



JUTLP

Journal of University Teaching & Learning Practice

The impact of COVID-19 on Health Science undergraduate students' academic experience and mental health: A pilot study

Dr Jahar Bhowmik^a, Dr Evie Kendal^a, and Dr Faith Kwa^a

^a Department of Health Science and Biostatistics, Swinburne University of Technology, Melbourne, Victoria, Australia

Abstract

The COVID-19 pandemic has created significant disruptions in teaching and learning at universities, predisposing university students to develop mental health issues which may impact their academic experience. This study evaluated the academic experience and mental health status of students enrolled in Health Science courses at Swinburne University of Technology via a mixed-methods cross-sectional survey conducted on 36 students (18+ years). Out of these students, nine attended in-depth interviews. Results obtained from both quantitative and qualitative data analyses found high levels of stress, anxiety and depression, with more than 50% experiencing levels above the clinical thresholds. About 39% of the participants reported feeling able to concentrate on their learning when materials were delivered via an online mode. Students' engagement through online learning was significantly disrupted, 97.2% of the respondents found it difficult to perform group work and 75% reported not being able to engage with their peers. Higher levels of stress, anxiety and depression were significantly associated with a compromised learning experience. Spearman's Rank Correlation showed a significant negative association between stress and students' engagement with online learning (Spearman's $\rho = -0.49$, $p = 0.003$). Supporting the learning experiences along with monitoring the mental health of all university students should be of high priority for university authorities.

Editors

Section: Student Experience
Senior Editor: Dr. Sally Ashton-Hay
Associate Editor: Cathy Mae Toquero

Publication

Received: 12 August 2023
Accepted: 16 September 2024
Published: 4 November 2024

Copyright

© by the authors, in its year of first publication. This publication is an open access publication under the Creative Commons Attribution [CC BY-ND 4.0](https://creativecommons.org/licenses/by-nd/4.0/) license.

Citation

Bhowmik, J., Kendal, E., & Kwa, F. (2024). The impact of COVID-19 on Health Science undergraduate students' academic experience and mental health: A pilot study. *Journal of University Teaching and Learning Practice*, 21(10). <https://doi.org/10.53761/zrw0c503>

Introduction

The advent of the Coronavirus (COVID-19) pandemic in 2020 brought extraordinary disruption to the higher education (HE) landscape, with campuses rapidly closing and classes swiftly moved online. Most countries around the world shared a common goal of curbing the spread of the virus by imposing social/physical distancing, avoiding face-to-face interactions, and restricting people's movements (Gonzalez et al., 2020; Watermeyer et al., 2020). Consequently, most universities implemented campus closures globally and experienced a massive "transition" from traditional face-to-face education to fully online. In a short period, most undergraduate students had to adapt to this change of learning style (Bashir et al., 2021; UNESCO, 2021). Delivering practical-focussed courses, such as Health Science, in fully online mode has been particularly challenging (Engzell et al., 2021; Mahdy, 2020; Simon et al., 2021). While some universities already had well-established online systems, smaller universities with practical-driven courses struggled under the weight of the demand, experiencing difficulties translating practical and laboratory classes into an online environment, in ways that allowed undergraduate students to develop the hands-on technical skills they would have acquired in a laboratory environment and fully meet their course or unit learning objectives (Jin et al., 2021).

The closures of the campuses of educational institutions had an unprecedented impact on education, particularly affecting the tertiary sector. Undergraduate students in HE tended to have a more mature understanding of the events that occurred during the early stages of the pandemic and the potentially harmful effects on physical, mental and emotional wellbeing, compared to their counterparts in primary and secondary schools. This can be partly attributed to their greater ability to independently assess news media reports and partly to the increased autonomy many university students have regarding their own health behaviours, especially those no longer living in the family home (it is noteworthy that adherence to protocols for personal protection have also been shown to be higher among graduate students versus undergraduate students) (Akhter et al., 2022). Nevertheless, some students in tertiary education expressed personal concerns about their health and that of their loved ones, and the need to adjust to changes in their academic environment and living arrangements due to job losses or changes to campus residential services. Some had to return to their family homes; with some international students impacted by travel bans (Lai et al., 2020; Patterson et al., 2021; Schwartz et al., 2021; Simon et al., 2021). Prior to the COVID-19 pandemic, not much research was done on stress responses in relation to extreme health circumstances, with much of the existing research focused on how young people react to distress associated with natural disasters (e.g. hurricanes and fires). These disasters have widespread community impact, including causing fatalities, homelessness and unpredictability, which are also applicable in the context of the COVID-19 pandemic (Sprang & Silman, 2013).

Research suggests university students are a high-risk population for mental health issues due to academic and financial pressures, loneliness and limited opportunities for self-care (Browne et al., 2017). Drane et al (Drane et al., 2020) emphasised an urgent need for a proactive and multifaceted response to address the educational needs of our most vulnerable undergraduate students to avoid widening existing educational disparities during the pandemic. For example, designing and developing curriculum that can be manageable within the home environment by providing more flexibility in accessing content and completing assessments, and applying curriculum changes that cater to the needs of remote learning (Farrell & Brunton, 2020; Matthews,

2016). As tertiary education embraces a “new normal” standard of teaching and learning, universities could improve overall student wellbeing by making study support a priority, especially for undergraduates (Plakhotnik et al., 2021). Studies demonstrated that appropriate utilization of technology and pedagogical strategies could meet the academic needs of learners in a more significant way during a crisis like a pandemic, war or natural disaster (Amir et al., 2020; Bordoloi et al., 2021; Lapitan et al., 2021; Lockee, 2021; Lorenza & Carter, 2021).

Transitioning to online learning to maintain educational continuity during the COVID-19 pandemic posed significant challenges for health science programs such as the Bachelor of Health Science course at Swinburne University of Technology (Melbourne, Australia) presented here. This course consists of approximately 1,000 undergraduate students who specialises in various disciplines: Biomedical Science, Clinical Technologies, Neuroscience, Nutrition, Public Health and Health Promotion, Psychology and Forensic Science, and Psychology and Psychophysiology. Each of these majors include different outcome units with stringent requirements that undergraduate students need to fulfil prior to graduation to be professionally ready. The university campus closures represented a significant problem as the learning outcomes of such units often necessitated access to specialised laboratories with industry-standard equipment. For example, having to replace the use of microscopes in the laboratory with digital tools (e.g. SLICE tool from the Best Network) to teach students how to identify the type of tissue and the disease processes associated with a tissue section, does not provide the same learning experience as being able to use the microscope to execute these tasks and fulfil learning outcomes that align with standard industry practices in a Pathology laboratory. Furthermore, undergraduate students who had enrolled in professional placements that were typically held at the host organisation, had suffered from delayed completion of their course or had to change to a course without a mandatory placement requirement. In general, the COVID-19 pandemic has significantly affected the teaching and practical training of health science undergraduate students worldwide. This public health crisis has disrupted the education of physicians, dentists, pharmacists, nurses, midwives, and other healthcare professionals by cancelling clinical clerkships and shifting on-site education to online formats (Găman et al., 2020; Găman, 2023; Ryan et al., 2022; Wang et al., 2024). Previous research emphasized the significance of human connection and comparisons to pre-pandemic teaching practices in Health Science courses (McGill, 2021). Simultaneously, there was a suggestion to reassess pedagogy and course design, while also underscoring the limited support available for educators navigating remote learning during stressful times (Abdull Mutalib et al., 2022; McGill, 2021; Naciri et al., 2021).

