Chapter 6

Hybrid digital exams

@ Birmingham City University

Context: Birmingham City University (BCU) is a sector leader in digital exam development and delivery, having won several awards with their innovative hybrid exam model. As a student-centred model that focuses on inclusivity and flexibility, it is employed across the institution for all exam delivery. Digital exams present possibilities for creative exam design, improved accessibility and reduced marking loads, as well as improving students' digital skills. By offering students the choice of taking their exams from home on their own device or on-campus on a University PC, the hybrid model at BCU builds in more flexibility than conventional digital exam approaches and provides opportunities for inclusivity and adaptability around student lives. We interviewed academic staff from Law, Nursing, Accounting and Engineering courses and invited their students to respond to a questionnaire in order to explore student and staff experiences of the now-established model, its relationship to learning and teaching practice and the impact of digital technology on exam provision.

Digital exams in Higher Education

Whilst higher education exams have traditionally been pen and paper-based, with students sitting in large exam halls, during the pandemic universities sought alternative solutions that took advantage of digital technologies that would enable them to maintain uninterrupted assessment provision (Butler-Henderson & Crawford, 2020). Digital exam uptake was very limited in the UK prior to this, though Birmingham City was running a pilot at the time. The introduction and evaluation of digital exams in other European countries had been tentatively positive, with students tending to prefer the digital approach, and academic staff generally positive about the time saving and quality aspects (Berggren et al, 2015; Butler-Henderson & Crawford, 2020). Over the pandemic period and in the time since, digital exams have been the subject of turbulent discussions across the UK sector. Digital invigilation, known as proctoring, has been particularly divisive, with many objections to the intrusiveness of the technology, which can often involve video and audio streaming and recording, and a potentially negative impact on the student experience (Marano et al, 2024). Concerns have also been voiced around the effectiveness of remote proctoring, with detection of academic misconduct a key issue. However, research studies suggest that well-designed provision can offer a positive experience for students and mitigate the potential for misconduct (see Patael et al, 2021, Hall et al, 2021). With the rapid development of Generative Artificial Intelligence capabilities and

availability, however, some academics are becoming more accepting of technology that can assist in maintaining exam integrity. However, in these cases, and indeed all cases, consideration should be given to alternative approaches to assessment, and a reactive uptake of exams avoided.

Digital exam software varies considerably in functionality and user experience. As a relatively new and evolving domain, it is important to have a good understanding of usage requirements before engaging with providers as there are myriad decisions to be made. Piloting a model can be extremely helpful, but attention needs to be paid to scalability and resourcing requirements should the aim be to roll out more broadly. See the *Routes to Practice* section below for further information on developing a digital exams model.

The potential for innovation is one of the most exciting aspects of implementing a digital exam model; software can offer opportunities to create authentic assessment types with new and creative question designs that involve digital tools that students will use in the workplace (Butler-Henderson & Crawford, 2020). Automated and on-screen marking reduce marking time and ease the burden on academic staff, and there are additional possibilities to reduce pressure on the university estate and budget if remote exams are considered, as discussed further below.

The user experience is a prime consideration in the implementation of a new model; students are at the heart of higher education and the development of a new assessment model is an opportunity to consider issues of inclusivity, accessibility, and the challenges that modern students face. Many are familiar and confident with technology, and digital exams cater well for their needs; but equally there are students whose experiences are very different, who have not interacted regularly with technology or who do not have access to hardware to gain these skills. It is vital to recognise this as a site of potential disadvantage that systems and processes must address within the design of a model. Digital exams offer many opportunities to bring a more inclusive experience to assessment, though, with accessibility tools and software that can be universally available, for example.

As a technology-based provision, digital exam delivery occupies a liminal space in the university – outside the academic space, between the traditional exam administration teams, often located within a Registry or Lifecycle function, and the IT team, whose technical support, data security, software delivery and architecture expertise may be vital. There is also a relationship with staff and student training and development teams, whether this is to support effective exam design or digital skills development. Due to this complexity, a digital exam team could usefully be situated in any of these areas; strong collaborative relationships and communication will be vital to maintain high performance in such a high-risk domain, however.

To undertake an exploration of student and staff experiences of the hybrid model developed and implemented at Birmingham City University, we identified courses that had been using the model for at least two years and held interviews with some of the module leaders on these courses; these were undergraduate courses in Nursing, Accounting, Engineering and Law. Five members of staff participated in the interviews. We also distributed a survey to students on those courses; a total of 57 students completed the survey. We were interested in how students and staff perceived digital exams generally, including invigilation methods, and more specifically their experiences and insights around remote and on-campus delivery of exams. The outcomes of the survey and interviews were analysed through thematic analysis plus descriptive statistics where appropriate for the survey. Below we discuss the findings from the research, placing it in context and developing a narrative around successful implementation and delivery of such a model.

