Considering User Experience in Smarter Hybrid Distance Learning

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Abstract

This paper discusses user experience and smarter hybrid distance learning, considering academic staff and students in higher education. Multiple challenges are faced when adapting courses to be delivered online, and these may be magnified in hybrid distance learning contexts. Establishing user requirements can be flawed and potentially misleading and while there is no easy solution to finding out what users really know or need, critically reflecting on typical digital skills and literacies in relation to aspects of learning and teaching remotely can support smarter decision making. The complex interplay between how users think of themselves versus what actually happens in real life and how to support learning and teaching in efficient ways remains a persistent challenge in digital learning. To illustrate common areas of digital literacy user experience consideration, reference is made to the on-going knowledge transfer project, Smartel Erasmus+, which concerns transfer of existing higher education courses to distance delivery models. Practical issues are discussed for key user groups, with brief attention to inclusivity of lower income, remote learners and those with special needs. Smarter hybrid distance learning is interpreted as technology-supported learning and teaching practice where learning design might incorporate fully distance learning delivery of courses for effective and efficient learning environments, delivery of content and process for learning.

Keywords: *user experience; hybrid learning; distance learning; remote learners; digital literacy; academic support*

Introduction

This paper concerns considerations for the delivery of distance learning courses using a hybrid distance learning model, and roles of technology are examined within a context of user experience, both from academic staff and student perspectives. The Smartel Erasmus+ project[1] provides a source of primary data to support discussion, reflection and critical review in 'real-world' contexts. However, this paper does not seek to report on the results of that project, but rather to critically reflect on the pedagogical and technological characteristics of user experience when considered through the lens of distance learning course delivery for undergraduate or postgraduate courses. The Smartel project is on-going, however data serves to illustrate points of reflection that may be of interest outside of that project or in a variety of similar contexts. Smartel investigated user requirements for adapting existing course designs to distance learning delivery, considering new pedagogical approaches and potentials for utilisation of multimedia technologies for learning, and sought to establish the readiness of their academic communities for this transition, for example after (Firat and Bozkurt, 2020).

Prior to the Covid-19 pandemic period of 'emergency remote learning' (Hodges et al., 2020), the move towards an increasing amount of courses being delivered exclusively using a 'distance learning' mode had already been embraced in various educational domains for some considerable time. Perhaps leading this trajectory towards distance learning were the early 'MOOC' courses offered by Stanford University's Coursera or Harvard's EdX around 2012, noted in(Atiaja and Guerrero, 2016), emerging from the Siemens and Downes course on Connectivism in 2008 (Downes, 2008).

Though not without their problems (Atiaja and Guerrero, 2016), MOOCs and distance learning courses in general espouse a learner-centric and more open and accessible educational opportunity,

[1] Smartel Project https://smartel.pr.ac.rs/

placing the learner in a self-determined role of time and task management. Tertiary level undergraduate and postgraduate distance learning degree programmes are now offered in multiple disciplines, utilising different course design scenarios including part or full time, module by module, biennial face-to-face meetings, or even ‘bite-size stackable programmes’, e.g. (Cranfield Sch. of Management, 2022). Arguably, the Open University in the UK is a benchmark of distance learning approaches as they have been operating in this field for a very long time (Atiaja and Guerrero, 2016).

This paper has been written to emphasise the need to revisit and perhaps reinterpret initial assumptions on findings from similar data gathered by digital projects. In this case, discussion is orientated toward learning and teaching online, use of technologies in the learning and teaching process, and underlying assumptions that may hide some aspects relevant to how users – both learners and teachers – impact the effectiveness of learning and teaching online. It is hoped that through reflection on the issues raised in this paper, further improvements to user experience might be made in a variety of digital learning contexts.

Defining Smarter Hybrid Distance Learning

It is useful for purposes of later reflection to attempt to define hybrid distance learning in light of discussion in this paper. A recent work by (Bozkurt, 2019) describes the development of distance education and provides background for the historical context of ‘hybrid’ distance learning. Hybrid distance learning can largely be considered as mixtures of pedagogical approach to learning, including both synchronous (live in real time) and asynchronous (available at any time) delivery of lectures and learning content. Various definitions and descriptions exist in the literature, with no single interpretation adopted by all, and recent work has acknowledged this fluctuating terrain (for example in (Bojović et al., 2020; Masalimova et al., 2021).