There have been various studies on undergraduate student performance during pandemic lockdown measures, but the current study is novel as it focuses on a practical health program within metropolitan Melbourne, the site of Australia’s longest and strictest COVID-19 lockdown. Between March 2020 and October 2021, Melbourne’s 5 million residents experienced a cumulative 262 days in lockdown, having already been given the nickname ‘world’s most locked down city’ even before 2020 was over (Goh et al., 2023). As a result of this extended disruption, various alternatives to remote learning, such as postponing practical components to future years of study, were not feasible. However, the pedagogical learnings to be explored in this study are not limited to pandemic conditions, but rather take into account how COVID-19 has led to a radical

shift in tertiary education delivery practices, including what seems to be a permanent change in favour of more online and blended learning options for reasons of practicality and inclusivity.

Impact of COVID-19: At universities located in less developed countries, students were facing various problems related to unfavourable study environments at home and mental health issues due to COVID-19-driven lockdowns (Kapasia et al., 2020). The online mode of the teaching and learning model is often discriminatory to poor, marginalized and students with disabilities (Jia & Santi, 2021). Although online and remote learning was a satisfactory experience for some, various inequalities were discovered; for example, undergraduate students whose first language was not English or those who were studying in remote locations in less developed countries with poor Internet connection, found it difficult to express their queries online and engage with the online classes, compared to face-to-face class iterations where communication is aided by body language (Day et al., 2021; Joseph & Trinick, 2021). It has also been demonstrated that hearing-impaired students face challenges in online learning (Daily Times, 2020). Furthermore, the pandemic has disproportionately affected students who have limited access to learning devices and those undertaking practical courses (Wang et al., 2024). Finding the right balance between online and face-to-face teaching will be a real strategic challenge for the future, where the digital and physical layers co-exist (Agasisti & Soncin, 2021). A recent systematic review comprising 32 studies examining the effects of COVID-19 on the mental health of university students uncovered a positive correlation between decreasing mental well-being and online learning. Additionally, a notable negative correlation was observed between physical activity levels and depressive symptoms and the findings were consistent across various countries and regions where the studies were conducted (Zarowski et al., 2024). To date, there have been several studies on the overall impact of COVID-19 on undergraduate students' learning experience, but limited research has been conducted to investigate the association between undergraduate students' online learning experience and their mental health status while studying an undergraduate degree that focusses on achieving practical and technical learning outcomes; usually achieved through attending practical classes on campus. It is therefore essential to critically evaluate this association to determine the important stress factors compromising the mental health of our students. Such research data would facilitate the design of effective learning interventions for delivery of a conducive online learning environment for future student cohorts beyond the pandemic.

This paper considers some pertinent questions regarding the impact of COVID-19 on student wellbeing: What are the impacts of related changes on undergraduate students' learning? What does the students' experience tell us about priorities and vulnerabilities? And what is the impact of COVID-19 on students' mental health and wellbeing? The answers to these questions are essential for university educators to make informed decisions regarding curriculum design of future courses and units. Using a mixed methods research paradigm, the primary aim of this project was to examine undergraduate students' perception of their learning experience within the Bachelor of Health Science degree during the times of COVID-19 and the impact of the pandemic on their studies and personal lives. The impact of the pandemic on Health Science degrees is relatively high particularly due to the transition of many face-to-face practical classes into online demonstrations and simulations. The survey questionnaire focused on the impact of COVID-19 on students' academic, mental health and personal life.

The findings from this pilot study will be used to evaluate the factors influencing undergraduate students' academic progress and mental health during COVID-19 and will provide insights for the design of large-scale intervention programs to tackle similar circumstances or manage the learning and teaching expectations of the "new normal" in the post-pandemic era by providing appropriate awareness of possible long-term effects and implementing additional supports based on the findings of this study. This project will reveal the various key points of consideration in online delivery of practical-focussed courses, e.g. those with laboratory and work-integrated learning components, which will assist other universities globally in selecting and incorporating suitable learning technologies and teaching methods as the world of higher education evolves with the changes brought about by the COVID-19 pandemic.

Materials and Methods

Data Collection and Procedure

The study used a mixed method cross-sectional study design with convenience sampling. A survey questionnaire was used by combining DASS-21 questionnaire (for stress, anxiety and depression) and a developed questionnaire on undergraduate students' learning experience following the change to online teaching mode. For the mental health assessment, the validated DASS-21 questionnaire was used. To evaluate students' learning experiences, a 22-item questionnaire was developed based on previous literature, the authors' experience, and the study's objectives. Students' demographic information was also collected through the online survey. Along with the online survey, nine students who agreed to participate in the interview were interviewed in depth about their experiences academically and personally due to COVID-19. An online survey was conducted first, followed by online interviews. The need for all data collection to occur remotely was a function of the ongoing legal restrictions on meeting in person at the time of the study. The survey was conducted three times between August 2020 and October 2021 and results were pooled. Participants were undergraduate students aged 18+, able to read and understand English, currently studying a health science course and enrolled in at least one core course unit at Swinburne University of Technology in Australia.

All undergraduate students who participated in this study were over the age of 18 and were admitted in one of six undergraduate health science courses and enrolled in HEA10001 Introduction to Health Sciences, HEA20007 Research Methods for Health Sciences and/or HEA30001 Health Sciences Project. Information about the study was sent to the students via email from the Chief Investigator and an announcement on the unit and Course Canvas learning management system sites during teaching weeks 5-8 of the 12-week semester, along with a link to the online survey in Google Docs. Each of these units typically has an enrolment of between 50 to 150 students per semester, but due to overlap among these cohorts, the exact number of students invited is not available. Students were asked to read the Participant Information Statement before completing the Consent Form to attend survey and/or interview and the survey was open for students until week 11 of their study period. In the online survey, students were asked if they were interested in participating in an in-depth interview. Those who agreed were later interviewed by the student investigators via Teams. The interviews were audio recorded on Teams, then transcribed and analysed using NVivo software. Data from undergraduate students

who did not consent to participate in the research was omitted from the analysis. The online survey contained questions on students' levels of academic engagement, mental health state (e.g. feelings of stress, anxiety and depression), personal experiences/responsibilities, perceived experience of learning remotely, including the extent to which they had accessed learning resources, and their level of engagement and satisfaction in their unit of study so far (see Supplementary File). A total of 36 undergraduate students participated in the online survey, and among them, 9 took part in the in-depth interviews. Study procedures were approved by the human research ethics committee at Swinburne University of Technology (Ref: 20214201-8120).

Measures and Instruments

Information on undergraduate students' learning experiences were collected through a mixed method study design (online survey and interviews). Students' self-reported mental health status was collected through the validated DASS-21 short questionnaire (Lovibond et al., 1995). The Depression, Anxiety and Stress Scale - 21 Items (DASS-21) is a set of three self-report scales each including seven items designed to measure the emotional states of depression (d), anxiety (a) and stress (s). The DASS-21 questionnaire measures these on a four-point Likert scale with response options ranging from 0 = Did not apply to me at all to 3 = Applied to me very much or most of the time. The online survey questionnaire developed for the purpose of this study included 22 questions on students' learning experiences that were measured on a five-point Likert scale with response options ranging from 1 = Strongly Disagree through to 5 = Strongly Agree, for each statement provided (Supplementary File). Some demographic information including students' age, gender and financial status was also collected. Open-ended questions were included to capture any personal feelings experienced by students' learning during the COVID-19 pandemic. Qualitative data on the impact of COVID-19 on students' learning experiences and their mental health status, were collected by in-depth interviews consisting of five open ended questions (Supplementary File).