Evolving an effective digital exam delivery model

At BCU, a fledgeling on-campus digital exam offering was launched in late 2019; within 6 months this had quickly pivoted to a fully remote provision, delivering a mixture of lengthy open-book un-invigilated assessments and closed book long, short and multi-choice exams. The post-lockdown period enabled a considered review of exam provision at the University, through which it became clear that neither was ideal for all students, many of whom commute to the university and have complex lives that involve caring responsibilities, full or part time work, cultural commitments and often low incomes.

The hybrid model evolved from a commitment to student-centred exam provision. There are, of course, arguments for and against exams as an effective assessment practice; this is acknowledged within the model, with the decision on appropriate pedagogical practice lying with individual course teams. The model brings together the affordances of digital technology with a flexible approach to exam location, providing simultaneous exam delivery at a dedicated on-campus facility and remotely, with most students taking exams from home on their own devices. Our hybrid digital exams journey is visualised below:

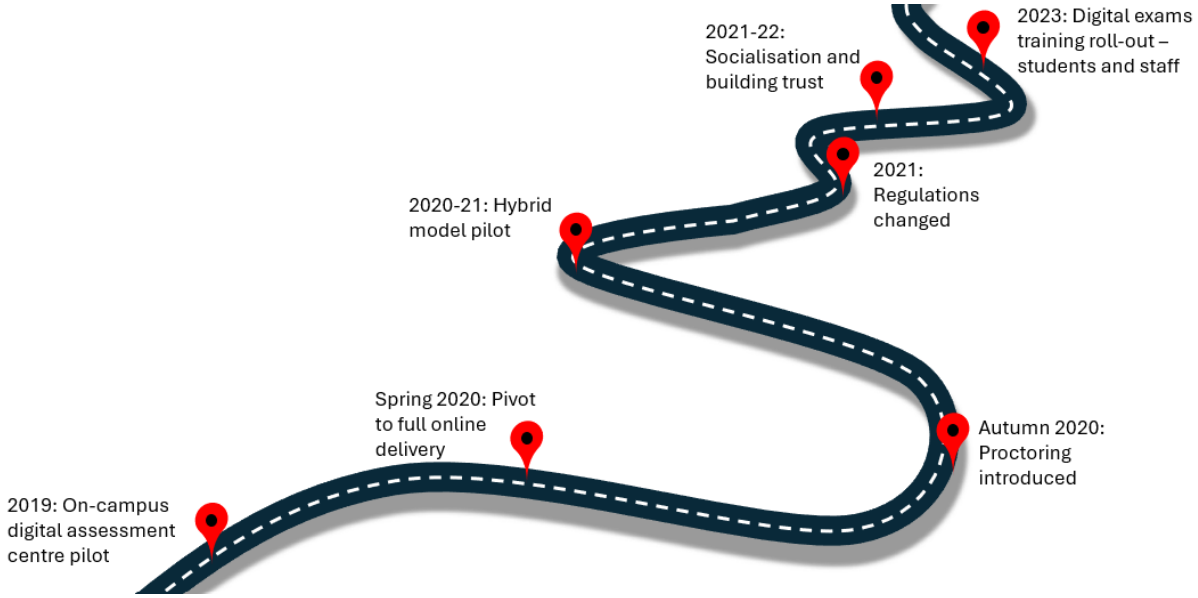

Fig.1. BCU's hybrid digital exams journey

Students taking their exams remotely are proctored by live and recorded video and audio stream, with data retention policies strictly adhered to. Video of the student and their screen is observed by trained proctors, who monitor approximately 16 students each. Student consent for data monitoring and collection is gained prior to each exam through an electronic form sent out in advance. Students who do not consent to having their data collected are able to choose to attend the in-person exam session on-campus.

Students who choose an in-person exam session are invigilated in-person, taking their exam on a University PC in a dedicated lab. Following the pandemic, University regulations and policies were

adapted, with remote and digital the default requirements for exams. Hence, the University runs all exams digitally; no paper-based exams are available unless required through a support summary.

The results of our student survey suggest that students have found the online proctoring to be generally a little less intrusive than in-person invigilation, although neither is felt to be particularly concerning, as can be seen from Fig. 2 and 3.

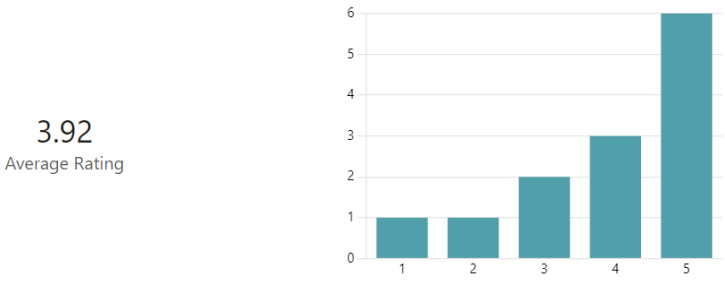

Fig. 2. Please rate your experience of the in-person invigilation from 1 to 5, with 1 being poor and 5 being excellent

