A Comparison of Student Preferences for Presentation Format in an Undergraduate Human Anatomy and Physiology Course Before and After the Pandemic

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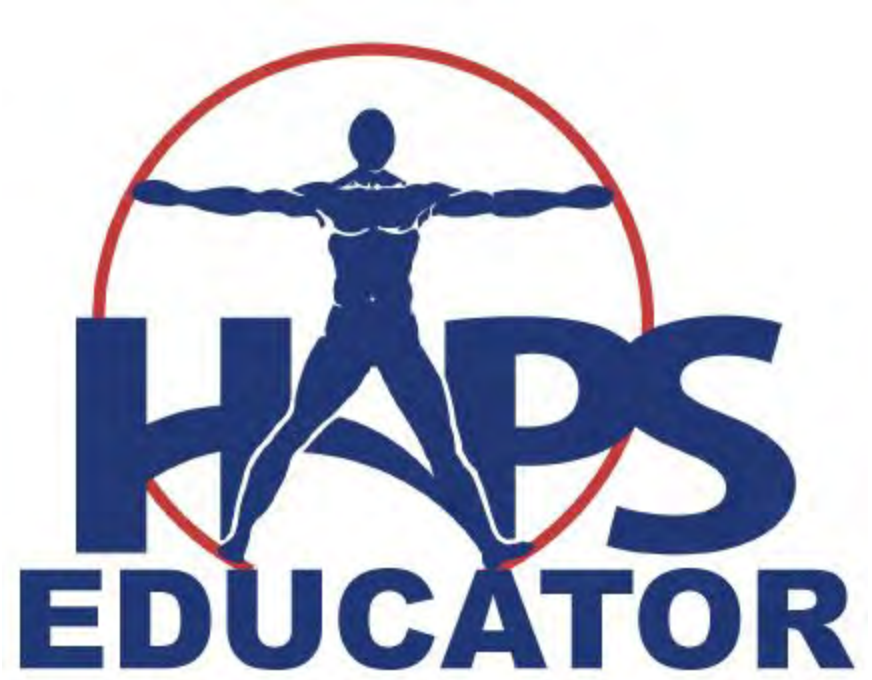

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A Comparison of Student Preferences for Presentation Format in an Undergraduate Human Anatomy and Physiology Course Before and After the Pandemic

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Abstract

Recently, we saw a forced transition in educational practice from traditional methods to online and virtual learning as higher education, along with nearly all aspects of society, was disrupted due to the COVID-19 pandemic. As many of us have returned to face-to-face instruction, questions remain regarding modes of instruction and what forms of presentation are preferred among students. This study was done to gain the students' perspective on the presentation of content in an undergraduate human anatomy and physiology course by surveying students both before and after the pandemic. Students were asked about their preferences regarding presentation of new material, conceptual and non-conceptual, and options to review content from the lecture or laboratory portions of the course. Our results indicate that, despite a trend toward virtual instruction and despite finding more students post-pandemic seemingly more comfortable with independent study, traditional educational methods such as face-to-face PowerPoint presentations and additional time in the laboratory are still valued by students. https://doi.org/10.21692/haps.2022.020

Key words: anatomy, physiology, education, preferences, format, pandemic

Introduction

The COVID-19 pandemic disrupted nearly all aspects of society including higher education. In response to the pandemic, there was a transition in educational practice from traditional forms of teaching such as didactic lectures and hands-on laboratory instruction to online and virtual learning. Students and instructors alike were thrust into utilizing various technologies to help ensure instructional goals were met during this time. Much of the emerging research on the effects of the pandemic has focused on mode of delivery – online, hybrid and face-to-face – and correlations with student performance (Cowan et al. 2022; Ediger 2022; Wilhelm et al. 2020).

The same issue of identifying the appropriate presentation format that not only benefits student success but is also delivered in a way students prefer, applies to combined courses such as anatomy and physiology. Although anatomy laboratories have typically been taught face-to-face, when possible, to allow visualization of anatomic structures and their relationship to each other in three-dimensions utilizing models or dissection, the instructional delivery of material as it relates to physiology occurs in a variety of ways. As with other disciplines, lecture-based instruction with some form of multimedia presentation is most commonly used to deliver the content.

