the $p < 0.05$, we reject the null hypothesis and conclude there are significant differences in the mean scores between different categories on the Excel skills test for online students.

Table 5. Mean and St. Deviation for Excel skills test categories

Excel skills Categories	Face-to-Face Modality		Online Modality	
	Mean	St. Deviation	Mean	St. Deviation
Manage Worksheets & Workbooks (C ₁)	77.39	17.92	53.80	23.07
Manage Data Cells & Ranges (C ₂)	69.31	22.75	78.42	19.11
Manage Tables & Data Table (C ₃)	73.77	21.68	69.97	22.75
Perform Operations by using functions & Formulas (C ₄)	67.02	27.18	64.45	29.95
Manage Charts (C ₅)	72.46	23.42	71.67	24.00

Table 6. One-way ANOVA face-to-face students.

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	4764.07	4	1191.018	2.293162	0.059033	2.396401125
Within Groups	189572.9	365	519.3778			
Total	194337	369				

Table 7. One-way ANOVA for online students.

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	24113.48	4	6028.369	10.43282	5.4E-08	2.397456
Within Groups	202239.6	350	577.8275			
Total	226353.1	354				

As seen in Table 7 above, in order to determine where the differences in the mean scores occur, the Tukey test for Post hoc comparison was used. Results as shown in Table 8 reveal that there are differences between the mean scores of exam categories for online students.

Table 8. Post hoc Tukey Kramer of mean differences for online students.

Comparison	Absolute Difference between means	Significance	Results
C1 to C2	24.62	0.00	Means are different
C1 to C3	16.17	0.00	Means are different
C1 to C4	10.65	0.06	Means are not different
C1 to C5	17.87	0.00	Means are different
C2 to C3	8.45	0.22	Means are not different
C2 to C4	13.97	0.00	Means are different
C2 to C5	6.75	0.42	Means are not different
C3 to C4	5.52	0.64	Means are not different
C3 to C5	1.70	0.99	Means are not different
C4 to C5	7.72	0.38	Means are not different

Table 8 above displays whether or not the means differ. From these results, we concluded that the mean of category one is different from the means of categories two, three, and five. Also, the mean of category two is different from category four. Online students did better in categories two, three, and five compared to category one. They also did better in category two compared to category four. Since Excel is available on two separate operating systems, MAC and Windows, the categories of the certification test where the features are not very different, online students have done better on face-to-face students. It goes into detail in the discussion section.

Discussion

This study, using the t-test at 0.05 level, did not find any significant difference in the mean score of the Excel MOS certification test and between face-to-face and online students. The mean score in a face-to-face modality was 41.1 points higher than the online mode. The lower score for online modality was attributed to synchronous online delivery via Zoom. The course was offered at a regular time on Zoom, yet many students prefer to watch recorded lectures. It is our belief that because of Covid-19 and other disruptions, the online students were not as focused as students in a face-to-face setting.

The second hypothesis of the study was to investigate course grade performance between face-to-face and online students. Like the first hypothesis, we did not find any significant difference in the grade performance of

students between the two modalities. Summers (et al., 2005) reported that online students had better grades because of more time to grasp the material. Though there was no statistical grade performance significance in our study, face-to-face students earned 54 As, Bs, and Cs (72.97% of total As, Bs, and Cs earned) while online students earned 39 As, Bs, and Cs (54.92% of total As, Bs, and Cs earned). Also, when viewing the D grade in each modality, only 6 (8.1%) face-to-face students earned the grade compared to 16 (22.53%) online students. The disparity in grade distribution between the modalities could be attributed to Covid-19, lack of attention on Zoom, and frustration when trying to complete complicated tasks because of medium delivery constraints.

For the last two hypotheses, the objective was to find the performance of students within a modality for different categories of the Excel certification test. With a one-way ANOVA test, we did not find any significant difference in mean scores of Excel certification categories for face-to-face students. The same does not hold true for online students. A post hoc test of Tukey was performed to find the differences in mean scores. Online students did very poorly in category one of the MOS Excel certification test, which covers managing workbooks and worksheets. It is our assumption that the lower scores in the category of the test are because of operating platform constraints. To elaborate, Excel is available on MAC and Windows operating platforms. The navigation of many features on those two platforms are very different from each other (Ali & Fitzpatrick, 2019). Many online students have MAC computers, and the Excel certification test is given on Windows operating system. As a result, it is not unreasonable to assume that the difficulty with adjusting to windows platform contributed to lower scores for students. Finally, it is very hard to visualize the struggle and frustration of online students on some of the technical skills related to the category. It is very easy to overcome those constraints for students in a face-to-face format. We hold the same argument for category four (perform operations by using formulas and functions), where online students scored slightly lower compared to other categories.

LESSONS LEARNED

Although we did not find any significant difference between the performance of students between the modalities, one key lesson learned from the study was the platform constraint for online students. The materials used for instructions were all Windows-based. This constraint can be overcome to a large extent in a face-to-face format. Also, face-to-face users with MAC computers have access to computer labs that are equipped with Windows machines. To address this issue, we collaborated with our computer services to develop a cloud system that should be available to future online students to overcome this constraint.

Another problem that was witnessed among online students was anxiety about assignments and the certification test. The problem was attributed to a lack of communication between the instructor and the students with the MAC computers, since EXCEL is not compatible with the Windows version. In the absence of a cloud system with remote connections, we recommended that for future online classes on Excel certification, the instructor must create extra assignments with explanations, especially for MAC users on how to complete tasks related to categories one and four.

Since many online students would watch the recorded lectures, it is recommended that they should also attend synchronized online sessions with the instructor with the aim that mandatory attendance for online students will minimize this lack of communication.

Due to Covid-19, Certiport developed a cloud-based certification process where an instructor can create sign up slots for a group of ten candidates at the most. Like any new system, the cloud-based testing system experienced some glitches which were brought to the attention of Certiport. It is recommended that an instructor not invite the maximum number of students allowed to a group on the day of the exam. Book more time slots and register at most eight students on the test day so that if a student cannot get access to the system, the extra links can be used.

CONCLUSION

The main purpose of the paper was to provide the results of the MOS Excel certification test for face-to-face and online learning during a pandemic. The transition from face-to-face to online was challenging but rewarding. There were many lessons learned in teaching a technical course, like Excel certification, in an online format. The paper looked at the performance of students for both modalities based on their Excel skills acquired over a semester. It will be interesting to find out whether the Excel skills learned can be retained and applied to higher-level courses. Due to Covid-19, the traditional education system was forced to adapt to the new realities, and online classes have become an alternative choice to in-person instruction. The paper was a small step to understand the effects of these

new realities for technical courses. Future studies should explore what are student needs and expectations in this emerging instructional format.

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