A mixed methods enquiry on student perceptions and experiences of online learning

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Abstract

This article reports on a small, in-depth study designed to explore qualitatively how first year Mechanical Engineering students in a UK University perceived their learning and their university experience during the academic year 2020/21, when much of the delivery was online due to the global pandemic. As we move forward to a new normal, where blended and hybrid learning will be at the centre of our education offer, it is important for us to better understand students' experiences and perceptions of online learning. To enable this understanding, students were invited to collaborate with us in this exploration, in June 2021 following the completion of their first year at University. Two options for collaboration were offered: an online survey and an in-depth interview. In our study, the results from the online survey informed and complemented the interviews.
Interviewed students generally perceived online learning as 'second class', with the use of breakout rooms being especially unpopular. Students were also particularly critical of hybrid experiences relating to groupwork (when in-person and online teaching and learning happen simultaneously). At the same time, they reported many positive experiences when using online tools, such as asynchronous videos followed by a collaborative flipped classroom. All students affirmed the importance of the social dimensions of learning and how their learning had been heavily affected by the pandemic. Key recommendations are that academics need to better understand group dynamics when using online and hybrid approaches and that high quality feedback on assignments is even more crucial when learning is taking place online.

Background

Online learning and teaching are not a new phenomenon – the Open University has been using and developing it for many years (see, for example, Macdonald, 2006), and many quantitative studies have investigated its effectiveness over the past two decades (Bennett & Bennett, 2002; Swan, 2003; Ni, 2018; Nguyen, 2015).

Having gradually become part of most Engineering courses over the past few years (Hiltz and Turoff, 2005), online learning now blurs the lines between traditional and distance learning. A new phenomenon, however, is the enforced and rapid shift to online teaching caused by the Covid-19 global pandemic. Since its onset, there has been a plethora of research into the impact of online learning and teaching on students and academics (Dhawan, 2020, Cahaya et al 2022), some of which has focused specifically on the experiences of engineering students (see, for example, Warfvinge et al., 2021 and Asgari et al, 2021).

Previous projects that the Mechanical Engineering Department in our study has been involved in, for example, Transforming the Experience of Students Through Assessment, TESTA (Jessop, 2016), demonstrated that feedback from students can be profound if captured on multiple levels and in a sustained manner. The Department gathers feedback from students via different channels, for example, all first-year students must attend weekly tutorials with an academic; these are small groups where students can voice their concerns. They can also contact their year's student representatives who attend a Student-Staff Liaison Committee (SSLC) each term. During the tutorial and SSLC sessions in 2020, when all university provision was online due to lockdown, many students reported being unable to form

connections with each other and with their educators. They felt as though they were spectators to their learning experience. Considering this feedback, it was important, therefore, to use a research method that gave students the opportunity to tell their stories to a researcher unconnected with the department and who could, when necessary, ask the naïve questions that would encourage them to reflect rather more deeply on their experiences.

The aim of this research project was to understand and build on first year undergraduates' perceptions and experiences of online learning. It emanated from student feedback and from our desire to form a new type of partnership between staff and students, a partnership that will enable us to build trust and to optimise the structure and delivery of our programmes. The project focused on gathering information on first year students' lived experiences during the 2020/2021 academic year, as they embarked on their university journey. This is part of a longitudinal study, that will follow this cohort of students during their university journey.

The structure of the article is as follows: we start with a literature review on online teaching and learning, focusing on students' perceptions and also qualitative research approaches followed by a discussion of the methodological approach and research methods used, together with the rationale for using them. We then discuss the findings, emphasising the qualitative data collected, supported by aspects of the quantitative data. The article concludes by highlighting the key issues emanating from the research, together with recommendations and next steps.

Literature review

Student perceptions of online learning were studied by Smart and Cappel (2006). They reported that students valued flexibility, instant feedback and developing a new learning perspective. As limitations, they reported technical issues as well as assessments being too long.

Online success can be measured at different levels, not only at the level of students' perceptions. A comprehensive model was developed by Al-Fraihat et al (2020), consisting of seven independent constructs including for example, technical aspects, educational and perceived satisfaction. There are many other studies aiming at assessing distance education during the pandemic period in many different countries, from Morocco (Elfirdoussi et al 2020), to Indonesia (Yusriadi et al, 2022). In general, these studies are positive, highlighting the effectiveness of online learning giving the very difficult distances we were going through.