Hybrid distance learning course delivery may involve various modes of student attendance, including exclusively distance learning mode. In layman's terms, hybrid *synchronous lecture delivery* might entail the lecturer and some students physically present in a classroom situation, while other students may be attending remotely at the same time via video lecture delivery, for example using Panopto[2] lecture capture technologies. *Asynchronous lecture delivery* means that lectures are provided in recorded video format. This permits learners to watch lectures at any time, and might entail both synchronous lecture delivery that is recorded, and lectures exclusively delivered asynchronously. In addition to lecture delivery (synchronous or asynchronous), other learning materials are provided. Materials such as PowerPoint slides, PDFs, Word documents are commonplace, but increasingly there is widespread use of (non-lecture based) video made by the lecturer or faculty, or using learning resources available from YouTube[3], Vimeo[4] or Open Educational Resources[5]. This mix of blended approaches serves to outline the complex terrain when using any generalised term for hybrid distance learning course delivery.

Pedagogical hybridity is described by (Cook et al., 2016) as two dimensional, consisting of formal and informal social structures in an activity system, combined with 'cultural-historically developed' physical and digital tools that mediate an individual's relation to the world in a "50-50 partnership" (2016, p.124). This partnership is pertinent to the user experience of hybrid distance learning, in the multiplexity of connections with people and tools that form hybrid distance learning environments. Prior work by this paper's author and colleagues (Lister et al., 2022) further examines the concepts of hybridity, expanding understanding in relation to considering this cultural-historical contextual hinterland of the learner (or teacher) and impact of place, tension between physical and digital

[2] Panopto Video platform https://www.panopto.com/

[3] YouTube https://www.youtube.com/

[4] Vimeo https://vimeo.com/

[5] OER Commons (example) https://www.oercommons.org/curated-collections/570

presence and complexity of additional socio-material aspects such as cultural interpretative impact in these conditions.

Smart Hybrid Learning

In (Hartono et al., 2018) smart hybrid learning is defined as a 'three layer architecture' of a flipped or inverted classroom, combined with challenge-based and /or case-based learning. These pedagogical approaches are applied to bolster 'Education 4.0', which they define as "the personalization of the learning process, where learners have total flexibility to be the architect of their own learning path and have the freedom to achieve the desired goals" (2018, p. 1). Education 4.0 focuses on learners as the centre of the educational ecosystem, emphasising peer and experiential learning, professional application and connections, supported by use of technologies for communication and flexible delivery. This chimes well with the purpose of the Smartel project and the wider remit of this paper, to indicate that smarter learning is as much about more advanced pedagogical approaches as it might be about utilisation of advanced technologies.

Remote or Distance Learning

During the period of the Covid-19 pandemic, university campuses were closed and all teaching took place online. This was very likely true across the globe (Bozkurt and Sharma, 2020), and for context here was certainly true for the universities referred to in this paper, and that of the author. It was noticeable very quickly whether or not teaching staff were familiar with teaching online, and how to use any supporting technologies such as Zoom video conferencing[6], Panopto lecture capture or utilising any implemented learning management systems (LMS) with more emphasis on student-centred learning designs. This rush toward 'emergency remote teaching' should not be conflated with distance or online learning pedagogical approaches (Hodges et al., 2020) though may still be considered as the same thing by some academic teaching staff, as is perhaps warned about elsewhere (Bozkurt and Sharma, 2020).

[6] Zoom video conferencing https://zoom.us/

Challenges of Delivering Courses Online

When courses are either designed specifically to be delivered at distance, or are existing courses that need to be adapted for this mode of learning, many challenges come into play. An abundance of research exists to support approaches to design or re-design of learning, assessment, communication, use of digital platforms and tools and training for staff and students. Examples of useful literature spanning many years can be found ranging from using focus group input for designing distance education (Bonk et al., 2002), user requirements for virtual classrooms (Tan, 2012), smart classrooms (Chang et al., 2016), flipped classrooms (Giannakos et al., 2016), and training staff for teaching online with video (T.O.V.I.D., 2022). This abundance of work may seem overwhelming at times, perhaps particularly to those who may be novices in the field of distance learning, may not be familiar with terminology or not possess 'tacit knowledge' of the area. This paper seeks to bring some key user experience characteristics of digital and distance learning to the fore, to offer a pragmatic view of issues at hand and possible solutions to these challenges.

Context of the Smartel user experience data

The Smartel (co-funded Erasmus+ Programme of the European Union) project sets out to "improve the process of education through the development of e-learning multimedia platform*(s)* and smart classrooms". In total, ten institutions form the Smartel partner consortium, six West Balkans Institutions (WBI) implementing the 'e-learning multimedia platforms and smart classrooms', and four EU Institutions (EUI) sharing knowledge and experience about their use and implementation of such platforms and technologies[7]. Starting in 2021, the Smartel project is expected to run until late 2023, with the overarching pedagogical potentials and LMS infrastructure requirements now established.