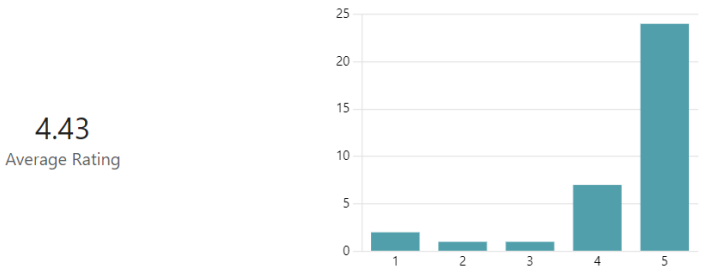

Fig. 3. Please rate your experience of the online invigilation from 1 to 5, with 1 being poor and 5 being excellent

Interestingly, there was a group of students who had experience of both modes of exam delivery; their perspectives provide a useful comparison:

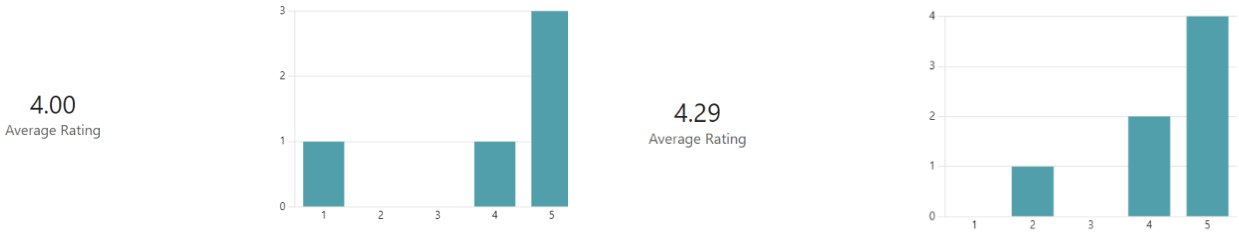

Fig. 4. Comparison of in-person (left) and online (right) invigilation.

Each course highlighted here has embedded hybrid digital exams into their assessment requirements for several years. For some this has been quite straightforward, with the benefits reaped almost immediately, and for some it has required significant adjustment and acceptance of change.

Creating an inclusive and flexible exam delivery environment

Understanding student lives

Compatibility with student lives is a key area of concern around exams and one that staff consider a particularly strong attribute of the hybrid model. The practical aspects of complex student lives, in an institution with a high proportion of local commuter students and large numbers with caring, working or other additional responsibilities, were highlighted by staff as presenting challenges that could be overcome through the provision of a choice of exam location. The reduction in the time and cost required for travel to campus, and therefore the time away from other responsibilities, as well as not needing to rely on public transport timetables were identified as positive effects of the model in recognising and catering for student needs.

Several staff emphasised the flexibility that is provided for students to choose the most comfortable and suitable environment is a real positive.

> *"One of the advantages of offering that hybrid approach is giving students freedom, giving them choice to say like what best suits me and my circumstances. And particularly given the demographic of our students, I think actually that flexibility, that hybrid approach has been really well received from the students' perspective". [Accounting lecturer]*

This perception is supported by the results of the survey carried out with students, which indicates that travel arrangements, access to technology and appropriate spaces for taking exams are the main influences on their decision making around where to take their exams (See Fig. 5)

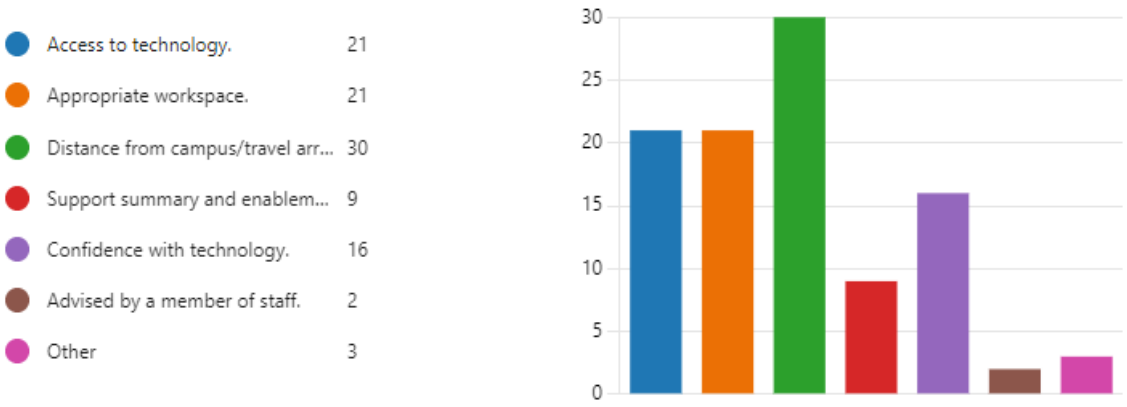

Fig. 5. Factors affecting student choice of location when taking a hybrid digital exam.

This finding aligns with the outcomes reported by Butler-Henderson and Crawford (2020) in their systematic review of digital exams research, which suggest that students tend to find online environments better support their wellbeing and performance.

Supporting student wellbeing

A subject highlighted by all the staff we spoke to was student mental health and exam anxiety. There is real concern about students being able to manage the pressures of assessment alongside other commitments, within a cost-of-living crisis. The flexibility of the hybrid exam model is considered a very positive way of recognising and responding to these challenges, by offering students flexibility and choice about the location of their exam.

