Enhancing student experience through partnership and co-creation in a post-pandemic learning environment – a longitudinal study

Alicia Gonzalez-Buelga, Sheila Trahar, Mike Wharton (University of Bristol) and Irina F Lazar (University College London)

Introduction

This paper reports on a longitudinal study which began in the academic year 2020/21 with the aim of understanding students' perceptions of online learning during the COVID-19 pandemic. Online learning and teaching are not a new phenomenon, but prior to the pandemic, when a rapid shift to online was enforced, most classes at traditional universities were offered in a face-to-face format (Singh et al, 2021).

It was this sudden shift during COVID that instigated the first step in our research project: to understand our students' perceptions of online learning by listening to their experiences. With the pandemic, higher education has changed forever, and many believe new models of education, employing high levels of information technology, will emerge (Li and Lalani, 2020). There has been a plethora of research into the impact of online learning and teaching on students and academics, identifying benefits and disadvantages (Singh and Matthees, 2021), some of which has focused specifically on the experiences of engineering students (Warfvinge et al, 2021; Asgari et al, 2021). Flexibility, and the ability to work in one's own time and at one's own pace, are the most cited benefits. Online learning was, on the other hand, found to be very challenging

in terms of motivation: in an online context, the importance of self-regulation and motivation is accentuated (Chiu et al, 2021). Online learning has also been found to be less inclusive, as students from underrepresented groups can be more affected by accessibility problems and mental health issues (Phillips and Colton 2021). Underrepresented groups may also have more constraints affecting their engagement, such as caring duties or lack of private space for studying (Neuwirth et al, 2021).

The rich data and emergent themes from the first phase, together with the overwhelmingly positive student response and satisfaction with their involvement in research led to the project morphing into a longitudinal study where the student role was redefined from participant to partner. Students as partners (SaP) collaborations can be defined as "a collaborative, reciprocal process through which all participants have the opportunity to contribute equally, although not necessarily in the same ways, to curricular or pedagogical conceptualization, decision making, implementation, investigation, or analysis" (Cook-Sather et al, 2014, pp 6-7). Such partnerships, with the goal of enhancing the educational experience (Lopatto, 2007) are becoming widespread in higher education and can take different formats depending on the type of activity – a research project, a teaching observation (Bovill, 2019) – and roles that students take – representative, consultant, co-researcher and pedagogical co-designer (Bovill et al, 2016).

Literature indicates that undergraduate research experience has a positive impact on students, improving their participation and persistence in academic fields (Linn et al, 2015). Such experiences help students develop a stronger sense of identity within their discipline and can attract and retain talented students in science careers (Lopatto, 2007). The benefits of staff-student partnerships are well-documented, and it is believed that these partnerships can have a transformative effect on institutional cultures (Kligyte et al, 2021). But it is important to acknowledge that resistance to student-staff partnerships exists and challenges may arise when attempting to implement them (Healey et al, 2019). Understanding the assumptions, expectations, and misconceptions that can lead to resistance is crucial in overcoming these challenges and fostering successful partnerships (Healey et al, 2019; Smith et al, 2021).

With the emergence of online tools, we have an opportunity to re-imagine teaching and learning in partnership with students, so that, rather than returning to previous approaches, we can use the experiences and the lessons learned during the pandemic to design new ones, that are more effective and more suited to 21st century learning (Neuwirth et al, 2021). While staff-student partnerships in higher education have been relatively widely explored, there is less literature focusing on the exploration of assessment methods within these partnerships (Deeley and Bovill, 2017). From Phase 2 onwards, we have placed assessment at the heart of our co-produced work, given its important role in student satisfaction and the significant assessment changes that universities had to implement during the COVID-19 pandemic.

This article is structured as follows: we begin with a brief overview of the longitudinal study, followed by the research design and methodology, together with the rationale for using them. We then discuss the findings and reflect on the impact that the collaborative project had on co-researchers. The article concludes by highlighting the key issues emanating from the research, together with recommendations and next steps.

Overview of the longitudinal research project

Figure 1 shows the timeline of the longitudinal research project presented in the paper (years 1-3) and future plans for the current academic year (year 4). The current paper presents the outcomes and reflects on the impact of the first three phases. In 2023/24, we continue our research, focusing on group assessment coursework dynamics.