[7] (Appendix A)

In the initial stages of the project, a data gathering exercise was undertaken in two stages to inform preparatory understanding of user requirements for all WBIs based on their current user experience of digital learning in a variety of contexts, including distance learning scenarios. Stage one was orientated towards teaching and learning with technology, stage two was more focused toward e-learning pedagogies and support strategies. Stage one questionnaire was entitled 'A general questionnaire about digital learning'[8], and investigated access to and use of digital devices, current digital skills of staff and students and general technology awareness and acceptance rates amongst the academic community. Discussion in this paper explores some observations that might be made from the data gathered in stage one, with some additional discussion informed in summary terms from stage two.

Summary of stage one data gathering

Five West Balkans Institutions took part in the first stage of data gathering, with a sixth contributing its own set of data previously collected in a recent similar exercise. Both academic staff and students took part in the questionnaire, with differing percentages of participants taking part from each institution. A summary of question sections is provided here, followed by short discussion of each. Sections had between two and five questions, using mainly a likert approach. Total number of participants was 906, for 5 institutions, including 55% students, 25% teachers. Age range was 55% 18-24 years, with the remainder spread across 25-64 years. This indicates the majority of participants were students under 25.

Question topics and scope

Topic questions were developed by the Smartel consortium partners.

- Demographic questions
- How you feel about online learning

[8] (Appendix B)

- Digital devices apps and software
- Digital access and experience
- Digital skills and knowledge
- Video and multimedia in digital learning

Describing the data

Data was examined in terms of possible trends and frequencies rather than drawing conclusions from statistical variance between institutions. The data was an overall snapshot of user experience for the topics of inquiry, and each WBI was encouraged to analyse their own dataset for their own institutional specific use-case needs. It is additionally important to note that data captured only those who volunteered to participate and therefore some trends may be invisible to the data due to those participant experiences being absent. Differing percentages of each WBI total academic community took part, making direct comparisons between institutions misleading. Noting that 55% of participants identified as aged 18-24, and 55% identified as students, participant statistical response rates emphasised student user experience rather than academic staff. Both student and staff experiences are significant in learning online, for pedagogical design, technological implementation and use, and in relation to the process of change for successful uptake of hybrid distance learning course delivery.

Challenges of self-skills audits and questionnaires

It has been widely known for some time that self-skills audits are problematic (Santi et al., 2020), (Aesaert et al., 2017) and unreliable when estimating actual digital competences among users (Martzoukou et al., 2020; Mccourt Larres et al., 2003). Self-skills audits are a snapshot of how participants *see themselves*, and self-estimation of knowledge may not be the same as actually having knowledge, therefore it is important to be alert to the possible accuracy issues of self-skills audits and take this into account. This may be significant, for example in the awareness of security issues, as self-audited awareness may not equate with actual awareness, and may only mitigate

some aspects of security on a personal device or within an institutions infrastructure. The issue certainly deserves serious further consideration (see for example in (Zwilling et al., 2022).

A further factor to emphasise in relation to user snapshot data is that data from students (or staff) with lower incomes, or who are less confident digitally, may be absent from the data because those participants could be disinclined to take part, or it may not even be possible to take part due to non-access to suitable digital devices or infrastructure. This absence may be significant to planning for support and training, or for technical provision decision-making.

What does user experience data tell us?

This paper seeks to act as a narrative discussion of user experience characteristics in the context of both digital learning in general and distance learning course delivery in particular, and is not reporting on any result of the Smartel project, which is currently still on-going. Questions that form discussion here are from 'A general questionnaire about digital learning'[8]. Discussion attempts to make general observations about what the data might be indicating, without making specific conclusions according to statistical analysis. Remembering that each participating WBI was encouraged to analyse their own data for their own institutional specific use cases, here it is useful to reflect and make observations in general terms for possible benefit to a wider readership. Each questionnaire section is briefly discussed, loosely reproducing some of what appeared in the general report that was created at the time, plus additional commentary. Any reference to specific institutions has been removed, to maintain anonymity. The full set of questions is available in Appendix B.

How you feel about online learning

The first section of the questionnaire orientated toward anticipating change for how courses were taught (or might be recruited for), and sought to establish how digitally self-confident, motivated and skilled the academic communities were. Questions asked how participants felt about online

education and digital learning, and how open they were to change in their study or work environment.

Overall data showed that there was a general positive awareness that 'digital tools and environments can provide interesting and imaginative ways for learning (66% for strongly agree or agree), and for confidence in using, responding to 'if I get problems using digital tools, I can usually find my way through' (82% for strongly are or agree). However, data also indicated that around a third of respondents weren't so positive. Notably, nearly half of respondents considered students more confident than staff in technology contexts (46% for strongly agree or agree). In terms of change, a majority considered it worthwhile to try new things with technology (75% for 'always or 'many times'), and risk of using new digital tools was considered low by nearly half of respondents (42% for rarely or never risky). Of note, the likert statement "Lecturers have to dedicate more time to prepare online teaching and learning" elicited a fairly high 'Always'/'Many times' response frequency total across all institutions (57%) to indicate that lecturers should spend more time preparing for online teaching sessions. This may be because a high number of students took part or that responses in 'Rarely'/ 'Never' were from staff, and perhaps illustrates the potential for participant bias or difficulty in interpreting data such as this.