> *"…it is really fantastic, especially around exam anxiety. It's really helping students who do struggle from that perspective by giving them the option to be in their own environment" [Nursing lecturer]*

In our study, some students indicated that they attended their exams on campus due to worries about technology or their own digital skills, though the majority of students emphasised the positive impact of being able to take their exam from home, with most comments explaining the benefits of reduced distractions and being in their own familiar environment in terms of stress reduction and ability to focus.

> *"I had no distractions so I didn't waste any second looking at other students and the walls, I also didn't get distracted by any unwanted sounds or movement of people. I speak for myself personally when I say that in an exam hall I would spend at least 10 minutes just looking up to see what made that sound or who left the hall or who is walking around or if other students are struggling or not. In other words I'm very easily distracted from my work and I have a very short attention span which doesn't help my case when I constantly have to hear movement." [Student]*

> *"I can do it in my own space and I feel more comfortable so I am less stressed when taking the exam" [Student]*

A hybrid model can also cater well for students with support summaries as it allows for a range of accessibility tools to be made available to all students via the exam software, thus reducing the need to provide different tools for different students, and eliminating the marking out of some students out as having different needs.

> *"We have a lot of students that have support summaries and have reasonable adjustments that need to be made for them. So, I know you can do things with like coloured overlays and text to speech readers, which if you're all in the exam hall taking a paper exam, you know you wouldn't have those options. So, I think it definitely is more inclusive for students and we can design with that in mind." [Nursing lecturer]*

Student responses to the questionnaire suggest that digital exams have met most accessibility needs, as shown in Fig. 6.

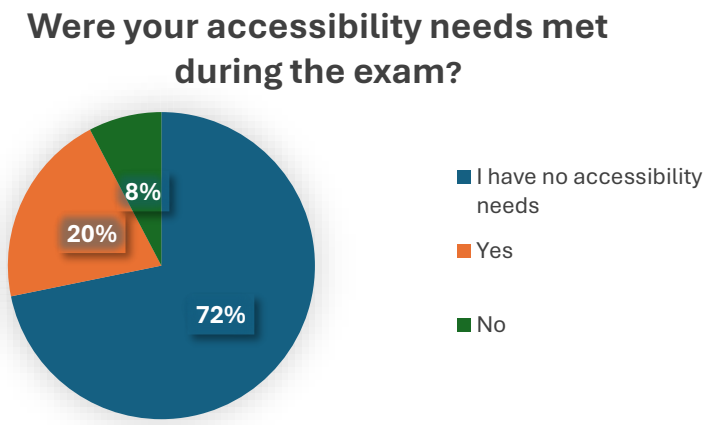

Fig. 6. Meeting student accessibility needs.

It is not possible to tell from the responses which needs were not met, but it is important to ensure that communication with support services provides as comprehensive a view of student needs as possible prior to the exam. The option to take exams from home can often reduce accessibility concerns, and equipping the exam room with adjustable-height desks, headphones, wrist, back and foot-rests can alleviate on-site issues.

Staff commented that students are not necessarily used to handwriting for long periods, particularly not for assessments, and typing alleviates some of the associated physical issues, as well as enabling editing and correction, allowing students to focus on their exam responses. Although a small number of students reportedly feel disadvantaged by needing to type and are not as expert or rapid typists as some of their peers, in line with the findings of Mogey and Fluck (2019), staff reflected that this could also be true of handwriting, with a focus on quantity of writing potentially counterproductive.

Student free text responses to the optional question ‘what were the benefits of taking your exam from home?’ are shown in the word cloud in Fig. 7.

Fig. 7. The benefits of taking exams from home

Experience: Providing choices around exams can give students agency in a situation where they often feel they have little control. It also provides the opportunity for an institution to pay attention to student needs and preferences and respond effectively to them, positively impacting wellbeing and engagement.

Supporting fairness and integrity

Exam integrity

Effective exam practice requires a strong focus on fairness. Students expect exams to fairly assess their understanding and skills, and to prevent anyone gaining an unfair advantage. Staff are particularly concerned with the fairness and integrity of exam delivery and monitoring. These concerns often centre around minimising opportunities for cheating, with our interviewees expressing contrasting perceptions of whether these are reduced or increased through digital assessment methods. There can be particular concern about large groups taking digital exams and whether this makes it difficult to effectively invigilate online. Butler- Henderson & Crawford's (2020) suggest that students perceive there to be more opportunities to cheat in online exams, though this may depend on the software and approach. Hence, it is important to develop processes and practices that minimise these opportunities in order to build trust and allay fears, whether or not they are justified. The processes in place at BCU limit the number of students being invigilated to 16 for each proctor, so the size of group has little impact. It is, however, essential to provide training for proctors to manage the very different elements of online proctoring versus in-person invigilation as the skillsets and approaches are not the same. Despite concerns from some about the potential for cheating, staff in our study generally felt that the affordances of digital exams can sufficiently address exam integrity and cheating; shuffling questions and answers to make it more difficult for students to collude, and utilising recordings of the proctoring stream provided more confidence in integrity, for example.