Moving into engineering education in particular, Asgari et al (2021) reported on a quantitative research project, evaluating the efficacy of online engineering education. In this work, challenges for students seem to focus on technical issues, such as internet connection or not having a private space to study. Similar problems were reported by Dhawan (2020), in a study about online learning strengths, weaknesses, opportunities and challenges (SWOC). This study also identified the lack of a community as a struggle. Flexibility is meant to be a strength of online delivery, but as reported in this study, students never seem to find the time to do what is required. The study presented by Warvinge et al (2021) focuses on the students' perceptions, collecting data from questionnaires. In particular, they compared the students' responses pre-pandemic with the responses after delivery moved online. Overall, students expressed less satisfaction with their courses, with feedback being one the key issues together with the development of teamwork skills. On a positive note, students developed new skills such as workload planning and were in general positive about online assessments, more focused on problem solving and less fixated on gathering facts. Coman et al (2020) also researched students' perceptions, using an online survey to collect data. The study found that students experienced technical difficulties and they perceived that the workload had increased, and that processing information had become more challenging. The annual UK Student Academic Survey for 2020 (Neves and Hewitt, 2020), provides an invaluable reference for comparison over the years. In 2020, it was reported that students felt that they were receiving less value for money due to the switch to online learning and that the technologies used for teaching were of lower quality. Where more advanced technologies were used, students were significantly more likely to feel they received good value, learnt more, and

developed useful skills. The perception about value for money declined even further in the following year's survey (Neves and Hewitt, 2021). In 2021, the survey included for the first time an open question about how the academic experience could be enhanced. Improving assessment and feedback and providing more in-person teaching were the actions suggested by students. In addition, in 2021 student wellbeing measures were at their lowest levels. In this survey, declining levels of wellbeing due to COVID-19 were also reported, especially affecting LGBT+ students and 1st year university students.

As can be seen, most of the research carried out to date is quantitative, usually employing questionnaires (surveys) to collect data. In our study, we employed a qualitative approach, with the aim of uncovering new students' realities and perceptions, in addition to exploring the reasons behind the trends detected via surveys.

Quantitative research is positioned within positivism and characterised by empirical results: answers can be reduced to indicators representing a unique truth (see, for example, Usher, 1996). In contrast, qualitative research is positioned, broadly, within interpretivism and constructivism: reality is socially constructed and hence constantly evolving (Sale et al, 2003). Traditionally, these philosophical perspectives were considered incompatible (Guba, 1987), but they have been used in combination over several years and the 'incompatibility thesis' has been rejected by many education researchers (see Howe, 1998, for example).

Purpose

The overall aim of the research was to understand first year undergraduate students' perceptions and experiences of online learning and to use the knowledge acquired to design a framework to enhance online delivery. The project was guided by three baseline research questions:

- How do first year students perceive the way in which their university experience unfolded?
- What is the students' perception towards online delivery and their ability to learn and assimilate information in a new environment?
- What are the key drivers or factors that would enable students to perceive online learning as high quality and to become more confident learners?

Methodology: in-depth interviews

In our research, we adopted a mixed methodological approach with a preliminary quantitative study to detect perception patterns using an online survey. The quantitative data were a starting point and complemented in-depth interviews that took place in a second stage. The approach could be defined as embedded (Creswell and Plano Clack, 2007) with the secondary data being the results of the survey, as the primary focus of our research was the qualitative analysis of the in-depth interviews. A qualitative approach is more suitable when the main research concern is participant perspectives (Bogdan, 2007). There are several engineering education studies using this approach, although many exhibit a strong preference for quantitative data and follow the inverse order where, for example, a preliminary focus group informs the development of a test/survey (Borrego et at, 2009). It seems in engineering education research there is still a pull towards quantitative research and positivist epistemologies (Kellam and Jennings, 2021). In quantitative research, the researcher aims to demonstrate generalization, but in qualitative research the emphasis is on transferability, hence, rich description is an essential aspect to ensure the findings are transferable to other contexts (Borrego et at, 2009). There are some exceptions to the focus on a quantitative approach, for examples, where phenomenological approaches are taken (Barlow and Brown, 2020).

The key aim for our research was to understand in more depth what takes place in real engineering classrooms (Case & Light, 2011, p.206) hence, one-to-one interviews with students were the core of

our research. We adopted a phenomenological approach: a qualitative research methodology, situated broadly within interpretivism, that investigates the qualitatively different ways in which people experience (or think about) something. This method is particularly well suited when studying what an experience means to a particular group of people (Grossoheme, 2014). Table 1, adapted to our study from Koro-Ljunberg and Douglas (2008), summarises the key aspects of this perspective. Within phenomenology, there are two different schools, critical and uncritical. The critical school concedes there are cultural aspects attached to our perceptions and attempts to unfiltered the true essence of the experience. On the other hand, this approach resembles somewhat positivism, in its assumption that there are invariant aspects true for all (Chism et al, 2008). We use phenomenology in an uncritical way (Chism et al, 2008), in the sense that experiences are described in terms of the perception of the person, in this case students, experiencing it.