Digital devices, apps and software

This section was about existing practice with technical devices, about general use and use in teaching and learning, with simple 'yes' or 'no' options. There is very high frequency of 'yes' responses to using laptops, desktop PCs, smartphones, tablets, cameras (93%). The same is seen for use of social media platforms including 'social' work apps e.g. MS Teams[9] (75%), general video or audio platforms (80%), office apps (83%) and messaging apps (87%). This trend only changes with image sharing platforms, image editing or video design, and more specialist creative design

[9] https://www.microsoft.com/en/microsoft-teams/group-chat-software/

software, where there is a much higher incidence of 'No' responses (95% total for image or video editing). Image and video editing are extremely useful skills for both students and staff to have in their academic life, and for students to benefit from in their work life after university, therefore it is considered very useful to provide training and support. 'Tips and tricks' training and best practice guidelines for *all* major software being used in an institution, additionally in uses of social media for both work and private life should be provided.

Digital access and experience

This section asked about access to devices and technical infrastructure at home, with another question about overall self-estimation of knowledge in using digital devices. Frequency for having access at home is shown in all institution responses as medium for desktop computer (45%), high for laptop (88%) and smartphone (89%), significantly lower for tablets (33%) and other digital devices such as Smart TV or gaming consoles (36%), and very low frequency for responses to 'none' (0.3%). This indicates that access at home to digital devices is almost pervasive. The highest use of a type of device was for smartphone (89%), indicating a potential high level of awareness of mobile device apps and functionalities. Tablets (49%) and Smart TVs or gaming consoles (44%) had the highest rates of 'never' being used. Notwithstanding this kind of data, provision for low income students regarding access to reasonable quality laptops and Broadband Wifi is always advised (Reisdorf et al., 2020).

The question "How do you consider your level of knowledge in using a computer / laptop / tablet / other digital device?", had the highest number of responses rating their digital device skills as 'good' or 'high' for desktop or laptop computers (41%) and smartphones (53%), with tablets receiving a high skills rating of 36%, even though in the previous question it was rated very low or never for being used. These figures may not tell us very much, except that about half of respondents think of themselves as highly skilled with computers or phones. It is important to acknowledge that 'being skilled' is a very relative concept, and different people think of this very differently. One

person might think installing an app and grasping how to use it as skilled, another person might think that system administration of their PC computer is skilled.

Digital skills and knowledge

The section on digital skills and knowledge was based on the DigComp 2.1 Digital Competency Framework (Carretero et al., 2017) and the AAL vINCI questionnaire (Active Assisted Living Programme, 2017), adapted for the Smartel project's purposes. The DigComp 2.1 provided a common set of standardised and accepted digital skills competences, and the vINCI questionnaire was considered an excellent summarised approach to the DigComp categorisation of skills. Questions in this section were divided into five categories: information, communication, content creation, safety and problem solving. All questions offered a scale of Usually, Sometimes, Not Very Often or Not At All to estimate skill/ability. Summaries of some Smartel data responses showed:

Digital skills: Information

Factors of digital skills and information were self-rated by a high number of respondents as Usually or Sometimes across all institutions. For 'Usually', responses were: searching and finding information (83%), estimating trust and reliability of information (69%) and knowing how to save and store information and media content (82%). This indicates that respondents thought of themselves as very digitally literate across this general category of Digital skills for Information. It is important to always bear in mind that participants who feel less digitally literate may be disinclined to participate in an online questionnaire, therefore their lack of digital skills and literacies are invisible in this data.

Digital skills: Communication

Factors for 'Digital skills: Communication' were self-rated by a high number of respondents as Usually or Sometimes across all institutions. Response rates for 'Usually' were: Communicating with others using mobile devices or apps (86%), sharing digital files and content (84%), interacting with online services, e.g. banks or health (65%), using social networks and collaboration tools

(75%), and understanding rules of behaviour for online communication (80%). Of note here perhaps is the slightly lower estimation for interacting with online services, which returned a higher percentage for 'Sometimes' (17.5%), and may be relevant as online services involve more complex website or mobile app navigation and might be somewhat similar to navigating around an LMS. Of further note, using collaboration tools for safe digital public space communication strategies or concerning issues of personal content data privacy, security or encryption are not asked about in these options (but are somewhat covered in sub-section 'd'), and may be generally unknown to all or many participants. These issues are increasingly important to learning and teaching (L&T) scenarios and should be considered as areas for on-going training and support in any academic community.