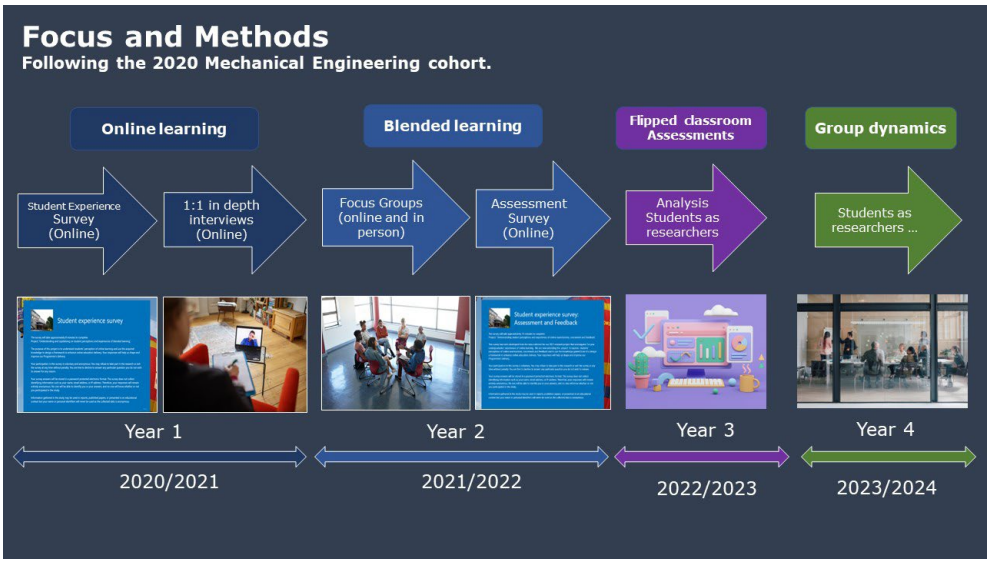

Figure 1 - Longitudinal research project timeline

Research Design

Philosophical Positioning and Methodological Approach

There were three academics involved in this project: a non-engineer from the School of Education (Author 2) and 2 from Mechanical Engineering (Authors 1 and 4). Author 2's main role was to advise on qualitative elements, to conduct interviews and focus groups. In Phase 3, we were joined by a student co-researcher (Author 3). The research is positioned within social constructionism with its emphasis on learning occurring between people in social contexts. This philosophical perspective reflects our beliefs and values and, importantly, is congruent with the overall aims of the research, which are to understand more deeply the learning experiences of the students and to co-create and establish partnerships with them. We used a mixed methodological approach that combined quantitative and qualitative research, with the main emphasis being on phenomenography: a qualitative methodology that investigates the different ways in which people experience (or think about) something. This approach is especially suitable when studying what an experience means to a particular group of people (Grossoheme, 2014).

Research Questions

The research questions evolved during the different phases of the project. During the first year, when the 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 research questions:

- How do first year students perceive their university experience?
- What is the students' perception of online delivery?
- What are the factors that would enable students to perceive online learning as high quality?

During the second year the project was guided by the following research questions:

- How did the students experience the transition from online to blended learning? Is in-person learning as effective as they anticipated?
- Do they have suggestions for improvement of blended learning?

During the third year, we focused on analysis, dissemination, and reflection.

Research Methods, Data Collection and Data analysis

The primary research methods used were questionnaires, semi-structured individual interviews and focus groups. The entire undergraduate cohort of 190 students was invited to take part in two online surveys, focusing on online learning (Phase 1) and online assessment (Phase 2). The response rate for both was 20%. In Phase 1, students completing the survey were invited to be interviewed. Data from the survey was used to inform the interviews with 7 students, conducted by Author 2. In Phase 2, two focus groups were organised: one online with 6 students and another in-person with 4 students. 3 students that were interviewed participated in one or two of the focus groups. All 3 academics participated in the focus groups. The students' role evolved as

during Phase 2, as well as being encouraged to share their opinions, they were asked to reflect on potential interventions. The interaction with students could be labelled as a co-creation workshop (Boone et al, 2023). Subsequently, one of these students (Author 3) was invited to take on a research role. Author 3 has participated in all phases of the study (interview, two focus groups, Phase 3 analysis).

The primary focus of our research was the qualitative analysis, as our main concern was participant perspectives (Bogdan and Biklen, 2007). When analysing transcripts and survey open questions, we combined phenomenography with thematic analysis (Braun and Clarke, 2013), identifying common themes following three steps: identification, sorting and contrasting. A SWOT analysis was performed on one theme – the flipped classroom approach.

Findings and Discussion

During Phase 1, perceptions of online learning, the themes that emerged from the analysis of the interview transcripts were: (i) online learning versus learning in a physical space, (ii) online breakout rooms, (iii) assessment and feedback, (iv) social interaction and (v) learning about oneself as a learner. Interestingly, two of the identified themes, breakout rooms and assessment and feedback did not emerge unprompted during the interview but when the interviewer put the subject on the table, students were vociferous in their comments.

(i) Online learning versus learning in a physical space

All interviewed participants stated that learning was most effective for them when they were in a physical space with others (Warfvinge et al, 2021). 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), to an acknowledgement that "having the ability to ask questions anonymously online is probably helpful" (Interviewee 1).