Quantitative Data Analysis

Thirty-six participants was sufficient to detect a large effect size of 0.5 to observe a significant association between change of learning management due to COVID-19 and students' learning experience, and between students' mental health status and learning experience at a power of 80% or above and a type 1 error rate of 5% (Cohen & Ebl, 1988; Hulley et al., 2013) for a two-sided test. Nine items in the DASS-21 responses had one missing value (1.4%), 12 had two missing values (2.8%) and one had three missing values (4.2%). Missing values were substituted by scale means. For easy interpretation of the survey responses, students' responses to the questions on their learning experience were categorised into "broadly agreed" and "broadly disagreed" by combining agree and strongly agree into one category (broadly agree) and other three options (strongly disagree, disagree and neutral/not sure) into the other (broadly disagree). Due to the small sample size and unknown nature of the population distribution, a non-parametric method was conducted to evaluate the association between students' learning experience and mental health status. Along with descriptive statistics, Spearman's rank correlation was used to assess the association between the items. Data were analysed using SPSS Version 28 and R 4.0.2.

Qualitative Data Analysis

Two qualitative researchers (blinded) analysed interview (open-text) responses using content analysis/NVivo (Hsieh & Shannon, 2005; Schreier, 2012). First, the authors independently read responses from the interviews and free-form questions and generated themes and codes to summarise the data. Themes were compared against each other to ensure interrater reliability and initial sub-categories of codes were identified as per the methodology published by Hsieh and Shannon (Hsieh & Shannon, 2005). The codes have been finalised in Appendix 3 (supplementary file) . Next, authors compared respective coding and reached consensus there was sufficient similarity to pool data from all iterations. Collaborative, focused coding was undertaken to form final categories after initial pooling. Thematic analysis of the qualitative data was done using the NVivo software (Version 1.5.2).

Results

Quantitative

Thirty-six undergraduate students completed the online survey. These students were studying at least one core unit within the Bachelor of Health Science degree at the time the survey was conducted. Seventy-eight percent were 25 years old or younger and only 5.6% were above 45 years old. Among the participants, 86% were local, 83% were female, 91.7% were studying full-time, 61% were born in Australia and were living with parent(s).

In the survey, participants answered a 22-item questionnaire on the perceived impact on their learning of changes to course delivery related to the ongoing pandemic. In response to these survey questions, many of the participants found that their learning experience was at least partly interrupted due to COVID-19 restrictions but most of the participants were generally satisfied with their online learning experience and the materials provided through the learning management system (LMS) (Table 1). Results presented in Table 1 indicate that students found it difficult to engage with learning during the pandemic while resources were delivered online, and only 27.8% respondents agreed that they were able to fully engage with online learning. Students' interactions with their peers and group work activities were affected due to online delivery with 97.2% of students reporting difficulties performing group work and 75% were not able to engage with other students through online learning management systems (LMS). About 39% of the students reported feeling able to concentrate on their learning when materials were delivered via an online mode. In response to a question on whether the online LMS through Canvas adopted during the pandemic provided a similar learning experience compared to face-to-face delivery; the majority of the students disagreed (58.3%).

Flexibility of the online teaching mode was appreciated by the majority of students where 80.6% students liked the accessibility and flexibility of online delivery of material, 69.4% students felt learning fully via an online mode was convenient without the need to travel to campus and 75% students felt comfortable using online tools.

Table 1

Participants' responses to the learning and teaching related questions/statements

Statements	Broadly agreed (%/n)
1. In general, I feel comfortable using online tools for learning.	75(25)
2. I am able to concentrate well when material is delivered via an online mode.	38.9(14)
3. I like the accessibility and flexibility of online delivery of material.	80.6(29)
4. Learning fully via an online mode is convenient without the need to travel to campus	69.4(25)
5. The changes in the delivery of classes due to COVID-19 restrictions has impacted my learning.	77.8(28)
6. The online learning makes my learning harder.	58.3(21)
7. The resources and support provided during the pandemic have helped me to engage with my learning similar to face-to-face teaching model.	27.8(10)
8. The resources and support provided during the pandemic have helped me to engage with other students.	25(9)
9. The online content delivered was accompanied by clear instructions via written, audio and/or visual means.	58.3(21)
10. I think the current learning management system, Canvas, is a good platform that provides me with a similar learning scope as I would have experienced in face-to-face classes I attend on campus	41.7(15)
11. The pre-recorded lectures were supported by Collaborate Ultra drop-in sessions.	55.6(20)
12. I found Collaborate Ultra drop-in sessions useful for my learning.	58.3(21)
13. Group work was easily conducted via Canvas Groups and Conference functions.	27.8(10)
14. Group work is easier via online means compared to face-to-face.	2.8(1)
15. Overall, the online resources provided during the pandemic are well structured and easy to follow.	50(18)
16. Overall, I am satisfied with the changes of the teaching structure from a face-to-face or blended (mixed on face-to-face and online) delivery to a fully online delivery.	44.4(16)
17. I am concerned about my education and the impact that the COVID-19 period has on my education.	63.9(23)
18. The issues related to internet connectivity have impacted my learning during this COVID-19 pandemic.	36.1(13)
19. The COVID-19 pandemic has affected my overall study plan.	55.6(20)
20. The changes to my learning and class delivery during the pandemic has caused me to withdraw from a unit(s).	22.2(8)
21. The COVID-19 pandemic may cause me to discontinue from my studies.	17.7(6)
22. I think, my overall learning outcome during this pandemic is decreased as compared to my previous on campus learning experience.	61.1(22)

Results of the DASS-21 questionnaire are presented in Figure 1 using three sub-scales: depression, anxiety and stress. The majority of students reported experiencing symptoms of anxiety (57%), with 33% reporting severe to extreme anxiety. More than half of the participants reporting being stressed (54%) and 26% said this was severe to extreme. Most of the participants (88%) reported symptoms of depression, with 40% reporting severe to extreme depression symptoms.

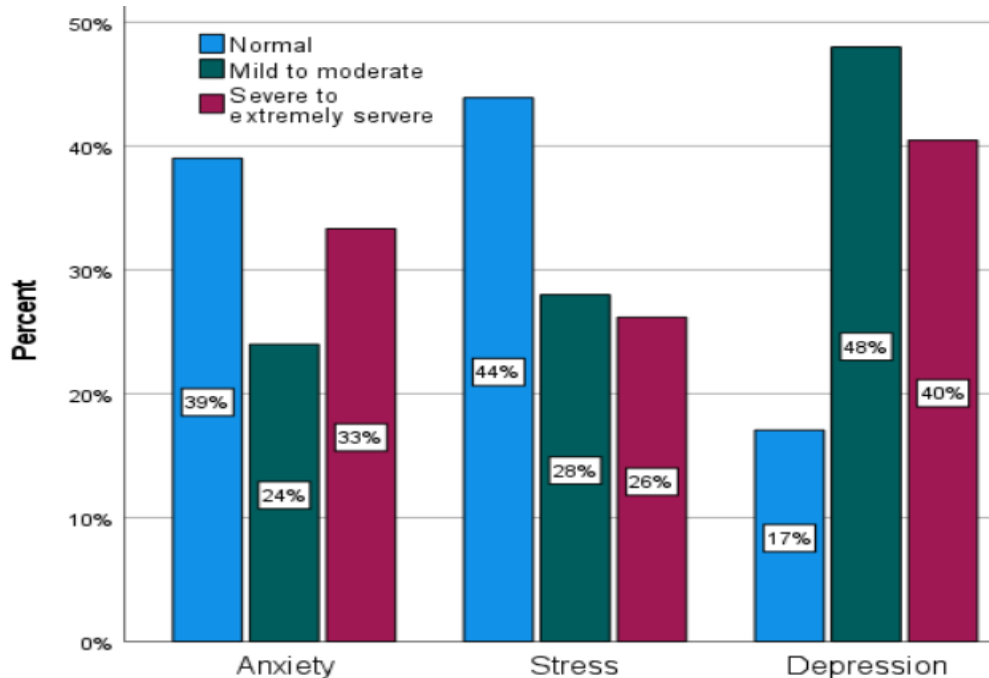


Figure 1

Distributions of the anxiety, stress and depress scores of the undergraduate students participated in the survey.