Digital skills: Content Creation

Noting that in the earlier general question relating to use of apps and software, a total of 95% said they did not use image or video editing software, responses in this section can be considered in that light. Respondents perhaps differentiate between simple text or images in a Word document (for example), as oppose to use of Adobe Photoshop or Premier Pro[10]. In this section we can see reasonable levels of self-confidence and awareness being shown, indicated by frequency of the 'Usually' response: aspects of simple digital content creation (71%), editing other peoples content (60%) and issues relating to intellectual property and copyright when sharing or creating original digital content (78%). For applying software settings or functions, only 53% responded with 'Usually'. Higher levels of frequency in the 'Not very Often/Not at all' were for editing other people's content (9.2%) and of applying settings and functions in software (15%). This indicates that software skills are estimated as poor by nearly half of participants, and would be advised that

[10] Adobe software: https://www.adobe.com/uk/products/photoshop.html; https://www.adobe.com/uk/products/premiere.html

core software (e.g. Microsoft Office[11], Google Office Apps[12], Adobe Photoshop and Premier Pro[10], free or low cost image and video software such as DaVinci Resolve[13], Pixelmator[14], Gimp[15], Affinity Photo[16] or others) can all be offered as training for staff and students. The use of rich media (video, audio, animation) for L&T is well documented, and though software preferences change, the principle of using, creating and consuming digital rich media content has only expanded exponentially in the past two decades. Digital skills development for content creation and manipulation should be supported for all users. A useful paper by (Laaser and Toloza, 2017) outlines the past and present terrain of using media in higher education, as well as various uses of media in the process for learning.

Digital skills: Safety

The concept of digital safety and security may have grown in general awareness amongst the population (Gkioulos et al., 2017) but this can vary widely according to various societal and demographic factors such as age, income, accessibility, educational level etc. Security of campus technological infrastructure is an increasing concern, "(w)ith a plethora of connected devices and increased utilization of the Internet, higher educational institutions are exposed to risks that impact their information and data security" (Singar and Akhilesh, 2020). Indeed, since the pandemic and a much wider uptake of distance learning as a mode of L&T, "the risk of DoS / DDoS attacks, cross-site scripting, spoofing, unauthorized data access and infection with malicious programs, but also the theft of personal data has increased dramatically" (Alexei and Alexei, 2021).

[11] https://www.microsoft.com/en-gb/microsoft-365/microsoft-office

[12] https://workspace.google.com/intl/en_uk/

[13] https://www.blackmagicdesign.com/products/davinciresolve

[14] https://www.pixelmator.com/pro/

[15] https://www.gimp.org/

[16] https://affinity.serif.com/en-gb/photo/

Within this context, this broad set of questions indicates reasonable awareness amongst the academic populations. All institutions showed a fairly high frequency of 'Usually', for basic steps to protect devices (e.g. anti-virus and passwords) (63%), awareness that personal credentials can be stolen (76%), should not reveal private information online (81%), and using digital technology too much might affect health (73%). Whilst these percentages imply that digital security and safety are understood, nevertheless, support should always be available, aimed at both training of staff and students, but also in terms of policy for use of technology on campus and in remote connectivity scenarios. This might include disclaimers on use of third party apps in L&T contexts, for example used at Linnaeus University in Sweden[17] for their Open Networked Learning staff training course. Regarding the health and wellbeing of the academic community, time on screen, light source while looking at screens in dark rooms, prolonged eye strain when using screens, repetitive strain injury from keyboard over use or other health issues perhaps need to be made more prominent in self health and well being at work campaigns. Health issues of using technology may additionally need to be considered in terms of policy and risk for institutions.

Digital skills: Problem Solving

This set of questions provided interesting data about how resourceful and knowledgeable users were to solve problems and challenges in their digital lives, with reasonable confidence shown. For finding support for technical problems or using new devices or programmes gave a 58% for Usually and 38% for Sometimes. For knowing how to solve routine problems (e.g.close program, re-start computer, re-install/update program, check internet connection etc) gave 76% for Usually and 14.5% for Sometimes. Knowing that digital tools can help solving problems but also have their

[17] LNU 3rd party apps disclaimer https://lnu.se/en/medarbetare/employed-at-lnu/professional-development-and-career-paths/open-networked-learning

limitations showed 70% for Usually, and 19.5% for Sometimes. For the statement ‘when confronted with a technological or non-technological problem, I can use the digital tools I know to solve it’ resulted in 48% for Usually and 34% for Sometimes. Overall these results might indicate that between 50-75% of respondents felt that they usually could solve problems and find solutions online, with a significant number of others feeling that they could sometimes solve these challenges.