Prior to the pandemic, college instructors were increasingly providing students with online notes and this trend has become more prevalent since the pandemic, although research is considered equivocal on how such notes affect student outcomes and which form of notes are most beneficial (Vijay 2021). Several studies conducted prior to the pandemic examined providing students with no notes versus full notes or partial notes versus full notes in their classes (Barnett 2003; Cornelius and Owen-DeSchryver 2008; Raver and Maydosz 2010). These studies found that students who received partial notes performed better on exams, including on conceptual questions during the cumulative final examination, than students who received full notes or no notes at all.

At our institution, anatomy and physiology students are given partial notes for the lecture content before class and are provided the chance to complete notes during in-class PowerPoint presentations that are explained verbally by the instructor. Although no internal studies have been done to directly measure student success using this method, we have found that student attendance is better when we do not provide students with fully completed notes and this is consistent with the findings of Cornelius and Owen-DeSchryver (2008). One interesting aspect of the format

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options that has not been explored in any depth is student preference. Furthermore, it is possible that students have changed their perspective on format options since the pandemic when they were forced to complete a significant portion of their education in online or hybrid formats.

The purpose of this research study was to address the following questions in the context of survey data from students in a variety of different majors and academic plans who were enrolled in the first semester of a two-semester, systems-based combined anatomy and physiology course sequence, both prior to the COVID-19 pandemic and after.

Which form of presentation or discussion do students prefer when first introduced to new material that is conceptually difficult and does that differ for material that is not conceptually difficult?

Do students prefer whole group discussion, small group discussions or to work alone after having been presented material in class?

Do students prefer to have more hands-on time in the laboratory or do they prefer to spend time studying photographs of slides, specimens and anatomic models on their own?

Methods

Study Context and Participants

This project was conducted at Frostburg State University (FSU), a comprehensive, regional, public, liberal arts university in Western Maryland. FSU is part of the University System of Maryland (USM) and is the only four-year public institution in the state west of the Baltimore-Washington metropolitan area. It serves as the educational center for Western Maryland and surrounding counties in Pennsylvania and West Virginia and typically enrolls 4,700 to 5,000 undergraduate and graduate students each year.

In this study, students enrolled in human anatomy and physiology I (A&P I; the first of a two-semester, systems-based human anatomy and physiology course sequence) were surveyed at the beginning of the semester and just before completing the course in fall 2016 and fall 2017. All data from 2016 and 2017 were combined and analyzed as pre-pandemic results. Another survey with the same questions was given to students enrolled in the same A&P I course during the fall 2021 semester, after the pandemic when the university had returned to fully in-person instruction.

At FSU, students in several different majors and academic pathways take the A&P I course. The majors include biology, chemistry, health science (pre-medical, pre-dental, pre-physician assistant, pre-physical therapy), and exercise and sport science. Students with other academic plans include transfer students (pre-nursing, pre-dental hygiene, pre-occupational therapy), and other majors, such as psychology, or undecided students, who take the course for a variety of personal and academic reasons. There was a total of 306 students enrolled in A&P I at the beginning of the fall 2016 and 2017 semesters and 282 students completed the course with 24 student withdrawals. There was a total of 151 students enrolled in A&P I at the beginning of the fall 2021 semester and 127 students completed the course with 24 student withdrawals. The study was approved by the FSU Institutional Review Board prior to the surveys in 2016/2017 and again in 2021 (FSU Project #H2016-001 and #H2022-002, respectively) and informed consent was obtained from all participants. Student participation was voluntary and anonymous and had no influence on course grades.

Description of Survey Questions

All students in A&P I were asked to complete two in-person paper surveys (see Appendix). There was no time limit for either survey. The initial survey was done at the beginning of the semester during the second week of class, and the final survey was done near the end of the semester during the second-to-last week of class before final exams began and grades were finalized. Note that the final survey was completed after the course withdrawal deadline (week 10), meaning that students who withdrew from A&P I in 2016 and 2017 (n=24) and 2021 (n=24) were not represented. In 2016 and 2017, a total of 294 students completed the initial survey (96.1%) and a total of 248 students completed the final survey (87.9%). In 2021, a total of 123 students completed the initial survey (81.5%) and a total of 79 students completed the final survey (62.2%).

