FEATURE ARTICLE

The Impact of the COVID-19 Global Pandemic on Undergraduate Nursing Students' Study of Anatomy and Physiology

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The COVID-19 global pandemic caused major disruptions to the delivery of human Anatomy and Physiology courses to nursing students worldwide. The aim of the current study is to evaluate nursing students' experiences and perceptions of transitioning from a blended to a purely online study mode for first year Anatomy and Physiology courses during the global pandemic. Qualitative and quantitative methodologies were used with a sample of undergraduate nursing students enrolled at a regional Australian university across its three campuses. Descriptive statistical analysis was used to describe the study population. Content analysis was used to evaluate the participants' use of resources, experiences, and preferences in studying anatomy and physiology. There were 101 participants recruited in the study. Results indicated that face-to-face study mode (41.86%) was the preferred method of delivery during the global pandemic and participants were having a renewed appreciation for the blended study mode (38.37%). Online study mode was the least preferred (19.77%), with the participants' opinions of this mode of study not altered by the global pandemic. Although the COVID-19 global pandemic shifted the traditional teaching of anatomy and physiology in nursing programs to an online environment, the long-term impacts of this disruption have yet to be ascertained.

KEY WORDS: Anatomy and Physiology, Blended, COVID-19, Global pandemic, Nursing, Online, Undergraduate

There is no doubt that human Anatomy and Physiology (A&P) is one of the most fundamental pieces of knowledge required by all health professionals. In nursing programs, A&P is established as an essential component of foundational knowledge, and the ability to transfer this knowledge is of the utmost importance in establishing clinical credibility within the discipline.[1] However, A&P has always been one of the most difficult subjects for first year Bachelor of Nursing (BN) students.[2–5] The challenge has always been to improve engagement and understanding of complex physiological mechanisms, especially to students with little or no science background.[5–7]

The global pandemic faced in 2020 had an unexpected and major impact on higher education for both students and academics alike. Pather et al[8] investigated the effect of the COVID-19 global pandemic on the academic experiences of A&P education in both Australian and New Zealand universities. Their data suggest that the global pandemic affected the ability to offer hands-on experiences, impacted academic workloads, and questioned traditional teaching methods and roles.[8] Government physical distancing regulations meant that A&P laboratories could no longer be delivered in the traditional face-to-face or blended study mode, forcing academics to rethink traditional delivery methods of A&P (reviewed by Iwanaga et al[9]).

Students have very different styles of learning; this could incorporate the way in which an individual learns or perhaps the mode of learning and the way an individual thinks, processes information, and demonstrates their learning.[9–11] The advantage of choosing a blended learning environment is that it incorporates both online and active learning or a face-to-face component to reinforce and compliment the online content. The importance of active learning sessions in engaging students particularly in the learning process is highlighted in the literature, which demonstrates that introducing activities into the traditional lecture promoted student engagement, improvement in recall of information, and remembering more of the content.[11–13] When students actively engage with the content, the learning is more effective as it encourages higher order thinking.[11,12,14–16] Therefore, this mode of blended delivery, combining online content with active learning sessions, is not in dispute as students prefer kinesthetic learning modes.[11,12] However, in 2020, institutes were left with no options and all learning and teaching was conducted online.

The way in which education transitioned from face-to-face or blended modes of delivery to purely online delivery of content during this period occurred rather rapidly at some institutes. This led to several challenges, particularly for courses

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that traditionally had a laboratory-based component.[17] Online learning provides a number of advantages, such as fitting in with the responsibilities of work and family, allowing students to work at their own pace, and study when and wherever they wish (as reviewed recently[6]). However, there is a risk that students, particularly those enrolled in the bioscience courses, and perhaps do not have a strong scientific knowledge base, may find this delivery mode difficult and withdraw if the necessary support systems and resources are not in place to guide them.

