RESEARCH ARTICLE

Learning during a pandemic: an Activity Theory analysis of the challenges experienced by Aotearoa/New Zealand university students

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Abstract

The worldwide disruption of higher education during the Covid-19 pandemic has been studied from the viewpoints of institutions and teachers, with some attention to students' health and learning challenges. Attempts to theorise the diverse and conflicting challenges faced by students learning online during the pandemic have been limited. It is helpful to analyse students' experiences as part of an activity system in order to unravel the system's elements and determine contradictions that occur. This study adopted a mixed methods approach to investigate students' online learning experiences at all eight New Zealand universities during the pandemic. Data obtained via a large-scale online survey, followed by focus groups and individual interviews, is presented in light of an Activity Theory framework. Findings show that students' key challenges were associated with new tools and technologies, lack of interaction and social connection, lack of routine and space, and clashing commitments due to multiple roles and responsibilities. Contradictions can be a driving force for change and development in teaching and learning contexts. We conclude with recommendations for tertiary institutions, teachers, learning designers and students to inform future learning and teaching plans.

Keywords Online learning · Student experiences · Activity Theory · Pandemic · Learning and teaching plans

Introduction

The sudden shift to online learning in response to Covid brought significant challenges to institutions, teachers, and students worldwide. Among the challenges were access and equity in terms of devices and skills, teacher readiness and capacity to teach online, and increased demand for support services (Barrot et al., 2021; Dawadi et al., 2020; Farnell et al., 2021; Suryaman et al., 2020). Many students faced a completely new situation, with multiple challenges as they moved to online learning. As educators, we are acutely aware of the significant difference between carefully planned, well-signalled online

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learning experiences and emergency remote teaching (ERT) in response to a crisis or disaster (Hodges et al., 2020).

This article stems from a national project conducted in 2020. Using data from 952 valid questionnaire responses and 19 individual and ten focus group interviews with 43 students across all eight universities, we explored how university students in Aotearoa New Zealand experienced online learning. Findings related to the challenges of online learning are the focus of this article. Findings related to other aspects of the project are reported elsewhere (Brown et al., 2021; Forbes et al., 2023; Hartnett et al., 2023).

This article aims to answer the research question:

- What challenges did university students face in learning online during the pandemic?

Using Activity Theory as a lens, in this article, we provide insights into the challenges and contradictions of students' experiences and explore implications for the design of post-Covid teaching and learning.

Transitioning to online learning

The physical closure of higher education institutions during Covid affected 220 million students worldwide (Farnell et al., 2021). Higher education institutions adopted ERT (Hodges et al., 2020) to provide educational continuity. As part of ERT, institutions adopted new technologies, prepared just-in-time teaching and learning guides, provided staff training, implemented infrastructure, and added support services. However, moving to a new learning space has resulted in significant challenges relating to pedagogy, technology, policy, training, workload, logistics, health, and equity (Donitsa-Schmidt & Ramot, 2020; Farnell et al., 2021; Varea & González-Calvo, 2021).

A large proportion of pandemic-related literature focuses on the impact of Covid on various aspects of education. The International Association of Universities survey report (UNESCO, 2020) provided the first global overview of the impact of Covid to better understand the disruption to higher education and the first responses by higher education institutions. Though the survey analysis was based on staff responses from 496 Higher Education Institutions from 112 countries, the data suggested an underrepresentation of the Americas and Asia/Pacific. The survey findings revealed that the main challenges affecting teaching and learning were access to technical infrastructure, online learning pedagogies, and staff and student distance learning competencies. Covid has also impacted international student mobility and domestic and international enrolment numbers (UNESCO, 2020).

Another theme emerging from Covid-focused literature focused on the experiences of teaching staff. Those accustomed to traditional teaching were challenged to embrace technology regardless of technological literacy. Teachers struggled to facilitate effective online learning due to limited knowledge of online pedagogies (Zhang et al., 2020). With little online teaching experience, teachers had to spend considerable time learning new skills (Zhang et al., 2020; Zhou, et al., 2020). In addition, teachers juggled other commitments and distractions, such as childcare and household demands, when teaching from home (Zhang et al., 2020). Teachers required continuous professional learning and development to facilitate pedagogically sound online teaching and learning experiences (Ali et al., 2022; Izhar et al., 2021; Zhang et al., 2020).

Studies of student experiences during the pandemic highlighted that while students appreciated learning continuity, many believed face-to-face learning was more effective than remote learning (Singh et al., 2020). Students faced multiple challenges such as lack of technological skills, lack of socialisation, high internet costs, technical difficulties and behavioural challenges while studying at home (Barrot et al., 2021; Khalil et al., 2020; Suryaman al., 2020). Khalil et al. (2020) emphasised that the online learning environments did not facilitate practical aspects of courses despite efforts to utilise online laboratories. It was evident that practical subjects such as health, sciences and teacher education faced significant difficulties in the virtual adaptation process (Forbes et al., 2023).

The emerging literature verifies an impact on student health. Copeland et al. (2021) reported that students' behavioural and emotional functioning had been affected by isolation and economic uncertainty. Similarly, Kapasia et al. (2020) found that students' learning was significantly disrupted by anxiety, depression, and issues with the internet connection and home learning. Studying online during lockdowns has also caused students to feel overwhelmed and isolated in many contexts (Fawaz & Samaha, 2021). In contrast, in some contexts, studying online positively impacted students' learning efficiency (Gonzales & Jackson, 2020). Positive contributions to students' learning included their continuous use of learning strategies. Some advantages of online learning during Covid were flexible learning environments, academic outcomes and student-centred learning (Bdair, 2021; Lemay et al., 2021).

Considering both positive and negative impacts on students and their learning, it is vital to gain a nuanced understanding of what did and did not work for students while studying online during the pandemic. While several studies have been published on the impacts of Covid on teaching and learning, many are written from the teachers' point of view (Mishra et al., 2021) and situated within a single course, programme or institution (Bond et al., 2021; Means & Neisler, 2021), with a tendency to be descriptive and devoid of theoretical analysis. To date, student-focused studies have centred on students' mental health (Copeland et al., 2021; DoE, 2021; Fawaz & Samaha, 2021), learning experience (Adarkwah, 2021; Kapasia et al., 2020; Singh et al., 2020), and studying in home environments (Khalil et al., 2020; Suryaman al., 2020). These student-focused studies have been predominantly conducted in America, the UK and Asian countries such as India, the Philippines, Nepal and Bangladesh.