Students were asked which form of presentation or discussion they preferred when first introduced to new material that is not conceptually difficult. They could select lecture presentation, with or without PowerPoint or other multimedia presentations, whole group discussions, small group discussions, or they could choose to work on their own. A similar question with the same optional responses was asked with reference to material that is conceptually difficult. Students were also asked whether they preferred whole group discussion, small group discussion, or working alone after they have been afforded time to work with material presented to them or assigned to them in class.

Finally, students were asked if they would prefer to have more time to work with microscope slides, specimens and anatomical models in the laboratory or if they would prefer to spend time studying photographs of slides, specimens and models on their own. In the final survey, students were asked the same questions and were given the option to note that they had changed their opinion from the initial survey. Given that students may not have accurately recalled their answer to this question from the initial survey, responses to this question are not reported.

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Data Analysis

Data from 2016 and 2017 were combined for statistical analyses for pre-pandemic results and data from 2021 were used for statistical analyses for post-pandemic results. Graphic results comparing initial and final survey data are reported as percentages to account for the reduced number of students completing the final survey each year and for the different number of student's completing the surveys before and after the pandemic. Chi-square tests for independence were used to compare initial and final survey responses and to compare survey responses between the years before and after the pandemic. Significance was set at $p \leq 0.05$.

Results

On the question of what presentation format was preferred by students when first introduced to new material, students most frequently selected the *Lecture with PowerPoint* format whether the material was conceptually difficult or not (Figure 1). This is true for those completing the survey both prior to and after the COVID-19 pandemic.

On the surveys conducted before the pandemic, 77.9% of students on initial survey and 77.7% on final survey indicated a preference for *Lecture with PowerPoint* when presented with new, non-conceptual material. There was no significant change between initial and final surveys ($p = 0.98$) among those choosing *Lecture with PowerPoint* for non-conceptually difficult material. Among students completing the survey post-pandemic, similar numbers of students preferred the *Lecture with PowerPoint* format (73.5% on initial survey and 71.5% on final) for non-conceptual material. Again, there was no significant change between the initial and final surveys ($p = 0.78$).

Regarding new, conceptually difficult material, 51.4% of students on initial survey and 63.8% on final survey indicated a preference for *Lecture with PowerPoint* pre-pandemic (Figure 2). There was no significant change between the surveys ($p=0.56$) in the numbers of students choosing this option. A higher number of students selected the *Lecture with no PowerPoint* format when presented with conceptually difficult material than did so for non-conceptual material preferring class discussions instead. Among students completing the survey post-pandemic, 60.6% preferred the *Lecture with PowerPoint* on initial survey while 58.0% of respondents did so on final survey with a greater number choosing small group discussions. Again, there was no significant change between the surveys ($p = 0.68$). In addition, there were no statistical differences between the pre-pandemic and post-pandemic surveys regarding student preference for the format of new material whether non-conceptual ($p = 0.74$) or conceptual ($p = 0.26$).