Table 1: Phenomenology epistemological perspective key aspects. Adapted from Koro-Ljunberg and Douglas (2008)

Epistemological Perspective:	View on reality	Purpose	Method	Role of the researcher	Research Outcome
Interpretivist: Phenomenology	Multiple subjective realities	To describe experiences and perceptions	In-depth semi-structured interview. Thematic analysis	Researcher and participants are partners	Situated descriptions

The most popular phenomenological data collection method is semi-structured interviews (Han and Ellis, 2019), which are often conducted using a set of pre-defined interview questions as well as the information emerging from participants' responses (Stenfors-Hayes et al., 2013).

Before embarking on the study, full ethical approval was obtained. Data were collected via an anonymous online survey and online one-to-one interviews.
All first-year students in the mechanical engineering programme were given access to an online survey and asked to complete it, and 38 responses were received (20% of the whole 1st year cohort). The survey consisted of six Likert scale type questions, built around the baseline research questions and three open questions. The survey can be accessed in the reference list (Survey, 2021).

In addition, students were invited to be interviewed about their experiences and 9 students accepted the invitation. All were emailed by an independent researcher (who was not a member of staff of the Department of Mechanical Engineering) and offered a time to be interviewed. Following their reply, they were sent an Informed Consent Form to complete and return, and a Zoom link to the online interview. Seven students were interviewed, six males and one female. The interviews were one hour long and were loosely structured in the sense that participants were invited to share their experiences of their first year but, at the same time, focused on the research questions and specific issues highlighted by the survey responses. Participants were encouraged to develop their comments and to reflect on the reasons for their responses and for their experiences by being asked to provide specific examples or to elaborate on a particular point. A member of the team read through the Zoom generated transcripts to anonymise the data. Anonymised transcripts were then emailed to participants. They were asked to read through them and to inform the interviewer if they felt that they could be identified or if they wanted any comments to be deleted. Nobody requested any changes. They were also sent a £20 voucher as an acknowledgement of their time.

The analysis of the data from the interviews consisted of three steps: identification, sorting and contrasting, see Table 2 for details. This table was adapted from Han and Ellis (2019). The main themes

are highlighted in the following section, in line with the principles of thematic analysis (Braun & Clarke, 2013).

Table 2: Data analysis processes. Adapted from Han and Ellis (2019)

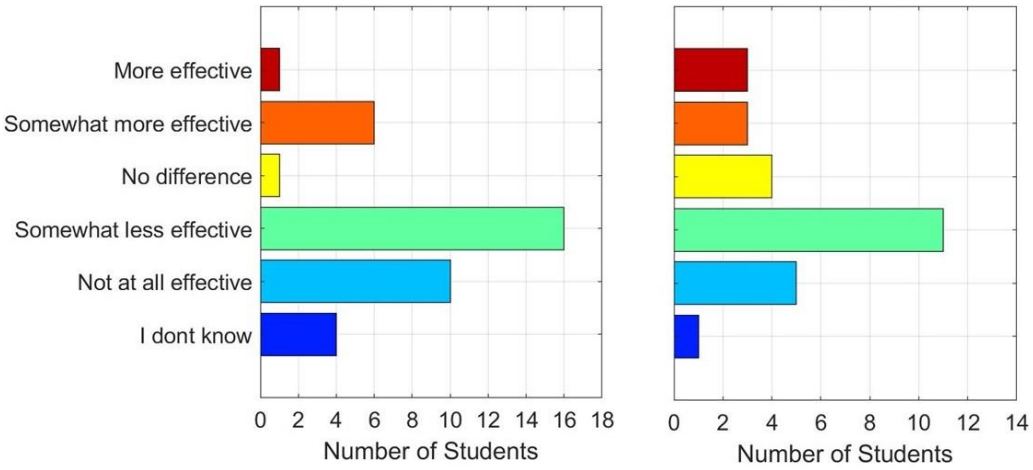
Identification	Sorting	Contrasting
The data related to our research questions are identified.	The identified data are sorted into recurring themes	The experiences on the same theme are contrasted.

Results of the Data analysis: identification, sorting and contrasting

The themes that emerged from the interview transcripts were – online learning versus learning in a physical space, online breakout rooms, assessment and feedback, social interaction and learning about oneself as a learner. In the presentation of the interview findings, the pronoun 'their' is used in order not to distinguish the gender of the participant. Interestingly, two of the identified themes, breakout rooms and assessment and feedback did not emerge unprompted during the interview. The interviewer invited comments as both were very poorly rated in the survey. Once the subject was 'on the table', students were vociferous in their comments. The sorted and contrasted quotations for each theme can be read in the following subsections.