This study aimed to assess the student experiences and perceptions of transitioning from a blended online to a fully online delivery mode of first year A&P courses in the BN program during the COVID-19 pandemic. The findings of this study will enhance the online learning experiences of students and provide valuable insight into their learning preferences in A&P courses.

METHODS

Study Design

This research focused on undergraduate BN students who were enrolled in A&P courses in 2020 at Federation University Australia. The study design incorporated mixed methods research in which both quantitative and qualitative data were collected and analyzed. Data were collected by way of a survey designed in Qualtrics™ with questions using a 5-point Likert scale incorporating strongly agree (5) to strongly disagree (1) or, in other questions, most useful (5) to least useful (1). The survey also incorporated a series of yes, no, N/A, or open-response questions. The survey design was based on a previously published study[18] and involved collection of a mix of both quantitative and qualitative data. The 20-minute survey was open for a period of 7 weeks with two reminder emails sent to students inviting them to participate in the survey.

Sample Population and Recruitment

Participants for this study were recruited from among 778 undergraduate BN students across three regional campuses in the state of Victoria, Australia. Undergraduate students enrolled in A&P in any delivery mode of delivery across two consecutive semesters comprised the participants for this study. Traditionally, standard students attend campus every week for active learning sessions, whereas flexible students predominately work online and attend the campus for intensive on-campus laboratories once in each semester. However, the entire student cohort resorted to solely online study in 2020 due to the COVID-19 global pandemic. An email invitation was sent to students inviting them to participate in this research project. The email included a flyer with the link to the plain language information statement and online Qualtrics survey. Implied consent was assumed when the participant clicked on the link and answered the survey questions. Participation in the project was voluntary, and participants were made aware that there would be no impact on their academic grades or opportunities for future employment.

Ethical Implications

A low minimum risk ethics application was submitted and approved by the University Human Ethics Committee (Project A20-120). No negative impact was anticipated by participating in this evaluation study. Counseling services were recommended to participants if required. The research team was not involved in the recruitment process.

Data Analysis

Data were analyzed using IBM SPSS Statistics version 26 (IBM Inc, Armonk, NY, USA). Descriptive statistical analysis was used to describe the study population and background demographics, expressed in percentages and frequencies with a mean, median, and mode. Content analysis was conducted to evaluate any changes in the participants' use of resources, experiences, and preferences in studying A&P, as reviewed by Vaismoradi and Snelgrove[19] and Erlingsson and Brysiewicz.[20] Content analysis involved categorizing the number of times participants stated certain themes/topics that were identified by both authors, thereby allowing quantitative reporting on the frequency of occurrence of themes/topics.

RESULTS

Demographics

Of 778 students enrolled in the courses, 13% (n = 101) completed the survey. Most of the participants consisted of an age range between 18 and 23 years, 36.63% (n = 24), followed by an age range of 36–40 years, 17.82% (n = 18); an age range from 24 to 29 years, 11.88% (n = 12); then an age range of 41–45 years, 3.96% (n = 4); an age range of 46–50 years, 2.97% (n = 3); an age range > 60 years, 1.98% (n = 2); and an age range of 51–55 years, 0.99% (n = 1). There were no participants that selected the age range of 56–60 years. The participants were comprised of 89.11% (n = 90) female and 10.89% (n = 11) male. There were 82.18% (n = 83) of participants who study full-time, and those who study part-time constituted only 17.82% (n = 18) of the total data set. Participants who were enrolled as standard (on-campus) students were 72.28% (n = 73), and 27.72% (n = 28) were enrolled as flexible students. Participants were also predominantly made up of domestic students (74.26%, n = 75), with the remainder being international students (25.74%, n = 26).