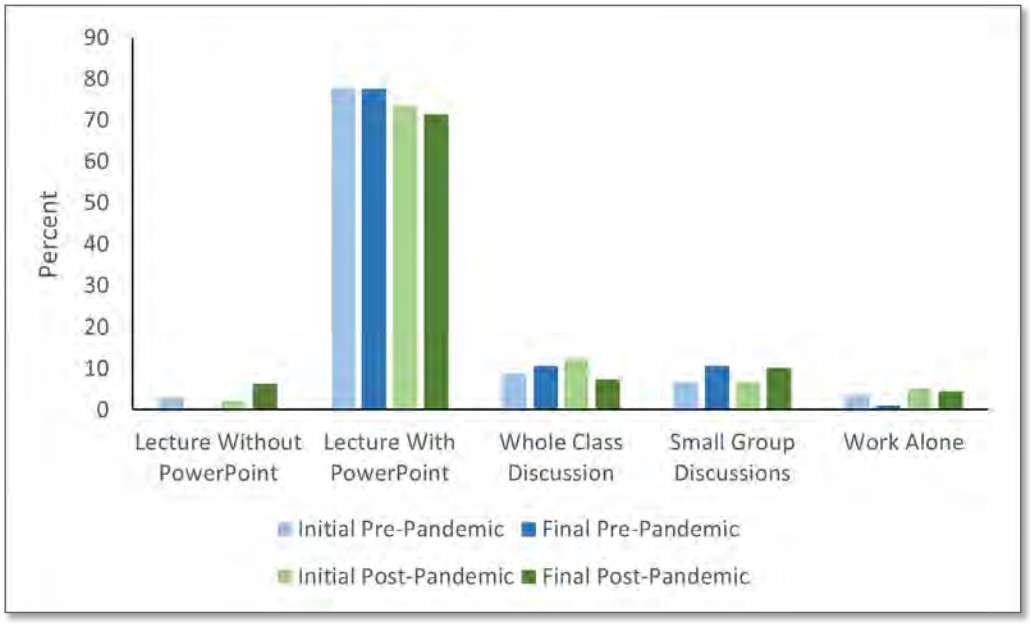

Figure 1. *Student preferences (pre- and post-pandemic) on form of presentation or discussion of new material that is not conceptually difficult expressed as percent of students completing initial and final surveys.*

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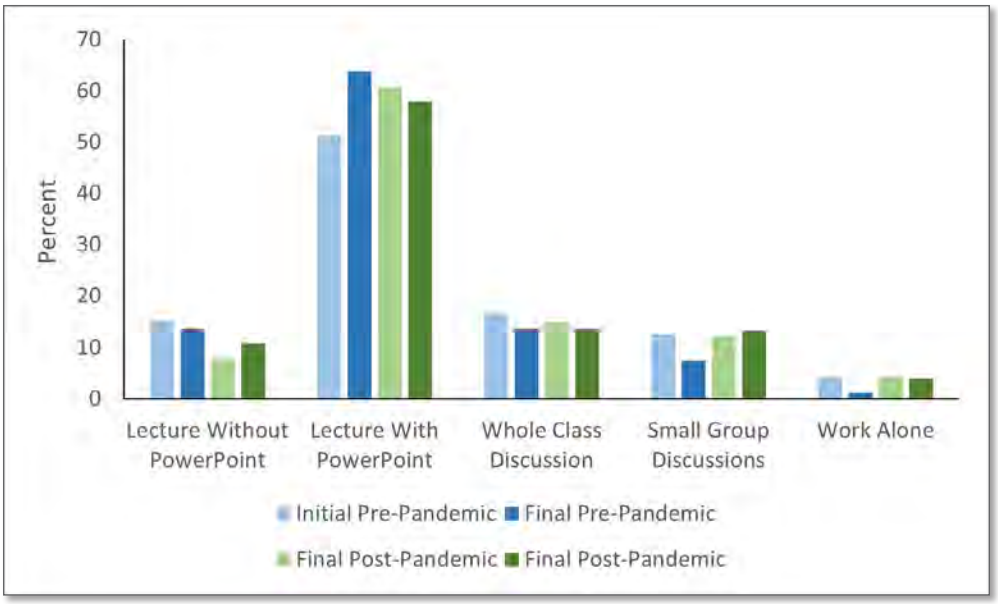

Figure 2. *Student preferences (pre- and post-pandemic) on form of presentation or discussion of new material that is conceptually difficult expressed as percent of students completing initial and final surveys.*

When surveyed on their preference for whole group discussion, small group discussion or if they preferred to work alone after having time to work on assigned material (Figure 3), students surveyed pre-pandemic preferred small group discussion (43.9% on initial survey and 44.8% on final). There were no significant changes from initial to final surveys ($p = 0.77$). The number of those who preferred whole group discussion declined from 38.6% on initial survey to 32.3% on final survey prior to the pandemic although the change was not significant ($p = 0.36$).

In contrast, those surveyed post-pandemic preferred whole group discussion for the review of material (45.2% on initial survey and 46.7% on final). There were no significant changes from the initial to final surveys ($p = 0.62$) among those who preferred whole group discussion. Fewer students (35.7% on initial survey and 28.0% on final survey) noted a preference for small group discussion. This is also a non-significant change between initial and final surveys ($p = 0.27$) among those with a preference for small group discussion post-pandemic. However, there were significant changes from the pre-pandemic to post-pandemic choices with students in the post-pandemic group preferring whole group discussion ($p = 0.02$).

