Adaptive, Sociable and Ready for Anything: Undergraduate Students Are Resilient When Faced with Technological Change

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Attending university is an important time for many young people's social lives. But changes are afoot with new innovative digital higher-education experiences being built, shifting students' social lives further online. However, it is unclear how a longer-term shift to a digital university ecosystem will impact students and their social relations and how current technologies could amplify their social experience. We report a focus group study investigating the impact of a primarily digital university experience on the social relationships of incoming undergraduates. In line with existing research, we demonstrate how technology-mediated communications can benefit some aspects of students' social relations and less so for others. Our novel contribution is evidence of students' remarkable adaptiveness when facing an online-only university experience. Crucially, our participants identified and utilised the nuances of different online platforms to start and maintain new relationships. This way, they preserved their ability to nurture social relationships, even when dealing with an unexpected learning environment. We provide design recommendations for future metaversities and discuss students' resilience in sustaining personal relationships that can inform online-centric university models.

CCS Concepts: • **Human-centered computing** ~Collaborative and social computing ~Empirical studies in collaborative and social computing

Additional Key Words and Phrases: digital university, social relations, social technologies

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1 INTRODUCTION

University is an important period for the social life of many young people. Friendships made at university have the potential to be sustained over years and even decades [57]. High-quality *social relations* (informal, meaningful, and recurring interactions between two or more humans [5]) are

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vital for adolescent social development and have been linked to increased performance and wellbeing outcomes both during and beyond university years [18, 22, 44]. Longitudinal evidence suggests that, in mid-age, the level of satisfaction with personal relationships is predictive of longevity [61].

Universities worldwide are now considering digitising the higher-education experience for the long term – commencing the age of the *Digital University* [20]. In the aftermath of the COVID-19 pandemic, higher-education institutions recognise the need for greater resilience and flexibility in their teaching operations, with multiple stakeholders (teaching staff, students, and think tanks) supportive of hybrid, blended, and even fully immersive teaching-delivery models [52, 78, 81].

Already, universities are offering a breadth of online teaching options to students [6]. For example, some universities are gradually experimenting with new virtual-reality-based campuses termed *Metaversities*, which afford real-time, fully immersive learning experiences [28, 70, 77]. This trend towards digitising the learning experience will mean that students' social lives will also increasingly rely on digital tools. However, the full impact of shifting more education online and away from shared physical spaces on students' social lives is poorly understood. Technology can be both good and bad when it comes to developing relationships. For example, whilst technology-mediated communication can positively impact social relations if used in a prosocial manner (e.g., engaging in online self-disclosure and social support), it can also disrupt the quality and time of face-to-face interactions, impair social skills, and promote negative social behaviours and experiences [24–26, 45, 56]. Regarding a move to online learning in universities, there are concerns that overreliance on digital learning may inhibit the development of social skills and the sense of belonging among students [1, 28].

Existing distance-learning platforms struggle to help their students achieve a sense of belonging and community [14]. Such problems will likely persist in the online-first metaversities of the future that take the traditional university model online. This problem should be a key concern for educators as an absence of quality social interactions is a barrier to engaging in digital collaborative learning [54, 66] and detracts from the learning experience [76, 88].

Nevertheless, there are also instances of positive social interaction in online-only learning – particularly in synchronous settings, which can provide emotional relief and a reduced sense of loneliness [8]. Looking to the future, there is hope that newer immersive technologies may support some elements of the critical aspects of developing social relations (e.g., social presence). However, we do not know how this may play out in the specific context of social life at university [68]. The sudden shift to online learning during the COVID-19 pandemic simulated how university students might experience a rapid shift to a more digitalised learning model and the range of consequences that this can have on their ability to thrive socially and emotionally.

We aimed to answer the following research question (RQ): ***What is the impact of a primarily digital university experience on the social relationships of incoming undergraduates?*** We conducted nine focus group sessions with first-year undergraduates studying in the U.K. who transitioned to university life during the pandemic. We found that the near-complete shift of university lives online created both challenges and opportunities for students' social lives. For example, students found that in-person social affordances were lost online, making peer-to-peer and student-teacher interactions more difficult. Notably, students displayed consistent resilience and adaptiveness. by harnessing their digital university experience in ways that supported their social relations. For example, engaging in novel behaviours using verbal/non-verbal information-rich technologies to help create new relations.

The key contributions of this work are: 1) empirical evidence of undergraduates' harnessing their digital university lives to deploy adaptive behaviours that strengthen their social relations; and 2) design recommendations for future digital higher-education technologies focused on helping students thrive socially.

This paper is organised into the following sections: Section 2 presents relevant Related Works that provide an overview of social relations and the role of technologies in higher education;

Section 3 outlines the current study's method; Section 4 describes the findings answering the RQ; Section 5 discusses the findings in relation to the broader literature and the design implications for future digital university experiences; Section 6 describes the limitations of the study, and we conclude our work in Section 7.

2 RELATED WORK

2.1 Social relationships during university

Social relations are informal, meaningful, and recurring interactions between two or more humans, e.g., bonds between family, friends, neighbours, and colleagues [5]. One of the benefits of students attending university is the opportunity it affords to develop new social relations [31]. It is a time of social exploration, where students often, for the first time, have the opportunity to meet other people from across the world [71]. The development of high-quality social relations at university (e.g., healthy levels of social integration, interactions, and social capital) has been linked to more excellent rates of student retention [83] and graduation [85]. It also shapes students' learning experiences [88] and educational outcomes [44].

Strong social relations during university correlate with increased wellbeing and life satisfaction [18]. Research has shown that social support is critical for first-year undergraduates to protect against emotional disorders (e.g., depression) [58] and to support adjustment into university life [36]. These benefits also go beyond the university period, with the number of social interactions made by the typical-aged student (20 years) during university reliably predicting psycho-social outcomes at midlife (50 years) [22]. Social relations are a strong predictor of longevity, with a seminal longitudinal study tracking a group of Harvard students over eight decades finding that good social relationships are a stronger predictor of longevity than social class, I.Q., and even one's genes [61].

2.2 The digital future of university

In the aftermath of the COVID-19 pandemic and the rapid progression of technologies such as augmented reality (AR) hardware (e.g. Apple Vision Pro headset [4]), Web3 decentralised infrastructure [63], and advanced cross-platform avatars (e.g. Ready Player Me [72]), universities are now exploring more flexible and connected digital learning/teaching-delivery models, commencing the age of the *Digital University* [1, 6, 20, 81]. On the one hand, institutions must protect themselves against future global disruptions by increasing their long-term responsivity and flexibility in teaching delivery [23]. On the other hand, they also need to recognise and accommodate the attitudes of students and teaching staff. Recent surveys show that staff and students believe in-class teaching and learning is not the future of higher education post-pandemic [89] and have a positive readiness to adopt new educational technologies, e.g., extended reality (XR) devices [52]. Learning models currently considered include *blended learning* (teaching that is delivered through alternating online and offline engagement) or *hybrid learning* (teaching that is delivered both online and in-person simultaneously) [9, 48, 81]. Digital learning can also vary in its *immersivity* (the level of integration with virtual, augmented, and mixed-reality technologies [21]) and synchronicity (real-time vs recorded) [89]. One notable example is the recent development trends of *Metaversities* – digital university campuses where students meet and learn with each other in real-time, fully immersive environments [28]. This development is spearheaded by large technology companies such as Meta, who are allocating funds for universities to develop these virtual campuses [77].

2.3 Social relations in a digital world

We know that modern technologies are shaping university students' social interactions. However, their cumulative impact is unclear. The ultimate – positive or negative – impact of technology-meditated communication on students' social lives depends on *how* technologies are designed and used. For example, research suggests that technologies can positively support the maintenance and development of new social relations if used pro-socially [56]. Using technologies to engage in intimacy-building self-disclosure (e.g., self-disclosing negative feelings or private information) and social support behaviours (e.g., providing emotional concern) can be beneficial. For example, students' use of social technologies during COVID-19 would reduce loneliness if used for self-disclosure in one-on-one private communication channels (messaging, phone, and video calls) [43].

However, at the same time, technology can also negatively impact social relations. For example, individuals can experience an increased sense of loneliness if relying on public social media use (due to social media platforms supporting interactions that do not build social resources, i.e., non-private communication channels [43]), reductions in the quality and amount of time spent with others in-person (due to individuals prioritising online interactions), diminished self-esteem (due to platforms increasing self-comparison behaviours), exacerbated socially toxic behaviours and experiences like cyberbullying (due to a removed sense of moral responsibility over one's actions), and deteriorated social skills (due to constant dependence on the technology as a mediator of interactions) [2, 3, 24–26]. All of the above must be considered when moving courses traditionally delivered in person to an online space.