Online learning versus learning in a physical space

From the survey, it was clear that students perceived in-person teaching and learning as more effective than the online provision. Figure 1 shows a graph with the answers given to the questions: (a) Online teaching compared to in-person teaching is ... and (b) Online learning compared to in-person teaching is …



(a) Teaching (b) Learning

Figure 1 Students' answers to the question: Online (a) teaching/ (b) learning compared to in-person (a)teaching/ (b) learning is …

All interview participants stated that learning was most effective for them when they were in a physical space with others (Warfvinge et al., 2021). One participant was unable to be in the university city for the entirety of their first year of study and so had not had any experience of being able to go to the university for any sessions (even when the restrictions allowed for in-person teaching activities) but, within the first few minutes of the interview stated, *"But I really think in person learning would be much better for me"* (Interviewee 5). Some participants qualified this preference by recognising that there were advantages to online learning which ranged from physical advantages such as being able to "*roll out of bed at five to nine, knowing that I could make my lecture on time"* (Interviewee 6) through

"*I think that the fact that I'm at home, not in accommodation, really helped me because I have food here, I don't have to spend time cooking"* (interviewee 5) and to an acknowledgement that *"having the ability to ask questions anonymously online is probably helpful for a lot of people because they feel too embarrassed to ask in front of everyone else so that ability could be beneficial"* (Interviewee 1). Some participants were more vociferous in their dislike of online learning than others. Interviewee 6, for example, said "*…I really don't like it and I like being in person, doing it in front of somebody and all that stuff, so I think doing it online does not work for me at all".*

In other ways, however, some of the in person learning that occurred that year was not at all helpful: *"I literally sat on a table for 4 people and worked on this random town in the middle of nowhere on how to improve transport links and used engineering problems to, you know, better suit the community or whatever. And it was literally me sat with two other people because one guy couldn't make it because he was in Kenya or something…sometimes I'd get there, and it would just be me and I'd have to put my headphones on and then talk to them on Zoom which kind of defeats the point of me going into uni"* (Interviewee 6). Interviewee 1 described a similar experience: *"We're all assigned groups of 4 and sat in a big room. I, along with quite a few other people didn't have anyone else who turned up because the groups were assigned before we went in. One of my group members was staying in London and others in Hong Kong. Another was meant to come to …l but didn't…I felt that lecturers really tried to make it so that they tried to prove to us that working as a group in person and online can be exactly the same – there's no difference in the experience. They tried to say, 'People can connect to your group online and you can sit in this room on site and you can video call them', but I would put it to them that the experience is, by nature, not the same. You can't deny that group work in person is more productive than online or hybrid or both and I think especially choosing the groups before we even turned up in person and having groups of mixed online and in person was not a very good decision in my opinion. It did get better through the year though".* There was a clear dislike for hybrid learning, defined here as the mixing in real time of online and in-person participants.

Interviewee 2 had spent part of the year in the university city and then returned to their home country in January 2021. Their experiences of blended learning were more positive than most participants and this appeared to be because they had taken significant advantage of opportunities to be in a range of physical spaces with others while in the city: *"I really enjoyed the course in the first 3 months, and I also enjoyed it after that…I got to go to the campus for 1 or 2 projects that I signed up for and those were really fun. I had a lot of fun using the equipment…".* This student was fulsome in their praise for the teaching experienced, comparing it several times, favourably, to the style of teaching in their 6th form: *"I found the lecturers to be very helpful when it comes to solving questions and I really liked the style that they use to teach throughout the first 3 months. I just really enjoy the way they teach, and I learned a lot in the first 3 months".* When invited to be more specific about what it was that they really liked about the teaching style, the response illustrated awareness of their 'style of learning': *"I have this really specific way of learning where I'm not really always on track with the teacher and the syllabus, so I always refer back to the material again and again throughout the year. I found it really helpful that everything was online, and I can go through the lectures that were recorded again and again. It was really helpful towards my style of learning because I'm not always on track, but I can always watch the recordings again and again".*

Being able to return to online material was deemed to be valuable by all participants as was preparing for online 'lectures' and viewing the videos (Romero-Ivanova et al., 2020). "*The videos were helpful. The way to the information was very concise and really helped me to build my notes. Yeah, the video and the notes were very helpful"* (Interviewee 5). "*It was some videos before the lectures. We practise the questions, then you have questions to talk about afterwards which I found a lot more useful…I found that a lot more useful than coming to a live session to listen to the teacher and then have your questions solved by the end"* (Interviewee 4). Like Interviewee 2, in addition to valuing the videos, most participants liked being able to revisit material that was available online. Interviewee 7, for example, said: *"As well as the videos, the fact that the lectures were recorded, you could always come back to them. You could actually save time by watching them at twice the speed, pressing pause and play, that's very useful. Having the material stored on the website, on Blackboard, is really useful".* There was,

however, some criticism of the videos, mainly of the length or the number required for preparation. *"The videos for every single lecture were totally different. There wasn't a set layout and a set time period…some of them, for one module, we had 4.5 hours of videos to watch. And my first thought was 'what's the point'?"* (Interviewee 6)

Breakout rooms

Survey responses indicated that the use of breakout rooms was the least liked and least successful of all the online learning activities. Figure 2 shows the results of the survey, where students were reflecting on their experience of using breakout rooms during online live sessions.

