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WHICH INSTRUCTION METHOD ENHANCES OUTCOMES AND SATISFACTION IN UPPER-LEVEL EXERCISE STUDIES?

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ABSTRACT

While numerous studies have investigated the difference between online and in-person instructors in several fields, variations in instructors, exclusive reliance on exam score data, and the absence of student satisfaction surveys characterize most of these investigations. Notably, none of these studies have explored the realms of health and exercise studies. This study compared all graded assignments, exams, oral presentations, optional resource data collection (time spent doing optional activities and scores on optional quizzes) and included a student satisfaction survey. At the end of the course, all grade book data was anonymized (any identifying information was removed), placed into a separate data sheet (Excel document), and analyzed. A course satisfaction survey was given at the semester's midpoint, separating this study from previous research, which did not include a student satisfaction survey. Both classes were correlated, determining if there is a relationship between which mode the course was taught and overall course totals. There was one activity that showed a significant difference between online and in person learning environments.

Keywords: Exercise Physiology, Assignments, PowerPoint Presentation, Exams, Student Satisfaction Survey.

INTRODUCTION

There have been multiple studies that involve in-person versus online learning modes, however not all of them are taught by the same person, many of them use only exam scores data, and none of them have utilized a student satisfaction survey. No studies have been performed in the fields that encompass health and exercise studies. The online/Distance Education mode of instruction is extremely popular among college students. Many students believe that the mode of online instruction is more convenient, is easier, is the "same as" the in-person mode of instruction and provides students "the same" experience as the in-person mode of instruction. This study will compare all graded assignments, exams, oral presentations, reflective questions, optional resource data collection (time spent doing optional activities and scores on optional quizzes) and include a student satisfaction survey. Having multiple methods of data collection that includes student ratings of satisfaction data is what sets this study apart from others. Limitations include students who choose not to participate in the collection of data, and students who do not understand the rigors associated with this elective four-hundred-level course. Potential contributions to the literature include and are not limited to having more components included in data collection (exams, reflection questions, student outcomes survey, optional course software assignments, assignments, PowerPoint, and oral presentation) which can better indicate which mode of instruction is better suited for the students enrolling in this course or any other course.

MATERIALS

The Student Outcomes Survey was utilized for this study. Using a validated peer-reviewed student satisfaction survey was critical for this study and includes 19 questions. "Questions (numbered 1 to 6) correlate to the teaching block, how the students perceive the assessment block, how the students perceived the assignments, exams, and any other assessments included in the course; and those (numbered 12 to 19) correlating with the generic skills and learning experience, how the students felt prepared for the course, and did the materials given to the students assist in their learning, blocks of questions" which assess how the students rated the instructor in those categories (Fieger, 2012). The generic skills block of questions were not included due to the nature of these being specifically for vocational education students. This survey's information is important because most studies evaluating course content success exclude a student satisfaction survey. Comparing the online or distance education (DE) course to an in-person course that contains the exact same graded components, optional assignments, and student satisfaction surveys is how learning outcomes success was measured in this study.

"Online education helps instructors and students with technology to enable time, privacy, and independent study" (Al-Kahtani, 2022); comparing online to in-person instructional methods can help instructors improve both methods of instruction. The research performed in the realm of exercise science is lacking, as well as using upper-level courses using two instructional methods is non-existent. This gap will no longer exist in this realm after this study.

Including the optional assignments through the textbook software link assisted in determining if this would increase student scores. According to Feldman "Choice over the learning process was suggested to increase intrinsic motivation by providing the learner a sense of control, thus promoting engagement and improving learning gains" (Feldman-Maggor *et al.,* 2022). The data collected using the text software link will give additional data to determine if this component actually aids students in increasing their exam scores. The optional assignments component along with exams, assignments, PowerPoint, and oral presentation scores, including the student outcomes survey, allowed for multiple data to be collected to determine which mode of instruction students scored higher. According to Li, the students were more effective at learning the

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definitions and influencing factors related to course content through online learning before class but struggled with applying the principles and formulas (Li, Liu, *et al.,* 2023). This can be found in most upper-level courses, as students must put in more time to learn concepts and applications for the content covered.

Educators recognize that learners overwhelmingly prefer and expect the use of electronic presentation software in learning activities (Bolkan, 2019), (Hill *et al.,* 2012). Learners take notes on electronic presentations to aid their individual understanding which enhances their learning. Learners identify that electronic software presentations aid in attentiveness and individual comprehension of information (Apperson *et al.,* 2008), (Hill *et al.,* 2012). Most online and in-person lectures provide students with a slideshow presentation in various formats.