However, technical problem solving for personal needs and digital life may be only a part of the story. In terms of the process and content of hybrid distance learning, numerous different technical problems may occur while delivering a hybrid lecture, as just one example. Internet connectivity issues, device breakdown, computer processing overload due to video, audio, online chat and WiFi all being used simultaneously are a significant challenge and cannot be ‘solved online’ in a few moments. This author might recommend making contingency plans for when the technology breaks down, as an alternative ‘standby’, in case the worst happens.

Video and multimedia in digital learning

Two further questions about use of video in L&T were included, to establish additional information relating to use of video for lecture delivery and communication. Whilst data is likely skewed toward how students under 25 might react to these questions, there seemed a fairly strong consensus across institutions that synchronous live or recorded lectures were ‘suitable for teaching or study’ (73% strongly agree or agree), and broadband access was sufficient to participate in video lecture sessions (79% strongly agree or agree). Use of video for communication and collaboration were responded to with strong agreement overall, and a further question about ‘active participation in video sessions’ was seen as preferable to ‘passive following the lecture’ by a large majority of participants (72% strongly agree or agree). However, referring to sources, video delivery of recorded or live L&T may entail further noted challenges (Brame, 2016; Kalaian, 2017; Lange and Costley, 2020; Nadler, 2020).

- Video sessions can be a variable experience dependent on factors such as class size, number of 'live' cameras, need for practical demonstration, use of screen sharing, use of synchronous breakout rooms;
- Synchronous video requires significant wifi bandwidth that can sometimes be a challenge to maintain, and interrupt flow or concentration. This can be impacted by relative capability of any device;
- Video sessions require different kinds of attention and may create cognitive 'Zoom' fatigue or overload;
- Video presents quite serious challenges for those with special needs, for sight, audio or subtitling.

Smart classrooms and labs

Part of the remit of the Smartel project is to design and implement smart classrooms in remote locations separate from main university campuses. Smart classrooms are considered as "managed digital environments where numerous tasks (e.g. teaching, discussion, and evaluation) can take place, assisted (and never hindered) by technology for seamless learning experiences" (Yang, 2015) in (Alfoudari et al., 2021). While acknowledging smart classrooms may often be considered as learning experiences driven by sensors, beacons and interactions data (Abdellatif, 2019), they may also be interpreted to include more dynamic, interactive, collaborative learning, supported by more advanced learner-centred pedagogies (Hartono et al., 2018). Smart classrooms may be a useful addition to a remote campus, where members of the remote learning community can participate in live events, enabled to contribute in real time via for example interactive screens, message boards or location based smart devices. Possible problems for special needs learners are highlighted in (Bakken et al., 2016), who quote various technology-emphasised smart classroom descriptions from the literature, but note that "no literature was located that dealt with analysis of possible impact of smart classroom concepts, features and functionality on students with disabilities" (p. 16). Bakken

et al. go on to outline various positive aspects of smart classroom for those with special needs, noted in a following section.

Lab work related activities pose specific challenges that are subject area dependent, and may require a variety of solutions. Brief suggestions here demonstrate various approaches provided as support by numerous HE institutions, or found in the literature. Organising practical work in remote premises for off-campus face-to-face/ hybrid remote attendance, perhaps especially embracing different pedagogical approaches, e.g. Arizona State University Strategies for Remote Labs[18]. Open educational resource online virtual labs, e.g. Harvard LabXchange[19] or Home Science kits are other solutions, e.g. Stanford Open Source Lab-in-a-Box (Mujica et al., 2015), Laborem (Letowski et al., 2019), Imperial College remote lab-in-a-box[20], (Santiago et al., 2022).

Inclusive hybrid distance learning

Following sections briefly cover factors of inclusive hybrid distance learning that were covered in stage two of the user experience data gathering. They benefit from being included here as concern providing support for digital learning in key user group areas. Challenges and potential solutions of inclusive support are briefly discussed for academic staff, students, remote and low-income learners, and learners with special needs.

Supporting academic staff and students for digital learning

Mechanisms for on-going support of students and staff for hybrid distance learning were only covered in a very general way in stage one of the user experience data gathering. However stage

[18] Arizona SU https://teachonline.asu.edu/2020/04/strategies-for-remote-labs/

[19] LabXchangehttps://www.labxchange.org/library

[20] Imperial Remote Labs https://www.imperial.ac.uk/staff/teaching-remotely/delivering-remote-labs/

two focused further on these issues asking various questions about anticipated or existing elearning support. Ways of providing support such as email ticketing, direct individual help, lunchtime session show-and-tells or longer workshops that might even contribute to official CPD recognition were proposed. As indicated in earlier sections of this paper, various resources are available to plan strategies to support e-learning, both centrally and in faculty or school contexts (e.g. Jisc Digital Capability[21]; Imperial College Remote & Online Learning[22]). Developing website communities may be another useful way to support and share academic practice (Lister, 2014).