Overall, there was a negative association between students' opinion on their learning experience during COVID-19 and their mental health status with respect to anxiety, stress and depression, e.g., students who were anxious, stressed and/or depressed reported lower levels of satisfaction with their learning experience. However, for most of the survey items, these assertions were not significant. Furthermore, students' opinions on engagement related questions (Q7 and Q8) were significantly associated with their stress (Q7: Spearman's $\rho = -0.49$, $p = 0.003$; Q8: Spearman's $\rho = -0.38$, $p = 0.023$), e.g., students less engaged with their peers reported feeling more stressed. There was a significant association between anxiety and stress (Spearman's $\rho = 0.804$, $p < 0.001$), and anxiety and depression (Spearman's $\rho = 0.579$, $p < 0.001$), with students with higher anxiety more stressed and depressed. Also, there was a significant association between stress and depression (Spearman's $\rho = 0.635$, $p < 0.001$), with students with higher stress scores reporting being more depressed.

Qualitative

As part of this mixed methods study, the responses to focus group interview questions relating to undergraduate students' feelings towards studying during the pandemic were examined. These data allowed this study to capture the full spectrum of students' perspectives on the impact of remote learning on both their academic performance and personal wellbeing. A total of 9 out of 36 study participants took part in the interviews.

Summarising some key themes that arose in the data, in response to the impact of COVID-19 and remote learning on students' academic performance, many students felt that their grades were not significantly impacted as online assessments were perceived to be easier and

extensions for submission deadlines were widely accessible, because of special policies put in place during the pandemic to support students. However, some students found that their performance was negatively impacted particularly when assessments involved group work. Communication with fellow peers suffered at times due to being in various time zones, with some respondents noting they had different preferred ways of communicating that were not available during remote learning. Students did acknowledge that while online learning during COVID-19 made studying very flexible, it was very challenging to keep motivated due to distractions that can take place at home affecting concentration. Using NVivo on the transcripts of these interviews it was possible to identify common words associated with this perceived negative impact to performance (see Table 2). There was general consensus amongst the participants that the impact of the COVID-19 pandemic on students' mental health and wellbeing was negative overall. While some reported that their studies distracted them from the pandemic, many found it hard to concentrate and most felt they lost their social life. Lockdowns restricted students from visiting places outside their sanctioned radius, thereby limiting interaction with others apart from the people living in the same household and reducing opportunities to engage in different types of activity which would normally help to alleviate mental stress levels. The lack of contact with peers on campus and the need to communicate with others online was perceived to be stressful as expressed by one student "I do feel lonely at first because I can hardly communicate with people overseas and it is difficult to make new friends online ... it is difficult for me to get into the group discussions which makes me feel very anxious and depressed". Some found it challenging having to adapt to speaking with people using online chat platforms and others were not as interested or proficient in using online means to communicate.

Many tended to resort to sending text messages instead, which meant that peer feedback was not always received in a timely manner. The need to propose ideas or engage in discussions online made it more stressful for some students compared to being able to engage in conversation or ask questions in-person. Recurring words representing negative emotions are displayed in Table 2. In response to the question regarding the support students received at Swinburne University of Technology during campus closures where classes were delivered solely online, very positive student feedback was recorded. Students were satisfied with the level of communication received from staff and the delivery of classes via online tools such as Teams, Canvas and Collaborate Ultra. Staff were understanding of the need for extensions and students appreciated the online resources and well-organisation of the online classes. This positive feedback can be reflected by the student quotes "I think it's quite good that some lecturers have released all of the content ahead of the weekly schedule just to create a slightly more easy learning environment" and "Pretty happy with everything we could have in these circumstances. We were provided with communication tools, received emails on mental support..." Students found the counselling services and telehealth appointments provided by Swinburne's Health and Well-being Centre very useful. Students also reported benefitting from receiving general advice from their peer mentors on how to manage university and life. The positive feedback regarding staff support was indicated by words presented in Table 2, which pertain to good communication, friendly and accommodating teachers/lecturers/staff, useful resources and well-structured online classes. Students appreciated the university support external to the unit delivery such as Studiosity and services provided by the Swinburne Health and Well-being Centre as indicated by the words in Table 2. The Peer Mentoring Program also provided extra support apart from those

mentioned above and students who participated found comfort in forming new friendships through this program during the pandemic. The words presented in Table 2 are associated with the benefits of peer mentoring support were found a total of 10 times in the collection of interview transcripts.

On the question of what their institution could do to support them while remote learning, students mentioned care for their mental health, providing counselling, and having additional flexibility with assessment deadlines. Overall, the online learning environment was characterised as being unsupportive of mental health, less personal in terms of content delivery, and more difficult to collaborate with peers, e.g. for group assignments. Most respondents noted they felt they were missing out compared to students who had been able to learn on campus, specifically the “physical connection” with staff and peers, “one-on-one” guidance, seeing people “face-to-face”, getting to socialise and “experience the uni life”, with one respondent also noting that not coming onto campus meant they didn’t get as much exercise as they would usually walk or cycle to class.

The final interview question allowed the respondents a chance to freely add any information they hadn’t had an opportunity to cover. Students noted a lack of motivation to study, including one who reported “Education cannot be totally online as we are missing a lot.” Two respondents noted they were really struggling, with one linking this to future concerns: “I was a first year last year, so like my entire uni experience has been with COVID. And so, I worry about like if next year is like this as well, I’m going to graduate and never had the unique experience that I should have... Because I haven’t done on campus work in labs and stuff that I might struggle more in the workplace.”

These responses were also aligned with those seen in the open-ended question on the online survey, where students reported difficulty remote learning, particularly transitioning to online lab classes, and doing groupwork online. Concerns about the quality of online learning materials featured, but overall online lectures were characterised positively, allowing for more personal time management, whereas online labs and assessments were considered less favourably.

Table 2

Recurring words or phrases in participants’ responses to focus group interview questions relating to undergraduate students’ feelings towards studying during the pandemic

Question Type	Recurring Words	Number of occurrences
Impact of COVID-19 and remote learning on students’ academic performance	Hard, difficult, harder, bad, challenging, challenge, difficulty, deteriorated, negative, negatively	15
	Easier, increased	4
Impact of the COVID-19 pandemic on students’ mental health and wellbeing	Negative, stressful, difficult, bad, challenging, depressed, lonely, anxious, panic, restricted, rigid, struggle	26

Level of staff support students received during campus closures	Good, teachers, communicate, motivation, easy, emails, extension, great, incredible, accommodating, available, conducive, drawings, handy, happy, resources, schedule, staff, structured, swift	40
Level of university support (Learning Academic Advisors, Swinburne Health and Wellbeing Centre) students received during campus closures	Appointments, writing, questions, advice, telehealth, counselling, mental, proof-read, service, telehealth	14
Level of peer support students received during campus closures	Mentor, questions, friendly, advice, meeting	10

Integrating the quantitative and qualitative results paints a stark picture when it comes to student wellbeing and perceptions of job readiness after studying during COVID. Recurrent issues identified across the two data collection stages include feelings of depression and students suffering a lack of concentration, as well as concerns regarding the quality and equivalency of education provided under remote conditions and how this may impact employability and skills acquisition. The qualitative and quantitative outcomes of this study support each other, and these important learnings will help educators to design effective and engaging online learning experiences in current and future programs.