There was a clear dislike for hybrid learning, defined here as the mixing in real time of online and in-person participants. 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 way to the information was very concise and really helped me to build my notes" (Interviewee 5). In addition to valuing the videos, most participants liked being able to revisit material that was available online. Interviewee 7, for example, said: "the fact that the lectures were recorded, you could always come back to them… watching them at twice the speed, pressing pause and play, that's very useful". There was, however, some criticism of the videos, mainly of the length or the number required for preparation.

(ii) Breakout rooms

Survey responses indicated that the use of breakout rooms was the least liked of all the online learning activities, hence during the interviews participants were asked to comment on it. 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. When prompted, however, most were able to identify moments when their experience was somewhat more positive. These occurred when a TA (teaching assistant) or lecturer 'entered the room' and facilitated the process by encouraging people to introduce themselves, to turn on their cameras and to engage with the task.

(iii) Elements of Assessment and Feedback

Survey data indicated students felt overall satisfaction with formative online quizzes, were neutral in regard to online exams, but felt major dissatisfaction relating to group coursework. In the interviews, students tended to describe the assessments focusing more on the feedback provided, rather than critiquing the forms of assessment. Peer feedback was controversial, some did not really understand how it could be used successfully: "You can't really get professional feedback from that because it is only other students who are reading it" (Interviewee 1). Interviewee 2 expressed a more positive view: "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". 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. 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: "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" (Interviewee 1).

(iv) Social interaction

The survey indicated that the students struggled with stabilising interactions with their cohort. Social interaction appears to have been almost non-existent. Interviewee 4, prompted to elaborate on the comment "I feel like, online … I learnt quicker", added "with not so much social interaction, you have a lot more time to think". Interviewee 1's observations were less positive: "I've met a lot less people than I would have in a normal year" and " All the friends I've made have been people I've met in person … So, I think, from a social point of view, it's also quite damaging to have students online entirely".

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 (Wenger, 2018). All the students, albeit in different ways, felt very strongly that not being able to get to know others impacted significantly on their learning experience.

(v) Learning about oneself as a learner

Participants seem to have learned about themselves and about themselves as learners, even if, in some cases, they did not appear to be able to acknowledge this. This lack of 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. 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”. Interviewee 4 made several references to the “shock” 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 ... I learnt that I need to put in more effort.”

At the end of this first phase, we contrasted our findings to other reports (Graham, 2022; Neuwirth et al, 2021). Interestingly students did not mention digital poverty, the lack of suitable learning environments off campus or ‘Value for money’. This may be due to the limited sample size or the institutional characteristics. Also surprising was students discovering themselves as learners and reflecting on their learning preferences, as many studies, including the one cited above, established the opposite, reporting that remote teaching led to students not knowing how to engage with the materials effectively and not being able to define their preferences or learning preferences.

As a general summary from the first phase: (i) there are many positive aspects to online delivery and online assessment, (ii) there is a need to undertake activities to develop a community/cohort feel with this group, (iii) hybrid approaches should be avoided unless there is a heavy investment in technology, (iv) always include facilitators in online breakout rooms, (iv) reflect on the amount and quality of formative feedback. These findings informed the strategy of the department in the following academic year, as in-person teaching returned gradually.

To give a clearer context for the following phase in our programme, after the pandemic, a flipped classroom approach emerged as the main form of teaching delivery, with preparation materials – usually videos and handouts (asynchronous materials) – hosted online for students to work with before lectures. There were also worked examples, test cases and other pieces of formative assessment as part of the asynchronous materials. During Phase 2, for the focus groups, after

preliminary online discussion with the students via a Padlet (Appendix, Figure B) we settled our discussion around two themes: (i) the flipped classroom and (ii) online assessments. We include in the following paragraphs some of the most meaningful quotes from students participating in the focus groups. The participants are coded as FGPO if they participated in an online focus group and FGPP if they participated in an in-person focus group.

(i) The flipped classroom

When starting the conversation about the flipped classroom approach, FGPO_5 stated that they were less distracted now in 'live lectures': "it's much easier for me to concentrate because, last year, with everything being online, I was easily distracted, like, for example, playing with my phone". FGPO_6 added: "I think the structure this year is perfect because you have a good mix of asynchronous and synchronous content. You can go back to the online content that you learnt, maybe a few weeks ago and you're also able to engage with new content easily by going to live sessions".

Participants expressed strong views about lecturers 'going over material' that they had been given beforehand in the form of asynchronous videos or other online resources, rather than using this preparatory work as starting points to stimulate discussion and questions. For example, FGPP_2 commented: "It feels like the wrong way around because you learn everything beforehand on your own and you can't ask questions to the person sitting next to you or whatever and then you go to the lecture. You think 'I've done this before' so it doesn't engage you as much as you don't need to write anything". FGPP_3 was even more critical, citing a specific example: "I was in one that was full and they say, right, we're just going to go over this material and at that moment half of the people went, genuinely because they just thought that there's no point in being there".