Supporting remote and low income learners

Various comments have been made in preceding sections of this paper regarding key mechanisms to support low-income students in remote learning contexts. Distance learning as well as more 'usual' course delivery has shown universities where technological provision needed to be prioritised: laptops, and WiFi (Reisdorf et al., 2020). Communication strategies are significant, both for contact between student(s) and lecturer, e.g. using mobile apps or Google Meet (Puma et al., 2022), and use of collaborative pedagogies supported by digital tools to engage students at distance (Masalimova et al., 2021). This applies to all the students, but lower income students may need to be actively supported into active participation in distance learning for various issues relating readiness and preparedness for distance learning (Firat and Bozkurt, 2020; Joosten and Cusatis, 2020).

Supporting learners with special needs

Learners with special needs are a significant user group in any learning context, and are of particular relevance in hybrid distance learning. (Şahin et al., 2022) investigated factors for adoption and use of e-learning systems by those with special needs and make a compelling case for embracing technology in an inclusive and fair manner. Use of technological services and systems

[21] JISC Digital Capability https://beta.jisc.ac.uk/building-digital-capability

[22] Imperial Remote & Online Learning https://www.imperial.ac.uk/staff/educational-development/teaching-toolkit/remote-online-learning/

by those with special needs builds a sense of belonging and independence for future daily life in society. As distance and online learning have increased, so has the amount of literature and resources available to underpin the approach an institution might take for developing policy and support provision of special needs learners. Supporting those with special needs falls into several areas: assessing learners' needs, supporting knowledge content delivery and interactions for those with specified special needs, supporting academic staff training for teaching special needs learners, and support of the learners themselves. *Assessment issues are not included here.*

- ***Establishing the digital literacy of special needs learners*** is recommended by (Cabero-Almenara et al., 2022). They examined digital literacy and disability types, using self-perception likert scales similar to the Smartel project;
- ***Assistive technology can be provided*** - many assistive technologies exist for supporting those with special needs. (Renuga Devi and Sarkar, 2019) provide definitions of areas of disability and lists recent examples of technologies. (Cabero-Almenara et al., 2022) highlight a lack of staff training in specialist technologies awareness;
- ***Smart classrooms can be good for special needs learners*** - (Bakken et al., 2016) highlight that smart classrooms may offer a real advantage for learners with special needs, accommodating different impairments or cognitive disabilities into design of build;
- ***Learning assistants*** may need to be available for ad-hoc assigned lectures, or assigned to an individual for the duration of the semester (or equivalent);
- ***Assess requirements of learners for special needs*** - For example, specialists reviewing submitted health records from educational authorities, and use of standardised criteria for support and assessment (Jisc Guide on Special Needs Learners[23]).

[23] Jisc Guide to assessing learners with special needs https://www.jisc.ac.uk/guides/meeting-the-requirements-of-learners-with-special-educational-needs

Conclusions

This paper has sought to provide a pragmatic narrative on the most pertinent issues relating to user experience considerations for smarter hybrid distance learning. Highlighting multiple key challenges that may be encountered when adapting learning and teaching to hybrid distance learning models, practical problems and hindrances have been outlined. These challenges were illustrated by the user requirements gathering exercise undertaken during the Smartel Erasmus+ Knowledge Transfer project. This paper cannot claim to be a comprehensive guide to smarter hybrid distance learning, and topics covered deserve careful further research and discussion amongst any teams involved in the process of implementing and supporting hybrid distance learning for all members of their academic community in a fully engaged and inclusive manner.

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References

Abdellatif I (2019) Towards A Novel Approach for Designing Smart Classrooms. In: *Proceedings of IEEE 2nd International Conference on Information and Computer Technologies (ICICT*, Kahului, HI, USA, 2019, pp. 280-284,.

Active Assisted Living Programme (AAL) (2017) Ageing Well in the Digital World. vINCI Digital Skills Questionnaire. In: *Project Code: AAL-2017-63-VINCI. AAL Europe*. Available at: http://www.aal-europe.eu/public_deliverable/vinci-digital-skills-questionnaire/.

Aesaert K, Voogt J, Kuiper E, et al. (2017) Accuracy and bias of ICT self-efficacy: An empirical study into students' over- and underestimation of their ICT competences. *Computers in Human Behavior* 75: 92–102.

Alexei A and Alexei A (2021) Cyber Security Threat Analysis In Higher Education Institutions As A Result Of Distance Learning. *International Journal of Scientific & Technology Research* 10: 128–133.