Discussion

This paper presents the impact of COVID-19 on both undergraduate students' academic experience and mental health at Swinburne University of Technology in Australia. The current findings are applicable to university teaching and learning practices around the globe and can facilitate educators to improve curriculum design for undergraduate courses beyond the pandemic. In particular, most universities have retained an element of online learning through a blended approach where lecture recordings are usually supplemented with live online and/or on campus experiences such as tutorials, workshops and practical classes (Broadbent et al., 2023). Our study indicated a negative impact related to COVID-19 on the learning experience and mental health of undergraduate students studying health science courses during 2020-2021, which supports the outcomes of past studies (Dodd et al., 2021; Kapsia et al., 2020; McGill, 2021; Zarowski et al., 2024).

The rapid transition to online learning has caused feelings of overwhelm and doubt in students' learning capacity. Results obtained from surveys of 120 tertiary education providers showed that almost 50% of students did not support online learning (Australian government tertiary education quality and standards agency, 2020). One of the key negative issues found in the survey was the level of engagement with their learning and with peers. A deficiency in online learning in terms of student-to-student interaction was linked to students feeling isolated and not fully embracing the online experience, particularly in accomplishing group tasks.

There was generally some positivity expressed by students about the flexibility of online learning and accessibility of resources, including early availability of lectures and tutorial questions. These findings are in line with the findings from past studies (Abdull Mutalib et al., 2022; Australian government tertiary education quality and standards agency, 2020; Dodd et al., 2021; Yang & Huang, 2021). These advantages have dominated the decision to retain aspects of online learning in Higher Education today. As a result of student feedback in this area and continuing safety concerns regarding COVID-19, many universities including Swinburne University of Technology, had chosen a partial return to campus strategy. This involves face-to-face tutorials and laboratory classes, but lectures remain online. It is hoped this will alleviate student dissatisfaction with remote learning with regards to lack of peer support, group work and access to teaching staff, while maintaining the flexibility and inclusiveness that online lectures offer, including for those students with special needs and competing time commitments, such as paid employment and family duties.

As harmful as the physical health effects of a global pandemic are, much has been speculated about the “second wave” of mental health crises, particularly among adolescents (Li et al., 2021; Schwartz et al., 2021). The overall findings of this pilot study indicate that participants were experiencing moderate to severe symptoms of depression, anxiety and stress. These negative emotions were only exacerbated by successive and long periods of lockdowns accompanied by the rapid decline in the quality of work-life balance which were supported by other studies (Manchia et al., 2022; Officer et al., 2022; Singh et al., 2020; Xiao et al., 2021; Zarowski et al., 2024). Many felt that their social life hardly existed and often, studying at home was disturbed by distractions previously not present while learning on campus. A few students did feel that they could focus on their studies better as there were limited activities they could engage with at home.

While technology ensured that tertiary education could continue during the pandemic and campus closures resulting from the lockdowns, various support strategies catered to the needs of a diverse student population may not have been comprehensive enough and this may be an important factor in students’ perception of their remote learning experience. The focus group interviews revealed that a few students found it difficult to stay focussed on completing tasks, resulting in submitting subpar work or not submitting at all. This study indicates that teachers must recognise that the relationship between academic performance and capability to use technology may not be linear and therefore, careful considerations must be made to rubric design. Some students may adapt well to using technology to facilitate deep levels of learning, but others may feel that the role of technology in education is ambiguous and forms a barrier to their learning. Hence, it is essential that students are told of the benefits and roles of online learning technologies and be given clear guidelines on how to use digital tools to communicate with staff and peers via consistent online platforms and to complete tasks. Demonstrations of the best practices in using various technologies by teachers have been proven to successfully engage students in a remote learning environment (Abdull Mutalib et al., 2022; Ellis & Bliuc, 2017).

However, dissatisfaction with remote learning in general, and group-based assessment in particular, is not the whole picture, as throughout the quantitative and qualitative aspects of this study there were some lessons to be learned about harnessing the power of technology to promote good pedagogy. Online lectures were frequently characterised positively, as a way of allowing students to take more control of their weekly schedule. Greater accessibility for students

with disabilities also appeared in discussions. Where activities had to be moved online, students consistently noted the value of synchronous learning opportunities, e.g. live Q&A sessions with lecturers or other drop-in sessions. Concerns about losing hands-on experience and workplace skills due to remote learning also represent an opportunity for tertiary institutions to tailor learning packages to students whose education was disrupted by the unprecedented events surrounding the pandemic. Moving forward, policies governing the division of in person and online educational delivery need to take into consideration the issues identified in this study, particularly regarding students' mental health and confidence approaching the workforce following their tertiary studies. There may also be grounds to develop additional support for practical and team-based skills development for those students and future employees most affected by COVID-19 remote learning interventions.

Is technology the complete answer to higher education in the 21st Century, especially following the COVID-19 crisis? Emerging from the pandemic, the rising cost of living pressures have since shifted the priority of many undergraduate students to work full-time while juggling their studies; with others weighing up the costs of studying alongside the cost of living and making a pragmatic decision that best suits their current circumstances (Pavlich, 2024). This has led to poor attendance at live online classes or the minimum engagement with digital resources since many of these are recorded and freely accessible. The undergraduate students would need to make a concerted effort in ensuring they allocate time to their studies. Therefore, for undergraduate students to value the proposition of online learning and to entice them to participate in the live online classes and effectively use the digital resources, active learning activities such as case study discussions relevant to industry and the workplace or interactive questions with spontaneous feedback in lecture recordings that would benefit their preparation of assessments, will need to be implemented (Nordmann et al., 2022). The challenge of striking the right balance between building digital literacies in our students and developing quality on-campus learning experiences for the optimisation of learning outcomes, remains a focal point in effective curriculum design and in the training of the World's future workforce. A well-planned blended learning approach that integrates both digital and face-to-face teaching could be the best teaching approach during the pandemic or similar future events.

Limitations

The response rate for this study was low, around 10% of the invited cohort, which limited inferences for further generalisability of the findings, however low response rates are common for studies of this nature. Due to small sample size, higher level statistical modelling and sub-group level analysis could not be done. Causal inference is not possible due to cross-sectional study design which does not have a control condition. The negative sentiments raised by the student participants regarding the impact of the pandemic on their academic experience and mental health may be biased by a limited understanding of the importance of digital literacies in their learning and careers in Health, and there was also the potential for selection bias, with those students suffering the most being more likely to engage in the survey to express these views. Additionally, using the DASS-21 instrument might present psychometric deficiencies with a small sample size. As this study only focused on health science undergraduate students and their attitudes toward digital alternatives to face-to-face learning, future studies could look at how these attitudes might influence their careers down the track, including those who will be involved in the

provision of health care services remotely. Since expansion of telehealth services is likely to be an ongoing impact of COVID-19, beliefs that online service delivery are inferior at the education stage might also impact the service provision stage of these undergraduate students' career journey. Further studies might also investigate whether this pattern holds true for other areas of study, particularly those typically involving hands-on practical classes.

Conclusion

This pilot study was conducted on undergraduate health science undergraduate students in Melbourne, Australia, where lockdown measures were the strictest globally. The results here, based on a small cohort of undergraduate students but supported by rigorous statistical validation, have allowed us to make the general conclusion that enhancing the health, wellbeing, and learning experience of all undergraduate students should be the highest priority for education providers and governments during and after the pandemic. Moving forward, policy-makers within government authorities and universities need to work together on improving the resourcing and delivery of online learning, and develop new strategies to support undergraduate students' mental health for the individuals pursuing undergraduate studies in health science. Providing a holistic and student-centred learning experience during the pandemic and beyond presents as the ultimate goal in delivering quality higher education. This can be thoughtfully designed by reviewing the best practices of online and face-to-face education via our past learning and teaching experiences; and integrating synchronous and asynchronous online and face-to-face content and activities that drive active learning and industry-based practices relevant to the health disciplines.