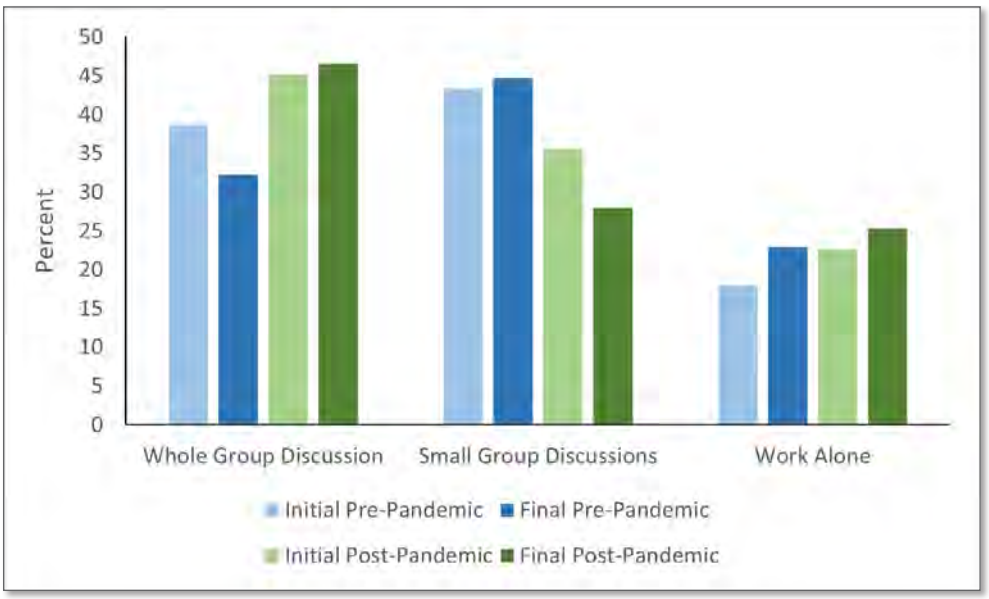

Figure 3. *Student preferences (pre- and post-pandemic) on time spent reviewing material they had been assigned expressed as percent of students completing initial and final surveys.*

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When asked if they preferred more time in the laboratory or would prefer to study alone (Figure 4), most students completing the surveys pre-pandemic preferred time in lab (66.4% on initial survey and 64.6% on final survey). Fewer students (33.6% on initial survey and 35.4% on final survey) indicated a preference for less time in the laboratory in exchange for more time to work alone. There were no significant changes from initial to final survey on the choice to work alone ($p = 0.65$) or among those choosing time in lab ($p = 0.81$) indicating students remained loyal to their preferences throughout the semester prior to the pandemic.

The percentage of students who completed the survey post-pandemic indicating that they wished to study on their own increased considerably from 26.5% at the beginning of the semester to 36.5% on the final survey ($p = 0.01$). Again, overwhelmingly, students prefer time in the laboratory and hands-on study (73.5% on initial survey; 63.5% on final survey). There were no significant changes from initial to final survey among those with a preference for lab time in the post-pandemic group ($p = 0.44$).

Discussion

In the present study, students enrolled in a combined anatomy and physiology course, both prior to the COVID-19 pandemic and after, overwhelmingly preferred traditional lecture with PowerPoint presentation where they were provided notes in outline format. This was true whether the covered material was considered non-conceptual or conceptually difficult. This mode of presentation was preferred over lecture without provided notes and over whole-group or small-group discussions and over studying alone. This is consistent with a study published in 2021 by Vijay where a majority of undergraduate medical students had a preference for traditional modes of teaching, agreeing that it provided better understanding of concepts. Studies such as those conducted by Barnett (2003), Cornelius and Owen-DeSchryver (2008) and Raver and Maydosz (2010), found students performed better on exams when given partial notes compared to either full notes or no notes being provided. Furthermore, students receiving full notes also self-reported more negative effects on attendance (Cornelius and Owen-DeSchryver 2008). Perhaps students in this present study felt better prepared for or performed better on assessments by attending traditional lectures where partial notes were provided.