Theoretical foundation

Activity Theory is a framework that can be used to study human practices (Engeström, 1987; Gedera, 2016; Greenhow & Belbas, 2007; Jonassen & Murphy, 1999; Kuutti, 1996; Yakubu & Dasuki, 2021). It provides a powerful lens for understanding and analysing various forms of human activity at individual and social levels (Kuutti, 1996). The two fundamental ideas that constitute Activity Theory are: "(1) The human mind emerges, exists and can only be understood within the context of human interaction with the world; and (2) this interaction, that is, activity, is socially and culturally determined" (Kaptelinin et al., 1999, p. 28). Activity Theory is based on Vygotsky's basic mediated action triangle that describes the relationship between a subject (individual or a group), an object (purpose, objective or a goal) and a tool or an artefact (physical or a mental tool). The interactions between humans and their environment do not occur directly but

are mediated by artefacts such as tools and signs (Greenhow & Belbas, 2007). These tools and signs that mediate human action can be physical, symbolic, mental or even virtual (Gedera, 2014).

Engeström's (1987) expanded Activity Theory comprises elements forming an activity system. Activity systems are meaningful units through which one can understand human activity (Kuutti, 1996, p. 25). Activity systems exist within socio-cultural settings like a classroom, school context or society. Thus, learning processes cannot properly be studied solely at the individual level, but one should consider the socio-cultural setting, which provides a more holistic approach (Lim, 2002). Activity has been usefully applied in educational contexts to understand online teaching and learning experiences and learner engagement (Allen, 2010; Baran & Cagiltay, 2010; Gedera, 2014, 2016; Shrestha et al., 2022; Yakubu & Dasuki, 2021).

An activity comprises a variety of mediators such as tools, rules and community and division of labour. These elements in an activity system act as mediators, and the relationships between these elements are constantly mediated. Figure 1 below shows the basic structure of the Activity Theory on which this article is based.

The following is a brief description of each element.

- The *subject* represents the individual or the group involved in an activity. The subject accomplishes an object through the use of tools.
- The *object* is the purpose of an activity, which can be a motive or a goal. The object is transformed into an outcome, distinguishing actions and sub-activities in an activity system.
- The *outcome* is the ultimate goal of an activity. When an object (a goal) of an activity is attained, it is transformed into an outcome.
- The *tools* mediate the object of activity. Tools are referred to as artefacts, and they can be physical (a computer), mental or conceptual (a plan), and psychological, symbolic or abstract (a language, experience). Tools assist in transforming an object into an outcome. This element shows the principle of mediation in an activity.
- The *rules* are the norms, practices, and expectations that control or influence actions and interactions in the activity system. The rules can be implicit or explicit depending on specific communities.
- The *community* represents the participants of an activity other than the *subject* who share the same *object* and outcomes of an activity. This element shows the collective nature of an activity.

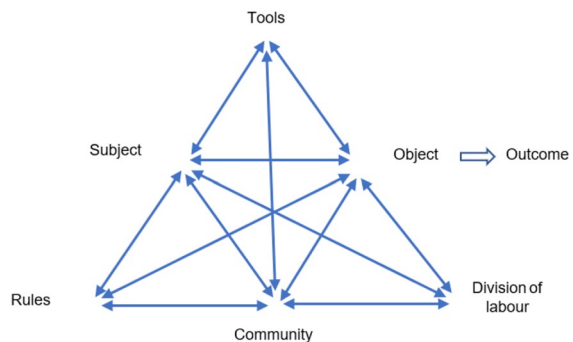**Fig. 1** The basic structure of an activity system (adapted from Engeström, 1987)

Table 1 The revised Activity Theory terminology

| Original terminology used in the Activity Theory framework by Engeström (1987)	The terminology used in the literature	The terminology used in this article
Subject	Subject, agent, actor, respondent	Participant
Instruments	Tools, artefacts, mediating tools	Tools
Object	Object, motive, stimulus	Objective
Rules	Rules	Rules
Community	Community, players	Community
Division of labour	Roles, division of labour	Roles
Outcome	Outcome	Outcome
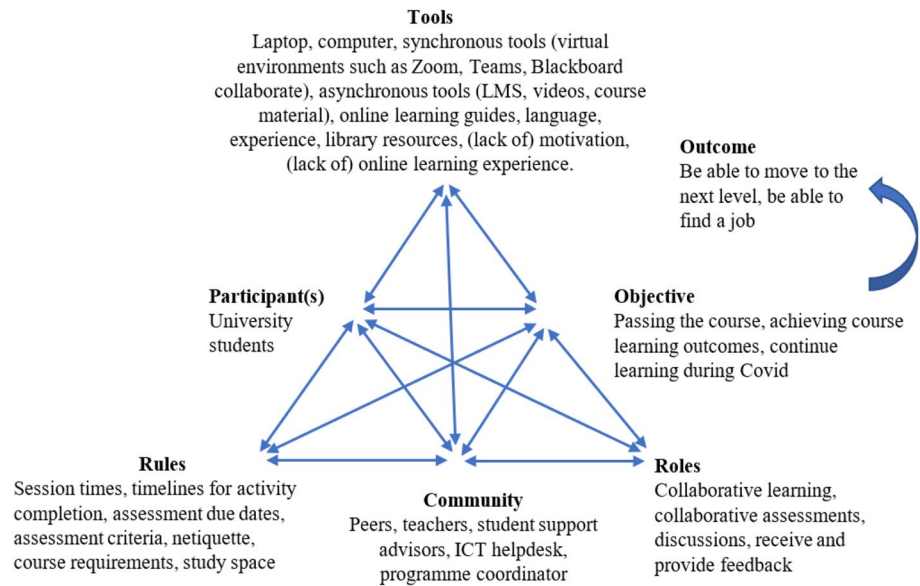
Fig. 2 Unit of analysis—learning online during a pandemic

- The *division of labour* represents the distribution of roles, tasks and responsibilities among community members. This element also denotes the status and power divisions.

With the Activity Theory framework, we can understand and analyse human activity. However, integrating the Activity Theory framework in an educational context requires some alterations to avoid confusion. Engeström predominantly uses the Activity Theory framework in work-related contexts. Thus, the current Activity Theory terminology does not easily translate to an educational context. For example, in Activity Theory, the term *object* is used instead of 'objective' to refer to the purpose of an activity. While this term is semantically correct, in the context of a classroom, the term 'object' can mean a real object (a noun) such as a computer. Therefore, to suit the needs of our research as well as to avoid confusion, the following terms specified in Table 1 are adopted in this article.