> *"I think that the concerns are probably more geared around students who are sitting exams on campus rather than at home." [Accounting lecturer]*

Interestingly, this comment suggests lower confidence in in-person invigilation of digital exams than online invigilation. On campus invigilation relies on invigilators roaming the room, and they are unlikely to have as comprehensive or continuous a view of students' screens as online invigilators do. There is also an implication in the comment that concerns are centred around the unauthorised use of online resources; something that digital exam software can mitigate through restricting access to these if the exam is designed with this in mind.

Practice: Acknowledging the concerns of staff and students around exam integrity, fairness and cheating is essential to gaining their confidence in new systems. Some concerns may be unjustified, but understanding and catering for apprehensive members of staff not only develops a deeper relationship but offers opportunities for innovation and tailored approaches that address concerns.

Marking

Marking is a feature of digital exam practice that is positively received by academic staff, not only for its convenience but for its contribution to ensuring fairness; a position that corresponds with the findings of Berggren et al (2015). The staff we spoke to agreed that when automated marking is used for multi-choice and short answer questions, this is unbiased in comparison with hand-marking paper scripts. Part of the reason for this is that they consider automated and on-screen marking to be more accurate with less likelihood of introducing the errors that would naturally creep into hand-marked scripts. Additionally, one lecturer noted that there are risks in accurately interpretating handwritten answers, even for multiple-choice questions:

> *"…marking can be subjective whereas using an MCQ on an online platform, it could arguably be more accurate marking and more objective…" [Nursing lecturer]*

Therefore, it can be argued that digital exams afford a more neutral and unbiased arena for exam delivery and marking than traditional handwritten and hand-marked scripts where biases and inaccuracies can creep in.

However, whilst the majority of staff expressed a positive view of automated or on-screen marking, more technical subject specialists find this less relevant to their subject areas; for example, Engineering teams operate exams where the completion and submission of workings requires a more complex question design and submission model that they feel adds to marking workload. Such challenges require an innovative mindset, and this is where a dedicated team of digital exam experts is beneficial; experience with a variety of disciplinary approaches and needs, plus significant experience with specialist software enables creative solutions to be devised. A responsive software provider can also take note of emerging needs and either add development work to their roadmap or create bespoke solutions.

Integration with pedagogy and curriculum

Digital exam design and delivery can provide opportunities to enhance the curriculum and teaching methods in various ways. Staff can feel inspired to review existing exam content with a critical lens, and the affordances of digital software give them a sense of freedom to change and be creative.

Designing for digital is the ideal, and when staff recognise the possibilities that this offers, their exams can change significantly. Whilst the technology is still evolving and likely to meet many more needs in the future, exams can be adapted to enable a focus on authenticity, enabling students to see the relevance of the assessment process (Butler-Henderson & Crawford, 2020). Images, videos and audio can be incorporated into exam papers to present students with in-depth case studies or situations that test applications of their understanding.

> *"We all agree if it's purely an online assessment it has to be designed for online assessment" [Engineering lecturer]*

Some BCU academics are currently working with the digital exam team to develop an automated, personalised feedback process that processes the students' performance in an exam and identifies areas of the curriculum where they have secure understanding or could focus some additional time. In a similar vein, the team are working with Nursing course teams to explore the use of exam data to directly inform the curriculum, scheduling and content for the coming academic year; gaining an understanding of questions that students spent more time answering, those that were straightforward, those that were more difficult can indicate where more of a focus is needed in the curriculum.

Philosophy: In addition to training staff in the practical use of digital exam software, there is an imperative to engage this functional development with pedagogical development. Linking with academic practice or staff development teams can generate fruitful collaboration on exam design and design for digital exams

Providing the infrastructure and resources for effective exam delivery

Exam spaces

One of the benefits of running predominantly remote exams is that pressure on the estate is relieved, and the associated costs reduced.

> *"I've got 500 people on my module, so that would be… how many people would need to invigilate that? How many rooms would we need to get 500 people in?" [Law lecturer]*

In the past, external venues were required to deliver paper-based, in-person exams at BCU. These were hugely costly; digital exam provision has eliminated this cost and whilst there are software expenses to take into account, these are significantly lower than the costs of venue hire. In order to

move away from the traditional exam model, however, consideration needs to be given to the space that is required, when it is required, where staff will be located and how many staff are needed. At BCU, approximately 25% of students taking exams choose to attend campus; this means that some on-campus lab space needs to be available, with a dedicated room the ideal; the only viable option to deliver on-campus exams for BCU has been a dedicated lab with PCs. This seats 70 students at once, is equipped with screening to the sides of the desks, and includes a staff working area. During very busy exam periods with multiple large exams running concurrently, additional labs are booked. This means that digital exam software needs to be available on all PCs in the building.