Social relations are necessary for building a strong sense of community within a university. This community supports academic performance through collaborative learning and wellbeing through a shared identity [37]. We know that existing online learning faces the challenge of helping geographically distributed students achieve a sense of community. For example, when communication between such students occurs online (e.g., via text-based and videoconference tools), the quality of social interaction between these students tends to be poor, creating feelings of isolation and alienation [10, 12, 76, 88]. Furthermore, during the COVID-19 pandemic – where university learning was exclusively online – students felt less motivated to learn due to the lack of social interactions and cues normally afforded in offline classes [54, 64], negatively impacting their academic success [38]. But, at the same time, there is evidence to suggest that digital platforms can provide students with feelings of connectedness and satisfaction with their campus community and classes. This is particularly true when videoconferencing learning (e.g., Zoom classes) is synchronous [8] and engages with prosocial features (e.g., video and audio functions), as this supports greater class engagement, peer interactions, and overall satisfaction [87]. Furthermore, social technologies, such as Facebook, are crucial to the *social glue* that helps university students settle into their new lives [62] and were also used to support collaborative learning during the pandemic [46, 50].

Newer immersive technologies are also now being deployed in higher education (e.g., AR learning and artificial-intelligence-infused Metaverse-based campuses) [40], which show promising results in supporting social interactions by increasing the level of *social presence* (the sense of being with another) in virtual interactions [67, 68]. However, they may also risk adverse outcomes, such as psychological stress caused by isolation when physical interactions are needed [11]. These findings suggest that, if done right, a digital university experience could offer students social benefits that, in turn, enhance their wellbeing and academic performance. However, a sudden or unplanned shift to an online environment could also risk students' social lives, a vital part of the university experience.

2.4 The current study

Higher education worldwide is set to become more digitised [84], with students' social lives at university relying on a large ecosystem of digital technologies. It is unclear if future generations of students can thrive in such circumstances. Existing research suggests that we need to be mindful of the potential negative impact of removing in-person interaction on students' ability to thrive socially, which they need both to learn and to remain well. There are some concerns that losing the physicality afforded by the traditional university experience may impact students' social skill development (e.g., intra-cultural communication skills) and their overall sense of belonging [1, 28], which has implications for their learning and wellbeing [37]. This is important for the Computer-Supported Cooperative Work (CSCW) area [71] because understanding how a digital university experience impacts social relations allows us to design systems that can help support a student's sense of community and, ultimately, collaborative learning practices.

One way of gaining insight into this future is by examining how undergraduates coped during the COVID-19 restrictions. Throughout this period, students heavily relied upon technologies to mediate their university social lives – so lessons learnt from their experiences may provide insight into how future undergraduates would experience a similar (albeit less unexpected) form of increased use of digital learning. We, therefore, conducted a focus group study consisting of a survey and nine focus group sessions to explore the effect a primarily digital university experience has had on undergraduates' social lives.

3 METHOD

3.1 Participants

A volunteer sampling technique was utilised and implemented using a recruitment advert. We recruited 38 first-year undergraduates (aged 18 – 21, m= 18.7; 11 Male, 26 Female, 1 preferred not to say) enrolled at U.K. universities, asking them to use their official university email addresses to enable us to verify university affiliation. Their learning environments at the time of the study ranged from 'A combination of remote learning and face-to-face teaching' (20/38) to 'Fully remote learning' (18/38). Participants were invited to complete an initial survey and indicate their availability. Focus group slots were then allocated on a first-come-first-serve basis. All recruited participants participated in a focus group session (see Table 1 for the participant's group allocation and learning environments). After completing the focus group session, participants were compensated with a £50 Amazon voucher.

Table 1: Participants focus group allocation and learning environment

Focus group session	Participant ID	Learning environment
1	1	A combination of remote learning and face-to-face teaching
	2	A combination of remote learning and face-to-face teaching
	3	Fully remote learning
	4	A combination of remote learning and face-to-face teaching
	5	Fully remote learning
2	6	Fully remote learning
	7	Fully remote learning
	8	Fully remote learning
	9	A combination of remote learning and face-to-face teaching
3	10	A combination of remote learning and face-to-face teaching
	11	A combination of remote learning and face-to-face teaching
	12	Fully remote learning
	13	Fully remote learning
4	14	A combination of remote learning and face-to-face teaching
	15	A combination of remote learning and face-to-face teaching
	16	Fully remote learning
	17	Fully remote learning
5	18	Fully remote learning
	19	A combination of remote learning and face-to-face teaching
	20	A combination of remote learning and face-to-face teaching
	21	A combination of remote learning and face-to-face teaching
6	22	Fully remote learning
	23	Fully remote learning
	24	Fully remote learning
	25	A combination of remote learning and face-to-face teaching
	26	Fully remote learning
7	27	A combination of remote learning and face-to-face teaching
	28	Fully remote learning
	29	A combination of remote learning and face-to-face teaching
	30	A combination of remote learning and face-to-face teaching
	31	A combination of remote learning and face-to-face teaching
8	32	A combination of remote learning and face-to-face teaching
	33	Fully remote learning
	34	Fully remote learning
	35	Fully remote learning
	36	A combination of remote learning and face-to-face teaching
9	37	A combination of remote learning and face-to-face teaching
	38	A combination of remote learning and face-to-face teaching

3.2 Materials

3.2.1 Survey. A sign-up survey was hosted on the Qualtrics platform. It included a participant information sheet, consent form, questions about background information (name, email, age, gender), and a request for participants to indicate focus group availability. We also asked several questions focused on teaching delivery and technology use, and relevant answers helped us refine interview scripts (see Appendix for the survey questions).

3.2.2 Focus group topic guide. We developed focus group topic guides centred on a range of questions exploring the use of digital technologies to regulate emotion and experiences of digital distraction, digital learning, and digital socialisation, all in the context of digital university life during the COVID-19 lockdowns. These focus group interviews were conducted as part of a broader research programme. Specifically for this paper, we focus on analysed data concerning the impact of a primarily digital university experience on undergraduates' social lives during the COVID-19 lockdowns. This data was elicited by asking participants open-ended questions focused on comparing their digital social lives and offline experiences, the role technology played in supporting their social lives, and what challenges they encountered during the COVID-19 lockdowns. Examples of these questions included: "How have you been using digital technology to stay connected with others and socialise with others since beginning university?", "Have you been able to use digital technology like social media messaging apps to build friendships?", "Have you found you are more dependent on social media?".

3.3 Design

A focus group study design was chosen because 1) focus groups are a valuable method for exploring an individual's experience in ways that would be less accessible during a one-to-one interview (for example, individuals' experiences of a digital university may vary or be quite specific, and so the group processes in conjunction with open-ended questions can help the student to better situate their experience in relation to others and to thus better explore and clarify their view); and 2) the group dynamics of focus groups support participants in generating more critical views of their experiences which can, in turn, help us richer understand what happened and how it affected our participants [51].

3.4 Procedure

Applicants interested in participating in the study first filled in a Qualtrics sign-up survey, which required them to read information about and consent to participate in the study, provide necessary personal information to validate their eligibility, answer background questions and indicate their availability to participate in a focus group session. Eligible participants were contacted by email and sent a Microsoft Teams invite to the online focus group session.

Nine focus group sessions were conducted over three days (November 10th, 11th, and 13th, 2020). During this period, England had just entered into its second national lockdown (beginning 5th November 2020) – with university campuses remaining open but the majority of teaching taking place online [80]; Scotland had entered a five-tiered lockdown system with the majority of areas in level 2/3 – meaning university teaching was delivered through blended or restricted blended learning [29]; and Wales had just exited a 17-day firebreak lockdown and had continued either a blended or fully online learning approach due to local lockdowns in some areas (e.g., Swansea and Cardiff) [30]. During this period, students could not fully socialise due to non-essential services (e.g., pubs, entertainment venues, restaurants) closing and the prescribed norm to stay at home unless necessary [42]. However, participants had a chance to briefly experience a full on-campus university experience before this period, as the government's prior guidance was that all students were to move back to campuses at the beginning of the autumn term (September 2020) [7].

Focus groups were held in cohorts of 4-5 participants (one final group consisted of 2 participants). Each session was hosted by an experienced coordinator who initially briefed participants about the schedule, their right to withdraw, and the code of conduct (e.g., confidentiality). The coordinator then asked permission from participants to record the session to begin formally. A series of focus group interviews were then conducted by four junior researchers, each taking, on average, 30 minutes, resulting in a total of four focus group

interviews per session divided by a 10-minute break. One of the junior researchers primarily focused on exploring how technology influenced the social lives of participants – meaning *at least* one-quarter of sessions involved collecting data that addressed this study's RQ. However, other researchers' interviews also elicited relevant data that was utilised, too. The researcher interviewers joined the online meeting only for their interview slot, while coordinators remained in the meeting for its entire duration to support and oversee the process. At the end of each session, coordinators informed participants of the forthcoming debrief email (consisting of a copy of the study information sheet and details on withdrawing their data if they wished) and an Amazon voucher.