Figure 2 below is an activity systems model developed for the activity of online learning during a pandemic using the Activity Theory framework to demonstrate how an activity can be overlaid in the frame of Activity Theory.

Activities are not rigid or fixed but under continuous change and development (Kuutti, 1996). The development of the activities is somewhat discontinuous as the activities are not straightforward. The reason for discontinuation is that every action has its own history, and as the activities develop, it is crucial to understand that history to grasp the current situation. In addition, activities are not isolated units. Other activities and the changes in their environments bring effects to activity systems. These external effects give rise to imbalances in the activity system and among the activity elements. These imbalances are called *contradictions* (Engeström, 2001).

Contradictions expose themselves as obstacles, interruptions, conflicts, tensions and gaps; however, contradictions are believed to be helpful in the development of activity systems (Engeström, 2001). As shown in Fig. 3, contradictions can occur within, between the elements of an activity system or between activity systems. For instance, when a new technology is introduced to a group of students, it might create tension if they lack knowledge of how to use the tool. This may lead some students to question the current situation or get frustrated when they cannot use the new tool (Gedera, 2016).

There are four levels of contradictions (1) primary, (2) secondary, (3) tertiary and (4) quaternary (Engeström, 1987). Primary contradictions occur within a single element of activity systems (e.g., within the community). Secondary contradictions arise between the elements of an activity system (e.g., community and participants), tertiary contradictions arise when activity participants face situations where they have to use an advanced method to achieve an objective (e.g., when they are introduced to new technology). When
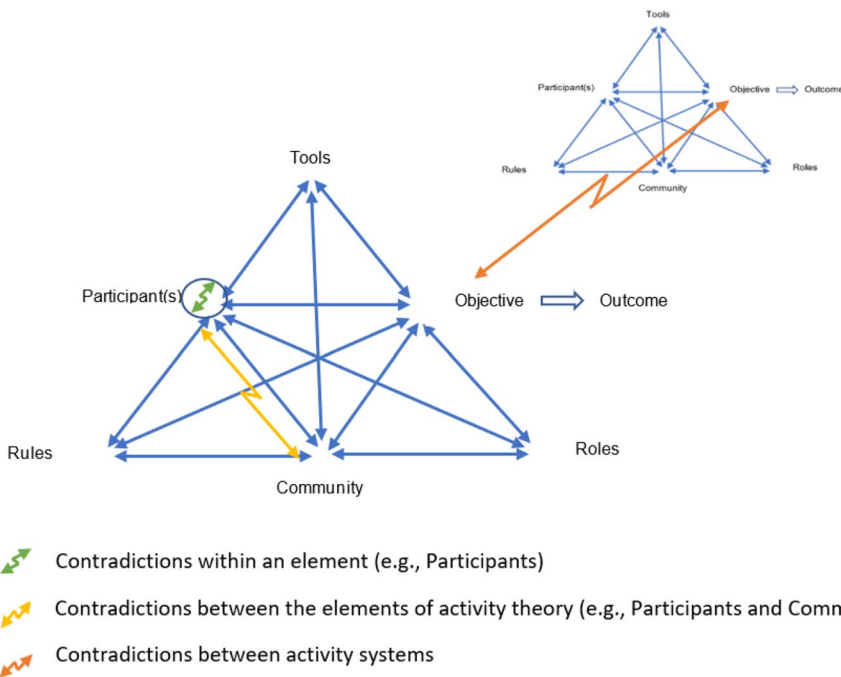

Fig. 3 Contradictions within and between activity systems

an advanced tool is introduced to the participants of an activity, that may result in frustrations, breakdowns and conflicts among participants and may require establishing new rules or new roles. These new practices may even reconfigure the activity. However, in the long run, participants' social and cultural practices influence how they use tools, and in return, the tools shape their practices.

The quaternary contradictions occur between the central activity system and outside activity systems.

Methodology

The current study adopted an explanatory sequential mixed method design, where quantitative data was collected in the first phase and used to plan the second qualitative phase (Creswell, 2014). This approach allowed researchers first to understand students' experiences of studying online during the pandemic through quantitative data. The subsequent qualitative data and analysis explored participants' views in greater depth. The basic premise of such an approach is that mixed methods research allows researchers "to have a complete understanding of research problems and questions" by "comparing different perspectives drawn from quantitative and qualitative data" (Creswell & Creswell, 2018, p. 216). Amalgamating quantitative data with qualitative data in this study, therefore, provided a richer understanding of students' experiences and specific challenges they faced when learning online during Covid. Ethical approval to undertake the study was gained before starting. The boards that granted the ethical approval are Auckland University of Technology (AUT (20/171), the University of Waikato (FEDU 036/20), and Massey University (4 000 023 000). The approvals were lodged with and ratified by the ethics committees of the other two universities, the University of Auckland and the University of Canterbury.

Participants

To ensure that student participants were studying at a New Zealand university at the time of this project, invitations to participants were sent via all eight university student associations in addition to the overarching New Zealand Union of Students Association (NZUSA), a body that represents all university student associations. All associations agreed to promote the questionnaire to all of their members via their various online communications channels.

Participants were enrolled in various programmes covering multiple disciplines at Diploma, Degree and Postgraduate levels. The student participants were from a range of ethnic backgrounds, such as Pākehā (New Zealanders of European descent), Māori (the indigenous people of New Zealand), Pacific islands and Asian. There were 952 valid questionnaire responses from all eight universities, and there were 19 individual interviews and ten focus groups involving 43 student participants, both onshore and offshore.

Comparisons with tertiary participation data for 2021 (Education Counts, 2022), show that the questionnaire respondent group were broadly representative of the wider student population in terms of the percentage of domestic versus international students, and students 24 years of age and under. Female participants were over-represented in the questionnaire (76%) compared to the broader student population (61%), and participants who identified as Māori were under-represented (5% versus 11%). A summary of the participant demographics is presented in Table 2 below.