Marking workload

One of the positive perceptions of digital exams is the reduction in marking workload due to the affordances of automated (for multiple-choice or short answer questions) or on-screen (for longer answers) marking (Berggren et al, 2015). As BCU has been developing and utilising the hybrid model for four years, some academic staff have only ever experienced exam delivery and marking through this method, and find it difficult to imagine paper based exams in large exam halls or handwritten scripts to mark. These staff often work in small teams with large student cohorts and could not manage the marking load that would be generated by paper-based exams; digital exams with onscreen and automated marking options enable marking to be turned around within relatively short periods without calling on other staff.

> *"…it's good for resources to run through a digital platform because we're not having to have a team of 20/30 markers. There's the four, five of us that will moderate to sample and that's OK." [Nursing lecturer]*

> *"…automated marketing…can be helpful because you have the rubrics or you can have the pre-built comments et cetera that can help in terms of making the marking a little bit quicker perhaps…" [Accounting lecturer]*

Developing digital expertise & preparing for the workplace

Employability

Employability skills are naturally developed through the digital exam process; students must engage with technology to sit their exam, from accessing exam information through the VLE and authenticating their identity before an exam to filling out an electronic form to decide their preferred exam location and ultimately completing their exam online. With a range of possibilities enabled by flexible proctoring software, exams may be completed in Microsoft Word or Excel, for example, or within the exam software itself. These kinds of digital skills are essential for most workplaces, and the flexibility of a proctoring shell means that industry-specific or PSRB-required software can be employed (for example, SafeMedicate for Nursing students).

"…we're actually able as module leaders to use assessment techniques or approaches or questions that students will be required to do when they're working. So that could be the creation spreadsheets, it could be the creation of reports…I can't imagine when they go out into the workplace, they're going to get asked to do a handwritten assignment or report or anything." [Accounting lecturer]

However, it is important to remember the variety of experience that students may have with technology and not make assumptions about what they will or will not find straightforward. In their 2019 study, Nardi & Ranieri highlight digital self-efficacy as a predictor of performance in digital tests, and add that students appear to perform better when using their own device than a university machine. One of the key elements of the hybrid digital model is training and development work with students to ensure there is no disadvantage to taking digital exams; this includes familiarisation with the VLE in order to access the exam, testing of technical aspects (webcam, operating system etc), provision of a practice exam using exam software and availability of staff and online materials for demonstration and support. Most students in our survey indicated that they did make use of support materials, as shown in Fig. 9; these are provided online and in-person through 1:1 tutorials.

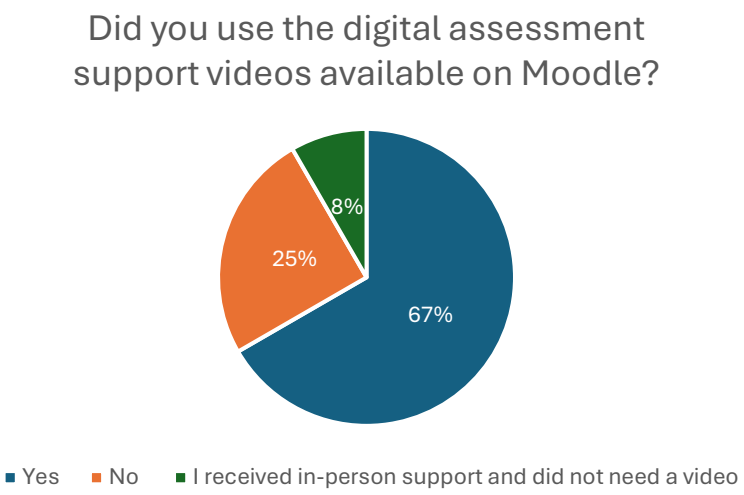

Fig. 9. Use of support

Staff training

At BCU we provide training for all staff with exams on their modules, and provide regular top-up training to maintain their confidence and update them on new developments. Ensuring that central digital exam team has sufficient time built into their workload allocation has been essential to benefit from the advantages of digital assessment; not only to provide formal training but to be responsive and supportive to academic staff concerns and issues. In addition, a creative and positive team mindset has helped to overcome barriers and resolve problems whilst also generating new approaches and processes to improve both staff and student experiences.

"I think the reason I am a big fan though as well is because of the support that we've received centrally because I think that's been key to us being able to implement this successfully…given the shift in in what we've done. So I think in terms of my own view, I

think it works well, but it only works well because of the support that we've received from the exams team…" [Accounting lecturer]

Innovation: A creative and innovative mindset is essential for a team dedicated to implementing and managing a digital exams provision, particularly if their responsibilities incorporate a range of disciplines. Collaboration with academic teams and gaining an understanding of disciplinary requirements, when combined with technical expertise and familiarity with software capabilities enables radical and unexpected solutions and the chance to experiment with new approaches. Ultimately these impact positively on students and the institution as exam design and delivery are continuously evaluated and improved.

Challenges in implementing and managing a hybrid digital approach to exams

Two key areas of challenge have been highlighted by conversations with staff and students: confidence and capability with technology, and cultural change with associated resistance. In addition to these there are challenges around the size and capacity of the resource put in place – staffing, space and budget are key considerations.