There was a lot of discussion about the length of the asynchronous videos that students were asked to watch before a lecture. The main issues were that there was a lack of consistency between units and, even within the same unit, there were discrepancies from week to week.

The conversation moved on to the students discussing in-class interactions, beginning with whether they felt comfortable to ask questions during a live session. Participants gave examples of specific academics and how they did or did not encourage questions. FGPP_4 began by saying: "I think people just aren't asking a lot of questions. We don't really want to be in a room full of 200 people". FGPP_2 commented how one of the lecturers encouraged group work during the class and that facilitated asking questions: "ask a question and then give us 5 minutes to discuss with our group and walk around the room and, if you have questions, it's really easy". FGPP_3 agreed: " I found that […] definitely easier to ask questions and stuff when they're just wandering around". One of the researchers then commented that, from the way in which they described the session, it seemed as if the lecturer was operating a flipped classroom, to which FGPP_2 responded: "That's the thing about it. The university is doing flipped classrooms and they haven't quite understood what it means".

(ii) Online assessments

The conversation moved onto discussing taking examinations online, focusing on their experience in the previous year, their first year, when there were problems with IT. Feelings expressed were not especially strong, other than from FGPP_2, who said: "It feels more professional if you are in a room and there's a piece of paper and someone telling you to be quiet". Participants had mixed opinions about online assessment and examinations. Most students perceived online examinations as less stressful, more inclusive and representing authentic assessment (more representative of employment conditions, where one can access resources to corroborate one's problem-solving approach and is not required to solve problems or exercises in isolation). All students were concerned about the fact that a part of the exam contains test-type questions, where marks are awarded for the correct answer, but no marks are

allocated for the method. For one participant it was very worrying that students could collaborate and collude with each other, as there is "nothing in place to stop them". The same participant also perceived there was less motivation to prepare for an online exam and it felt less professional in approach.

To summarise the discussion about flipped classrooms, a SWOT analysis was performed by Authors 1 and 3, summarising the students' discussion (Table 1). For most participants, the main weakness of the approach was repetition and "precious" in-person time was lost. They identified several strengths and opportunities: the material is very accessible, and when following a flipped classroom approach, there are more opportunities to have interactive, engaging in-person classes. Interaction was valued very highly by all; it was important for them to be able to check their knowledge and understanding anonymously by using, for example, live polls. They also found it extremely helpful to work in small groups to solve examples, feeling more confident to ask questions of the lecturer when they walked around the room.

Working from this SWOT analysis and the focus group transcripts, Author 3, assisted by Author 2, prepared a poster, (Appendix, Figure A), and gave a presentation at the 2023 Bristol Institute of Teaching and Learning (BILT) conference (BILT, 2023) on the theme of a flipped classroom from a student's perspective.

The prevalence of the assessment topic in the focus group discussions carried out in the second phase of the project informed the second survey which is dedicated to online assessment. The survey was analysed by Authors 2 and 3 and they produced an executive summary and action plan that was presented to the Head of School. The action plan included several aspects: accessibility, equity, collusion and format of questions. For example, our work is informing a decision on developing a new approach to online examinations: the proposed exam will be open book and online (*more authentic* according to students) but will be held on campus and invigilated (rather than at home as is the case now), with students all using the same type of computer and internet connection (more equity) and reducing the opportunities for collusion.

Table 1 SWOT Analysis: the flipped classroom approach

Strengths • Self-pace. • Accessibility. • Autonomy. • Inclusive.	**W**eaknesses • Quality asynchronous videos. • Repeating material during in-person time
Opportunities • Opens doors for more interactive sessions: polls, groupwork, facilitate questions.	**T**hreats • Students falling behind. • Not delivering authentic flipped classroom.

Reflections on the research journey

Participating in the project has been very rich and powerful for both students and academics (Neary, 2019). As already mentioned, three academics were involved in this project. The non-engineer had some trepidation as she felt that qualitative research might be greeted with cynicism. This has not been the case, and she has appreciated, and was surprised by, the openness of the conversations, the willingness to talk and the extent to which participants reflected on themselves as learners. Participating in this research has reinforced for her, once more, the importance of social learning and how, even with subjects that may not lend themselves naturally to being discursive for the majority of participants, learning is most successful when students are with others and are encouraged to discuss. In addition, it has also affirmed for her that having some understanding of group dynamic theory is crucial if one is to facilitate groupwork successfully. She was aware of this from her own research and practice and