Acknowledgements

Five student researchers were involved in data collection for this project: Tracy Manito, Ciara Cornish, Lawrence Komba, Samuel Maricic and Duaa Hashim O Alghamdi. No potential conflict of interest was reported by the authors. This research received no specific grant from any funding agency. The data sets used and analysed during the current study are available from the corresponding author on reasonable request. The authors have not used AI in any part of their manuscript.

The authors list the following CRediT contributions: J Bhowmik conceptualized the study, structured the manuscript, conducted literature review, compiled the quantitative data, performed the statistical analysis, drafted the manuscript, and edited the manuscript. F Kwa conceptualized the study, aided in variable selection, contributed to drafting the manuscript, analyse the qualitative data and critically reviewed the manuscript. E Kendal aided to conceptualize the study, synthesized the analysis plan for qualitative data, performed analysis of qualitative data and critically reviewed the manuscript. The final manuscript was read and approved by all the authors.

References

- Abdull Mutalib, A. A., Md. Akim, A., & Jaafar, M. H. (2022). A systematic review of health sciences students' online learning during the COVID-19 pandemic. *BMC Medical Education*, 22(1), 524. <https://doi.org/10.1186/s12909-022-03579-1>
- Agasisti, T., & Soncin, M. (2021). Higher education in troubled times: on the impact of Covid-19 in Italy. *Studies in Higher Education*, 46(1), 86-95. <https://doi.org/10.1080/03075079.2020.1859689>
- Amir, L. R., Tanti, I., Maharani, D. A., Wimardhani, Y. S., Julia, V., Sulijaya, B., & Puspitawati, R. (2020). Student perspective of classroom and distance learning during COVID-19 pandemic in the undergraduate dental study program Universitas Indonesia. *Bmc Medical Education*, 20(1), 392. <https://doi.org/10.1186/s12909-020-02312-0>
- Australian government tertiary education quality and standards agency. (2020). *Foundations for good practice: The student experience of online learning in Australian higher education during the covid-19 pandemic*. <https://www.Teqsa.Gov.Au/sites/default/files/student-experience-of-online-learning-in-australian-he-during-covid-19.Pdf?V=1606442611>
- Bashir, A., Bashir, S., Rana, K., Lambert, P., & Vernallis, A. (2021). Post-COVID-19 Adaptations; the Shifts Towards Online Learning, Hybrid Course Delivery and the Implications for Biosciences Courses in the Higher Education Setting [Original Research]. *Frontiers in Education*, 6(310). <https://doi.org/10.3389/educ.2021.711619>
- Bordoloi, R., Das, P., & Das, K. (2021). Perception towards online/blended learning at the time of Covid-19 pandemic: an academic analytics in the Indian context. *Asian Association of Open Universities Journal*, 16(1), 41-60. <https://doi.org/10.1108/AAOUJ-09-2020-0079>
- Broadbent, J., Ajjawi, R., Bearman, M., Boud, D., & Dawson, P. (2023). Beyond emergency remote teaching: did the pandemic lead to lasting change in university courses? *International Journal of Educational Technology in Higher Education*, 20(1), 58. <https://doi.org/10.1186/s41239-023-00428-z>
- Browne, V., Munro, J., & Cass, J. (2017). The Mental Health of Australian University Students. *Journal of the Australian & New Zealand Student Services Association*, 25(2).
- Cohen, J., & Ebl. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). L. Erlbaum Associates. <http://dx.doi.org/10.4324/9780203771587>
- Daily Times. (2020). *Online teaching and challenges of covid-19 for inclusion of pwds in higher education*. <https://dailytimes.com.pk/595888/online-teaching-and-challenges-of-covid-19-for-inclusion-of-pwds-in-higher-education/>
- Day, T., Chang, I. C. C., Chung, C. K. L., Doolittle, W. E., Housel, J., & McDaniel, P. N. (2021). The Immediate Impact of COVID-19 on Postsecondary Teaching and Learning. *The Professional Geographer*, 73(1), 1-13. <https://doi.org/10.1080/00330124.2020.1823864>
- Dodd, R. H., Dadaczynski, K., Okan, O., McCaffery, K. J., & Pickles, K. (2021). Psychological Wellbeing and Academic Experience of University Students in Australia during COVID-19. *International Journal of Environmental Research and Public Health*, 18(3). <https://doi.org/10.3390/ijerph18030866>
- Drane, C., Vernon, L., & O'Shea, S. (2020). *The impact of 'learning at home' on the educational outcomes of vulnerable children in Australia during the COVID-19 pandemic* [Literature

- review]. National Centre for Student Equity in Higher Education. <https://apo.org.au/node/303566>
- Ellis, R. A., & Bliuc, A.-M. (2017). Exploring new elements of the student approaches to learning framework: The role of online learning technologies in student learning. *Active Learning in Higher Education*, 20(1), 11-24. <https://doi.org/10.1177/1469787417721384>
- Engzell, P., Frey, A., & Verhagen, M. D. (2021). Learning loss due to school closures during the COVID-19 pandemic. *Proceedings of the National Academy of Sciences*, 118(17), e2022376118. <https://doi.org/10.1073/pnas.2022376118>
- Farrell, O., & Brunton, J. (2020). A balancing act: a window into online student engagement experiences. *International Journal of Educational Technology in Higher Education*, 17(1), 25. <https://doi.org/10.1186/s41239-020-00199-x>
- Găman, M.-A., Ryan, P. M., & Bonilla-Escobar, F. J. (2020). To Stay at Port or to Go to Sea: Are Clinical Clerkships a Double-Edged Sword During the COVID-19 Pandemic? Where Do We Go From Here? *International Journal of Medical Students*, 8(2), 92-95. <https://doi.org/10.5195/ijms.2020.715>
- Găman, M. A. (2023). Health Sciences before, during and after the COVID-19 Pandemic. *Eur J Investig Health Psychol Educ*, 13(4), 759-761. <https://doi.org/10.3390/ejihpe13040057>
- Gonzalez, T., De La Rubia, M. A., Hincz, K. P., Comas-Lopez, M., Subirats, L., Fort, S., & Sacha, G. M. (2020). Influence of COVID-19 confinement on students' performance in higher education. *Plos One*, 15(10), e0239490. <https://doi.org/10.1371/journal.pone.0239490>
- Hsieh, H.-F., & Shannon, S. E. (2005). Three approaches to qualitative content analysis. *Qualitative health research*, 15(9), 1277-1288. <https://doi.org/https://doi.org/10.1177/1049732305276687>
- Hulley, S. B., Hulley, S. B., & Proquest. (2013). *Designing clinical research* (Fourth edition. ed.). Wolters Kluwer/Lippincott Williams & Wilkins. <http://ebookcentral.proquest.com/lib/ed/detail.action?docID=2031635>
- Jia, L., & Santi, M. (2021). Inclusive education for students with disabilities in the global COVID-19 outbreak emergency: some facts and thoughts from China. *Disability & Society*, 36(7), 1186-1191. <https://doi.org/10.1080/09687599.2021.1925226>
- Jin, Y. Q., Lin, C. L., Zhao, Q., Yu, S. W., & Su, Y. S. (2021). A Study on Traditional Teaching Method Transferring to E-Learning Under the Covid-19 Pandemic: From Chinese Students' Perspectives. *Front Psychol*, 12, 632787. <https://doi.org/10.3389/fpsyg.2021.632787>
- Joseph, D., & Trinick, R. (2021). 'Staying Apart Yet Keeping Together': Challenges and Opportunities of Teaching During COVID-19 Across the Tasman. *New Zealand Journal of Educational Studies*, 56(2), 209-226. <https://doi.org/10.1007/s40841-021-00211-6>
- Kapasias, N., Paul, P., Roy, A., Saha, J., Zaveri, A., Mallick, R., Barman, B., Das, P., & Chouhan, P. (2020). Impact of lockdown on learning status of undergraduate and postgraduate

