Key findings:
Blended Learning for STEM at Levels 3-6 during the COVID-19 Pandemic and its implications for pedagogy and skills

This research project with Leeds College of Building and York College is focused on reviewing the student experience of blended learning during the lockdown periods. The research explores STEM subjects, which do not traditionally lend themselves to blended learning due to the significant practical elements required of students. This extract from the main research report details the key findings. Further details can be found in the full research report.

Impact of COVID-19 on students' access to FE and HE?

Students reported that the utilisation of LMS and VLE amongst teaching staff was inconsistent. This included the amount of time and access granted by tutors online and reflected a skills gap in the ICT literacy of different tutors. Students themselves tended to struggle more with subject specific aspects of online learning (such as CAD and engineering maths). Students reported learning maths online as being particularly difficult, particularly when transitioning from level 3 to level 4 and above. This had a knock-on impact on confidence but the presence of online peer support in some groups (via WhatsApp) appeared to be useful.

Students also struggled with motivation and isolation during the lockdowns, particularly Level 3 students who missed social aspects and the structured environment. This had an anecdotal knock-on impact on mental health and achievement amongst those groups. Some students also reported having difficulty finding a productive space to work at home due to noise and the need to share IT equipment and wi-fi access with other household members. However, this situation improved once colleges reopened. Practical sessions such as CAD and surveying were best delayed until in-person teaching resumed (demonstrating the importance of a blended rather than fully online approach). However, using online learning for more practical elements might be improved if development time is given for more bespoke ground-up approaches to emerge.

Teaching and learning approaches appeared to be more behaviourist and repetitive during the pandemic and students felt that units heavy on theory/legislation were the easiest to

learn online. Innovation and engagement in lessons was dependent upon individual tutors' ICT literacy. Access to employment also varied significantly during the pandemic. Full time Level 3 T-Level and BTEC students found arranging work placements difficult without pre-existing connections. Some apprentices spent a significant amount of time on Furlough, whereas others (particularly Civil Engineering Higher and Degree apprentices) remained in work and on-site throughout the pandemic.

Positive aspects of students' blended learning experiences

Positive usage of LMS and VLE included more flexible learning and the ability to re-listen/re-watch recorded sessions, which in turn promoted greater reflection. There was also greater resilience and standardisation as time went on. Students were also positive and forgiving of the difficulties of quickly transitioning online. Some students who knew each other well pre-pandemic used the VLE to meet socially after lessons. Some students also preferred online learning due to convenience and reduced need to travel. However, others felt that it blurred the lines between home, work, and education. In terms of providing individual support to students, evidence from the focus groups found that one-to-one support was provided around mental health, maths support, and to facilitate enhanced social interactions.

The overall approach to blended learning frameworks taken by LCB and York College during the COVID-19 Pandemic demonstrated some promising innovations and evidence of positive blends that outweigh the disadvantage that some tutors are not yet able or willing to take advantage of them. This enabled a smooth transition between online and in-person learning over intermittent lockdowns and in-person periods of learning. However, in order to continue the adoption of blended learning across STEM subjects going forwards, developing innovative approaches rather than porting existing ones online will be critical.

Negative aspects of students' blended learning experiences

There was inconsistent application of LMS and VLE software, delivery, ICT skills and teaching presence. This included different software being used by different tutors for the same thing. Linked to this, the limitations of ICT and digital skills made it challenging for tutors to replicate in-person experiential learning that stimulates all of the senses (Kolb, 1984; Laird, 1985). There also appeared to be a prevalence of behaviourist and theoretical approaches where staff and students were surviving rather than thriving. This also presents a danger that blended learning tools are overused without thought for pedagogy.

From the perspective of the student experience, there appeared to be a weaker sense of identity, lack of structure and co-presence which had a knock-on impact on motivation, social isolation, social networks, and relationships. Home environments were also not always conducive to blended learning and blurred the lines between work, education, and home life.

Academically, students reported finding the online delivery of maths for engineering particularly challenging, especially in managing the transition from level 3 to level 4. There was some anxiety and frustration over a lack of work experience and on achievement and assessment, particularly amongst level 3 students in this study.

Reducing barriers to enhance access and participation to blended learning

This research included analysis of how the barriers to access and participation in blended learning identified by Boelens *et al.* (2017) could be reduced.

Better incorporation of flexibility in blended learning provisions would require:

- Self-discipline from students and trust from staff and employers that those students have the motivation and resilience to take responsibility for their learning (mostly likely at academic levels 5 and 6).
- The ability to watch some sessions/videos in their own time that introduce fundamental concepts as seen in blended or flipped classrooms.
- Complementary training to improve ICT and practical skills, which could include giving students the confidence to explore Revit and CAD in their own time.
- A challenge to the assumption that Level 4 students are ready for HE without further support. Some HE students in this study were concerned that it was hard to retain knowledge between academic years given the fragmented nature of FE/HE study with long summer breaks.
- The reduction of accessibility barriers to ICT and Wi-Fi highlighted during COVID-19, which means that colleges and universities should continue to provide flexible study spaces beyond the classroom on site.

Better stimulation of interaction in blended learning provisions would require:

- Buy-in from staff and students, some of whom spoke quite negatively about wanting such interaction in this study.
- Space for students to actively participate in sessions so that they don't feel they are disrupting the flow of the lesson.
- The delivery of some in-person content because the more technical and practical aspects of STEM benefit from a more collegiate learning environment.
- Barriers to be overcome in terms of the relationship between pedagogy, curriculum development and the implementation of online lessons, particularly in terms of an over-reliance on behaviourist approaches to learning.
- Additional training and support to ensure that students can make the most of digital tools available to them, particularly in terms of engagement between students.

Better facilitation of students' learning processes would require:

- Further development of successful staff-student relationships to promote openness, confidence, and ICT literacy confidence amongst all concerned.
- Space in curriculum development to provide a more bespoke set of resources that tutors teaching similar practical/mathematical subjects could share.

Better fostering of an effective learning climate would require:

- On-site alternative study spaces to overcome difficulties around working from home in the future.
- Additional training and support to build students' resilience, support motivation, and promote wellbeing.
- Regular opportunities for pastoral and mental health support both in-class and online.
- Using a blended approach to provide additional support for students with additional learning support needs, particularly where in-person catch up sessions are not always practical or effective.

Enhancing digital skills and knowledge to support better progression into the workplace

The research identified digital skills and knowledge gaps that students required more support with. These included:

- ICT literacy
- independent learning and critical thinking skills
- self-motivation and resilience
- self-directed software tutorials to complement learning in class for Revit and CAD
- fundamentals of engineering mathematics
- creating and maintaining professional networks, including opportunities for direct involvement.

In order to address this, two interventions are recommended:

1. The development of a linear CPD programme of twenty sessions for tutors to enhance their use of blended learning;
2. A non-accredited course on digital skills and employability for FE and HE students at levels 3-6 made up of sixteen modules/tutorials that could be delivered in-person or online.

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