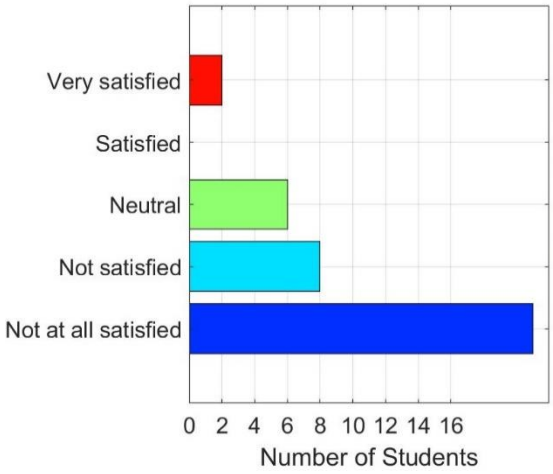


Figure 2 Experience using breakrooms during live session.

In the interviews, therefore, if participants did not mention breakout rooms, they were asked to comment on their experience of them. In contrast to other relevant research (e.g.Romer—Ivanova et al., 2020; add more), all participants expressed their dislike for this online activity although Interviewee 4 had a slightly more positive perspective, feeling that "*some people are honest behind screens".* This participant added: *"It kind of brought out that a lot of people are going through the same, the same troubles. You know, when you don't know many people, it's a lot easier to think you're the only one going through struggles. But sometimes when you speak to people, they are a lot franker when you're not in the same room and you notice that it's a problem that's kind of common".*

Interviewee 1 provided a more balanced perspective: *"Unless you know the people you're working with beforehand, group work online can be a little frustrating, can be isolating and it can also just be really unproductive…even with all of these issues it was probably still the only opportunity we had to actually talk to other people".*

Whereas Interviewee 6 was adamant that breakout rooms were *"a complete waste of time"*. This participant did, however, continue to identify occasions when, they were a more productive experience: *"The only time they worked was when the breakout rooms lasted about 45 minutes and they were supervised. So, we had either a TA or a lecturer in there to talk to us and give us a hand. That was actually helpful. That was like being in a classroom, being able to put your hand up and have some help".*

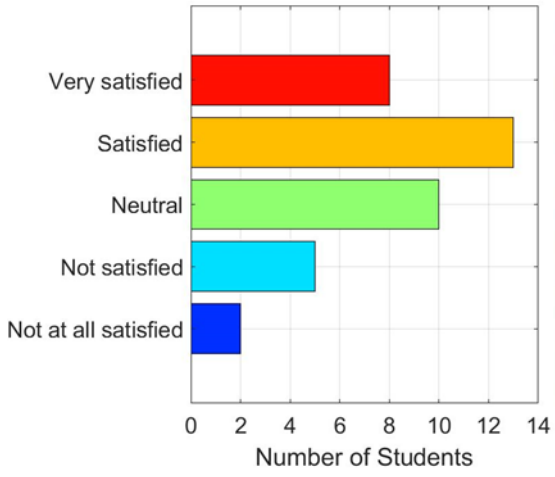
All students reported experiences of people not turning cameras on, sitting behind black screens, and of nobody speaking. The management of these groups does not seem to have been very effective for them unless a Teaching Assistant (TA) joined a breakout room and initiated interaction. When this happened, students reported working together more effectively.

Elements of Assessment and Feedback

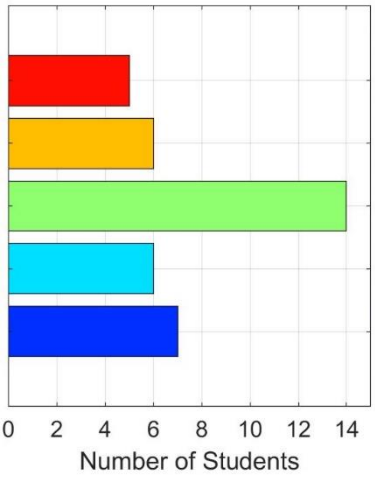
Survey data indicated overall satisfaction with formative quizzes, were neutral with regards to online exams with their major dissatisfaction relating to group coursework, see Figure 3.