Throughout history, traditions, cultural identities, lessons, and morality codes were passed on with spoken words from those who knew more to those who knew less (Speering, 2023). Adding a slide show to the lecture helps to enhance the lessons taught in today's lecture environment, whether in-person or online. Power Points accompanied all lectures and these lectures were recorded in Panopto so both sections could access these throughout the course. Incorporating a student assignment relating to presenting a related subject in Power Point to their peers was a component that was analyzed in this study. The online classroom removes participants from the emotionally rich, in-person, social interaction; eye contact, facial expressions, and physical gestures, which are just not as engaging online as they are in person (Bonnicci *et al.,* 2023). Within the in-person environment, the instructor is able to witness if the students are understanding a difficult concept by watching the students' expressions, however, in the online format that interaction is absent. Students in an online format are appreciative of instructors who are enthusiastic about the content being delivered regardless of if the content is difficult or easy to comprehend; the students in this study commented on and ranked this as important to their learning in the student satisfaction survey.

The literature on student engagement, learning preferences, and the efficacy of online education presents a rich variety of perspectives, offering insights into how educational methods and tools influence learning outcomes. Apperson, Laws, and Scepansky (2008) conducted a study exploring undergraduate students' preferences regarding the structure of PowerPoint presentations. Their findings highlighted that students tend to favor well-structured presentations that clearly organize content, supporting the notion that presentation design impacts attention and learning. This preference aligns with Bolkan's (2019) work on multimedia presentations, which underscores the importance of segmented Power Point presentations to maintain student attention and facilitate learning.

Further research on online and blended learning environments, especially in the context of health sciences, reveals diverse student experiences. Al-Kahtani *et al.,* (2022), examined Saudi health science students' perspectives on sustaining blended learning. They found that while students adapted well to online and blended learning, the shift from traditional to digital classrooms introduced challenges related to engagement and motivation. Similarly, Alviar, Dale, and Galati (2019) explored communication dynamics in academic presentations, suggesting that the structure of such communications is integral to enhancing engagement in both in-person and remote settings.

The importance of student satisfaction and engagement in online learning is emphasized by several studies. For instance, the work of Keržič *et al.,* (2021) presents a comparative analysis of student satisfaction and perceived academic performance across ten countries during the COVID-19 pandemic. Their findings point to the significant role of engagement in shaping student success in e-learning environments. Similarly, Kandiko Howson and Matos (2021) analyzed student surveys to measure the relationship between satisfaction and engagement, concluding that higher satisfaction correlates with greater academic success and engagement in online courses. In terms of course design and teaching strategies, the use of interactive and flexible learning formats has gained attention. Ahshan (2021) proposed a framework for fostering active student engagement in remote teaching during the pandemic, emphasizing strategies that combine interactivity, collaborative tools, and asynchronous learning options to maximize student involvement. Ahlstrand *et al.,* (2022) also examined health care and social work students in higher education, focusing on health-promoting factors and their impact on learning outcomes, suggesting that fostering well-being can enhance engagement and academic success.

Li *et al.,* (2023) introduced a blended BOPPPS (Bridge, Objectives, Pre-assessment, Participatory Learning, Post-assessment, and Summary) model in the teaching of fermentation engineering, advocating for an integrated approach that combines online and offline methods to improve student learning outcomes. This approach aligns with findings from Bugarcic *et al.,* (2014), who noted the effectiveness of blended learning in enhancing students' skills in scientific argumentation through oral presentations, demonstrating the value of interactive and practical learning experiences. While these studies underscore the potential of online and blended learning models, they also highlight challenges such as student disengagement, lack of interactive elements, and varying levels of technological access. These findings are consistent with those of Corell *et al.,* (2018), who explored competitive learning tools and their effects on medical students, showing that incorporating competitive elements can motivate students but may also create stress if not carefully managed.

Lastly, the issue of presentation effectiveness is discussed by Moulton, Türkay, and Kosslyn (2017), who compared different presentation tools like PowerPoint and Prezi. They concluded that the medium of delivery impacts how the message is received and understood, further emphasizing the importance of selecting appropriate tools for effective communication in educational settings.
The literature indicates that the structure of presentations, the use of blended learning environments, and the fostering of student engagement are critical factors in enhancing learning outcomes, especially in online and remote education contexts. However, it also highlights the need for careful consideration of students' preferences and the incorporation of interactive, flexible, and health-promoting strategies to maximize their learning experience. In this study, very few students utilized the online assignments. Only four students between the two method deliveries used online assignments, so this component was deleted from the overall results and data analysis because only 11% of the students used this resource. Four out of thirty-six students did not allow adequate data analysis, which was a disappointing participation rate for this resource.