Noteworthy, too, is that when presented with new material considered conceptually difficult, a group discussion was a popular choice. The vast majority, however, preferred traditional lecture (with PowerPoint presentation). Small-group discussion was popular among students completing the survey pre-pandemic; meanwhile, whole-group discussion was preferred among students post-pandemic.

During the pandemic, our students, like most, were largely forced to continue their education online. Some disadvantages of online curricula may include lower levels of engagement with instructors, fellow students and the course material itself (Cowan et al. 2022; Pollock 2002; Wester 2021; Wilhelm et al. 2020). Multiple cohorts of medical students gave lower scores for the overall learning experience when surveyed about their online versus in-person versus education (Cowan et al. 2022). We can speculate that perhaps it is students' lack of feeling engaged that was identified by the authors cited above that could account for the higher percentage of post-pandemic

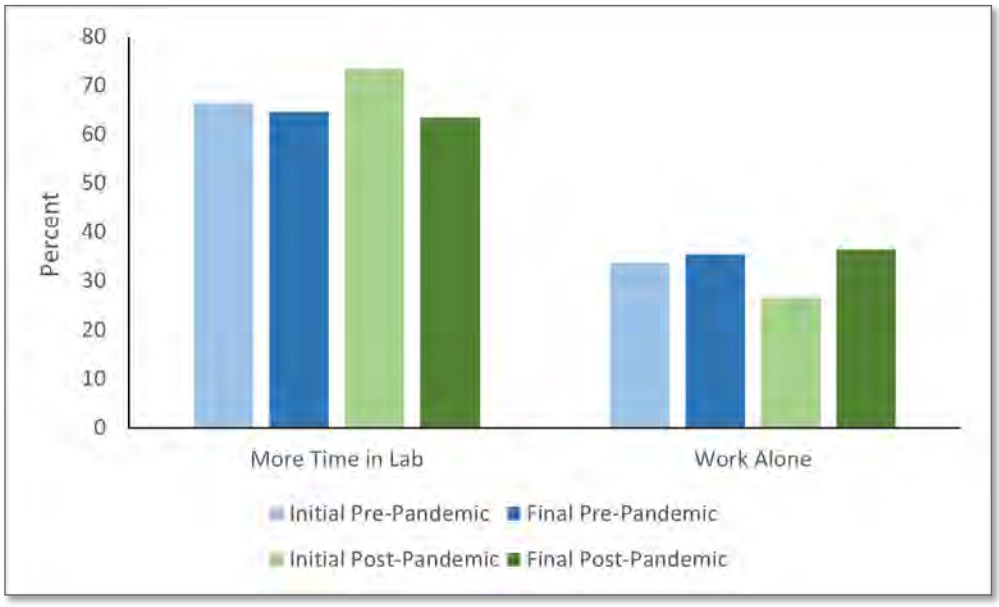

Figure 4. *Student preferences (pre- and post-pandemic) on more time in lab versus studying alone expressed as percent of students completing initial and final surveys.*

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students opting for small-group discussion on final survey in the present study. It could also account for a greater percentage of students in the post-pandemic cohort with a preference for whole-group discussion when asked if they prefer small-group or whole-group discussions or if they prefer to work alone *after* being presented with or assigned material in class.

On the question of whether students preferred more time in the laboratory or would prefer to study alone, the majority of students completing the survey pre-pandemic preferred lab time as did the post-pandemic cohort. Willingness to exchange time in lab for more time to study outside of class was popular with the post-pandemic cohort compared to those surveyed pre-pandemic.