the unpopularity of online breakout rooms is further testimony of the need to understand that simply allocating people to groups is not sufficient for them to be effective – they need to be facilitated. The other two academics have shifted towards a more collaborative and dialogical approach to teaching and learning since participating in this project, by enabling active student participation in the design of activities and developing a more proactive response to real-time feedback. They were impressed by how articulate students were in reflecting and talking about perceptions, breaking the engineering student nerd-genius stereotypes they unconsciously had in mind. Finding out about their biases can be a sobering experience for academics, but it is hardly surprising as shown in recent studies (Erhlinger et al 2018; Starr, 2018). They have truly enjoyed learning about qualitative research and breaking away from the need to quantify and generalise, which is so often privileged in Engineering Education (Pawley et al, 2016). From a practice perspective, they are now open to conversations with students about their teaching approach. Their practice could be described now as more democratic (Deeley and Bovill, 2017) giving students more choice (activities format, interaction levels, assessment format) and responsibility for their learning through the ownership of these choices. Transitions to more democratic classrooms have their own risks, academics sometimes tend to become defensive in the face of less positive student feedback, which can be perceived as criticism as reported in conversation with peers working in the sector. They may feel the need to defend their practices and maintain the status quo rather than embrace change and student feedback (Bovill, 2014). Of course, one should not let go of one's academic judgement, but instead reflect on feedback constructively and work with students to understand the best way forward. From a research perspective, co-creation with students is now at the centre of their practice and they are developing other projects with students, for example around embedding sustainability in the curriculum and engaging with local communities.

Students found it very rewarding to participate in the study, they felt listened to and active players in the process. One of the students took a substantial researcher role analysing, preparing reports, and presenting at a conference, developing qualitative research and communication skills. Students taking part in the interviews and focus groups reported how much they have

learnt about themselves. They particularly appreciated the opportunity to voice their opinions, as they felt in engineering there had not been many opportunities for critical discussion of their learning experience. They found it rewarding that they could make a difference for themselves and future students. The student joining as a co-researcher from Phase 2 collaborated in writing this paper, presented at a conference and co-wrote internal reports informing university practice on online assessments and flipped classroom approaches. He found the role reversal he went through particularly interesting and motivating: he was now delivering knowledge to a group of academics. He found this to be very powerful and suggested it should be explored more in future research projects.

There are some limitations to this study which are those typically associated with qualitative research. As mentioned earlier in the paper, 20% of the student cohort participated in the quantitative stage of the project by answering the survey and ~ 5% participated in the qualitative stage by attending focus groups or individual interviews. However, the study is focused on the depth of experience and is informing local practice rather than seeking to generalise findings.

Conclusions and Future Steps

Our study revealed diverse student views on online learning preferences and challenges. Recommendations emphasised building a cohesive community, supporting blended teaching and learning approaches, and improving feedback. The actionable recommendations resulting from our analysis are informing the department's strategy moving forward.

The project will continue for another year, with the cohort of students in their final MEng year. In this last phase we are focusing on understanding group work dynamics and partnering with students to create an enhanced experience for them. Group work is widely used in the department and while there is research supporting its benefits and significant literature on group dynamic theories, there are few studies about what occurs in groups during their work (Chririac, 2014) and the factors contributing to successful groupwork in engineering. In previous phases of

the study, students have reiteratively reported issues when working as part of a group and it was decided with them that this was an interesting area of study.

Our journey through this project has been transformative in different ways. It has affirmed the experiences and approaches to learning and teaching for one of us and changed the academic practice of the others, together with our students' perceptions. It has made us perceive and believe we are creating a difference by working together.

Acknowledgements

This research has been funded by the Engineering Education Research Group of the Faculty of Engineering and the Bristol Institute of Teaching and Learning.

References

Asgari, S., Trajkovic, J., Rahmani, M., Zhang, W., Lo, R. C. and Sciortino, A. (2021) 'An observational study of engineering online education during the COVID-19 pandemic', *PLoS One*, 16(4). doi: 10.1371/journal.pone.0250041.

BILT Conference (2023) Available at: https://bilt.online/call-for-contributions-bilt-annual-conference-2023-building-community-and-belonging-in-a-challenging-and-changing-world/ (Accessed 7 September 2023)

Bogdan, R. and Biklen, S. K. (2007) *Qualitative Research For Education*, 5th ed., London: Pearson A&B. ISBN: 0205482937

Boone, A., Braeckman, L., Michels, N., Kindermans, H., Van Hoof, E., Van den Broeck, K. and Godderis, L. (2023) 'Accessibility, Retention and Interactivity of Online Co-Creation Workshops: A Qualitative Post-Hoc Analysis', *International Journal of Qualitative Methods*, 22. doi: https://doi.org/10.1177/16094069231180169

Bovill C (2014) 'An investigation of co-created curricula within higher education in the UK, Ireland and the USA', *Innovations in Education and Teaching International*, 51(1), 15-25.

Bovill, C. (2019) 'Co-creation in learning and teaching: the case for a whole-class approach in higher education', *The International Journal of Higher Education Research*, 79(6), 1023-1037.