METHODS

Research design for this study was a correlational mixed methods study that utilized data collection and data analysis, quantitative and qualitative. The subjects of the study were American university students enrolled in the exercise physiology and sport science class; this is an elective four-hundred-level class that students choose to take. These students were asked to complete a consent form that was approved by the IRB of the university. These students attended class and performed as they would regardless of the research being

conducted. Classes were held two days a week for 75 minutes each day, which is recorded and saved in Panopto (the preferred recording method for our Moodle Learning Management System. All assignments, exams, PowerPoint submissions, and oral class presentation scores were used in data collection. Each group of students were required to answer reflection questions at the end of each exam, as well as a Student Outcomes Survey during the eighth week of class. The Student Outcomes Survey was taken from Peter Fieger, National Centre for Vocational Education Research (Fieger, 2012). At the end of the course, all grade book data was anonymized (any identifying information removed), placed into a separate data sheet (Excel document), and then analyzed. All analysis and interpretation occurred after the conclusion of the course and after final grades were submitted. All students were anonymized into random letters "A-Ah". This data is stored on a flash drive which is encrypted with a code and locked in a safe. Each delivery method was correlated to determine if there is a relationship between which mode the course was taught compared to overall scores on the assignments, exams, and oral presentation. Both sets of students were given a student satisfaction survey as an additional measure. Both sets of students were tested in the same environment where they chose which testing location was available and convenient on the dates given for the tests. They were given three dates to choose from to take the exams in the Digital Education and Learning Technology Applications Testing Center. The students had access to the same lectures (the in-person class lectures were recorded uploaded to the online/DE course in Moodle), making this study valid, reliable and repeatable. Both sets of students had mandatory attendance dates for the final oral presentations (the online section was held synchronously for three days). There were 10 students who completed the in-person course (seven females and three males) and 24 (19 females and four males) students who completed the online course. The unequal class sizes are a result of students dropping the course at various intervals before the drop course deadline. Students may drop a course for any reason (difficulty, unexpected circumstances, etc.), without grade penalty before the last day to drop a course (usually five weeks into a course, this date is university wide). The data analysis has measurements of central tendency, t-tests, p-scores, and other statistical measures to verify significance. Statistical software SPSS 29 was utilized to help in the data analysis and correlational relationships if any. All analysis and interpretation occurred after the conclusion of the course and after final grades were submitted. There were seven total exams, three assignments associated with the final PowerPoint presentation (a topic choice, an initial PowerPoint presentation, and finally the oral PowerPoint with any recommended fixes) and the student satisfaction survey.

RESULTS

Hypothesis-Students will score similarly in both delivery methods, in-person and online for the same course taught by the same instructor. This hypothesis was found to be correct in all but one score. The oral class presentation scores were the exception with Welch's t-test (due to unequal sample sizes) having a t score of -2.452, a significance of one-sided p score = 0.01, and a two-sided p score = 0.02 resulting in a rejection of the null hypothesis. The in-person class scored significantly higher than the online delivery method class. A Mann-Whitney U Test of Independent Samples (0.042 double sided) was used to verify the p-score (0.01). Means of all scores were within 5 points, which made the result of the oral class presentation a significant find. The PowerPoint assignments were broken into three parts, the topic submission, the initial submission and the final submission with oral presentation. The final submission with oral presentation was the one assignment with statistical significance. Each method of instruction had identical instructional materials and identical Moodle pages with identical content including rubrics, announcements and instructor office hours to cover any questions or concerns regarding any component of all assignments and exams. Both methods also included mandatory attendance for the synchronous presentations for the online course and in-person presentations.