Table 2 Demographics of questionnaire participants compared with New Zealand University student demographics (population data from Education Counts (2022)

Variable	Categories	Study (n)	Study (%)	Population (%)
Type of student	Domestic	839	89	86
	International	105	11	14
Ethnicity	New Zealand European	528	56	58
	Asian	195	20	18
	Pacific peoples	72	8	8
	Māori	51	5	11
	Other	102	11	5
Gender	Female	722	76	61
	Male	205	22	39
	Gender diverse	10	1	–
	Prefer not to say	9	1	–
Age	Under 20 years	280	30	17
	20–24	304	32	47
	25–39	234	25	25
	40 years and above	125	13	11

Measures

Data were collected using an online questionnaire, semi-structured interviews and focus groups with students. We developed the questionnaire, interview questions, and related protocols after reviewing relevant online teaching and learning literature (Bayne et al., 2020; Gedera, 2016). We also conducted several rounds of peer/expert review to refine the questionnaire and interview questions during the development process.

The questions in the first part of the questionnaire were related to various demographic details such as students' university, programme of study, age, gender, ethnicity, internet and device accessibility, the usual mode of study and if they were domestic or international students. The second part of the questionnaire consisted of a range of questions asking students about their online learning experience during the lockdown, including the challenges and benefits of online learning. The two open-ended questions at the end of the questionnaire asked students what they appreciated most about online learning and the aspects they would like to see continued in future course design and teaching (See Hartnett et al., 2023 for the full questionnaire). From the questionnaire, we have included the demographic data to give a background to the sample and aspects related to the focus of this article, the key challenges of online learning during the pandemic.

In the semi-structured individual and focus group interviews, we explored students' online learning experiences in-depth. The questions asked students to explain the benefits of online learning, the biggest challenges they faced when studying online and their impacts, the aspects that supported their learning and what they look forward to when they return to university (see attached Appendix for the interview questions). Based on students' online learning experiences and challenges, probing questions were asked to gain a nuanced understanding of their context and experience.

Procedure

The data collection proceeded in two distinct phases. In the first phase, data were gathered through an online questionnaire. The project team collaborated with student associations in each university to invite participation through social media, institutional newsletters and blogs between July and Oct 2020. The online questionnaire was available via Qualtrics and took about 20 min to complete.

In the second phase, participants were self-selected for the semi-structured interviews. At the end of the questionnaire, students were asked to complete a separate form to provide their contact details if they were interested in participating in an individual or focus group interview. Once we negotiated the date and time, we conducted individual and focus group interviews online using Zoom.

The questionnaire data was analysed separately after the first phase of data collection. In analysing the quantitative data, first, the data were cleaned for invalid responses. Then descriptive statistics (frequency counts and percentages) were generated across a range of demographic variables and responses to other questionnaire items. The qualitative data then helped explore in more detail the initial quantitative data. Once both phases were completed, all interview transcripts and the open-ended responses from the questionnaire were imported into NVivo. Qualitative data analysis involved reading and re-reading all textual data to determine the breadth of themes and sub-themes. The relevant units of data related to the activity of learning during a pandemic were selected and coded according to the elements of Activity Theory.

In Activity Theory, the activity system is the minimal meaningful context through which many kinds of human activity can be understood and analysed (Barab, 2002; Engeström, 2001; Kuuti, 1996). In our study, the minimal meaningful unit of analysis was the online learning activity during the pandemic. In analysing the qualitative data, we used the elements of Activity Theory as "buckets" for organising the collected data to gain an in-depth understanding of the participants, processes and components of the learning activity (Barab et al., 2004, p. 207). For example, when students talked about how the loss of routine and space affected their learning, we arranged the relevant data into 'Rules' (as implicit and explicit rules governed the learning activity mediated students' learning).

Activity Theory also provided us with a lens to identify the contradictions that emerged within and between activity systems in the study. The contradictions manifested themselves in the form of tensions, frustrations and challenges and affected students' learning. In addition, by using activity as the unit of analysis, we were able to encapsulate multiple perspectives about students' online learning experience during the pandemic at the individual as well as collective levels (Gedera, 2016). Based on the type of contradiction (e.g., between the subject and community), we categorised it as a primary, secondary, tertiary or quaternary contradiction. Over the analysis process, some of these sub-themes were merged or discarded based on how significant they became. Later, some extracts of the transcribed interviews were incorporated as quotations in this article to help answer the research question.

Credibility, dependability, confirmability, and transferability

Credibility, dependability, confirmability, and transferability are important considerations in mixed-method research studies. To address credibility, employing triangulation as a

technique, we used multiple data sources, such as individual interviews, focus groups and an online questionnaire in our study.

Miles and Huberman (1994) assert that "definitions become sharper when two researchers code the same data set and discuss their initial difficulties", which they refer to as the "check-coding" method (p. 64). Adopting Miles and Huberman's check-coding method, two researchers coded the data, and a further three researchers reviewed the codes. The coded themes and sub-themes were consistent throughout, although some of the codes were worded differently by the two researchers. We then had several rounds of review where the researchers merged or discarded the sub-themes based on how significant they were in relation to the research question. The iterative review process and constant debriefing sessions that we conducted as experienced researchers assisted in strengthening the credibility of our data analysis.

To address dependability, researchers can document their methods and procedures thoroughly and ensure consistency in data collection and analysis. Our study used detailed and systematic procedures for data collection and analysis. We systematically stored data such as audio-recorded interviews, transcripts and questionnaire data for future reference to ensure the dependability of our study.

We achieved confirmability by maintaining an audit trail of the research process, including data collection, analysis, and interpretation. We recorded our ideas, interpretations, and reflections as part of the research process. We then discussed these in our peer review and debriefing sessions to ensure confirmability.

To address transferability, we collected data from all eight universities in New Zealand covering a range of programmes, levels of study, subjects, and both international and domestic students' experiences. We also offer recommendations for tertiary institutions, teachers, learning designers and students based on our findings. It is hoped that the readers will find these diverse aspects of student experiences and the recommendations useful when planning future learning and teaching approaches in their own contexts.

Findings

The quantitative data (n=952) revealed that most of the questionnaire respondents were female (76%) and domestic students (89%) under the age of 24 years (61%). Most students were studying full-time (87%) on campus (70%) at one of the eight universities in Aotearoa New Zealand at the time of the 2020 lockdowns. A large percentage (89%) of students had broadband or ultrafast fibre internet connections, and most used their laptops (95%) for studies. Three-quarters of all respondents were studying on-campus, as opposed to in a blended/hybrid mode or fully online. Slightly more than half (53%) of the students had no prior online learning experience. Based on the quantitative data analysis, the biggest challenges respondents faced (where respondents could choose all that apply) when studying online during the lockdown are shown in Table 3 below.