3.5 Data Analysis

Video recordings of focus groups were downloaded from the Microsoft Teams platforms. Audio files were extracted and transcribed using automatic transcription software and were then checked for accuracy and anonymised. Transcripts of the nine focus group sessions were analysed through a *reflexive thematic analysis* (RTA) approach [15, 17, 19] using NVivo-12. We chose an RTA approach because our RQ focused on investigating individual lived experiences (students' experience of a primarily digital social life) that are contextually bounded (when starting university under COVID-19 restrictions) [13]. Stating the researchers' philosophical and theoretical assumptions is recommended when conducting an RTA [14]. In this study, an *essentialist* (language is a unidirectional reflection of experience), *experiential* (thoughts, feelings, and experiences reflect an individual internal state), *inductive* (codes solely reflect the content in the dataset), and *semantic* (codes reflect the explicit meaning of the data) leaning approach was taken. This approach to conducting an RTA aligns with our interest in exploring students' lived accounts and their own developed and expressed meaning.

The RTA process began with a familiarisation phase involving actively listening to the audio recordings and reading text transcripts, noting preliminary trends and salient information. Initial codes were then generated through an inductive coding process, with codes continually reviewed, merged, and updated when necessary. This was followed by an iterative theme development process, in which codes were organised and collapsed to generate themes and sub-themes. Themes were continually reviewed for their *quality* (themes relevant to the RQ), *internal homogeneity* (whether data items within a theme share a unifying concept), and *external heterogeneity* (whether themes provide a sufficient interpretation of the data to the RQ) – and merged or discarded if necessary. The candidate themes were then defined and named to develop a final thematic map.

As an RTA approach does not align with (post)positivistic beliefs and values about knowledge (i.e., truth exists out 'there' and can be interpreted accurately), inter-rater agreement approaches were not deemed suitable to conduct. Instead, the quality of the analysis process was ensured through the presentation and discussion of codes and themes of preliminary analyses with co-researchers experienced in qualitative research [16].

4 FINDINGS

RQ: What is the impact of a primarily digital university experience on the social relationships of incoming undergraduates?

Answer: The social experience of a digital university was drastically different (from an in-person on-campus experience), with technologies used during digital university only appropriate for some stages of social relationships. Nevertheless, students engaged in successful adaptive digital behaviours to support their social relationships.

The answer above is based on the following three generated themes presented in the following order: 1) *How the digital university experience compared to an in-person experience*; 2) *How*

technologies supported students' relationships during digital university (or didn't); and 3) *How students coped with social challenges encountered with a digital university experience*. The underlying codes and sub-themes of these themes are presented in Table 2. The RTA analysis identified themes 1 and 2 as being narratively linked to theme 3: the former themes help to illustrate undergraduates' digital university social life experience, whilst the latter explores how they responded within this context.

Table 2: Data Analysis: Summary of codes and themes

Codes	Sub-themes	Themes
Social media loses the nuance and deepness of offline interaction	In-person affordances are lost when online	**How the digital university experience compared to an in-person experience**
Social media does not best represent oneself or personality		
Q&A in online environments is not as good as offline environments	Peer and student-teacher interactions are impaired online	
Online learning lacks the social benefits of the offline learning experience		
Digital interactions are better once you've met up offline	Social technologies allowed students to maintain pre-existing relationships	**How technologies supported students relationships during digital university (or didn't)**
Social technologies are preferred for closer relationships rather than acquaintances		
Social technologies can help initiate relationships if cemented through future offline interactions	Social technologies did not support social relationship initiation at university	
Students self-organised opportunities to socialise online with new course-mates	Students engaged in novel digital behaviours to help create new university relationships	**How students coped with social challenges encountered with a digital university experience**
Students move from formal to informal platforms such as Snapchat or Instagram when creating new friends online		
Socialising is difficult in large online groups	Students engaged in digital behaviours that best emulated offline interactions	
Video-calling one-to-one with people is preferred		
Text messaging is not socially meaningful or personal		

4.1 How the digital university experience compared to an in-person experience

4.1.1 In-person affordances are lost when online. Our participants were vocal about the drawbacks of online socialising with their university peers during lockdowns. Digital spaces failed to emulate the casual, spontaneous and nuanced social interactions, which have the potential to develop into deep social relationships, typically afforded by offline university environments:

> "In real life, you could walk up to any person from your course and just say hi and ask them to go out for coffee. And now, well, at least I would feel super awkward just randomly calling someone on Teams, asking them if they want to talk for a moment." (P15)

Socialising (mainly via video calls) always had to be scheduled when learning remotely. This, as well as the fact that the sole purpose of the digital meeting was to socialise, made interactions feel less casual:

> "If you are meeting face to face, you can have some excuse to meet, be like yeah let's have lunch but on an online phone call, your real actual aim is doing the call. What you're doing is only for the call. So, you don't have any excuse for other things to do. And that's awkward in this situation." (P17)

Having to schedule online interactions was a challenge as students would "*have to find a time when you're both free*" (P16). This pre-planning was contrasted against the spontaneity afforded by physical university environments:

> "I think it's harder. I think it's so much harder because you have to be like, oh, should we call? You have to schedule a call instead of going up to them like hi." (P14)

This need for planning and lack of spontaneity in online socialising made reaching out to one's peers effortful. Students knew that "*you're not just going to bump into someone, you have to actively message someone*" (P21).

Furthermore, physical environments usually provide external environmental cues which students can include in social interaction to stimulate conversation. Students found digital spaces lacked this affordance, with interactions often running dry due to a shortage of topics to talk about:

> "Yeah, I guess it's more difficult to actually sustain a conversation without external stimuli if you're just texting" (P28)

Students also shared that online socialising lacked nuance. They were aware that, when interacting offline, they could use subtle yet vital social information (like mannerisms, tone of speech, and interaction with other people present) to make decisions about individuals:

> "When you meet people in real life, you learn about their mannerisms a lot more and just how they speak and you kind of get their sense of personality if that makes sense" (P10)

A lack of such information could make establishing deep relationships challenging:

> "And now when I'm just looking at people's faces, I feel I'm missing certain information. How they treat other people, for instance. You can't discover that as easily in a virtual setting as you would be able to in person. So, to me, it makes it… I find it hard to deepen a friendship because you're only seeing a picture of another person." (P6)

Finally, digital spaces lacked non-verbal information, like gestures or facial expressions, seen as important for directing the flow of conversation:

> "It's hard to see where the conversations is going or when to stop and let them talk and stuff like that because usually you can pick it up through hand gestures and facial expressions, but you can't really see as much over Zoom" (P27)

These deficiencies made students feel that online socialising with their university peers was not as deep or meaningful as offline socialising. Students found that there is "*something about being in person, actually talking to someone which is just so much more, it's like a deeper bond*" (P13).

The lack of in-person affordances also led some students to feel dissatisfied with their online interactions as they did not best represent their personalities:

> "Yeah, I find it weird. You don't really come across yourself like [removed] said, you're completely different, especially over text, you kind of come across quite blunt really because you haven't really got the whole voiceover to really show yourself. So yeah, I find it weird, and I don't really like it." (P20)

One student found that this was also the case when video-calling. They explained that "one of the people who I met up with outside in person, I was talking about this with her, and she was like yeah you come across completely different on Zoom to real life". (P18)

These deficiencies also had adverse social outcomes. The inability to communicate with others online in a way that aligns with one's true self-led one student to develop a fear of their words being misconstrued online. They mentioned a case where an online comment by another student, which could pass as dark humour in an offline conversation, resulted in disciplinary action:

> "Things can be misconstrued a lot because there was just this time when someone was sarcastic, they had coronavirus, and then they said, oh, maybe we should mix, you know, natural selection and on a WhatsApp group chat, and if they said it in person, it's like I think it would be seen as a joke because, you know, they'd be like, ha ha ha. But then because they said on WhatsApp, it got screenshotted and sent to the disciplinary deans in college. And so, they got in tons of trouble." (P5)

4.1.2 Peer and student-teacher interactions are impaired online. Learning is a reciprocal and dynamic interaction involving student-teacher and student-student relationships. With the switch to online university learning, students felt these relationships were severely impaired.

Regarding student-teacher interactions, many of our participants felt that the question-and-answer mechanism within online learning was inferior to in-person learning. This deficiency impeded students' understanding of class material. On the one hand, watching an online lecture and asking questions during the next meeting with the teachers was tricky because new material was now being discussed, and the questions were "*not that relevant anymore*" (P7). The limited contact time meant that, during online Q&A sessions, lecturers could not answer all the questions submitted by students: "*there's only one hour, usually only half an hour allocated to synchronous lecture for every three hours of real lecture*". (P8). Students also found it took much more effort to ask questions online:

> "And when I have to wait to the end of the lecture and then the Moodle forum and post my question and worded nicely, I'm just reluctant to do it." (P9)

When they did manage to ask questions, the lecturers' answers were often delayed and sometimes never given:

> "But then we also have this other lecturer who's really good and he's really engaging in every single question that we send on the Zoom chat and stuff while the other one doesn't even read any of the things." (P22)

When lecturers did respond, students found that written answers, typical in online learning, were not satisfactory:

> "It's much easier when someone explains it to you." (P16).