Upon comparing student performance in anatomy and physiology between face-to-face, hybrid, and online A&P lab styles, Pollock published in 2022 that hybrid lab students reported better experiences and greater satisfaction, attended more labs, and outperformed online lab students. Face-to-face lab students, however, outperformed hybrid lab students. Yet another study conducted during the transition to emergency remote teaching found the prevalent challenges reported by anatomy students included those related to the loss of access to lab, including difficulty identifying and visualizing structures in three dimensions and the loss of context and sensorial cues (Wilhelm et al. 2020). In their survey of medical students' perceptions on gross anatomy education in 2020, Liang and colleagues reported that among the various methods for laboratory instruction experienced, the only significant preference was that "no lab" was the least preferred by the overall class. Among 168 microbiology students surveyed by Joji et al (2022), 50.6% preferred face-to-face lab sessions compared to 30.4% who preferred online labs. Meanwhile, among the faculty, 85.7% preferred the face-to-face mode of teaching. On comparing students' perceptions of face-to-face and online anatomy teaching, Potu et al (2022) found students to be in favor of face-to-face demonstrations for better understanding of the spatial orientation and the visualization of the anatomical relations between structures, understanding the difficult anatomical structures, understanding the clinical correlations, and making them more confident about their practical exams. However, students were in favor of online demonstrations for retaining key information, confidence levels on discussing anatomy learning needs, effective utilization of demonstration time, and lower stress associated with online learning. The majority of the students who participated in the survey preferred a mixture of both face-to-face and online anatomy demonstrations.

These studies explain our students' preferences in this study for face-to-face laboratory instruction and may explain the greater desire of students in the post-pandemic cohort to exchange a portion of that lab time for study on their own. Online instruction during the pandemic likely revealed the importance of hands-on lab instruction and also, likely, resulted in students' comfort with independent study and perhaps the use of technology to aid in their study. Anecdotally, we have observed students in the A&P lab utilizing smart phones and tablets to take pictures of specimens, models and histological slides to create images for labeling or using various virtual anatomy apps to supplement their review of the material.

Conclusions

This study reveals that the anatomy and physiology students surveyed before and after the pandemic preferred traditional modes of teaching, such as lecture where they are provided with notes in an outline format, over group discussions or working alone when being presented with new material, whether that material was conceptually difficult or not. Students also overwhelmingly preferred face-to-face time in anatomy lab instruction. However, there was a greater increase in the percentage of students after the pandemic who, by the end of the course, preferred to exchange some lab time for study on their own as compared to pre-pandemic numbers. This is likely due to developing a greater comfort in working independently during the pandemic. Increasing use of technology may also account for students' preferences for giving up some lab time for study on their own. Since the pandemic there was also an increase in the percentage of students who prefer whole-group, in-class discussion to review material that was previously covered in class. Feelings of disengagement during remote instruction during the pandemic may account for this desire to study as a group.

Despite trends towards virtual instruction, traditional means of instruction remain popular and are indispensable, especially in a course such as anatomy and physiology where hard-to-understand physiology concepts are presented and where face-to-face, hands-on instruction is necessary to allow visualization of anatomic structures and their relationship to each other in three-dimensions. These kinesthetic activities have been shown to be important to many students in supporting their ability to learn (Keller and Hughes 2021; Pollock 2022). Other modes of instruction or presentation formats may have their advantages but care must be taken to limit their disadvantages such as lack of student engagement and motivation (Britson 2022; Cowan et al. 2022). We must remain cognizant of our students' preferences in order to help keep them engaged in the extensive content of human anatomy and physiology courses.

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About the Authors

Dr. Frank Hughes is an associate professor in the Department of Biology at Frostburg State University in Maryland where he has taught human anatomy and physiology since 2015. He has also presented workshops in diagnostic imaging for the institution's nurse practitioner program as well as for other healthcare provider organizations. As a chiropractic physician, Dr. Hughes operated a successful integrative healthcare facility prior to his career in academia. Dr. Karen Keller is a professor in the Department of Biology at Frostburg State University in Maryland. She teaches undergraduate human anatomy and physiology and a combination of undergraduate and graduate level comparative anatomy, histology, and parasitology courses. She also advises students interested in pursuing careers in various health professions.

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Appendix 1: Initial and Final Surveys Given to Students in Fall of 2016, 2017 and 2021

Human Anatomy and Physiology Research Study Initial Questionnaire

We are interested in learning your initial perceptions about the presentation format of the material covered in the human anatomy and physiology course. With this in mind, we are asking you to complete the following questionnaire. Your participation is voluntary and will have no influence on class grades as all responses will be anonymous and class information will be kept confidential. If you choose to participate, please answer all of the following questions honestly. Do not put your name anywhere on this survey. *If you have any questions about this questionnaire, please ask your instructor.*

Instructions for Questions: Put an "X" by the correct option for each question. Please answer the questions as honestly as you can and choose the most appropriate answer to each question. Do not spend a long time on each question as your first reaction is probably your best answer.