Bovill, C., Cook-Sather, A., Felten, P., Millard, L. and Moore-Cherry, N. (2016) 'Addressing potential challenges in co-creating learning and teaching: overcoming resistance, navigating institutional norms and ensuring inclusivity in student-staff partnerships', *Higher Education*, 71(2), 195–208

Braun, V. and Clarke, V. (2013) *Successful Qualitative Research: A Practical Guide for Beginners.* London: Sage. ISBN: 9781847875815

Chiriac, E. H. (2014) 'Group work as an incentive for learning – students' experiences of group work', *Frontiers in Psychology*, 5. Doi: https://doi.org/10.3389/fpsyg.2014.00558

Chiu, T. K. F., Lin, T. J. and Lonka, K. (2021) 'Motivating Online Learning: The Challenges of COVID-19 and Beyond', *Asia-Pacific Edu Res*, 30, 187–190. doi: https://doi.org/10.1007/s40299-021-00566-w

Cook-Sather, A. and Kaur, A. (2022) 'Embracing epistemic confidence, open-mindedness, and cocreation: An exploration of how the psychological constructs of attitudes and intentions can inform staff contributions to successful student-staff partnership', *Journal of Educational Innovation, Partnership and Change*, 8(2).

Deeley, S. J. and Bovill, C. (2017) 'Staff student partnership in assessment: enhancing assessment literacy through democratic practices', *Assessment & Evaluation in Higher Education*, 42(3), 463-477. DOI: 10.1080/02602938.2015.1126551

Ehrlinger, J., Plant, E. A., Hartwig, M. K., Vossen, J. J., Columb, C. J. and Brewer, L. E. (2018) 'Do gender differences in perceived prototypical computer scientists and engineers contribute to gender gaps in computer science and engineering?', *Sex Roles*, 78, 40–51. doi:10.1007/s11199-017-0763-x

Graham, R. (2022) *Crisis and Catalyst report*. Available at: https://www.4tu.nl/cee/Publications/2022-10-31-crisis-and-catalyst.pdf (Accessed 10 September 2023)

Grossoheme, D. H. (2014) 'Research Methodology Overview of Qualitative Research', *J Health Care Chaplain*, 20(3), 109-122

Healey, R. L., Lerczak, A., Welsh, K. and France, D. (2019) 'By any other name? The impacts of differing assumptions, expectations and misconceptions about student-staff "partnerships"', *International Journal for Students as Partners*, 3(1), 106-122.

Kligyte, G., van der Bijl-Brouwer, M., Leslie, J., Key, T., Hooper, B. and Salazar. E. (2021) 'A Partnership Outcome Spaces framework for purposeful student–staff partnerships', *Teaching in Higher Education*, 28(8), 1867-1885. DOI: 10.1080/13562517.2021.1940924

Li, C. and Lalani, F. (2020) *The COVID-19 Pandemic Has Changed Education Forever. This Is How*. Available at: https://www.weforum.org/agenda/2020/04/coronavirus-education-global-covid19-online-digital-learning (Accessed 13 September 2023)

Linn, M. C., Palmer, E., Baranger, A., Gerard. E., Stone, E. (2015) 'Undergraduate research experiences: Impacts and opportunities', *Science*, 347(6222).

Lopatto, D. (2007) 'Undergraduate research experiences support science career decisions and active learning', *CBE Life Sci Educ,* 6(4), 297-306. doi: 10.1187/cbe.07-06-0039

Neary M (2019) *Student as producer and the democratisation of science*. Available at: http://eprints.lincoln.ac.uk/id/eprint/35761/2/36-Article%20Text-142-2-10-20190423.pdf. (Accessed 10 September 2023)

Neuwirth, L. S., Jović, S. and Mukherji, R. (2021) 'Reimagining higher education during and post-COVID-19: Challenges and opportunities', *Journal of Adult and Continuing Education*, 27(2), 141-156. doi: https://doi.org/10.1177/1477971420947738

Nicol D, Thomson A and Breslin C (2013) Rethinking feedback practices in higher education: a peer review perspective. *Assessment & Evaluation in Higher Education* 39 (1) 102 -22

Pawley, A. L., Schimpf, C. and Nelson, L. (2016) 'Gender in engineering education research: A content analysis of research in JEE, 1998–2012', *Journal of Engineering Education*, 105(3), 508–528. DOI: https://doi.org/10.1002/jee.20128

Phillips, C. and Colton, J. S. (2021) 'A new normal in inclusive, usable online learning experiences'. In: Thurston, T. N., Lundstrom, K. and González, C. (Eds.), *Resilient pedagogy: Practical teaching strategies to overcome distance, disruption, and distraction*, Utah: Utah State University, 169-186. doi: https://doi.org/10.26079/a516-fb24.

Romero-Ivanova, C., Shaughnessy, M., Otto, L., Taylor, E. and Watson, E. (2020) 'Digital practices & applications in a Covid-19 culture', *Higher Education Studies*, 10(3), 80-87.