- students during COVID-19 pandemic in West Bengal, India. *Child Youth Serv Rev*, 116, 105194. <https://doi.org/10.1016/j.chilgyouth.2020.105194>
- Lai, A. Y.-k., Lee, L., Wang, M.-p., Feng, Y., Lai, T. T.-k., Ho, L.-m., Lam, V. S.-f., Ip, M. S.-m., & Lam, T.-h. (2020). Mental Health Impacts of the COVID-19 Pandemic on International University Students, Related Stressors, and Coping Strategies [Original Research]. *Frontiers in Psychiatry*, 11(1082). <https://doi.org/10.3389/fpsy.2020.584240>
- Lapitan, L. D. S., Jr., Tiangco, C. E., Sumalinog, D. A. G., Sabarillo, N. S., & Diaz, J. M. (2021). An effective blended online teaching and learning strategy during the COVID-19 pandemic. *Education for Chemical Engineers*, 35, 116-131. <https://doi.org/10.1016/j.ece.2021.01.012>
- Li, S. H., Beames, J. R., Newby, J. M., Maston, K., Christensen, H., & Werner-Seidler, A. (2021). The impact of COVID-19 on the lives and mental health of Australian adolescents. *Eur Child Adolesc Psychiatry*, 1-13. <https://doi.org/10.1007/s00787-021-01790-x>
- Lockee, B. B. (2021). Online education in the post-COVID era. *Nature Electronics*, 4(1), 5-6. <https://doi.org/10.1038/s41928-020-00534-0>
- Lorenza, L., & Carter, D. (2021). Emergency online teaching during COVID-19: A case study of Australian tertiary students in teacher education and creative arts. *International Journal of Educational Research Open*, 2, 100057. <https://doi.org/https://doi.org/10.1016/j.ijedro.2021.100057>
- Lovibond, S. H., Lovibond, P. F., & Psychology, F. (1995). *Manual for the Depression Anxiety Stress Scales* (2nd ed.). University of New South Wales.
- Mahdy, M. A. A. (2020). The Impact of COVID-19 Pandemic on the Academic Performance of Veterinary Medical Students [Original Research]. *Frontiers in Veterinary Science*, 7(732). <https://doi.org/10.3389/fvets.2020.594261>
- Manchia, M., Gathier, A. W., Yapici-Eser, H., Schmidt, M. V., de Quervain, D., van Amelsvoort, T., Bisson, J. I., Cryan, J. F., Howes, O. D., Pinto, L., van der Wee, N. J., Domschke, K., Branchi, I., & Vinkers, C. H. (2022). The impact of the prolonged COVID-19 pandemic on stress resilience and mental health: A critical review across waves. *European Neuropsychopharmacology*, 55, 22-83. <https://doi.org/https://doi.org/10.1016/j.euroneuro.2021.10.864>
- Matthews, K. E. (2016). Students as partners as the future of student engagement.
- McGill, M., Turrietta, C., & Lal, A. (2021). Teaching health science students during COVID-19: Cross-hemisphere reflections. (18(5)). <https://doi.org/https://doi.org/10.53761/1.18.5.3>
- Naciri, A., Radid, M., Kharbach, A., & Chemsî, G. (2021). E-learning in health professions education during the COVID-19 pandemic: a systematic review. *J Educ Eval Health Prof*, 18, 27. <https://doi.org/10.3352/jeehp.2021.18.27>
- Nordmann, E., Clark, A., Spaeth, E., & MacKay, J. R. D. (2022). Lights, camera, active! appreciation of active learning predicts positive attitudes towards lecture capture. *High Educ (Dordr)*, 83(3), 481-502. <https://doi.org/10.1007/s10734-020-00674-4>

- Officer, T. N., Imlach, F., McKinlay, E., Kennedy, J., Pledger, M., Russell, L., Churchward, M., Cumming, J., & McBride-Henry, K. (2022). COVID-19 Pandemic Lockdown and Wellbeing: Experiences from Aotearoa New Zealand in 2020. *Int J Environ Res Public Health*, 19(4). <https://doi.org/10.3390/ijerph19042269>
- Patterson, Z. R., Gabrys, R. L., Prowse, R. K., Abizaid, A. B., Hellemans, K. G. C., & McQuaid, R. J. (2021). The Influence of COVID-19 on Stress, Substance Use, and Mental Health Among Postsecondary Students. *Emerging Adulthood*, 9(5), 516-530. <https://doi.org/10.1177/21676968211014080>
- Pavlich, E. (2024). High school student fears dream of university is out of reach as housing, cost-of-living pressures rise. *Australian Broadcasting Corporation*. <https://www.abc.net.au/news/2024-06-11/rental-crisis-student-poverty-housing-issues/103958584>
- Plakhotnik, M. S., Volkova, N. V., Jiang, C., Yahiaoui, D., Pheiffer, G., McKay, K., Newman, S., & Reißig-Thust, S. (2021). The Perceived Impact of COVID-19 on Student Well-Being and the Mediating Role of the University Support: Evidence From France, Germany, Russia, and the UK [Original Research]. *Frontiers in Psychology*, 12(2663). <https://doi.org/10.3389/fpsyg.2021.642689>
- Ryan, M. S., Holmboe, E. S., & Chandra, S. (2022). Competency-Based Medical Education: Considering Its Past, Present, and a Post-COVID-19 Era. *Acad Med*, 97(3s), S90-s97. <https://doi.org/10.1097/acm.0000000000004535>
- Schreier, M. (2012). *Qualitative content analysis in practice*. Sage publications.
- Schwartz, K. D., Exner-Cortens, D., McMorris, C. A., Makarenko, E., Arnold, P., Van Bavel, M., Williams, S., & Canfield, R. (2021). COVID-19 and Student Well-Being: Stress and Mental Health during Return-to-School. *Canadian Journal of School Psychology*, 36(2), 166-185. <https://doi.org/10.1177/08295735211001653>
- Simon, J., Helter, T. M., White, R. G., van der Boor, C., & Łaszewska, A. (2021). Impacts of the Covid-19 lockdown and relevant vulnerabilities on capability well-being, mental health and social support: an Austrian survey study. *Bmc Public Health*, 21(1), 314. <https://doi.org/10.1186/s12889-021-10351-5>
- Singh, S., Roy, D., Sinha, K., Parveen, S., Sharma, G., & Joshi, G. (2020). Impact of COVID-19 and lockdown on mental health of children and adolescents: A narrative review with recommendations. *Psychiatry Res*, 293, 113429. <https://doi.org/10.1016/j.psychres.2020.113429>
- Sprang, G., & Silman, M. (2013). Posttraumatic Stress Disorder in Parents and Youth After Health-Related Disasters. *Disaster Medicine and Public Health Preparedness*, 7(1), 105-110. <https://doi.org/10.1017/dmp.2013.22>
- UNESCO. (2021). *Education: From disruption to recovery*. <https://en.unesco.org/covid19/educationresponse>
- Wang, W., Li, G., & Lei, J. (2024). The impact of COVID-19 on medical students. *GMS J Med Educ*, 41(1), Doc10. <https://doi.org/10.3205/zma001665>

Watermeyer, R., Crick, T., Knight, C., & Goodall, J. (2020). COVID-19 and digital disruption in UK universities: afflictions and affordances of emergency online migration. *High Educ (Dordr)*, 1-19. <https://doi.org/10.1007/s10734-020-00561-y>