In the interviews, students tended to describe the different types of assessments that they had had during the year, focusing more on the feedback provided, rather than critiquing the forms of assessment. Interviewee 6, for example, when invited to comment on their experience of assessment, responded: *"The actual tests were pretty good, some better than others, because some of them, they told you exactly what you've done wrong, or they give you a hint it's the right idea why you've done something wrong. And some others said 'No, try again' which was really irritating because you didn't know what you got wrong, because it was multiple choice*".

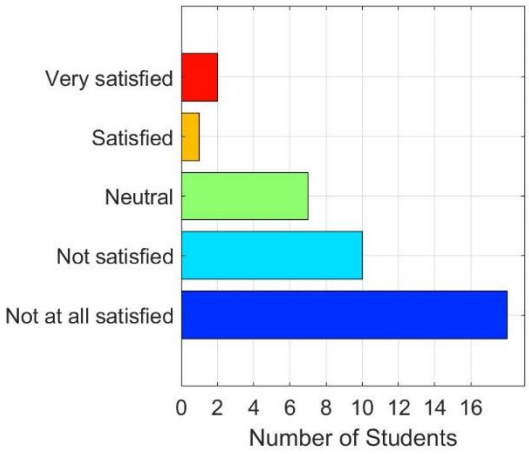
Students' reported experiences of feedback on their work varied. Those who spoke about peer feedback could see the value of it, but it seemed clear that some did not really understand how it could be used successfully: *"We did peer feedback, in which students gave feedback to other students. That was helpful, definitely, but it was more like a very thorough proofreading. You can't really get professional feedback from that because it is only other students who are reading it"* (Interviewee 1).



(a) Experience using online formative quizzes



(b) Perception of taking online exams



(c) Experience of doing group coursework

Figure 3 Survey responses relating to Assessment and Feedback

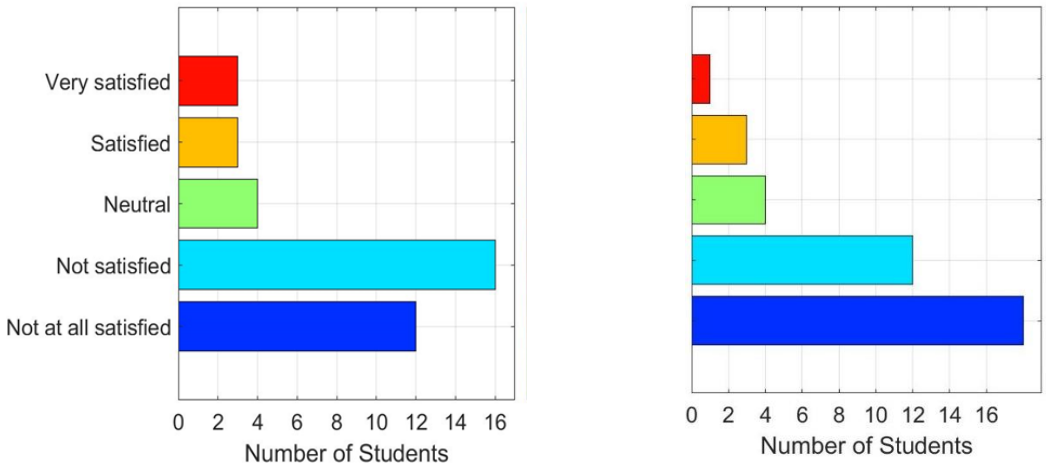
Interviewee 2 expressed a more positive view, after having commented somewhat negatively on their experience of a pass/fail assignment they completed: *"I would say the feedback I got on that wasn't so good, because we did 4 reports before submitting the final one and all were peer marked. I enjoy peer marking because, when you peer mark someone else's work, you're able to see the parts you missed and you're able to ameliorate your own work. I think peer marking is good, but I'd want at least 1 or 2 to be marked by the professors, so we know what we're missing from their point of view and what they expect of us in the final report".*

It was clear, from the student comments, that they felt that they did not receive sufficient feedback to allow them to understand completely any errors that they had made in their work and those areas that they needed to develop: *"It was really just ticking assessment objectives and saying whether or not we've done them and maybe like a sentence afterwards to give us some very brief notes on what we could have improved"* (Interviewee 1).

Invited to define the feedback that would be ideal for them, all students wanted to have it given to them individually in a face-to-face meeting. At the same time, they recognised that this was impossible, assuming that this would be because of the large number of students: *"In an ideal world, they would mark everything we do. That would be great for motivation, but I can understand that's probably not possible because there are too many students and not enough people marking…the feedback that they do give us doesn't need to be very often, but it should be more human. Maybe they should write a paragraph or something to actually show that they've read our work because, especially when you need so much motivation to do the work, it's difficult when you receive very little validation from it. All that time and effort has gone into something that's taken many hours and all you receive is a couple of quick notes"* (Interviewee 1).