Students also felt that online learning did not adequately support student-student interactions. This resulted in students feeling that they were missing out on the social side typically afforded in offline lectures:

> "I'm not really enjoying remote learning because having thought about what lectures could have been like in person" (P31)

They were dissatisfied with the videoconference' breakout room' sessions, which were meant to replace the socialising that naturally happens when attending an in-person lecture. These breakout rooms were not seen as conducive to socialising as they were often randomly distributed, preventing genuine rapport from developing:

> "As soon as you started, to get to know someone and find something interesting about them and click with them, the breakout room would end, and you'd move on to a different group of people." (P34)

Breakout rooms, and video calls with new contacts, in general, were only helpful in developing friendships at university when they were part of a longer-term group project that students were assigned. Recurring group work with the same team of peers allowed students to meet consistently, and familiarity, as well as having a common goal, supported further social interaction via other channels:

> "Because we've had to work together, we've had to add each other on Snapchat. And that's been quite nice". (P21)

4.2 How technologies supported students' relationships during digital university (or didn't)

4.2.1 Social technologies allowed students to maintain pre-existing relationships. Students tried to develop new relationships through social media platforms during their digital university experience. Many, however, found that these platforms were best suited for maintaining relationships established offline. Meeting someone "*even if for half an hour or whatever in real life*" (P36) was essential in making the relationship feel more genuine, as they could develop a better idea of what the other person was like, and thus how they could better interact with them online:

> "I think it kind of brings you closer to them, you kind of become less formal almost, you kind of know what they're like and how you act around them a bit better." (P18)

Some students explicitly preferred using social media only with close friends during the pandemic and found it awkward to interact with new friends and new acquaintances on social media. Video-calling was better with closer friends than newer friends or acquaintances as "*there's no awkwardness in how we interact and already know how… we all know each other's mannerisms*" (P11). Students anticipated that video calls with the latter would feel less natural:

> "I found that I haven't done it with any new uni friends. I think it would be a bit awkward for now" (P15)

4.2.2 Social technologies did not support social relationship initiation at university. Whilst digital technologies were valuable tools for staying connected with current friends, their ability to support establishing new relationships when in a digital university experience was limited. Some noted that interacting with a new person through social media did not compare to meeting them in person:

> "Yeah, because you want to know what they're like in person, over the phone, they can be someone completely different and you might like this person, but then in person they're not the same." (P1)

An online-only start to a friendship could lead to a misguided investment of time and emotional resources. Students, therefore, felt that it is "*better to meet people first and then decide whether you want to be mates with them, rather than trying to develop a relationship or friendship by text first and then you meet them and you find out, OK, what, I don't like this person*". (P3)

Other students found the idea of digital-first meetings intimidating. One student did not want "*to seem like I'm begging...and they're like, why are you talking to me*" (P11). Another student mentioned that they were "*really nervous about messaging people just out of nowhere*" (P18).

Some students saw social media platforms as useful for getting to know their peers so long as they could meet in person immediately afterwards. When this was possible, students viewed social media platforms as a space where they could initially "*break the ice*" (P29) and then organise events offline and develop relationships further:

> "[The] WhatsApp group [created] since having the offers a few months back has helped a bit because we were introducing ourselves. And then I actually made a close friend from there and then we met up and we had drinks before and during summer when it was safe to do so. And we're actually quite close friends now, which is a good thing." (P19)

4.3 How students coped with social challenges encountered with a digital university experience

4.3.1 Students engaged in novel digital behaviours to help create new university relationships. Students experienced multiple drawbacks in initiating new social relationships during this period of the digital university experience. Strikingly, however, we found that our participants adapted quickly and identified ways to thrive. The stringent social restrictions dictated by COVID-19 lockdowns pushed students to develop new digital behaviours to help create new relationships. This adaptiveness was especially true for students living at their home addresses who were more reliant upon digital technologies to socialise than those living with peers in term-time addresses, as the latter, for example, had other lockdown-permissible opportunities to socialise e.g., exercise and recreation outdoors [42].

Some students would relocate digital relationships from impersonal spaces such as more extensive course or society group chats onto more personal platforms such as Instagram and Snapchat. These platforms provided a more intimate presentation of one's life, and doing so led students to feel they were able to get to know their peers better:

> "We talk basically in our group every single day since we started the course, which is a good thing because we can connect with each other. And then we also exchange our social medias like Instagram in the group chats. So, we kind of follow each other on Instagram and we kind of know, I wouldn't say we properly know that person, but you know them better through social media in a way." (P19)

One student described how this dynamic of shifting from less intimate to more intimate forms of online communication played out in their workgroup. They explained that *"somebody suggested it'd be easier to work together via Instagram or WhatsApp*" (P18). This shift supported the formation of closer and deeper social relationships. As the student explained, on "*platforms like Instagram or Snapchat where you get to see what they're putting up, you get to kind of know their personality a bit more*". (P18). Another student recounted how they made a friend from another course by solely interacting and shifting through these more intimate and prosocial platforms:

> "I have one friend that I made on a different course, we met on WhatsApp. And then once you add them on Instagram and then Snapchat, it just becomes a lot more easier to start a conversation because you can swipe up on stories and stuff like that" (P14)

Several students also self-organised digital opportunities to socialise. They used digital platforms with video-calling features, such as Zoom, Discord, and Instagram, to coordinate social meetups with fellow students, where they would chat, play games, and work on reports together. Students described how, before starting university, they had not expected to use video calls to socialise:

> "So right now, sometimes, I think it's like a once-a-week thing where people on our course we meet up via Zoom to kind of chat, or chill or play games and stuff. And I never thought I would be socialising through Zoom." (P19)

A student who was still living at home abroad explained how these student-organised digital meetups helped them to create new connections with others who were located across the globe; which they otherwise wouldn't have been able to do:

> "Since a week or two I've been using Discord. So, video chat to chat to other students who are abroad. We've got a couple in Malaysia, in the U.K., other parts of the U.K. and we come together about once every two nights and we have a call and chat, catch up that way. So, I guess that's the main way in which I've been attempting to make friends at, in this difficult time." (P6)

4.3.2 Students engaged in digital behaviours that best emulated offline interactions. Students engaged primarily with those digital features that best emulated the offline socialising experience. These behaviours could be sharing what they did offline via the Instagram stories feature. For students, doing so felt "*much more informal and it feels as if times were normal, and we actually knew each other rather than only through the Internet.*" (P15).

Offline, humans do not typically socialise in very large groups, and students similarly found smaller online group chats to be more conducive to successful communication. These smaller groups made them "*make more meaningful connections*" (P8). In contrast, in more extensive groups, behaviour indicative of deindividuation, a lack of personal responsibility, and the *bystander effect* [55] were common. For example, one student who sought help on an assignment was "*constantly spamming this group chat and literally everyone had seen it, and no one was replying.*" (P1). In turn, this disincentivised others to engage due to fears of also being ignored:

> "You don't want to get aired on the massive group chat." (P5)

Offline interactions are conducted face-to-face. Students preferred video-calling over text messaging as this best emulated their offline socialising experiences. They found interactions over text messaging to be de-personalised and devoid of depth, making it difficult, in turn, to develop a meaningful relationship:

> "Yeah, and even over text, I just don't feel it to be that personalised of a conversation. It's not really a very personal communication that is going on. So, you don't really bond" (P4)

The intentionality of calling versus texting was also valued, as students appreciated that someone had set time aside for them:

> "I think if you actually make a time to sit down and call someone, I think it's it shows that when people call me to see how I am and stuff, it makes me like, I appreciate it because it's like, oh, they care, it's an intentional friendship." (P16)

5 DISCUSSION

Our study was concerned with understanding the impact of a primarily digital university experience on the social relationships of incoming undergraduates. It was found that the impact of technology on social relations is not wholly positive or negative. Like any tool, its effectiveness is dependent on how it is used. Whilst initial themes (1 and 2) confirm previous research pointing to the limitations of digital learning in the context of students' social interaction, this study contributes new evidence of students' adaptive workarounds (theme 3). Below, we discuss our findings in relation to our RQ and the broader literature. Here, we also provide design recommendations for future digital-first universities (*metaversities*) that can be designed to support undergraduates' social relations in an increasingly virtual learning world.

5.1 Adapting to a lack of 'embodied' social interaction

Theme 1 highlighted how the digital university experience under COVID-19 lockdowns failed to facilitate the causal, nuanced, and deep social interactions between students typically afforded by offline university life. This finding confirms prior research on the lower quality of social interactions between students through technology-mediated communication [10, 12, 76, 88]. This deficiency was due to the lack of an *embodied* element in existing forms of online interactions. Specifically, online interactions lack an accurate translation of essential aspects (form, substance and meaning) underlying offline social interaction [34]. For example, most online spaces lack a situated spatial dimension to afford chance encounters, stimulate or redirect an ongoing conversation, or filter out nonverbal cues essential to support deeper empathic interactions [39]. A similarly negative impact of this missing spatial dimension of social interaction has been demonstrated among workers who relied upon videoconferencing technologies during the pandemic. For these workers, reliance on digital workspaces created a tension between social encounters that were spontaneous and informal and those that were task-oriented and formal [10].