Singh, J. and Matthees, B. (2021) 'Facilitating interprofessional education in an online environment during the COVID-19 pandemic: A mixed method study,' *Healthcare*, 9(5), 567. DOI: https://doi.org/10.3390/healthcare9050567.

Singh, J., Steele, K. and Singh, L. (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), 140-171. doi:10.1177/00472395211047865

Smith, S., Akhyani, K., Axson, D., Arnatu, A. and Stanimirova, I. (2021) 'The partnership co-creation process: Conditions for success?', *International Journal for Students as Partners*, 5(2), 48-66.

Starr, C. R. (2018). '"I'm Not a Science Nerd!": STEM Stereotypes, Identity, and Motivation Among Undergraduate Women', *Psychology of Women Quarterly*, 42(4), 489–503. DOI: https://doi.org/10.1177/0361684318793848

Survey (2021) *Student experience survey*. Available at: Link (Accessed 1 October, 2023)

Survey (2022) *Student experience survey: Assessment and Feedback*. Available at: Link (Accessed 1 October 2023).

Warfvinge, P., Löfgreen, J., Andersson, K., Roxa, T. and Akerman, C. (2021) 'The rapid transition from campus to online teaching – how are students' perception of learning experiences affected?' *European Journal of Engineering Education*, 47, 211-229. doi: https://doi.org/10.1080/03043797.2021.1942794

Wenger, E. (2018) 'A social theory of learning'. In: Illeris, K. (Ed.), *Contemporary Theorists of Learning: Learning Theorists…In Their Own Words*, (2nd ed.), Abingdon: Routledge. ISBN: 1138550493