Table 1: Break down of Power Point Assignments Independent Samples Test

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means							
						Significance				95% Confidence Interval of the Difference	
		F	Sig.	t	df	One-Sided p	Two-Sided p	Mean Difference	Std. Error Difference	Lower	Upper
Assignment:Topic for Oral PowerPoint Presentation (Real)	Equal variances assumed	1.640	.210	.643	32	.262	.525	.292	.454	-.632	1.215
	Equal variances not assumed			.538	12.252	.300	.600	.292	.542	-.886	1.469
Assignment:PowerPoint (Real)	Equal variances assumed	3.108	.087	-.723	32	.238	.475	-1.842	2.548	-7.031	3.348
	Equal variances not assumed			-.534	10.436	.302	.604	-1.842	3.446	-9.476	5.793
Assignment:Final PowerPoint (Real)	Equal variances assumed	2.459	.127	-1.845	32	.037	.074	-4.183	2.267	-8.801	.434
	Equal variances not assumed			-2.452	31.602	.010	.020	-4.183	1.706	-7.660	-.706

This table (Table 1) includes each of the three assignments covered in the Power Point Presentation. The topic which was assigned the first week and due by the end of the second week of classes (this allowed for late add students to participate. The initial PowerPoint which allowed the instructor to give constructive feedback on what was missing or needed improvement before the final submission and oral presentation. Finally, the Final PowerPoint which included corrections and an oral presentation.

Table 2: Effect sizes for the Power Point Assignments Independent Samples Test

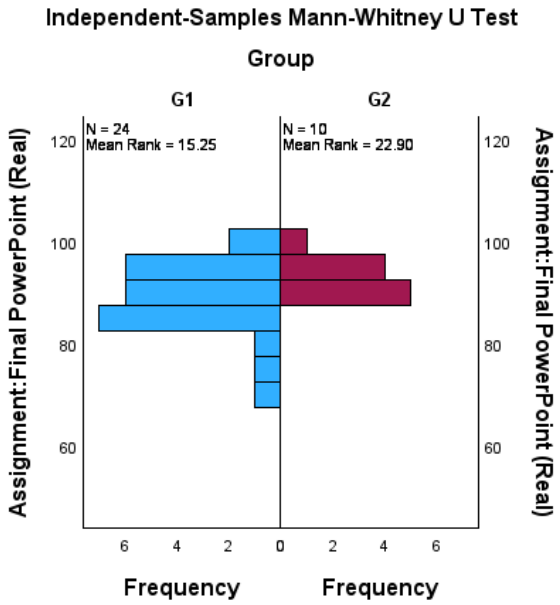
Independent Samples Effect Sizes

		Standardizer[a]	Point Estimate	95% Confidence Interval Lower	Upper
Assignment:Topic for Oral PowerPoint Presentation (Real)	Cohen's d	1.205	.242	-.500	.980
	Hedges' correction	1.234	.236	-.488	.957
	Glass's delta	1.581	.184	-.563	.922
Assignment:PowerPoint (Real)	Cohen's d	6.769	-.272	-1.011	.471
	Hedges' correction	6.933	-.266	-.987	.460
	Glass's delta	10.495	-.175	-.913	.571
Assignment:Final PowerPoint (Real)	Cohen's d	6.023	-.695	-1.446	.067
	Hedges' correction	6.169	-.678	-1.412	.066
	Glass's delta	3.107	-1.346	-2.284	-.366

a. The denominator used in estimating the effect sizes.
Cohen's d uses the pooled standard deviation.
Hedges' correction uses the pooled standard deviation, plus a correction factor.
Glass's delta uses the sample standard deviation of the control (i.e., the second) group.

The effect sizes for the PowerPoint topic were small 1.21, however the PowerPoint and Final PowerPoint was moderate, 6.77 and 6.02, which would substantiate the finding that we should reject the null hypothesis of both courses would have similar scores on all components.

Figure 1: Mann-Whitney U Test for Power Point Assignments



This graph (Figure 1) shows how each method scored, the online method in blue and the in-person in red. The in-person method's lowest score was 90 percent. The online method's lowest score was 70 percent.

The findings of this study have significant implications for international educational contexts, especially considering the increasing global shift towards online and blended learning models. The correlation between different delivery methods—online versus in-person—provides valuable insights into how diverse teaching approaches impact student performance, satisfaction, and engagement. These results are especially relevant to international education systems that are navigating the balance between maintaining traditional in-person experiences and adopting more flexible, technology-driven approaches. The study's conclusion that students perform similarly across most course components, except for oral presentations, challenges assumptions that online education inherently leads to lower learning outcomes. This is particularly pertinent for institutions worldwide that are considering the long-term integration of online learning into their curricula, especially in light of the COVID-19 pandemic, which accelerated the adoption of remote education.