Strikingly, however, we found that undergraduate students could navigate this new disembodied interaction context to make the most of their social interactions. Despite the inadequacy of the social experience of a digital university, students persevered and engaged in digital behaviours that best emulated intimate offline face-to-face interaction. Students spontaneously increased their use of video-calling (a behaviour not usually performed before the pandemic) and emulated offline social dynamics as much as possible (e.g., by interacting with smaller group chats). Indeed, engaging in online prosocial behaviour [75], using richer verbal/non-verbal information communication mediums [39], and participating in smaller online groups [82] are all effective ways of maximising digital intimacy within current computer-mediated communication.

5.2 Adapting to the new group dynamics of group work

Theme 1 also highlighted how students experienced impoverished peer and student-teacher interactions within the online learning environment. This finding confirms prior research that under COVID-19, students found it more challenging to interact with teachers online – with online learning failing to support adequate teacher feedback, reactions and clarification [32, 88]. This deficiency was partly attributable to the low *social presence* (the sense of being with others) within online learning [23]. Poor student-student interactions negatively impacted their social experience through stifled group dynamics. Constantly changing breakout rooms, with short and obscure tasks, contributed to this poor experience. This confirms prior research that the lack of social interactions and cues normally afforded in offline classes negatively impacts the learning experience [54, 64],

However, notably, in this context, our participants successfully navigated the deficiencies of the online-only university experience. Students identified consistent and long-term online group work activities as practical ways to develop more profound and rewarding peer connections and engaged in such behaviours for work when possible. This finding demonstrates their ability to critically assess the novel group learning setting they participated in during their digital university experience. This ability allowed them, at least to some extent, to alleviate the detrimental social impact of the transition to online learning. Indeed, engaging with prosocial videoconferencing features (e.g., video and audio functions) helps to support social interactions and work measures (e.g., engagement and satisfaction) [87].

5.3 Adapting to starting new peer relationships online

Theme 2 highlighted that although reliance on digital tools to communicate with peers had a detrimental impact on the early stages of new social relationships, students engaged in adaptive behavioural workarounds to make the most of these tools. Below, we first discuss the difficulties students experience when initiating relationships with their peers online. We then outline and contextualise the creative ways they adapted their uses of technology to maximise their ability to make new friends despite the online-only context of learning.

During the pandemic, social media acted as a critical tool to maintain established relationships – students enjoyed using it to keep in contact with close friends and family. However, they did not see it as helpful in communicating with acquaintances, thus ruling out a wide use of social media as a tool to broker new university friendships. This finding is unsurprising, as prior research shows that one of the main reasons for engaging in smartphone texting is to communicate with an individual's strong-tie networks [69], with students mainly engaging with social technologies to maintain pre-existing relationships [35].

Conversely, students struggled to create new relationships in their digital university life. One of the novel reasons for this, identified in this study, was that students could not fully gauge the person's true personality online, leading to worries that the relationship dynamics would not work well in the offline world. Interestingly, whilst online behavioural data statistically predict aspects of an individual's personality [51,69], the current findings suggest digital personas are insufficient for a student to judge an individual's personality online accurately. In other words, students did not feel comfortable initiating a new relationship online. This finding suggests some questions for future research: what aspects of a digital persona are required for an individual to perceive an accurate reading of another's personality? Does the perceived accuracy of another's personality mediate the intention of an individual to initiate a friendship online?

Most notably, despite the limitations of current technology in supporting the initiation of new university relationships, students displayed perseverance through adaptive digital behaviours. First, students leveraged social and conference technologies to support the creation of new social relations. They intentionally transitioned digital university relationships from larger, impersonal social media platforms, e.g., WhatsApp group chats, to more personal and intimate platforms, such as Instagram, which allowed them to get to know their peers better. From a social perspective, smaller online group chats – versus larger ones – may decrease diffuse responsibility (the level of perceived responsibility of negative consequences of inaction) and thus facilitate greater social participation among individuals [47]. This adaptive behaviour also displays an implicit awareness, on the part of our participants, of the utility of leveraging richer verbal (e.g., video-calling) and non-verbal (e.g., posting daily stories or pictures) information to support increased empathy between social partners online [39].

Furthermore, students self-organised meetups on videoconferencing platforms to talk, work and play with each other. Previous research has demonstrated that this can improve student-student interactions in online learning [88]. The fact that students in the current study engaged in this behaviour intuitively can be seen as evidence of their ability to adapt to change. Future

HCI research could employ longitudinal studies to clarify whether such student-borne strategies effectively support social relations over the longer term.

5.4 Future universities: design focused on maximising student adaptability

Suppose digital university hybrid/blended-learning models are to effectively support students' social relations in the digital lecture hall and beyond. In that case, the social dimension of such environments needs to be explicitly designed. Advancing the online learning infrastructure will help solve some of these social deficits and create digital learning communities [59]. For example, universities have, for the last one to two years, partnered with software companies (e.g., Meta) to develop state-of-the-art virtual reality-based university campuses (*Metaversities*) [41, 65, 86]. Whilst the immersive nature of metaversities may help to improve social relations and learning outcomes naturally [27, 53] (e.g., by increasing social presence [67, 68]), our findings point to specific prosocial design recommendations that universities aiming to digitise the learning environment could incorporate that support the adaptive strategies identified in this study. Based on our findings, universities could:

Support offline face-to-face interaction dynamics in online learning. Future digital universities could consider addressing the loss of offline affordances and supporting identified student-borne strategies by designing their digital environment in line with the dynamics of offline environments and interactions. Future digital universities could minimise the filtering of socioemotional cues and support more offline-like face-to-face interaction styles by 1) utilising richer communication channels (e.g., increasing the level of non-verbal cues transmitted online or richer supplementary features such as audio when conversing with other students [49]); 2) implementing customisable communication content (e.g., emotionally personalised emoticons [60], or avatars for increased embodied virtual intimacy through more accurate non-verbal cue transmission, e.g., facial expression and body language [73]); 3) curating digital spaces to support offline social dynamics (e.g. designing environments to explicitly support chance encounters and meetups after lectures, such as in virtual university cafes and libraries); and 4) having digital spaces that obey physical laws (e.g., capping group sizes and rooms depending on their social function/purpose).

Humanise online learning. Future digital universities could consider *humanising* online education, prioritising human connection and relationship development between student-lecturer and student-student [74]. Designing systems with this heuristic in mind will help students engage in digital behaviours that best emulate offline interactions. Online learning platforms could be humanised for student-teacher interactions by increasing *teaching presence* [74] (e.g., lecturers holding virtual open office hours). Digital learning could be humanised for student-student interactions by increasing long-term collaborative practices in the virtual classroom [74] (e.g., implementing small, consistently grouped virtual breakout groups with goal-driven tasks that utilise prosocial features such as video and audio functions [87]).

Researchers aiming to explore and design new digital higher-education experiences could use these recommendations as prompts to motivate the development and testing of learning systems that support social relations. The recommendations can also help investigate students' social relations in digital spaces more widely. For example, how can digital learning platforms best capture, as Sherry Turkle describes, *the rich and often messy dynamics of offline social relations* [79] – so that interactions can be more than a connection, but a conversation?

6 LIMITATIONS

Our study sought to understand several facets of the student experience. To have sufficient time to explore their experiences, each focus group lasted approximately 2-2.5 hours. This time length and the use of an online environment for conducting the study may have resulted in participants

experiencing *zoom fatigue*. In addition, whilst training was provided to researchers on focus group facilitation, the limitations of conducting a group discussion in an online environment meant that conversational turn-taking was more rigid and less fluid than might be experienced in an in-person focus group. These factors could negatively impact the depth of detail of the collected data. However, the satisfactory quality of the data gathered, and the insights generated suggest that our decisions to 1) use relatively small groups (2-5 people compared to traditional focus groups of 8-9) to ease communication [33], 2) include breaks, and 3) rotate researchers across focus groups that were being conducted concurrently to alleviate fatigue, appear to have been adequate mitigations.

It is also worth reflecting on the generalisability of the study findings to future undergraduates' situations. Whilst future students will have greater autonomy and opportunities in their offline social lives versus, during the COVID-19 restrictions, undergraduates (particularly those entering university immediately after secondary education) will still be motivated to expand their social networks beyond those developed in their early adolescent and childhood years [71]. Therefore, if metaversities and digital learning more broadly are to become mainstream, they will play an essential role in supporting their ability to develop new social relations during this formative period. We believe this study is thus helpful to understand better how current digital university experiences are failing in this respect and how they can be addressed in future platforms.