Cultural change

For any culture change there are challenges; and assessment, as might be expected, can bring a diverse range and intensity of views. At BCU we began with a pilot but this very quickly snowballed during the pandemic into cross-institutional business as usual. Keeping up with the demands was, and remains, very challenging for a small team. Embedding the provision and the team into everyday assessment design and practice has taken time, but we are now at a point where this has been accepted across the University; the challenge this brings is of increasing demand for a proven and trustworthy provision and the capacity of the resource available.

"The initial first year of implementation was a sort of a step into the unknown" [Accounting lecturer]

Technical challenges

Technological challenges for both staff and students are expected with new software. Students' concerns with remote exams tend to focus on the capability and reliability of their technology. Fig. 10 below summarises the technical challenges identified by respondents to the student survey:

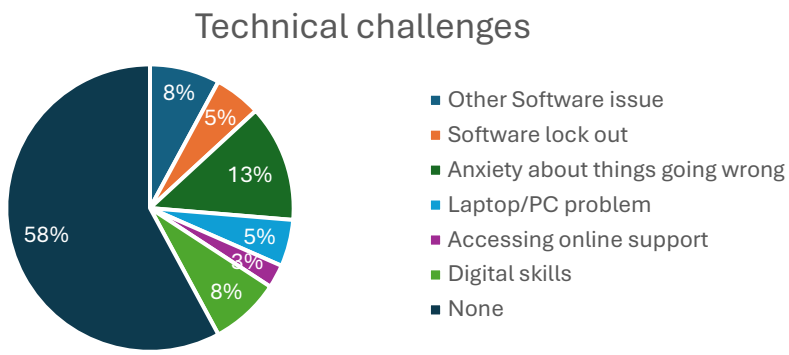

Fig. 10. Technical challenges highlighted by students

The majority of the students (71%) who completed the survey did not experience issues with technology; however, 13% did experience anxiety about the possibility of things not working as expected. 5% of the students who answered this question experienced the software locking them out of the exam; this is always user-error and is easily put right almost instantly, but this combined with the digital skills challenges highlighted demonstrates the need for both training prior to exams and access to prompt and expert technical support during them. One of the positive features of digital exams is that almost every technical issue is resolvable within a few minutes, and exam timings can be easily adjusted to compensate for the time spent on this.

> *"I think that it is improving the student experience… to give them the flexibility should they want to come on to campus. So they've got that security of the Wi-Fi is going to work with somebody there…" [Law lecturer]*

Whilst new exam platforms are being developed, and existing ones are quickly evolving, new features are continuously becoming available; staff must adapt to these in order to make the most effective use of the platform for delivery or marking of exams. There is therefore an evolving requirement for training – training is never 'done' but must be updated – the digital exam team must devote time to updating materials and video training and providing additional workshops for staff, and staff must devote some time to updating their training.

> *"…it has required that professional development in terms of sort of familiarising yourself with Moodle with Teams, with Word and with Excel..." [Accounting lecturer]*

Conversely, the knowledge that technology development is responsive to user requirements can create an impatience in staff who can envision how they would like to use it, and are frustrated by the time it takes for software companies to release new features. In general, though, there is a sense that staff believe that technology is the way forward and that it will develop to meet their needs.

Listen to this podcast episode exploring multimodalities in higher education through the lens of digital exams. Maggie Gibson from Birmingham City University and Tim Burnett, EdTech consultant and community champion discuss the opportunities and challenges for the HE sector.

Routes to practice: Hybrid Digital Exams

In this chapter, the experiences of staff and students have been drawn together with the perspectives of the digital exams team to provide an overview of the hybrid digital exams model implemented at Birmingham City University. Other models for digital exam delivery are in use in the UK, though digital exam delivery is more established in other European countries, such as Sweden and Norway, and the USA. These models include Bring Your Own Device (BYOD) approaches, where students use their own laptops in dedicated on-campus spaces, purpose-built labs with complete digital kit provided, and fully remote exams that students take from their homes on their own devices. Proctoring and invigilation approaches vary from fully in-person through light proctoring using periodic photographs and CCTV to fully streamed and recorded video and audio.

Based on the insights gained from staff and student perspectives presented in this chapter, the following strategies might be considered as a means of optimising digital assessment implementation and practice:

1. **Create a flexible and appropriate model for the institution**

   In order to meet the challenges discussed above and develop a robust model, consider the needs of the institution and the make-up and location of the student body, as well as the most appropriate process for involving voices from across the institution, from senior management to lecturers and students. Replication of the model presented here, or any other model, may not be a suitable approach for an individual institution; it is important to recognise its needs and aims before moving forward with developing an appropriate approach. At BCU, two task forces were created; the first focused on the practical and logistical aspects of implementation – including software selection and procurement, the identification and adaptation of on-campus space and the processes for managing IT and space. The second group consisted of academic staff representatives from all faculties, students, the central learning development team and the academic practice team. A project manager, senior leader and lead for the digital exam provision provided continuity and direction across both teams. In this way, voices from across the institution were present in the planning and design from the outset and therefore it was a collaborative effort to create something that worked for the University and its students.