The qualitative data, which included the open-ended questionnaire responses, were analysed and organised into four key themes based on the focus of this article, the key challenges students faced while learning online during the pandemic:

Theme 1:   Rules—loss of routine and space.
Theme 2:   Community—interaction, collaboration, and social contact.
Theme 3:   Tools—mediating digital technologies.

Table 3 The biggest challenges students faced during lockdow

Biggest challenges	n value	Percentage of respondents (%)	Associated theme
Lack of routine/structure	560	59	Rules—loss of routine and space
Balancing study & other life demands	552	58	Activity system—clashing commitments
Stress	516	55	Rules—loss of routine and space
Distraction	506	54	Rules—loss of routine and space
Anxiety	504	53	Rules—loss of routine and space
Too much screen time	478	51	Rules—loss of routine and space
Too much time indoors	430	46	Rules—loss of routine and space
Isolation	424	45	Community—interaction, collaboration, and social contact
Boredom	307	32	Community—interaction, collaboration, and social contact
Difficulty obtaining help with study	229	31	Community—interaction, collaboration, and social contact
Access/resource issues	271	29	Tools—mediating digital technologies
Technology issues	272	29	Tools—mediating digital technologies
Technology skills	79	8	Tools—mediating digital technologies

Theme 4:   Activity system—clashing commitments.

In the "Discussion" section, the following findings are discussed through the lens of Activity Theory's principle of contradictions.

Theme 1: rules—loss of routine and space

The implicit and explicit rules that governed the learning activity mediated students' learning. A key challenge students faced during the lockdown was the struggle to manage their time and study routine. As a result, it was difficult to resist distractions and procrastination to stay motivated.

> I didn't have a routine… even Zoom classes. Sometimes I would just watch them later. I just didn't really feel that great because I used to be quite good with my routine when I had the physical classes. (FG10 P1).

Not having a routine made many (59%, 560) students less productive. They ended up "doing less work overall" (INT P9). Students stressed that "the whole everyday structure went out the window" (INT P19), and it was "hard not to procrastinate when you can watch your classes whenever you want" (questionnaire). As a result, things were "piling up" (INT P2). As often happens, procrastination would, in turn, lead to stress.

> The more I fell behind in my workload, the stressed and anxious I become, which made me seek an escape from these emotions in distraction (TV, movies, games, etc...), a self-perpetuating cycle (questionnaire).

Our research showed that stress was a significant challenge for many students. Over 50% of the questionnaire respondents identified "stress', "depression", "lack of motivation", "mental health", and "anxiety" as key challenges they faced while studying online during the lockdown. Students attributed anxiety and stress to various factors, including feeling loss of control, isolation, and lack of motivation.

Students often had constructive stress management approaches, but the lockdown disrupted their usual strategies. For example, students were unable to go to the gym. This is a further example of how the loss of routine interfered with productivity and wellbeing.

> My entire lifestyle was changed at that time. So, the first thing I do in the morning is go to the gym to start my day and the gym was closed for a month, so I wasn't doing that…like all the days were lazy days through which I had to navigate... And there was no clear demarcation in all the activities, how I allocate my time (INT P14).

"Not having a designated space or time" (INT P17) was another challenge students faced. In some cases, the physical spaces that were available were not conducive to studying:

> My flat isn't set up for study. So, I didn't have a clear area of desk. It was like, I'm gonna work on the floor today (INT P9).

While some students found it difficult to be productive at home, others discovered more time in their day. Just over half (486, 53%) of the students who responded to this question (n = 915) in the questionnaire, identified not having to travel as a key benefit.

> Being able to cut out travel time has given me three hours of extra study time in a day, the flexibility that online university sort of, operates on has enabled me to fit it in around daily life, reduce stress a little bit, reduce anxiety, I feel more in control of

the work that I do, …I definitely work better when … feel like I have to take charge of my own learning (FG5 P1).

Despite the struggles to create a productive routine, students did appreciate the ability to self-pace their learning, with recorded sessions affording flexibility.

I found that with the video is really helpful because I can go back, pause it and take more notes and then continue, which I found really good because I just struggle to - keep up in in-class lectures (FG9 P1).

Of the participants who answered the question about helpful teaching behaviours in the questionnaire (n=915), 61% of students found video recordings helpful. Almost half of the students (454, 50%) identified flexibility as a key benefit of studying during the lockdown. Thus, while some students found the loss of their routine stressful, others found they benefited from carving out a more flexible, personalised schedule that worked for them.

Another rule-related change that took place during the lockdown was associated with course assessments. While not unilateral, changing the types of assessment and submission deadlines was widespread.

Changes to the deadlines or duration of the assessments were introduced, providing more flexibility for students who had other family commitments:

…most of my assessments in the first trimester were, online tests which could be done over a 24-hour period, which was really good because it allowed me for the time, to wait till their kids are gone to bed, so I could actually do the work (FG7 P1).

In addition to the above, 59% (537) of students (n=915) identified extensions to assignment deadlines as helpful teaching behaviour.

Theme 2: community—interaction, collaboration, and social contact

In an activity system, the community element comprises all the people involved in an activity together with the participant(s) who achieve a common objective.

In our study, students expressed that a lack of interpersonal engagement, interaction and collaboration impacted their learning. Students highlighted that "engagement with the lecturers was just a voice and slides on a screen" and that they were "unable to ask questions directly from the lecturer" (questionnaire).

Students compared their online learning experience with previous face-to-face experiences to illustrate their challenges in the virtual learning space.

I tried to attend a few early Zoom classes, but I didn't find it that engaging for some reason.…it wasn't the same as real face-to-face interaction (INT P14).
Very few classes had good interaction and engagement with the lecturer and other students online.... I feel a lot more comfortable asking questions in person, you can go up at the end of class to engage with someone rather than a blank screen (INT P15).

However, this was by no means a universal experience; some students reported supportive interaction and collaborative learning online.

A lot of peers were helping each other, like in our online sessions, we have breakout rooms that you can go, just chat with other peers, ask any question (FG9 P1).

Conversely, some students found the online group work challenging due to absent and unresponsive peers.

> In online classes, group work was more difficult with the unwilling classmates... people disappearing and stuff (FG6 P1).

As a result of these challenges, some students negotiated with their lecturer to complete group projects individually.

> I found working in a group difficult. … I'd had a conversation with my lecturer if I could do the group project solo, and so I did. (FG5 P1).