7 CONCLUSION

We investigated how undergraduates' social relations were impacted by having a primarily digital university experience under COVID-19 restrictions. This work highlighted various ways a digital university experience may impact students' social relations. In addition to confirming results from previous research, we demonstrated students' remarkable adaptability and expertise through prosocial digital behaviours that supported their social relations despite current technological limitations. Lastly, we proposed various design recommendations to support students' social relations in a digitised higher-education future.

REFERENCES

[1] A new start in Japan for hybrid learning: 2022. *https://www.timeshighereducation.com/hub/blackboard/p/new-start-japan-hybrid-learning*. Accessed: 2022-09-12.

[2] Antonucci, T.C. et al. 2019. Social Relations Across the Life Span: Scientific Advances, Emerging Issues, and Future Challenges. *Annual Review of Developmental Psychology*. 1, 1 (2019), 313–336. DOI:https://doi.org/10.1146/annurev-devpsych-121318-085212.

[3] Antonucci, T.C. et al. 2017. Social Relations and Technology: Continuity, Context, and Change. *Innovation in Aging*. 1, 3 (Dec. 2017), igx029. DOI:https://doi.org/10.1093/geroni/igx029.

[4] Apple Vision Pro: *https://www.apple.com/apple-vision-pro/*. Accessed: 2023-08-07.

[5] August, K.J. and Rook, K.S. 2013. Social Relationships. *Encyclopedia of Behavioral Medicine*. M.D. Gellman and J.R. Turner, eds. Springer. 1838–1842.

[6] Back to School for College Students Is Shifting From Campuses to Online: 2022. *https://www.gao.gov/blog/back-school-college-students-shifting-campuses-online*. Accessed: 2022-09-12.

[7] Baker, C. et al. 2021. Coronavirus: Higher and further education back to campus in England in 2020/21?. Technical Report #9030. House of Commons Library.

[8] Barriteau Phaire, C. 2022. In the Zoom Where it Happens: From Overwhelmed to Overcome, Collegiate Students' Experiences during the COVID-19 Pandemic. *The Clearing House: A Journal of Educational Strategies, Issues and Ideas*. 95, 5 (Sep. 2022), 220–229. DOI:https://doi.org/10.1080/00098655.2022.2105782.

[9] Bashir, A. et al. 2021. Post-COVID-19 Adaptations; the Shifts Towards Online Learning, Hybrid Course Delivery and the Implications for Biosciences Courses in the Higher Education Setting. *Frontiers in Education*. 6, (2021), 310. DOI:https://doi.org/10.3389/feduc.2021.711619.

[10] Bergman, R. et al. 2022. Meeting (the) Pandemic: Videoconferencing Fatigue and Evolving Tensions of Sociality in Enterprise Video Meetings During COVID-19. *Computer-Supported Cooperative Work*. (Nov. 2022).

[11] Bilotti, U. et al. 2023. Machine Learning for Educational Metaverse: How Far Are We? *2023 IEEE International Conference on Consumer Electronics (ICCE)* (Las Vegas, NV, USA, Jan. 2023), 01–02.

[12] Boling, E.C. et al. 2012. Cutting the distance in distance education: Perspectives on what promotes positive, online learning experiences. *The Internet and Higher Education*. 15, 2 (Mar. 2012), 118–126. DOI:https://doi.org/10.1016/j.iheduc.2011.11.006.

[13] Braun, V. and Clarke, V. 2021. Conceptual and design thinking for thematic analysis. *Qualitative Psychology*. (May 2021). DOI:https://doi.org/10.1037/qup0000196.

[14] Braun, V. and Clarke, V. 2021. One size fits all? What counts as quality practice in (reflexive) thematic analysis? *Qualitative Research in Psychology*. 18, 3 (Jul. 2021), 328–352. DOI:https://doi.org/10.1080/14780887.2020.1769238.

[15] Braun, V. and Clarke, V. 2019. Reflecting on reflexive thematic analysis. *Qualitative Research in Sport, Exercise and Health*. 11, 4 (Aug. 2019), 589–597. DOI:https://doi.org/10.1080/2159676X.2019.1628806.

[16] Braun, V. and Clarke, V. 2022. Thematic analysis : a practical guide / Virginia Braun and Victoria Clarke. SAGE Publications Ltd.

[17] Braun, V. and Clarke, V. 2006. Using thematic analysis in psychology. *Qualitative Research in Psychology*. 3, 2 (Jan. 2006), 77–101. DOI:https://doi.org/10.1191/1478088706qp063oa.

[18] Bye, L. et al. 2020. The impact of social capital on student wellbeing and university life satisfaction: a semester-long repeated measures study. *Higher Education Research & Development*. 39, 5 (Jul. 2020), 898–912. DOI:https://doi.org/10.1080/07294360.2019.1705253.

[19] Byrne, D. 2021. A worked example of Braun and Clarke's approach to reflexive thematic analysis. *Quality & Quantity*. (Jun. 2021). DOI:https://doi.org/10.1007/s11135-021-01182-y.

[20] Caitroina McCusker et al. Transforming higher education - The Digital University.

[21] Calvet, L. et al. 2020. Immersive Technologies in Higher Education: Applications, Challenges, and Good Practices. *Proceedings of the 2019 3rd International Conference on Education and E-Learning* (New York, NY, USA, Jan. 2020), 95–99.

[22] Carmichael, C.L. et al. 2015. In your 20s it's quantity, in your 30s it's quality: The prognostic value of social activity across 30 years of adulthood. *Psychology and Aging*. 30, (2015), 95–105. DOI:https://doi.org/10.1037/pag0000014.

[23] Chang, C.-M. and Hsu, M.-H. 2016. Understanding the determinants of users' subjective well-being in social networking sites: an integration of social capital theory and social presence theory. *Behaviour & Information Technology*. 35, 9 (Sep. 2016), 720–729. DOI:https://doi.org/10.1080/0144929X.2016.1141321.

[24] Chukwuere and E, J. 2021. The impact of social media on students' social interaction. *Journal of Management Information and Decision Sciences*. 24, 2S (Jul. 2021), 1–312.

[25] Clark, J.L. et al. 2018. Social Network Sites and Well-Being: The Role of Social Connection. *Current Directions in Psychological Science*. 27, 1 (Feb. 2018), 32–37. DOI:https://doi.org/10.1177/0963721417730833.