1. Which form of presentation or discussion do you prefer when you are first introduced to new material that is somewhat easy to understand (not conceptually difficult)?

   ___Lecture presentation (without PowerPoint or other multimedia presentations)

   ___Lecture presentation (with PowerPoint or other multimedia presentations)

   ___Whole group (entire class) discussion

   ___Small group discussions

   ___None of these choices; I prefer to work on my own by reading assigned material

2. Which form of presentation or discussion do you prefer when you are first introduced to new material that is conceptually difficult?

   ___Lecture format (without PowerPoint or other multimedia presentations)

   ___Lecture format (with PowerPoint or other multimedia presentations)

   ___Whole group (entire class) discussion

   ___Small group discussions

   ___None of these choices; I prefer to work on my own by reading assigned material

3. After you have had time to work with material that was presented to you or assigned to you in class, which form of classroom engagement do you think is most helpful?

   ___Whole group (entire class) discussion

   ___Small group discussions

   ___None of these choices; I prefer to work on my own

4. Would you prefer to have more time to work with microscope slides, specimens and models in the laboratory or would you prefer to spend time studying photos of the slides, specimens and models on your own?

   ___Additional time studying slides, specimens and models in the laboratory is more beneficial

   ___Studying photos on my own time is more beneficial

Thank you for your participation! Drs. Keller and Hughes

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Human Anatomy and Physiology Research Study Final Questionnaire

Now that you have almost completed the Human Anatomy and Physiology class, we are interested in learning whether your initial perceptions regarding the presentation format of the material covered in the Human Anatomy and Physiology course have changed. We are asking you to complete a final questionnaire. As before, your participation is voluntary and will have no influence on class grades as all responses will be anonymous and class information will be kept confidential. If you choose to participate, please answer all of the following questions honestly. Do not put your name anywhere on this survey. *If you have any questions about this questionnaire, please ask your instructor.*

Instructions for Questions: Put an "X" by the correct option for each question. Please answer the questions as honestly as you can and choose the most appropriate answer to each question. Do not spend a long time on each question as your first reaction is probably your best answer.

1. Which form of presentation or discussion do you prefer when you are *first introduced* to new material that is somewhat easy to understand (not conceptually difficult)? (*If you have changed your opinion on this question, put an "X" on the first line **in addition** to your current choice*.)

   ____*I have changed my opinion on this question*

   ____Lecture presentation (without PowerPoint or other multimedia presentations)

   ____Lecture presentation (with PowerPoint or other multimedia presentations)

   ____Whole group (entire class) discussion

   ____Small group discussions

   ____None of these choices—I prefer to work on my own by reading assigned material

2. Which form of presentation or discussion do you prefer when you are *first introduced* to new material that is conceptually difficult? (*If you have changed your opinion on this question, put an "X" on the first line **in addition** to your current choice*.)

   ____*I have changed my opinion on this question*

   ____Lecture format (without PowerPoint or other multimedia presentations)

   ____Lecture format (with PowerPoint or other multimedia presentations)

   ____Whole group (entire class) discussion

   ____Small group discussions

   ____None of these choices—I prefer to work on my own by reading assigned material

3. After you have had time to work with material that was presented to you or assigned to you in class, which form of classroom engagement do you think is most helpful? (*If you have changed your opinion on this question, put an "X" on the first line **in addition** to your current choice*.)

   ____*I have changed my opinion on this question*

   ____Whole group (entire class) discussion

   ____Small group discussions

   ____None of these choices—I prefer to work on my own

4. Do you think you benefitted more from working with microscope slides, specimens and models in the laboratory or spending time studying photos of the slides, specimens and models on your own? *(If you changed your opinion on this question, put an "X" on the first line **in addition** to your current choice.)*

   ____*I have changed my opinion on this question*

   ____Additional time studying slides, specimens and models in the laboratory is more beneficial

   ____Studying photos on my own time is more beneficial

Thank you for your participation! Drs. Keller and Hughes

Back to TOC