From a policy and pedagogical perspective, these results suggest that institutions may need to reconsider how certain assessments, such as oral presentations, are conducted in online environments. The significant difference in oral presentation scores between in-person and online groups points to potential limitations of the online format in fostering the same level of engagement and skill development in public speaking. Policymakers and educators should explore ways to enhance online presentations, perhaps by incorporating more interactive elements or leveraging new technologies to create more immersive and supportive learning environments. Additionally, the findings stress the importance of ensuring that online courses are designed with the same level of rigor and student support as in-person courses, including the use of detailed rubrics, synchronous sessions, and comprehensive course materials. These pedagogical adjustments could be crucial for maintaining equity in learning outcomes across different delivery methods. Ultimately, the study's results underscore the need for a nuanced approach to online and in-person education, particularly when designing assessment strategies that accurately reflect student learning in both contexts.

DISCUSSION

There were some limitations in this study, the first was the unequal size of participants. The in-person section started with 25 students, however after realizing the rigor of the course, 15 students dropped. Determined to find out why there was such a high drop rate, the students all stated that they heard this was an easy course from their advisor because there were no prerequisites. After participating in the two exams prior to the official drop period, these 15 students decided that this course was much harder than they anticipated. The online course started with 45 participants and 10 of these students dropped the course due to the difficult nature of the course. Welch's t tests were used due to the unequal sample sizes to minimize concerns of having unequal sample sizes.

A second limitation was how this course is described in the course catalog, "Basic principles of human anatomy, physiology, and biomechanics and their relationship to athletic coaching". This description is deceiving because it doesn't describe what students will learn. This is in the process of being revised to "This course will cover basic principles of human anatomy, physiology, and biomechanics and their relationship to exercise, sport science, health professions and athletic coaching. This comprehensive course provides an in-depth exploration of physiological responses and adaptations to exercise, focusing on how various body systems interact to support physical activity. Students will learn mechanisms associated with acute responses and chronic adaptations of the cardiovascular, respiratory, and muscular systems, examining how these systems function both at rest and during exercise". This description is a much more thorough explanation of what will be covered and explains some of the topics that will be covered. This is covered in the first lecture of the course to inform students that this is a difficult 400 level course. Another limitation was that all students were underprepared for the time commitment this course requires. Due to no prerequisites, just a recommendation for one anatomy course, the first three weeks are anatomy-heavy to help with the anatomy concepts covered. The first three weeks require memorization of muscles, bones, and ligaments in the upper and lower limbs and kinesiology concepts of planes, movements, and types of joints. At this university there are no other courses offered that would prepare students for the materials that are covered. All students had access to the online software that the

textbook publisher offered, however very few students took advantage of this resource. This course requires most students to study at least 6-9 hours outside of class. Most students take this course as a pre-requisite for Physician Assistant, Physical Therapy, Athletic Training, and medical school because this specific course is recommended as the preferred pre-requisite for many Physical Therapy programs.

A final limitation could be that this was the first time this course had both sections taught by the same instructor. Previously the in-person course was taught by one instructor and the online course by another. The previous online section had no textbook required which frustrated many students (many transferred to my in-person section), while this format had the same components for both sections. The previous online section only had exams that determined their grade, no other assignments. Making this course mirror each delivery method was imperative to completing this study. Both sections of the delivery methods had ample opportunity to meet with the instructor, who met many times with students in both sections outside of office hours. The instructor also was available to meet via Zoom or Google Meet. The instructor made certain to respond to emails within 24 hours, unless on a Friday or weekend when replies would occur within 48 hours. All lectures were recorded and could be replayed by the students in both sections.

CONCLUSIONS

The delivery method did not affect most scores; however, the oral presentation scores were higher in the in-person class. This assessment was taken very seriously by the in-person class. The in-person students appeared to have practiced their presentations, some used note cards, but didn't look at them, all students dressed as if they were presenting at a conference or were going to an interview (dresses, suits, jackets, ties, etc.). The online students appeared to be unprepared and did not follow the feedback given in a previous assignment. The online students didn't fix their PowerPoint slides, which had been discussed in the lectures multiple times to make certain to do so or the grades would reflect the lack of improvement. Only five of the twenty-four students dressed in professional attire (suits, dresses, ties, etc.) during their online presentations, which this component was covered in lecture and in the rubric given to the students on the first day of class. The professor wore a red pant suit with white polo to demonstrate the proper attire for the presentations, or what would score the highest attire grade. All ten students dressed in professional attire for the in-person presentation. Both sections were given the exact same directions, and rubrics, receiving individual feedback in Moodle prior to the final presentation, and advice on how to dress. The opportunity for both sections to score similarly was present, however, the in-person section took this assignment more seriously than the online section. Many of the online students contacted the instructor post presentation due to scoring low on the visual, content, and attire components in the rubric. Most admitted that they didn't see there was a second page of the rubric, they didn't feel that they should have to dress professionally for an online presentation (t-shirts, hoodies, and casual wear should be appropriate), and students didn't think I would actually compare their initial Power Point submission to the final PowerPoint submission as they were told I would be doing so in the lectures leading up to this assessment. There was a disconnect in the online student delivery method students compared to the in-person students. The in-person students demonstrated diligence in adhering to the rubrics, using the feedback to improve the Power Points and practicing the delivery of the presentations, compared to the online students.