Social interaction

The survey indicates that the students struggled with stabilising interactions with their cohort. As shown in Figures 4, both academic collaboration and developing friendships were a challenge online.



(a) Rate your ability to: Collaborate virtually with classmates

(b) Rate your ability to: befriend classmates virtually.

Figure 4 Survey results relating to social interaction

Social interaction appears to have been almost non-existent for most participants interviewed. All found it difficult to get to know fellow students and staff on the course other than Interviewee 3, who communicated a sense of being much more independent than their peers. In addition, this participant

had spent the whole year in the city: *"I am quite a lot older than most first year students…I think that's really contributed towards how positively I felt towards the online experience because I've lived in a really big flat with 22 people. I've had another engineer in the flat so I've kind of had the social contact".*

Interviewee 4, prompted to elaborate on the comment *"I feel like, online, things that would have taken me maybe 4 or 5 years to learn, I learnt quicker"* added: *"With not so much social interaction, you have a lot more time to think about you, what you want in your life and that makes it easier to be able to say 'OK, this is what I want'. Might be a bit uncomfortable…but it makes things a lot easier to categorise I guess."*

Interviewee 1's observations were, however, more reflective of the majority experience: *"I've met a lot less people than I would have in a normal year…You have to try very hard to interact with as many people as possible to make friends in this setting. All the friends I've made have been people I've met in person. I can't say I've been in a video call and made friends with the people there. So, I think, from a social point of view, it's also quite damaging to have students online entirely, which is probably why so many people felt isolated this year".*

Learning about oneself as a learner

Participants appear to have learned about themselves and about themselves as learners, even if, in some cases, they did not appear to be able to recognise or acknowledge this. This lack of recognition or acknowledgement may signal a lack of maturity but also appears to be related to the 'independent' learning required of them in their first year at university. On an intellectual level, they seem to be aware of this, but not at an emotional level. On being asked to reflect on their previous experiences of learning, not only to make comparisons with their experiences of their first year but also to support them to discern what they understood about themselves as learners and thus to develop as engineers, some demonstrated significant insight. The first comment made by Interviewee 2, for example, indicated clear awareness of how they ensured that learning was most effective:

"The online environment has worked for me in that it's opened up a lot of flexibility for me to work in a way that I know I work well…having my own structure that's really good for the way I work so, being given the freedom to set up my own structure worked very well for me. I didn't run late for any of my lectures this year, I mostly kept on top of them very easily".

Interviewee 4 made several references to the "s*hock*" of "*learning being a lot more independent"* and, during the interview, spoke about what they had learned about themself during the year: *"I feel like this year of uni has been more about learning about me than the uni". "I learnt that I need to put in more effort. That was one of the things that did shock me, how much effort it actually requires of you…I have learnt some things that I probably need to change, like my time management and my consistency with work…with not as much social interaction, you have a lot more time to think about you, about what you want in your life. That makes it easier to say 'OK, this is what I want'".*

Interviewee 3 differentiated clearly between how they approach learning as an undergraduate and how they did so previously: *"That's the way I've kind of grown into in later life since I've started having my independence…at A level, I started trying to teach myself stuff. I kind of appreciate now the value of understanding things as soon as you can, understanding them as thoroughly as you can but, no, I haven't really been like that before…I now know for me it's the best way of learning it and I'm more likely to know it for longer and understand it better if I've done my research before and already have a kind of basic understanding of what we are learning".*

Discussion

It is clear that, for these students, in person learning is preferred to learning online, although the majority identified many positive aspects of the latter and recognised that most academic staff were doing their best to support them during a very difficult time.

Our study is a clear example of how interviews and surveys can be used as complementary tools in qualitative research. For example, the survey highlighted the dislike of breakout rooms and the interviews enabled us to understand why this online activity was so disliked by the students. In contrast to other research, where students reported successful group work interaction and fluid communication (Romero-Ivanova et al., 2020), the use of breakout rooms was disliked by all interviewed students.