Changes in Work-Life Due to the Global Pandemic

Participants were asked to report their current employment status. The majority of students reported that their current employment status was part-time (40.23%, n = 35). This was followed by being not employed at all (22.99%, n = 20),

being employed full-time (19.54%, n = 17), having casual employment (16.09%, n = 14), or being self-employed (1.15%, n = 1). Throughout the pandemic, 51.72% (n = 45) of participants reported their employment status had changed, whereas 48.28% (n = 42) reported that this did not change. Participants also reported if this change had a significant impact on their ability study. Here, 57.65% (n = 49) of participants reported that this had no impact, whereas 42.35% (n = 36) reported this had an impact on their study ability. In addition, 48.24% (n = 41) of participants reported that they had added parenting or caregiving responsibilities during the global pandemic, whereas 51.76% (n = 44) did not.

Changes in the Resources Used in the Study of Anatomy and Physiology

Participants were asked to rate, in order from most (5) to least (1) useful, the resources they used in the study of A&P. The top three were practice quizzes (mean, 4.42), checkpoint questions (mean, 4.34), and watching videos (mean, 4.22) (Table 1 shows the resource items and their mean response from least useful [1] to most useful [5]). The lowest ranked resources included using the online forums (mean, 3.58), the virtual classes (mean, 3.60), and reading the textbook (mean, 3.60).

Participants were asked if their use of the resources has changed due to the COVID-19 global pandemic and the shift to online-only learning for A&P. A total of 55.55% (n = 55) of participants reported that yes, their use of resources had changed. A total of 44.44% (n = 44) of participants reported that no, their use of resources did not change due to the COVID-19 global pandemic and the shift to online-only learning for A&P. Participants were also asked if they had used any additional external resources other than what teaching staff made available to them via their online learning management system. A total of 66.29% (n = 59) stated that yes, they did use external resources, whereas a total of 33.71% (n = 30) stated they did not. Participants were also asked if they participated in any of the scheduled online virtual classes. A total of 82.22% (n = 74) of participants stated that they did attend these, whereas a total of 17.78% (n = 16) of participants did not. Participants were then asked if they did attend a virtual class if they found them easy to participate in. A total of 71.59% (n = 63) reported that they found these easy to participate, whereas a total of 28.41% (n = 25) stated they did not (Table 2 shows the analysis of the students' learning experiences in A&P due to the global pandemic). When comparing the participant responses with the statements to their study load (full or part time) or mode (on campus or flexible), there was no significant difference between responses (Table 2).

Table 1. Analysis of Resources Utilized in the Study of A&P

Resources	Frequency	Mean[a]	SD	Variance
Reading the textbook	96	3.60	1.43	2.03
Making detailed notes	99	4.00	1.19	1.41
Working through online lessons	97	4.02	1.19	1.42
Learning objectives	99	4.08	1.19	1.41
Course descriptor	98	4.02	1.26	1.59
Introduction to the online platform	95	3.67	1.50	2.26
Contact with lecturer	97	3.96	1.37	1.87
Watching videos	96	4.22	1.15	1.32
Weekly lesson plans/updates	96	3.73	1.33	1.76
Weekly checklists	97	4.08	1.30	1.68
Working through online activities	96	3.68	1.29	1.68
Checkpoint questions	98	4.34	1.05	1.10
PASS sessions	91	3.86	1.27	1.62
Practice quizzes	98	4.42	1.05	1.10
Online forums	95	3.58	1.52	2.31
Virtual classes	98	3.60	1.31	1.71

Abbreviation: PASS, Peer Assisted Study Sessions.

[a]Mean values represent scores from least useful (1) to most useful (5).

Experiences and Preferences for the Study of Anatomy and Physiology

The participants were also asked to rate, in order from strongly agree (5) to strongly disagree (1), several statements about their experiences of the study of A&P. The participants tended to strongly agree to the statements "I felt supported whilst study A&P" (mean, 4.28) and "I would rather study A&P in either a face-to-face or blended delivery mode" (mean, 3.94) (Table 3). When participants were asked their preferences for study mode for A&P, the majority of responses were for either face-to-face delivery (41.86%, n = 36) or a blended option (38.37%, n = 33). The option to study online for A&P scored last (19.77%, n = 17). Interestingly, the participants were then asked if the experience of studying A&P online throughout the global pandemic had changed their opinion of online study. The majority of participants reported that this had not changed (53.49%, n = 46), with 46.51% (n = 40) reporting that this had changed their opinion of online study of A&P. When comparing the participant responses with the statements to their study load (full or part time) or mode (on campus or flexible), there was no significant difference between responses (Table 3).