[26] Clark, J.L. and Green, M.C. 2019. The Social Consequences of Online Interaction. *The Oxford Handbook of Cyberpsychology*. A. Attrill-Smith et al., eds. Oxford University Press. 215–237.
[27] Cobb, S.C. 2009. Social presence and online learning: A current view from a research perspective. *Journal of Interactive Online Learning*. 8, 3 (2009).
[28] College in the Metaverse Is Here. Is Higher Ed Ready? 2022. *https://www.insidehighered.com/news/2022/08/03/college-metaverse-here-higher-ed-ready*. Accessed: 2022-11-14.
[29] Conor Matchett 2020. What do the new lockdown tiers mean for Scottish schools, universities and childcare? *The Scotsman*.
[30] Coronavirus timeline: Welsh and UK governments' response: 2020. https://research.senedd.wales/research-articles/coronavirus-timeline-welsh-and-uk-governments-response/. Accessed: 2022-12-05.
[31] Denovan, A. and Macaskill, A. 2013. An interpretative phenomenological analysis of stress and coping in first year undergraduates. *British Educational Research Journal*. 39, 6 (Dec. 2013), 1002–1024. DOI:https://doi.org/10.1002/berj.3019.
[32] Dodd, R.H. et al. 2021. Psychological Wellbeing and Academic Experience of University Students in Australia during COVID-19. *International Journal of Environmental Research and Public Health*. 18, 3 (Feb. 2021), 866. DOI:https://doi.org/10.3390/ijerph18030866.
[33] Dos Santos Marques, I.C. et al. 2021. Implementation of virtual focus groups for qualitative data collection in a global pandemic. *American Journal of Surgery*. 221, 5 (May 2021), 918–922. DOI:https://doi.org/10.1016/j.amjsurg.2020.10.009.
[34] Dourish, P. 1999. Embodied interaction: Exploring the foundations of a new approach to HCI. *Work*. (1999), 1–16.
[35] Ellison, N.B. et al. 2007. The Benefits of Facebook "Friends:" Social Capital and College Students' Use of Online Social Network Sites. *Journal of Computer-Mediated Communication*. 12, 4 (2007), 1143–1168. DOI:https://doi.org/10.1111/j.1083-6101.2007.00367.x.
[36] Friedlander, L.J. et al. 2007. Social Support, Self-Esteem, and Stress as Predictors of Adjustment to University Among First-Year Undergraduates. *Journal of College Student Development*. 48, 3 (2007), 259–274. DOI:https://doi.org/10.1353/csd.2007.0024.
[37] Gautam, S. and Rosson, M.B. 2021. Exploring Feelings of Student Community across a Geographically Distributed University. *Proceedings of the ACM on Human-Computer Interaction*. 5, CSCW1 (Apr. 2021), 1–16. DOI:https://doi.org/10.1145/3449167.
[38] Gillis, A. and Krull, L.M. 2020. <? covid19?> COVID-19 remote learning transition in spring 2020: class structures, student perceptions, and inequality in college courses. *Teaching Sociology*. 48, 4 (2020), 283–299.
[39] Grondin, F. et al. 2019. Empathy in computer-mediated interactions: A conceptual framework for research and clinical practice. *Clinical Psychology: Science and Practice*. 26, 4 (2019), e12298. DOI:https://doi.org/10.1111/cpsp.12298.
[40] Han, X. et al. 2022. Design and Research of Campus Culture Application Based on AR and Metaverse Technology. *2022 International Conference on Computation, Big-Data and Engineering (ICCBE)* (May 2022), 97–101.
[41] Hassanzadeh, M. 2022. Metaverse, Metaversity, and the Future of Higher Education. *Sciences and Techniques of Information Management*. 8, 2 (2022), 7–22.
[42] Haves, E. 2020. Coronavirus: November lockdown for England.
[43] Hoefer, G. et al. 2022. Bridging the Social Distance: Offline to Online Social Support during the COVID-19 Pandemic. *Proceedings of the ACM on Human-Computer Interaction*. 6, CSCW2 (Nov. 2022), 429:1-429:27. DOI:https://doi.org/10.1145/3555530.
[44] Hommes, J. et al. 2012. Visualising the invisible: a network approach to reveal the informal social side of student learning. *Advances in Health Sciences Education*. 17, 5 (Dec. 2012), 743–757. DOI:https://doi.org/10.1007/s10459-012-9349-0.
[45] Hossain, E. et al. 2022. Motivational and Situational Aspects of Active and Passive Social Media Breaks May Explain the Difference Between Recovery and Procrastination. *CHI Conference on Human Factors in Computing Systems Extended Abstracts* (New Orleans LA USA, Apr. 2022), 1–8.
[46] Huddart, D. et al. 2020. # MedStudentCovid: How social media is supporting students during COVID-19. *Medical education*. 54, 10 (2020).
[47] Hudson, J.M. and Bruckman, A.S. 2004. The Bystander Effect: A Lens for Understanding Patterns of Participation. *Journal of the Learning Sciences*. 13, 2 (Apr. 2004), 165–195. DOI:https://doi.org/10.1207/s15327809jls1302_2.
[48] Hybrid and blended learning: the flexible future of higher education? 2022. *https://higheredpartners.co.uk/hybrid-and-blended-learning-the-flexible-future-of-higher-education/*. Accessed: 2022-08-03.
[49] Ishii, K. et al. 2019. Revisiting media richness theory for today and future. *Human Behavior and Emerging Technologies*. 1, 2 (2019), 124–131. DOI:https://doi.org/10.1002/hbe2.138.
[50] Khan, M.N. et al. 2021. Social Media for Knowledge Acquisition and Dissemination: The Impact of the COVID-19 Pandemic on Collaborative Learning Driven Social Media Adoption. *Frontiers in Psychology*. 12, (2021).

[51] Kitzinger, J. 1995. Qualitative Research: Introducing focus groups. *BMJ*. 311, 7000 (Jul. 1995), 299–302. DOI:https://doi.org/10.1136/bmj.311.7000.299.

[52] Kluge, M.G. et al. 2022. Current State and General Perceptions of the Use of Extended Reality (XR) Technology at the University of Newcastle: Interviews and Surveys From Staff and Students. *SAGE Open*. 12, 2 (Apr. 2022), 21582440221093348. DOI:https://doi.org/10.1177/21582440221093348.

[53] Krassmann, A.L. et al. 2022. What Is the Relationship between the Sense of Presence and Learning in Virtual Reality? A 24-Year Systematic Literature Review. *PRESENCE: Virtual and Augmented Reality*. 28, (May 2022), 247–265. DOI:https://doi.org/10.1162/pres_a_00350.

[54] Labrie, A. et al. 2022. Toward Video-Conferencing Tools for Hands-On Activities in Online Teaching. *Proceedings of the ACM on Human-Computer Interaction*. 6, GROUP (Jan. 2022), 1–22. DOI:https://doi.org/10.1145/3492829.

[55] Latane, B. and Darley, J.M. 1968. Group inhibition of bystander intervention in emergencies. *Journal of Personality and Social Psychology*. 10, (1968), 215–221. DOI:https://doi.org/10.1037/h0026570.

[56] Lattie, E.G. et al. 2019. Technology and College Student Mental Health: Challenges and Opportunities. *Frontiers in Psychiatry*. 10, (Apr. 2019), 246. DOI:https://doi.org/10.3389/fpsyt.2019.00246.

[57] Ledbetter, A.M. et al. 2007. Forecasting "friends forever": A longitudinal investigation of sustained closeness between best friends. *Personal Relationships*. 14, 2 (2007), 343–350. DOI:https://doi.org/10.1111/j.1475-6811.2007.00158.x.

[58] Lee, C. et al. 2014. A Closer Look at Self-Esteem, Perceived Social Support, and Coping Strategy: A Prospective Study of Depressive Symptomatology Across the Transition to College. *Journal of Social and Clinical Psychology*. 33, 6 (Jun. 2014), 560–585. DOI:https://doi.org/10.1521/jscp.2014.33.6.560.

[59] Lenning, O.T. and Ebbers, L.H. 1999. The Powerful Potential of Learning Communities: Improving Education for the Future. ASHE-ERIC Higher Education Report, Vol. 26, No. 6. ERIC Clearinghouse on Higher Education, One Dupont Circle, N.

[60] Liu, F. et al. 2021. Significant Otter: Understanding the Role of Biosignals in Communication. *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems* (Yokohama Japan, May 2021), 1–15.

[61] Liz Mineo 2017. Good genes are nice, but joy is better. *Harvard Gazette*.

[62] Madge, C. et al. 2009. Facebook, social integration and informal learning at university: 'It is more for socialising and talking to friends about work than for actually doing work.' *Learning, Media and Technology*. 34, 2 (Jun. 2009), 141–155. DOI:https://doi.org/10.1080/17439880902923606.

[63] Marr, B. 2022. What Is Web3 All About? An Easy Explanation With Examples. *Bernard Marr*.

[64] Means, B. and Neisler, J. 2020. Suddenly online: A national survey of undergraduates during the COVID-19 pandemic. Digital Promise.

[65] Metaversities are real-world college campuses in VR: 2022. *https://www.digitaltrends.com/computing/metaversities-attend-college-in-vr/*. Accessed: 2022-09-14.

[66] Muilenburg, L.Y. and Berge, Z.L. 2005. Student barriers to online learning: A factor analytic study. *Distance Education*. 26, 1 (Jan. 2005), 29–48. DOI:https://doi.org/10.1080/01587910500081269.

[67] Oh, C.S. et al. 2018. A Systematic Review of Social Presence: Definition, Antecedents, and Implications. *Frontiers in Robotics and AI*. 5, (2018).

[68] Oh, H.J. et al. 2023. Social benefits of living in the metaverse: The relationships among social presence, supportive interaction, social self-efficacy, and feelings of loneliness. *Computers in Human Behavior*. 139, (Feb. 2023), 107498. DOI:https://doi.org/10.1016/j.chb.2022.107498.

[69] Park, N. et al. 2016. Uses of cellphone texting: An integration of motivations, usage patterns, and psychological outcomes. *Computers in Human Behavior*. 62, (Sep. 2016), 712–719. DOI:https://doi.org/10.1016/j.chb.2016.04.041.

[70] Progress on 'Metaversities'? Universities Taking It Slow: 2023. https://www.govtech.com/education/higher-ed/progress-on-metaversities-universities-taking-it-slow. Accessed: 2023-10-13.

[71] Ravert, R.D. 2009. "You're Only Young Once": Things College Students Report Doing Now Before It Is Too Late. *Journal of Adolescent Research*. 24, 3 (May 2009), 376–396. DOI:https://doi.org/10.1177/0743558409334254.

[72] Ready Player Me - The World's leading avatar platform: *https://readyplayer.me/*. Accessed: 2023-08-07.

[73] Sadowski, A.S. and Lomanowska, A.M. 2018. Virtual intimacy: Propensity for physical contact between avatars in an online virtual environment. *Computers in Human Behavior*. 78, (Jan. 2018), 1–9. DOI:https://doi.org/10.1016/j.chb.2017.09.011.

[74] Singh, J. et al. 2021. Combining the Best of Online and Face-to-Face Learning: Hybrid and Blended Learning Approach for COVID-19, Post Vaccine, & Post-Pandemic World. *Journal of Educational Technology Systems*. 50, 2 (Dec. 2021), 140–171. DOI:https://doi.org/10.1177/00472395211047865.

[75] Sproull, L. 2011. Prosocial Behavior on the Net. *Daedalus*. 140, 4 (Oct. 2011), 140–153. DOI:https://doi.org/10.1162/DAED_a_00120.