Xiao, Y., Becerik-Gerber, B., Lucas, G., & Roll, S. C. (2021). Impacts of Working From Home During COVID-19 Pandemic on Physical and Mental Well-Being of Office Workstation Users. *J Occup Environ Med*, 63(3), 181-190. <https://doi.org/10.1097/jom.0000000000002097>

Yang, B., & Huang, C. (2021). Turn crisis into opportunity in response to COVID-19: experience from a Chinese University and future prospects. *Studies in Higher Education*, 46(1), 121-132. <https://doi.org/10.1080/03075079.2020.1859687>

Zarowski, B., Giokaris, D., & Green, O. (2024). Effects of the COVID-19 Pandemic on University Students' Mental Health: A Literature Review. *Cureus*, 16(2), e54032. <https://doi.org/10.7759/cureus.54032>

Questionnaire used for survey and focus group interview

Appendix 1

Online Survey questionnaire: Part 1

1. What is your student status?

1	Local	
2	International	

2. Which age group do you belong to?

1	18-25	
2	26-35	
3	36-45	
4	46-55	
5	56-65	
6	Over 65	

3. What is your gender?

1	Female	
2	Male	
3	Other/I do not want to specify	

4. What is your study type?

1	Full time (enrolled in 3 units or more during semester)	
2	Part time (enrolled in 2 units or less during semester)	

5. Which undergraduate degree are you studying?

1	Bachelor of Health Science	
2	Bachelor of Health Science (Professional)	
3	Bachelor of Health Science/Bachelor of Arts	
4	Bachelor of Health Science/Bachelor of Business	
5	Bachelor of Health Science/Bachelor of Media Communication	
6	Bachelor of Health Science/Bachelor of Science	
7	other	

6. Which unit are you currently studying this semester?

1	HEA10001	
2	HEA20007	
3	HEA30001	
4	Please specify if you are enrolled in more than one of the above units.	

7. Is English your first language?

1	Yes	
2	No,is my first language.	

8. In which country were you born?

1	Australia	
2	Elsewhere	

9. What is your current residence status?

1	Living with parent(s)	
2	Other places (shared accommodation, relative home, rental home etc.)	

10. Do you have full-time access to internet?

1	Yes	
2	No	

11. Have you studied online before the COVID-19 pandemic?

1	Yes	
2	No	

12. Have you completed a unit or a course delivered with an online learning component at University prior to attending this course/unit(s)?

1	Yes	
2	No	

13. How much do you agree with each of the following statements? (please tick one box only for each statement)

Statements	Strongly disagree	Disagree	Neutral/not sure	Agree	Strongly agree
1. In general, I feel comfortable using online tools for learning.					
2. I am able to concentrate well when material is delivered via an online mode.					
3. I like the accessibility and flexibility of online delivery of material.					
4. Learning fully via an online mode is convenient without the need to travel to campus					
5. The changes in the delivery of classes due to COVID-19 restrictions has impacted my learning.					
6. The online learning makes my learning harder.					
7. The resources and support provided during the pandemic have helped me to engage with my learning similar to face-to-face teaching model.					
8. The resources and support provided during the pandemic have helped me to engage with other students.					
9. The online content delivered was accompanied by clear instructions via written, audio and/or visual means.					

10. I think the current learning management system, Canvas, is a good platform that provides me with a similar learning scope as I would have experienced in face-to-face classes I attend on campus					
11. The pre-recorded lectures were supported by Collaborate Ultra drop-in sessions.					
12. I found Collaborate Ultra drop-in sessions useful for my learning.					
13. Group work was easily conducted via Canvas Groups and Conference functions.					
14. Group work is easier via online means compared to face-to-face.					
15. Overall, the online resources provided during the pandemic are well structured and easy to follow.					
16. Overall, I am satisfied with the changes of the teaching structure from a face-to-face or blended (mixed on face-to-face and online) delivery to a fully online delivery.					
17. I am concerned about my education and the impact that the COVID-19 period has on my education.					
18. The issues related to internet connectivity have impacted my learning during this COVID-19 pandemic.					
19. The COVID-19 pandemic has affected my overall study plan.					
20. The changes to my learning and class delivery during the pandemic has caused me to withdraw from a unit(s).					
21. The COVID-19 pandemic may cause me to discontinue from my studies.					
22. I think, my overall learning outcome during this pandemic is decreased as compared to my previous on campus learning experience.					

Any other comments including suggestions that may help to improve your learning during the COVID-19 pandemic:

.....

Online Survey Questionnaire Part 2 (DASS-21)

The Depression, Anxiety and Stress Scale - 21 items (DASS-21) is a set of three self-report scales designed to measure the emotional states of depression (d), anxiety (a) and stress (s). Please read each statement and circle a number 0, 1, 2 or 3 which indicates how much the statement applied to you over the past week. There are no right or wrong answers.

Item no.	Item's content	Did not apply to me at all	Applied to me to some degree, or some of the time	Applied to me to a considerable degree or a good part of time	Applied to me very much or most of the time
1 (s)	I found it hard to wind down	0	1	2	3
2 (a)	I was aware of dryness of my mouth	0	1	2	3
3 (d)	I couldn't seem to experience any positive feelings	0	1	2	3
4 (a)	I experienced difficulty in breathing (e.g. excessively rapid breathing, breathlessness in the absence of physical exertion)	0	1	2	3
5 (d)	I found it difficult to keep motivated in my studies	0	1	2	3
6 (s)	I tended to over-react to situations	0	1	2	3
7 (a)	I experienced trembling (e.g. in the hands)	0	1	2	3
8 (s)	I felt that I was using a lot of nervous energy	0	1	2	3
9 (a)	I was worried about situations in which I might panic and make a fool of myself	0	1	2	3
10 (d)	I felt that I had nothing to look forward to	0	1	2	3
11 (s)	I found myself getting agitated	0	1	2	3
12 (s)	I found it difficult to relax	0	1	2	3
13 (d)	I felt down-hearted and blue	0	1	2	3
14 (s)	I was intolerant of anything that kept me from getting on with what I was doing	0	1	2	3
15 (a)	I felt I was close to panic	0	1	2	3
16 (d)	I was unable to become enthusiastic about anything	0	1	2	3
17 (d)	I felt I wasn't worth much as a person	0	1	2	3
18 (s)	I felt that I was rather touchy	0	1	2	3
19 (a)	I was aware of the action of my heart in the absence of physical exertion (e.g. sense of heart rate increase, heart missing a beat)	0	1	2	3
20 (a)	I felt scared without any good reason	0	1	2	3
21 (d)	I felt that life was meaningless	0	1	2	3

Appendix 2

Focus group interview questionnaire

The following questions will be asked at the interview (approved by Swinburne Ethics):

- 1) How would you describe the impact of COVID-19 and remote learning on your academic performance?
- 2) How would you describe the impact of COVID-19 and remote learning on your mental health and wellbeing?

- 3) Regarding your remote learning experience during COVID-19, what do you think your institution has done well to support you?
- 4) Regarding your remote learning experience during COVID-19, what do you think your institution needs to improve to support you?
- 5) Do you have any further comments or suggestions?

Appendix 3

Themes and codes used in the qualitative data analysis

Themes	Codes
Transition to online learning and assessment	Easier, increased access, flexibility
Social interaction and mental wellbeing	Negative, stressful, difficult, bad, challenging, depressed, lonely, anxious, panic, restricted, rigid, struggle/struggling, mental health, connection, exercise, socialise, missing out
Groupwork	Hard, difficult, harder, bad, challenging, challenge, difficulty, deteriorated, negative, negatively, communication, online discussion
Quality of online learning	Motivation, easy, emails, missing practicals, lack of workplace preparedness, lack of teamwork skills
Impact of type of online learning activity	Recorded labs, assessment amendments