Experiences and Perceptions of Online Study of Anatomy and Physiology

Participants were also asked to give their opinions of online, face-to-face, and blended modes of study for A&P. Content

Table 2. Analysis of the Students' Learning Experiences in A&P Due to the Global Pandemic

Statement	Yes	No	Total	t Test (*P*)			
				Full Time	Part Time	On Campus	Flexible
Has your use of resources changed during the COVID-19 pandemic?	55.56% (n = 55)	44.44% (n = 44)	99	<.001	<.001	<.001	<.001
Did you use any external resources other than those made available to you?	66.29% (n = 59)	33.71% (n = 30)	89	<.001	<.001	<.001	<.001
Did you participate in any of the scheduled virtual classes?	82.22% (n = 74)	17.78% (n = 16)	90	.004	.001	.001	<.001

analysis of the responses asking the opinions of an online study mode for A&P showed mixed responses. Several comments indicated a hatred for this mode of study (n = 15). Participants commentated that, "I am not a person who can read and understand by myself all the terms and content. I am a person who can learn faster on face to face learning. It has required me to do further study to understand topics that usually I could ask directly to the lecturer in a classroom setting." Another participant comments on their dislike for online-only learning, "…I need to physically be in class touching models and learning with the teacher and other students, being online makes that a lot harder to do…." In contrast, several participants commented that they loved the online study mode for A&P (n = 19). One such participant comments, "I appreciate the convenience of online study when you have other competing obligations. Studying virtually means being able to access study resources at any time which is not the case with class attendance." Participants also commented on the ability online study afforded their lifestyles (n = 26), "Online studies helped to attend classes and lectures anywhere at any time, when we are free and feel comfortable" and that "I find it easily accessible especially with young children. More flexibility as to when you can get your work/study done. You need to be self-driven to commit to online study, during the pandemic it was easy to lose your focus and there were a lot more distractions." In addition, many participants also commented on the lack of driving required for online-only studies (n = 7), "I prefer it because I did not have to travel as much and can watch they [as] recordings anytime."

In addition, two further groups of responses were also seen: participants who made comments about how easy they thought online learning for A&P was going to be, yet how difficult they found it (n = 5), and the reverse where participants commented how difficult it was going to be but now find it to be ok (n = 6). For participants who thought the online learning was going to be easy but decided it was not, their comments pertained to issues around distractions and motivations, "Originally I thought online would be easier as you do not have to go on campus but because you are not on campus you aren't as motivated to learn and prioritize other responsibilities over study and you also cannot make connections in your learning." Another participant comments, "I use to thought [as] that online study would be easy and more convenient than face to face studies but seriously, it is really hard job because it is hard to divide time between the family members, household chores and study." In contrast, participants who commented that they found online study difficult but now think it is ok made comments to their adaptation to the online learning over time. One participant commented, "I would never choose to be an online learner, and this has forced me to be. It has been a challenge, but I've managed better than I initially thought I would." Another participant also comments, "Online learning was difficult, but I got used to it over time which made it more enjoyable."

Table 3. Analysis of Students' Experiences and Preferences for the Study of A&P

Statement	Frequency	Mean[a]	SD	Variance	t Test (*P*)			
					Full Time	Part Time	On Campus	Flexible
I felt supported whilst studying A&P.	86	4.28	0.92	0.85	<.001	<.001	<.001	<.001
I felt lost and/or overwhelmed while studying online.	86	3.31	1.32	1.75	<.001	<.001	<.001	<.001
I would rather study A&P in either a face-to-face or a blended delivery mode.	86	3.94	1.26	1.59	<.001	<.001	<.001	<.001
Moving from blended to online delivery was difficult for A&P.	86	3.40	1.38	1.91	<.001	<.001	<.001	<.001

[a]Mean values represent scores from strongly disagree (1) to strongly agree (5).