In other instances, the lecturers "took away the group collaborations" (FG5 P2).

In addition to in-class interaction and collaborative group projects, students missed the opportunity to connect socially with their peers, with many (45%) experiencing isolation.

For some, the social connections did not evolve naturally in the virtual learning spaces compared with face-to-face environments. Particularly, the feeling of 'connectedness' was missing in online interactions.

> It's nice to have the chit-chat during, before, and after the lecture, you don't get that on Zoom, and I'm pretty good at Zoom conversations by now, but it's a different art from face-to-face conversations (FG P1).

Whereas many students missed social interaction, others found it occurred flexibly. As mentioned, flexibility was recognised as a key benefit (454, 50%), and for a small proportion of students, connections with teachers and peers were also identified as benefits of study during the lockdown.

> I could just switch between different things, talking to different people, catching up socially and that was really easy. If a lecture did run over time and if I had like a group of friends who were meeting over zoom, it was okay, because I could just slip in later (FG1 P1).

Theme 3: tools—mediating digital technologies

The *tools* in a learning activity can be physical, conceptual, cultural, virtual or psychological. In this context, the new virtual learning spaces and technologies mediated and impacted students' learning. The technologies included institutional learning management systems (LMS) such as Blackboard, Canvas, and Moodle and web conferencing tools such as Teams and Zoom. Some of these tools and virtual learning spaces demanded significant new learning for some participants.

> …the Zoom meetings and the Zoom classes were a new thing, so the professor and the students were all struggling and trying it, and there were a lot of technical issues emerging (INT P14).

However, where students (and staff) were already fluent users of the technologies, they were able to experience some advantages:

> I had the experience of doing a miniature conference online …because of Zoom rooms, it worked really well. You can even have a break room and using those for this miniature conference presenting posters was a really good experience. I feel like a lot of us would have been more nervous if we had done face-to-face (FG1 P1).

 Students found that the online mode impeded practical learning. For example, questionnaire responses highlighted:

> "Teaching midwifery online is a hard job, felt a lot of time was wasted each session."
> "Having no practical aspect to help consolidate and understand the theory, I feel the depth of my learning and retention was negatively impacted"

> This was also evident from the focus group and interview data:

> The biggest challenge would have been, adjusting to the changes in the practical component of the course, we were doing a spinal paper at the time, which requires you to actually work on people's bodies (FG9 P2).

 Exceptions were evident when students experienced using digital technologies that did succeed in mediating practical learning. For example, video demonstrations were helpful for medical students as they could watch their lecturer performing a dissection, and the opportunity to observe this was helpful.

> Because in real person cadaver… you have to do the work and sometimes you can't see the stuff by yourself. Whereas in the video, the lecturer dissects everything and show you exactly what is happening before. Sometimes in the room, you don't really know what to look for. I think that's a pro (INT P2).

Theme 4: activity system: clashing commitments

In addition to being university students, they had multiple commitments and responsibilities in their lives. Thus, they were part of many activity systems (e.g., working in an organisation, looking after children, taking care of a vulnerable family member). These work and family commitments resulted in clashes, distractions and pressures.

> I work part-time, so it was difficult to keep focus on my studies during lockdown whilst going to work at a medical center (questionnaire).
> I am a primary school teacher, so also had to contend with a huge increase in workload as we moved learning online, then try to study (questionnaire).
> Honestly, I don't want to remind myself of that experience because that was really tough for me and I'm also a mom. I've got two little young ones, one and three. So, 24/7 you are surrounded by two little ones just, hugging your legs all the time (FG3 P1).

 In addition to the workload pressures, some students had larger households and cultural commitments to consider, which added extra responsibilities to juggle.

> In an island household it's hard to focus on studies while being at home…a lot of my family members got redundant and then they lost their house. There were 11 people staying in my house. I couldn't study. And then I was also working at the same time. I had to pick up more shifts to help…and my house was always loud (FG5 P32).

Discussion

Our analysis revealed that all four types of contradictions—primary, secondary, tertiary and quaternary—impacted students' learning. These contradictions are not just problems but can be the driving force of change and development in teaching and learning contexts.

Below we discuss the types of contradictions evident in our research data using the Activity Theory framework:

- Primary contradictions: loss of routine and space
- Secondary contradictions: loss of routine and space; Interaction, collaboration, and social contact
- Tertiary contradictions: mediating digital technologies
- Quaternary contradictions: clashing commitments

Primary contradictions

Loss of routine and space

It is well-established that the pandemic created psychological stress among students (Barrot et al., 2021; Kapasia et al., 2020). For students in our study, stressors included procrastination, and there was a cyclical effect here whereby some students procrastinated due to a lack of prescribed timing and structure (rules), and the procrastination, in turn, led to workload issues, anxiety, and escapism via continued procrastination. Students attributed anxiety and stress to various factors, including feeling a loss of control, isolation, and lack of motivation.

Students who could take control and structure their own time and space avoided these pitfalls, in turn experiencing empowerment and productivity similar to that described elsewhere (Gonzales & Jackson, 2020). In these ways, primary contradictions saw participants wrestling internally with stress and anxiety and working to re-establish coping mechanisms (rules) to rebalance the elements of the system. From the primary contradictions emerged tertiary contradictions (discussed below) as students were compelled to develop advanced means of achieving their objectives by working with unfamiliar technologies and by developing new rules and even new roles as self-directed learners. Coping strategies used by students were a focus for Barrot et al. (2021), who found that the most used strategies were resource management and use, help-seeking, technical aptitude enhancement, time management, and learning environment control.

Secondary contradictions

Loss of routine and space

Students reported disruption to their usual study routines, making distractions and procrastination harder to resist. Attendance at physical classes creates an expectation of presence, with implicit and explicit rules around time and space and the demarcation of activity. Without these boundaries, disturbances were common, hindering productivity. The loss of study spaces, such as classrooms, lecture theatres, and libraries, was acutely felt by some students who lacked a suitable study space at home, mirroring the findings reported by Kapasia et al. (2020) and Barrot et al. (2021). As Kapasia et al. (2020) emphasised, the lack of "a positive space for study" (p. 5) was a sign of inequity experienced by students in rural and remote areas with poor internet connectivity and by students who did not have a separate room (or even a desk) for study. These factors were evident in Aotearoa, as in West Bengal, India (Kapasia et al., 2020), the Philippines (Barrot et al., 2021), and Nepal (Dawadi et al., 2020), as well as in Europe (Farnell et al., 2021). Whereas Barrot et al.