Appendix

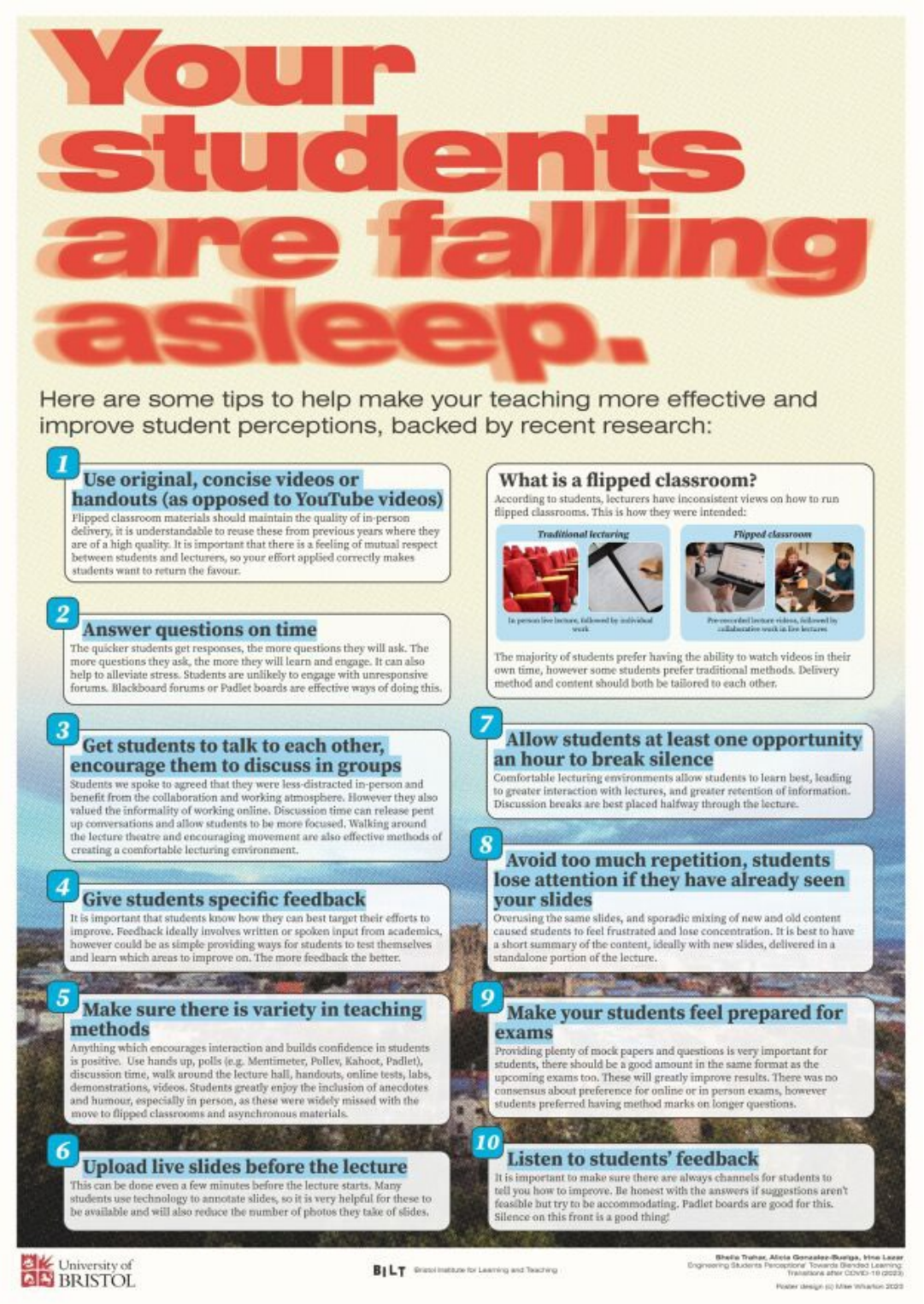

Figure A - flipped classroom poster produced by 3rd year Mechanical Engineering student

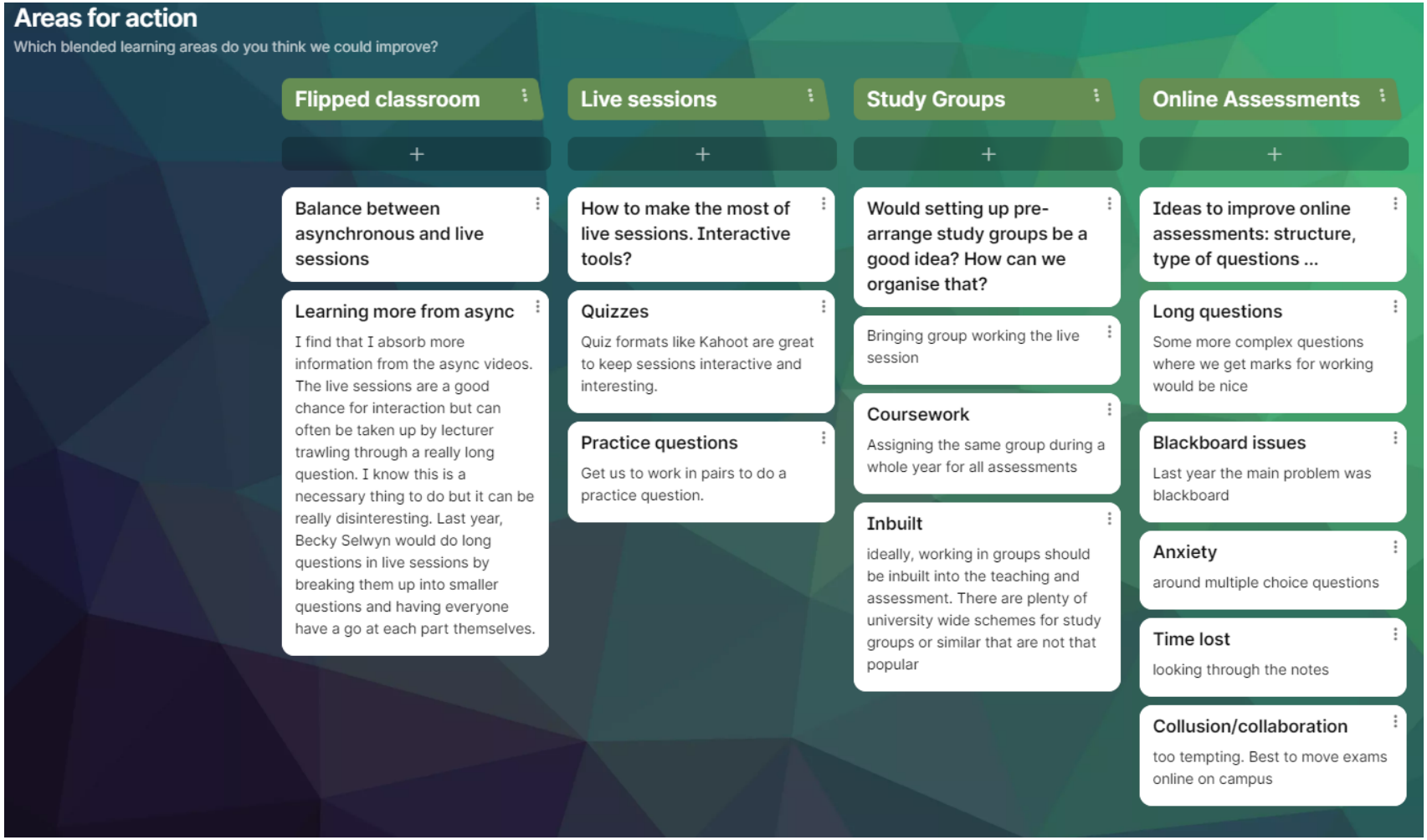

Figure B - Padlet created by 2nd year students participating in the online focus groups, prior to the meeting - Phase 2.