Experiences and Perceptions of Face-to-Face Study of Anatomy and Physiology

The participants' opinions of face-to-face as their chosen mode of learning for A&P predominantly indicated that the students were afforded more opportunity for question and answer or discussion time (n = 13). For example, one participant comments, "I am able to understand more of the information being talked about and questions asked by both myself and others is a big help in understanding the course content." Another participant continues this notion by stating, "It helps to visualize and further understand content with peers, as we can all communicate, help each other with the content and we can ask face to face questions with other students and teaching which is easier than email and virtual classrooms." Participants also made a comment about the face-to-face learning environment affording much more interaction (n = 6), which they found more beneficial for their study of A&P, "I think that one can learn better in face to face [as] interaction between teachers and other classmates is much better" and that "interacting and having discussions with peers assists me greatly." Lastly, some participants also made a comment on the benefits of the practical or physical interactions possible in the face-to-face learning environment (n = 2), "I learn better through doing activities and touching and looking at models to help me grasp the understanding of concepts."

Experiences and Perceptions of a Blended Study Mode of Anatomy and Physiology

Interestingly, some of the participants also gave opinions of a blended study mode as their preference for learning A&P. Participant comments fell into two categories: the need for practical learning (n = 9) and the ability blended learning affords the consolidation and understanding of content (n = 5). For example, participants commented on the need for practical learning, "Practical skills cannot be learnt online" and that "I think the hands-on lab content is helpful with learning." In comparison, participants also commented on the blended mode affording consolidation of content, "A mix of online and face to face consolidates learning for this course since some of the lab content is better visualized" and that "I enjoy having the flexibility of studying online, however I feel I would benefit from coming on campus to put some theory into practice."

DISCUSSION

The primary purpose of the current study was to assess the student experiences and perceptions of transitioning from a blended mode to a full online delivery mode of first year A&P courses in the BN program during the COVID-19 global pandemic. The major findings from this study were that participants' study mode preferences of A&P during the global pandemic were predominantly still in favor of a face-to-face delivery (41.86%, n = 36). Participants also displayed a renewed appreciation for the blended study mode (38.37%, n = 33). The option to study online for A&P scored last (19.77%, n = 17). These findings are consistent with the literature that demonstrates students prefer active learning sessions to consolidate their learning of A&P.[11,12,14–16] For example, literature suggests that the majority of students prefer practical sessions as the most efficient way of learning A&P for first year nursing.[12,16] Similarly, although virtual environments may offer added benefits for the academic in delivery to large cohorts, it drastically reduces the relationships that develop between students and academics in a face-to-face environment.[17] In particular, this allows for a deep approach to learning A&P, allowing students to engage with the content, and encourages higher order thinking.[12,16]

Interestingly, the global pandemic appeared to have no effect on the participants' opinion of the online study mode of A&P. In the current study, participants indicated an appreciation for some of the benefits of online learning. Mullen[6] supports these claims that online learning provides several advantages, including work-life balance and flexibility. Page et al[7] also suggest that students' perceptions of their learning experiences in A&P are affected by being overwhelmed by the content, the quality of the teaching in the subject, and if they felt supported by the teaching staff. In this study, despite participants reporting feeling a high level of support, they still predominantly showed preference for face-to-face or blended study modes for A&P over online. In addition, Raynault et al[21] showed that students preferred a blended study mode to be able to learn with, from, and about each other; this was reflected in the findings reported in the current study where participants commented that they were able to understand the course content when actively in class asking questions and engaging with their peers directly. Venkatesh et al[22] support this same role of effective communication between students in active learning sessions.