(2021) attributed the learning environment challenge to the developing country context, it is apparent that socio-economic disadvantage also impacted negatively on the experiences of students in NZ who similarly experienced distractions, noise and limited space to study.

The affordance of flexibility via recorded lectures and asynchronous learning created a paradox by removing the prescribed structure. The effect was paradoxical because, in theory, one would expect flexibility to be positive, enabling greater control, and this was indeed the case for some students. However, flexibility led to primary contradictions and dysfunctional patterns for other students, such as procrastination.

In Activity Theory terms, the disruption to rules altered the norms, practices, and expectations that influence learning actions. In some cases, these rules were explicit—the need to attend classes at particular times, in designated spaces, and submit assignments by deadlines. Prior to the pandemic, many students attended classes on campus in lecture theatres, tutorial rooms, and laboratories. Students attended work placements in schools and other workplace and community settings. Timetables assumed great importance, and intricate plans were made to avoid clashes and to shape a student's weekly programme of study. Assignment deadlines were often strict, as were exam timetables. Amid the pandemic, the explicit rules around time and space shifted. In some cases, these were replaced by similar timetables, with a shift to synchronous online spaces, via Zoom and Teams. The physical spaces from which the students (and staff) connected virtually were variable and often a source of inequity, as noted. Attempting to replicate face-to-face classes via synchronous technologies was met with mixed responses, presenting both positive and negative impacts on the learning experience.

There was a more fundamental shift to time and space in some cases as learning became asynchronous, with recorded video lectures, LMS forums, and independent study tasks. Consequently, norms, practices and expectations were entirely disrupted, and new forms of practice emerged, some more aligned with learning than others (e.g., procrastination vs self-direction).

In the case of deadlines, rules around assessments were altered and generally led to more generous time allowances for assessments, as extensions were granted and assignments replaced exams. This aspect of flexible timing was generally experienced by students in our study as a positive factor in learning, as it mitigated pressure and relieved stress. This finding contrasts with some reports of students being "left in the lurch" through cancellation or suspension of exams (Daniel, 2020, p. 94). As Aotearoa universities replaced exams with alternative assessments, students were able to complete requirements.

Alongside explicit rules around time, space and deadlines, there were also implicit and informal routines/rules for individuals, such as the habit of starting one's day at the gym, followed by studying at the library and taking breaks with peers in one's community. Secondary contradictions, therefore, manifested as tensions and interruptions due to the shifting rules. On the other hand, there was a liberating effect to the reduction in the routine commute, and when students could harness the benefits of flexibility and create their own structures and revised routines, there was an emergence of new rules and roles in the system.

Interaction, collaboration, and social contact

Our findings showed that for some students, lack of interpersonal engagement, interaction and collaboration negatively impacted their learning experience. Students missed natural interactions with lecturers, such as being able to ask questions and discuss ideas as

they would face-to-face. Students viewed synchronous tools like Zoom and Teams as a poor substitute for in-person conversation, and there was a sense that there were too many people on a Zoom call, with a lack of one-to-one time. For some students, the sense of crowding was mitigated by using breakout rooms to enable smaller group conversations. However, group work was challenging for some students due to absent peers. Social and incidental contact was reduced, leading to feelings of isolation, a finding also reported by Suryamanet al. (2020), Barrot et al. (2021) and Fawaz and Samaha (2021). These patterns—lack of interactive learning and social isolation—show the importance of the community element in learning.

As such, this illustrates secondary contradictions between elements in the activity system. Specifically, there is a contradiction between participants and the community regarding rules and roles. Where the community was disrupted, and regular and incidental in-person interactions were impacted, the rules of engagement shifted for students who felt less supported individually. Students felt similarly deserted when peers in the community stopped playing their roles in collaborative tasks. On the other hand, when small group interactions were continued via breakout rooms or social media, this was a supportive experience for students. Indeed, Barrot et al. (2021) identify consultation with classmates as a coping strategy students use in response to various challenges, including the disadvantage of a poor learning environment at home.

When lecturers could sustain a degree of one-to-one support, students were appreciative of the efforts of staff to connect. Since connecting one-to-one with students outside of physical classes arguably requires more/different effort from staff, this indicates the development of new roles.

Tertiary contradictions

Mediating digital technologies

Activity Theory 'helps understand how technologies can affect educational change' (Bellamy, 1996). One of the key principles of Activity Theory is *tool mediation,* in which tools are seen as means that mediate human interactions (Russell, 2002). Tools mediate the *objective* of activity and assist in transforming an objective into an outcome. These mediating tools can be physical, psychological, cultural, symbolic and virtual. In the context of our research, the new digital tools mediated students' learning presenting both positive and negative impacts.

Practical learning in a virtual space was a significant challenge for some students during the lockdown (Day et al., 2021; Khalil et al., 2020). The lockdowns limited students' practical learning experiences (Barrot et al., 2021). In the absence of face-to-face practical components, digital tools such as video facilitated mediated learning in some other subject areas. Students found the video demos valuable for their multimodal capabilities (Gedera & Larke, 2021). However, demonstrations were insufficient in some cases. For example, students in osteopathy were required to master specific techniques while working on a real human body. Despite the best efforts to offer alternative methods, such as virtual laboratories, our findings revealed that practical components became theoretical in such cases.

While there were benefits of tool-mediated learning, *tertiary contradictions* were evident in this context. Tertiary contradictions arise when activity participants face situations where they have to use an advanced method to achieve an objective (e.g., when they are introduced to a new technology to achieve an objective) (Gedera, 2014). The findings

indicated that the key challenges participants encountered while studying online were a result of the abrupt and unplanned decision to adopt new virtual tools for the transformation of the teaching and learning activity during the pandemic. Even before the pandemic, we knew little about students' readiness for online learning (Lemay et al., 2021; Tang et al., 2021).

There is a widespread belief that new generations of learners are tech-savvy and spend most of their time on devices (Gedera & Zalipour, 2021). However, it is evident that they do not inherently possess digital literacy skills. Exposure to tech and social media does not equate to the effective or pedagogical use of technology. They need guidance, technical support and time to get used to new tools, just as teachers do. Most of the students who participated in our study were familiar with the institutional learning management systems (LMS) and had used the LMS to access course resources pre-pandemic. However, using the LMS for fully online instruction went beyond their comfort zone. The new online synchronous tools introduced to the activity system, such as Teams and Zoom, demanded new learning that challenged some participants. Although all these seem like tensions, challenges and frustrations, our findings illustrate Engeström's (2001) claim that contradictions are a source of change and innovation in practice. As Engeström (2001) accentuates, 'In important transformations of our personal lives and organisational practices, we must learn new forms of activity which are not yet there. They are literally learned as they are being created' (p. 138).