2. A consistent focus on resourcing

Any digital exams model will have a different resourcing requirement to paper-based exams, the most obvious being technical resource. Appropriate space, hardware and software are key considerations at the outset, though to what extent will depend on the model being developed. At BCU we have found a dedicated space to be the only viable option; the number of exams now delivered means it is not possible to share the space with other functions.

It is also vital to consider the number of staff required to support implementation and sustain an effective provision. Check the likely peaks and troughs of exam demand and allow for the peaks to always be sufficiently staffed. Whilst exam delivery periods can be intense, the few weeks beforehand provide the time for preparation and can be almost as busy; it is vital to make sure there is also staffing available for these periods. It is also worth considering whether digital exam staff will be required to deliver training to staff and/or students; this activity can take place in less busy periods, and can create a more consistent staffing requirement through the year.

3. Invest in training

Staff confidence in using technology themselves is a vital area for focus when implementing exam delivery on a digital platform. It is likely that a dedicated team will be in place to support the creation, upload and technical support of exams; however, academic staff require an understanding of the features, affordances and limitations of the technology being used, so it is important to place an emphasis on early and continuing training provision. This enables staff to make the most of the functions available when designing and marking their exams, and to deliver or supplement training for students prior to the exam. Additionally, when staff feel at ease with the platform and understand what the students will experience, they often become advocates for the digital approach to exams. This translates into positive and productive engagement with the exam team and enables issues to be identified and resolved quickly. It also permeates the learning environment and student confidence in taking their exams.

4. Develop Technology & training for students

Technical challenges for students centre around confidence/experience with technology and the availability of suitable technological tools, such as wi-fi reliability, laptop choice, up-to-date operating systems and webcams. A key consideration for an institution considering implementing digital exams is in ensuring equitable access; if students do not have appropriate devices or systems to offer reliability and stability within their exams, there needs to be the means within the model to identify and resolve this. Additional challenges can occur around familiarity with institutional systems, such as the VLE, and confidence in using the exam system itself, and it will be essential to address training needs before the critical point where students take their exams. At BCU our training provision has reduced technical queries at the start of exams by over 90%, enabling the team to focus on students with urgent issues that require expert assistance.

5. **Data security**

   Proctoring and invigilation are significant considerations for an institution preparing to deliver digital exams with a proctored element. When a proctoring solution is chosen, GDPR should be a priority; for this reason it is vital to involve data protection teams at the earliest opportunity. A comprehensive plan should be developed that addresses all potential concerns, and part of the software selection process should focus on data security and retention policies. At BCU students are required to agree to biometric data collection before taking any proctored exam. If they do not agree, they are able to attend campus and sit their exam with a human invigilator present; provisions such as these may be necessary. Data deletion timescales and agreements will need to be agreed with software providers, with policies detailing who within the institution can access recordings. Consider whether your academic misconduct committee needs to have access, or whether the exam team can provide verbal reporting, as they might with a campus-based exam. It is also worth providing guidance for students around appropriate places to take exams, maintaining privacy and avoiding others entering the view of the camera.

As with any large-scale and high-stakes change in practice, planning and piloting will assist with understanding needs and possible barriers to successful implementation. However, the BCU model and ongoing provision demonstrate that it is possible to develop an approach that works across an institution. There are multiple affordances of digital approaches to exams, from finance, time and space-related to improved student confidence and reduction in anxiety, as well as opportunities for innovation and creativity within exam design. The underpinning requirements for success at BCU have been senior management sponsorship and a dedicated and high-performing team and a flexible, adaptable and proactive student-centred approach.

Institutional Project Team

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Key sources

Berggren, B., Fili, A. and Nordberg, O. (2015) Digital examination in higher education – Experiences from three different perspectives. *International Journal of Education and Development using Information and Communication Technology*, 11(3), pp. 100 – 108.

Butler-Henderson, K. and Crawford, J. (2020) A systematic review of online examinations: A pedagogical innovation for scalable authentication and integrity. *Computers & Education*, 159, pp. 1 – 12.

Hall, E., Spivey, C., Kendrex, H. and Hvrda, D. Effects of remote proctoring on composite examination performance among doctor of pharmacy students. *American Journal of Pharmaceutical Education*, 85(8), pp. 824+.

Mogey, N. and Fluck, A. (2015) Factors influencing student preference when comparing handwriting and typing for essay style examinations. *British Journal of Educational Technology,* 46(4), pp. 793 – 802.

Nardi, A. and Ranieri, M. (2019) Comparing paper-based and multiple choice examinations with personal devices: Impact on students' performance, self-efficacy and satisfaction. *British Journal of Educational Technology,* 50(3), pp. 1495 – 1506.

Patael, S., Shamir, J., Soffer, T., Livne, E., Fogel-Grinvald, H. and Kishon-Rabin, L. (2022) Remote proctoring: Lessons learned from the COVID-19 pandemic effect on the large scale on-line assessment at Tel Aviv University. *Journal of Computer Assisted Learning*, 38(6), pp. 1554 -1573.