In comparison with the study conducted by Barbagallo et al,[18] where the most useful resources used included attending laboratory classes, reading the textbook, making notes, and having online lessons, the current study shows that the global pandemic has shifted the preference of these resources to online practice quizzes, checkpoint questions, and watching videos. The fact that laboratory classes were not deemed useful in the current study was a direct result of the inability of the participants to attend them due to government restrictions in place during the global pandemic.

Online forums were not deemed important previously[18] and remained so in the current study in addition to virtual classes and reading the textbook despite the onset of government restrictions during the global pandemic. Despite this finding, 82.22% of participants indicated that they did attend

the virtual classes offered. Page et al[7] suggest that students desire more conversation and contact time with lecturers and tutors in order to consolidate learning; however, together with the data presented here, students preferred this to be in a face-to-face environment rather than in an online or virtual space. Jowsey et al[17] report that communication is least effective when restricted to an online setting. In addition, open and prompt communication reduces anxiety and resistance to online learning.[17] Jowsey et al[17] suggest the positive benefits of support mechanisms for online communication including discussion boards, forums, and interactive videos. However, the data presented in the current study refute this.

de Tantillo and Christopher[23] suggest that the global pandemic may shift nursing schools to have a stronger online teaching presence for their nursing programs moving forward and some may find this transition difficult.[24] Considering the changes in teaching A&P through the global pandemic, although remaining difficult for academics and students alike, it remains to be seen what effect these may have on student performance and competence in the development of their nursing skills and knowledge moving forward.

LIMITATIONS

The number of participants who completed the Qualtrics survey was less than anticipated (n = 101). This limits the ability to generalize the findings of the current study, and the researchers understand that a more in-depth analysis of the experiences and preferences of the undergraduate nursing students in the A&P courses during the global pandemic could be made with a larger sample size. In addition, a wider survey encompassing additional regional as well as the inclusion of metropolitan universities would provide a more in-depth insight into the impact of the COVID-19 global pandemic on undergraduate nursing students' experiences and preferences for studying A&P.

RECOMMENDATIONS

Students will prefer face-to-face or blended over online study modes for the study of A&P in the BN program. Participants gained an appreciation for the online study mode during the global pandemic, although it was not their preferred study mode. In terms of the changes to the resources used by nursing students studying A&P, their preferences focused on the use of online quizzes, checkpoint questions, and interactive videos, with lower preferences towards online forums, virtual classes, and reading the textbook. As such, consideration of the balance between online and face-to-face learning for nursing students in A&P courses must be considered with more focus on how students are supported during online study. With students identifying preferences for interactive videos, more emphasis on how these can be tailored to compliment and, if the situation requires, perhaps replace the face-to-face active learning sessions is needed. Although there may be resources available that allow students to simulate laboratory sessions online, these would need to be tailored or re-written before being incorporated into an A&P course. Live laboratory sessions could also be recorded and placed online with interactive resources allowing students to manipulate laboratory data; this has the added advantage of connecting with our students. Although the study population is concentrated on students enrolled in the BN program, the findings would be easily transferable to other tertiary level courses to ensure quality student learning experience and outcomes. Further long-term research on the impact of the COVID-19 global pandemic on the nursing A&P curriculum and the effects on the student is required.

CONCLUSIONS

The COVID-19 global pandemic has shifted the traditional teaching of A&P to nursing students to an online environment. Despite the lack of hands-on learning, the online environment has afforded a greater appreciation from the students yet still remains the least preferred study mode when given the option. Further exploration of the long-term impacts of the global pandemic on the undergraduate nursing A&P courses is required to ascertain the balance between online and face-to-face delivery in a blended study mode. However, given that we are still in the midst of a global pandemic and the unlikely return to pre-COVID face-to-face delivery, more emphasis must be placed on how students are supported and the usefulness of the resources placed online.

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