Activity Theory emphasises that human beings not only act on their environment both individually and collectively with the use of tools but also, they learn with tools (Engeström, 1987). Our research showed that students who were familiar with the virtual spaces and technologies found their way around in the virtual space and capitalised on the added benefits of tool-mediated learning. For instance, students found online presentations less daunting compared to face-to-face presentations. This is an example of how humans' social and cultural practices influence how they use tools and how the tools shape their practices over time (e.g., how students learn new digital presentation skills to suit the online environment over time).

Quaternary contradictions

Clashing commitments

Engeström's (1987) fourth-level contradictions, known as *quaternary contradictions*, refer to the tensions between the central and neighbouring activity systems. Activity systems are never isolated but linked to other neighbouring activity systems somehow. As we participate in activity systems such as home, school, work and societies, we bring different histories of diverse involvements to activity systems (Russell, 2002). For example, in our study, in addition to being part of the activity system of studying online, students were also part of many other activity systems, such as working part-time or full-time, looking after children, or looking after a sick family member. As part of multiple activity systems simultaneously, students had various other responsibilities that clashed with the central activity system. The resultant quaternary contradictions appeared as distractions, pressures and clashes, disrupting students' learning. Disrupted learning due to distractions was also a finding reported by Barrot et al. (2021) and Bdair (2021).

Activity systems are multi-voiced, and participants take various roles and have different perspectives within an activity system. The shared nature of activities means that a

change within an element of the activity system can affect other elements. In our study, when participants shared the activities with the community or family members, they had to re-negotiate the rules related to time, space, and roles. Some cultural commitments were not up for negotiation in some households where the family comes first. Balancing other responsibilities and studying was hard for many students.

Key conclusions and recommendations

The findings revealed that students' learning experience was not homogeneous, and the challenges encountered varied in terms of type and extent. Our focus on contradictions in this context supports Engeström's (2001) claim that contradictions are a source of change and can lead to innovative practice.

Students' key challenges during the lockdown were associated with the new tools and technologies, lack of interaction and connections, lack of routine and space, and clashing commitments due to multiple roles and responsibilities in their lives.

Several implications can be drawn from the findings of our research. We suggest the following recommendations to institutions, teachers, learning designers and students:

Routine and space

- Provide a structure for study or help students to develop one. Share models of study routines (built-in time for leisure and breaks).
- Share ideas for study spaces—inexpensive desk options, room dividers, noise-cancelling headphones.
- Provide workshops and resources on time and stress management (refer to support services, set realistic goals, and help manage workload).
- Clarify communications and expectations (e.g., weekly hours spent on learning and assessments, scaffold with deadlines for small chunks of work, and regular progress reports).

Interaction, collaboration, and social contact

- Create opportunities for online collaboration. Provide resources for group formation, collaborative spaces, netiquette, group protocols, activity logs, and ways to assess both individual/group contributions). Overtly encourage peer-tutoring/mentoring and community help forums.
- Establish opportunities for students to give and receive self, peer and lecturer feedback regardless of the mode of study.
- Foster social learning and social presence both face-to-face and online by nurturing relationships and creating opportunities (e.g., chit-chat before and after virtual sessions, online icebreakers to get to know each other, and study groups).
- Provide one-to-one and small group interactive opportunities (e.g., drop-in sessions to ask questions individually).

Tools

- Allow time to play/practice when new tools are introduced. This can be achieved by scheduling practice sessions to explore new technologies and tools. Provide an extended orientation to all new technologies, with a range of ongoing support such as how-to guides, on-demand technical support and peer tutoring.
- Help develop student skills and competencies both face-to-face and online (e.g., collaboration skills). Create opportunities, allow time, and reward the group processes with feedback and recognition.
- Find alternatives to facilitate practical learning if authentic contexts are not available (e.g., virtual internships, virtual field trips, video demonstrations, games, AR and VR).
- Offer staff upskilling opportunities—systematic training and support with online teaching to go beyond the substitution level (Puentedura, 2013).

Clashing commitments

- Create opportunities to participate in in-person or online workshops, maximising the benefits of blended or hybrid/hyflex learning.
- Establish support systems at the institutional level/let students know where to get help (e.g., financial help).
- Provide assessment choices/flexible options/scaffolded assessment, so it is easier to achieve goals.

Exploration of our data through the lens of Activity Theory has provided a nuanced understanding of the complexities and contradictions of students' online learning experiences during the pandemic. Whilst the era of national "lockdowns" may be behind us, we are still navigating the convolutions of shifts between virtual and face-to-face engagement as educators and students transfer between different modes of learning and teaching. We are acutely aware of the inconsistency of student's voice in the higher education context and have sought to capture and amplify this throughout the article. Our recommendations provide a solid basis for ensuring our practices and structures are better positioned to support the quality and flexibility of learning and teaching.

Limitations

This study adopted a mixed methods approach to investigate New Zealand university students' online learning experiences with a key focus on the challenges they faced during the pandemic. One limitation of this study is that it focused exclusively on students' perspectives. Future studies can focus on both teachers' and students' perspectives to gain a complete understanding of both learning and teaching experiences.

Although the study involved a large sample size, the participants were limited to university students in New Zealand. Therefore, some findings related to the New Zealand higher education context might not be transferable to educational contexts in other countries. Future studies may expand the learning context to schools and higher education institutions in different geographical regions.

Appendix

Interview questions

1. Let's start by hearing a bit about what lockdown was like for you?
2. Thinking about your study in particular, what was the impact of lockdown for you?
3. What were the biggest challenges for your study during Covid lockdowns—learning during level 4? And level 3? And level 2?
4. What benefits or upsides were there to study/learning during the pandemic?
5. Who/What helped or supported you during this time? What further support would you have preferred?
6. In terms of online learning specifically, how did study at this time differs from your regular experiences? [Could you describe your average "day in the life of a lockdown student"?]
7. What are your thoughts about online learning now?
8. What are you most looking forward to/excited about going back to university (in level 1)?

Declarations

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