[76] Symeonides, R. and Childs, C. 2015. The personal experience of online learning: An interpretative phenomenological analysis. *Computers in Human Behavior*. 51, (Oct. 2015), 539–545. DOI:https://doi.org/10.1016/j.chb.2015.05.015.

[77] The Metaverse Is Built on University Innovation. Higher Ed Should Stake Its Claim - EdSurge News: 2022. *https://www.edsurge.com/news/2022-11-03-the-metaverse-is-built-on-university-innovation-higher-ed-should-stake-its-claim*. Accessed: 2022-11-28.

[78] The Promise of Immersive Learning: Augmented and Virtual Reality's Potential in Education | ITIF: 2021. *https://itif.org/publications/2021/08/30/promise-immersive-learning-augmented-and-virtual-reality-potential/*. Accessed: 2022-11-14.

[79] Turkle, S. 2016. Reclaiming conversation: The power of talk in a digital age. Penguin.

[80] Universities to stay open during England's second Covid lockdown: 2020. https://www.timeshighereducation.com/news/universities-stay-open-during-englands-second-covid-lockdown. Accessed: 2022-12-05.

[81] Universities UK 2022. Lessons from the pandemic: making the most of technologies in teaching.

[82] Wang, C.-M. 2011. Instructional design for cross-cultural online collaboration: Grouping strategies and assignment design. *Australasian Journal of Educational Technology*. 27, 2 (Apr. 2011). DOI:https://doi.org/10.14742/ajet.968.

[83] Wilcox, P. et al. 2005. 'It was nothing to do with the university, it was just the people': the role of social support in the first-year experience of higher education. *Studies in Higher Education*. 30, 6 (Dec. 2005), 707–722. DOI:https://doi.org/10.1080/03075070500340036.

[84] Will 2023 Be The Year Of The Metaversity? https://www.forbes.com/sites/traceyfollows/2023/03/13/will-2023-be-the-year-of-the-metaversity/. Accessed: 2023-10-13.

[85] Willoughby, T. et al. 2021. A Long-Term Study of What Best Predicts Graduating From University Versus Leaving Prior to Graduation. *Journal of College Student Retention: Research, Theory & Practice*. (Jan. 2021), 1521025120987993. DOI:https://doi.org/10.1177/1521025120987993.

[86] With Money From Facebook, 10 Colleges Turn Their Campuses into 'Metaversities' - EdSurge News: 2022. *https://www.edsurge.com/news/2022-06-01-with-money-from-facebook-10-colleges-turn-their-campuses-into-metaversities*. Accessed: 2022-09-14.

[87] Wu, Y. et al. 2022. What Do You Get from Turning on Your Video? Effects of Videoconferencing Affordances on Remote Class Experience During COVID-19. *Proceedings of the ACM on Human-Computer Interaction*. 6, CSCW2 (Nov. 2022), 1–21. DOI:https://doi.org/10.1145/3555773.

[88] Wut, T. and Xu, J. 2021. Person-to-person interactions in online classroom settings under the impact of COVID-19: a social presence theory perspective. *Asia Pacific Education Review*. (Feb. 2021), 1–13. DOI:https://doi.org/10.1007/s12564-021-09673-1.

[89] Yuan, T. et al. 2022. The Exploration of the Future Teaching Mode in Post-pandemic Higher Education. *Proceedings of the 7th International Conference on Distance Education and Learning* (New York, NY, USA, Aug. 2022), 222–227.

APPENDIX

Appendix A. Online Survey Questions

Q3 Please provide your first and last name (we need this information to demonstrate to our funder that the vouchers have been distributed to our participants).

_____

Q4 What is your gender?

- ○ Male (1)
- ○ Female (2)
- ○ Prefer to describe in my own words (3)
- ○ Prefer not to say (4)

Q5 How old are you?

_____

Skip To: End of Survey If Condition: How old are you? Is Less Than 18. Skip To: End of Survey.

Q6 Please provide your email address so we can contact you in the future

_____

Q7 On which of these dates could you attend the workshop (at 2pm)?

- ○ Tuesday 10th November (1)
- ○ Wednesday 11th November (2)
- ○ Either date (3)

End of Block: Demographics

Start of Block: Survey

Q8 What is your learning environment right now?

- Fully remote learning (1)
- Fully face-to-face teaching (2)
- Combination of remote learning and face-to-face teaching (3)

Q9 How many online pre-recorded lectures do you have per week?

- 1-3 (1)
- 4-6 (2)
- 7-9 (3)
- 10+ (4)

Q10 What is the average length of these pre-recorded lectures?

- > 1 hour (1)
- 1 hour (2)
- 1-2 hours (3)
- 2+ hours (4)

Q11 How many online live lectures do you have per week?

- ○ 1-3 (1)
- ○ 4-6 (2)
- ○ 7-9 (3)
- ○ 10+ (4)

Q12 What is the average length of these live lectures?

- ○ > 1 hour (1)
- ○ 1 hour (2)
- ○ 1-2 hours (3)
- ○ 2+ hours (4)

Page Break

Q13 Where do you watch lectures during the pandemic?

- ○ Bedroom (1)
- ○ Home (not the bedroom) (2)
- ○ Library (3)
- ○ Other (4) _____

Q14 Has your experience in the past month matched your expectations of university life?

- ○ No (1)
- ○ Yes (2)

Q15 Do you think technology has affected your motivation to learn?

- ○ No (1)
- ○ Yes - Positively (2)
- ○ Yes - Negatively (3)

Q16 Did you use technology to help you plan learning? If yes, please state which technology (e.g. apps) you are using.

- ○ No - I do not plan (1)
- ○ No - I write down my plans (2)
- ○ No - technology is not useful for planning (Please state your reasons) (3) _____
- ○ Yes (4) _____

Q17 Did you use technology to help you focus while you are learning?

- ○ No - technology is not useful for focusing (1)
- ○ No - other (2) _____
- ○ Yes - I use anti-procrastination apps (3)
- ○ Yes - I listen to music (4)
- ○ Yes - other (5) _____

Q18 Do you use any anti-procrastination apps while working? If so, which ones?

- [ ] No (1)
- [ ] Freedom (2)
- [ ] Leechbug (3)
- [ ] FocusMe (4)
- [ ] Cold Turkey (5)
- [ ] Others (6)

Q19 Did you use technology to help you revise?

- ○ No - I do not revise (1)
- ○ No - technology is not helpful for revision (2)
- ○ No - other (3) _____
- ○ Yes - I use note-taking apps (4)
- ○ Yes - other (5) _____

Q20 Do you think technology has helped you achieve your academic tasks in the past month?

- ○ No (1)
- ○ Yes (2)

Page Break

Q21 Has the lockdown impacted your mental wellbeing?

- ○ No (1)
- ○ Yes - Positively (2)
- ○ Yes - Negatively (3)

Q22 Did you use any apps designed to help your mental wellbeing in lockdown?

- ☐ Yes - Therapy Apps (1)
- ☐ Yes - Meditation Apps (2)
- ☐ Yes - Other Apps (3)
- ☐ No (4)

Q23 Do you think technology has affected your mental wellbeing in lockdown?

- ○ No (1)
- ○ Yes - Positively (2)
- ○ Yes - Negatively (3)

Q24 Did you use any of these types of apps to try to improve your mental well-being in lockdown?

- ☐ Yes - Music Apps (1)
- ☐ Yes - Movie/TV Apps (2)
- ☐ Yes - Exercise Apps (3)
- ☐ Yes - Gaming Apps (4)
- ☐ Yes - Social Media Apps (5)
- ☐ No (6)

Q25 Did any of these apps improve your mental well-being without you intending them to?

- ☐ Yes - Music Apps (1)
- ☐ Yes - Movie/TV Apps (2)
- ☐ Yes - Exercise Apps (3)
- ☐ Yes - Gaming Apps (4)
- ☐ Yes - Social Media Apps (5)
- ☐ No (6)

End of Block: Survey

Start of Block: Block 3

Q26 What social media or messaging applications do you use?

- [ ] Instagram (1)
- [ ] Facebook (2)
- [ ] Twitter (3)
- [ ] Whatsapp (4)
- [ ] Snapchat (5)
- [ ] Other (6) _____
- [ ] None (7)

Q27 Do you like using technology to interact with others?

- ○ Yes (1)
- ○ No (2)
- ○ Sometimes (3)

Q28 Has starting the 1st year of university during COVID-19 negatively impacted you, socially?

- ○ Yes (1)
- ○ No (2)
- ○ Not that much (3)
- ○ Quite a lot (4)

Q29 Have you felt lonely since beginning university?

- ○ Yes (1)
- ○ No (2)
- ○ Sometimes (3)

Q30 Has it been difficult to make friends since beginning university?

- ○ Yes (1)
- ○ No (2)
- ○ Not that much (3)
- ○ Quite a lot (4)

End of Block: Block 3

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