Figure 2: Course Total Mann Whitney U Test

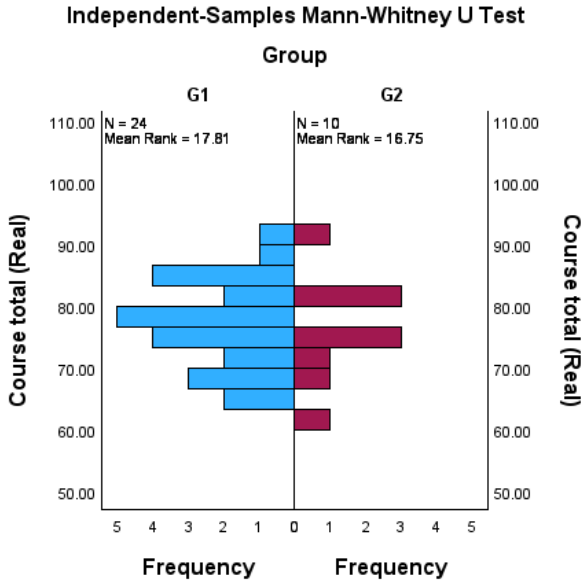


Figure 2 indicates the overall totals for each method of instruction, the online in blue and the in-person in red. The lowest score for the online method of instruction was 65.77 percent, and 61.57 percent for the in-person method. The highest score for in person method was 92.67 percent and for the online method 90.52 percent.

Figure 3: Student Satisfaction Survey Totals

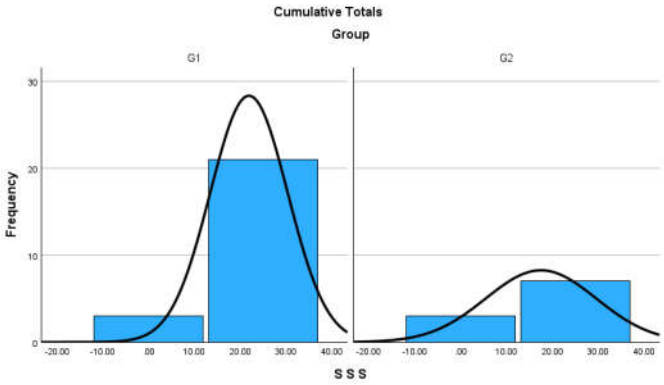


Figure 3 indicates that most students were satisfied with the delivery and instruction of this course, and all students completed the student satisfaction survey. This survey was conducted during week 8 of this 16-week course.

This study was performed because after an exhaustive research search, there were no studies incorporating an upper level Exercise Studies course that also implemented a student satisfaction survey during the course of study. All students could opt out of the study at any time, and no students did so. All students were given the same materials, instructions, and ample time to meet with the instructor if they chose to. This study was meant to show that there should be no difference between online and in-person courses, however, that was not the case. This is an ongoing study, as the IRB runs out in 2026.

Potential contributions to literature include and are not limited to having more components included in data collection (exams, student outcomes survey, optional course software time spent on quizzes, other assignments, PowerPoint, and oral presentation) which can better indicate which mode of instruction is better suited for the students enrolling in this course or any other course. 1. Evaluate which method of learning and instruction scores are higher in overall

course outcomes. 2. Analyze which assignments, exams or "optional assignments" correlate to higher scores in overall course outcomes. 3. Formulate a plan for what items should be included and excluded to aid students in scoring higher in overall course outcomes.

Future research should be conducted to determine if other types of courses with these delivery methods yield similar results. The courses should be taught by the same person, as this will ensure continuity for both methods of delivery. This study should be conducted in other countries as well to determine if there is a difference in learning between American students and European students. Long term studies should also be conducted to determine the impact of teaching mode on student learning outcomes.

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