At the beginning of the pandemic, when online learning started to be rolled out, breakout rooms were considered to be an ideal tool to enhance student interaction (The chronicle of Higher Education, 2020) and a vital opportunity for active learning, encouraging metacognition and reflection and a method of retaining student engagement (Riggs & Linder, 2016). This was not the case for the students interviewed in our study. Breakout rooms were not used effectively and, in a sense, only deepened the feeling of isolation. When prompted, however, most were able to identify moments when their experience was somewhat more positive. This was when a TA 'entered the room' and facilitated the process by encouraging people to introduce themselves, to turn on their cameras and to engage with the task. In continuing the use of breakout rooms, academics not only need to understand the negative feelings towards them, but they also need to take steps to mitigate these by being mindful of basic group dynamics. Putting a group of people together who do not know each other 'in a room' and expecting them to communicate with each other and to focus on a task without prompting or support is overly ambitious – someone must facilitate it, whether the group is in a physical space or online. It is clear from the data that, when a TA was in the breakout room, students were encouraged to participate in the activity. Either a TA ought to be assigned to a breakout room and be with the group from the beginning, or students need to be told exactly what they need to do i.e., switch on their cameras, introduce themselves etc. and then be 'monitored' to ensure that they are 'on task'. Group interactions in online and hybrid setting were clearly one of the main problematic issues, as we moved to the new normal these will be less prevalent but definitely still part of students and staff teaching and learning experiences.

Feedback is an essential aspect of learning (Dawson et al., 2019). Formative feedback helps students to understand aspects of their assignments that need to be developed and how to do so and also assists in helping them to build on the application of their understanding and what they are doing well. From the student interviews, it was apparent that they would all like feedback to be clear, specific and given to them face to face but, at the same time, they realise that this is probably not possible. Even though it may be unrealistic for students to be provided with feedback on their assignments in such a personal manner, good principles of feedback can still be adhered to. These include providing comments that are constructive, usable, personalised to the student's own work and developmental. Greater use could be made of peer feedback (Nicol et al., 2013), but only if students understand how to give and receive it i.e., that it should be constructive and specific.

Learning is a social activity, and the responses of these students all affirm the value of a social constructionist perspective on learning i.e., that we learn about a subject through interaction with other people (see, for example, Wenger, 2018). All of the students, albeit in different ways, felt very strongly that not being able to get to know others impacted significantly on their learning experience.

In contrast with other research studies on online learning, several of which we reviewed earlier, the students participating in this research did not mention technical difficulties as barriers to online learning. This could be because they are very digitally able, having experienced online learning at school for part of the previous year. 'Value for money' which is also a reoccurring theme in other studies was not mentioned as a problem by any of the participants.

Finally, academics need to take regular feedback from students to identify what is working effectively and what is not working for them and then indicate how they are responding to that feedback.

"I'm worried that they're not going to listen to what we have to say and they will try and continue things that people have had negative experiences with…I just hope that, in the future, they will listen to students' feedback…I know it must be difficult for them but…it would be a shame if they didn't listen to students' feedback" (Interviewee 1).

Using feedback constructively is a skill in itself and there may be scope to teach this more formally, through tutorials or as an activity embedded in an appropriate unit that students take during their first year of study. This could set the tone for how students interact and use feedback for the remainder of their degrees.

Conclusions and future work

This was a small-scale study, conducted, as indicated previously, in order to learn about students' experiences of the first year of their degree, undertaken during the global pandemic and the pivot to online learning.

Data from one-to-one interviews gave us rich insight into students' lived experiences over the past year. We did not set out to generalise our findings to the whole undergraduate population in the Department of Mechanical Engineering, but rather to gather rich in-depth information from a small sample of students. At the same time, the experiences and perceptions of students who started university during the pandemic and had not experienced it in 'normal' times will be different those of students who needed to transition between the two modes of delivery. It is also worth mentioning that we did not seek to establish the 'truth' of these experiences, but rather to hear from students what were their 'truths'. It could be argued that only those students who felt negative about their experiences volunteered to be interviewed, yet as is evident from the data, this was not the case. Even though we focused on the areas that students reported as problematic, students were mostly balanced in their views. Importantly, all seemed to appreciate being given the space to reflect on and to talk about their first-year experience. Being interviewed by a person who was not a member of staff in their Department may also have mitigated researcher- response effect, that is where participants provide responses that they believe the interviewer expects, add to the credibility of our study.

Based on the data, we have made recommendations in terms of the use of online breakout space, the need for academics to better understand group dynamics, the use of interactive activities and the provision of feedback. Conducting qualitative research added invaluable richness to our study and we recommend that this is employed more often in engineering education research to ensure a fuller picture of students' perspectives and experiences can be drawn.

This project is being carried forward with the same cohort of students, who are now completing theye are completing their 3rd year of studies. The second stage of the project is centred on co-creation of improved blended learning tools with students, using focus groups with emphasis on asynchronous teaching materials, interactive live sessions, and optimised online assessments.

Data Availability
Survey data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest
The authors declare that they have no conflicts of interest.

Authors' Contributions
All authors contributed equally to this work.

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