Alfoudari AM, Durugbo CM, Aldhmour M, et al. (2021) Understanding socio-technological challenges of smart classrooms using a systematic review. *Computers & Education* 173.

Atiaja L and Guerrero R (2016) MOOCs: Origin, characterization, principal problems and challenges in Higher Education. *Journal of e-Learning and Knowledge Society* v.12, n.1: 65–76.

Bakken JP, Uskov VL, Penumatsa A, et al. (2016) *Smart Universities, Smart Classrooms and Students with Disabilities* (eds V Uskov, R Howlett, and L Jain). Smart Innovation, Systems and Technologies 59. Cham: Springer.

Bojović Z, Bojović PD, Vujošević D, et al. (2020) Education in times of crisis: Rapid transition to distance learning. *Computer Applications in Engineering Education* 28(6): 1467–1489.

Bonk CJ, Olson TM, Wisher RA, et al. (2002) Learning From Focus Groups: An Examination of Blended Learning. *Journal of Distance Education* 17(3): 97–118.

Bozkurt A (2019) From Distance Education to Open and Distance Learning: A Holistic Evaluation of History, Definitions, and Theories. In: Sisman-Ugur S and Kurubacak G (eds) *Handbook of Research on Learning in the Age of Transhumanism*. Hershey, PA: IGI Global, pp. 252–273.

Bozkurt A and Sharma RC (2020) Education in normal, new normal, and next normal: Observations from the past, insights from the present and projections for the future. *Asian Journal of Distance Education* 15(2).

Brame CJ (2016) Effective Educational Videos: Principles and Guidelines for Maximizing Student Learning from Video Content. *CBE Life Sciences Education* 15(4): 6.

Cabero-Almenara J, Gutiérrez-Castillo JJ, Palacios-Rodríguez A, et al. (2022) *Digital Competence of University Students with Disabilities and Factors That Determine It. A Descriptive, Inferential and Multivariate Study*. Education and Information Technologies. Available at: https://doi.org/10.1007/s10639-022-11297-w.

Carretero S, Vuorikari R and Punie Y (2017) *DigComp 2.1: The Digital Competence Framework for Citizens with Eight Proficiency Levels and Examples of Use*. European Commission. Publications Office of the European Union. Available at: https://doi.org/10.2760/38842.

Chang CY, Chen CLD and Chang YH (2016) Smart Classroom 2.0 for the Next Generation of Science Learning in Taiwan. In: Li Y, Chang M, Kravcik M, et al. (eds) *State-of-the-Art and Future Directions of Smart Learning. Lecture Notes in Educational Technology*. Singapore: Springer, pp. 61–67.

Cook J, Ley T, Maier R, et al. (2016) Using the Hybrid Social Learning Network to Explore Concepts, Practices, Designs and Smart Services for Networked Professional Learning. In: Li Y, Chang M, Kravcik M, et al. (eds) *State-of-the-Art and Future Directions of Smart Learning, Lecture Notes in Educational Technology*. Springer, pp. 123–129.

Cranfield Sch. of Management (2022) *Bite-Size Postgraduate Programmes Open Online, Flexible Learning to All*. Cranfield University Press Release.

Downes S (2008) Places to Go: Connectivism & Connective Knowledge. *Innovate: Journal of Online Education* 5(1): Article 6.

Firat M and Bozkurt A (2020) Variables affecting online learning readiness in an open and distance learning university. *Educational Media International* 57(2): 112–127.

Giannakos MN, Krogstie J and Aalberg T (2016) Toward a Learning Ecosystem to Support Flipped Classroom: A Conceptual Framework and Early Results. In: Li Y, Chang M, Kravcik M, et al. (eds) *State-of-the-Art and Future Directions of Smart Learning. Lecture Notes in Educational Technology*. Singapore: Springer, pp. 105–114.

Gkioulos V, Wangen G, Katsikas S, et al. (2017) Security Awareness of the Digital Natives. *Information* 8(2): 42.

Hartono S, Kosala R, Supangkat SH, et al. (2018) Smart Hybrid Learning Framework Based on Three-Layer Architecture to Bolster Up Education 4.0. In: *International Conference on ICT for Smart Society (ICISS*, Semarang, Indonesia, 2018, pp. 1–5.

Hodges C, Moore S, Lockee B, et al. (2020) The Difference Between Emergency Remote Teaching and Online Learning. *Educause*. Epub ahead of print 27 March 2020. DOI: https://er.educause.edu/articles/2020/3/the-difference-between-emergency-remote-teaching-and-online-learning.

Joosten T and Cusatis R (2020) Online Learning Readiness. *American Journal of Distance Education*. Epub ahead of print 2020. DOI: 10.1080/08923647.2020.1726167.

Kalaian SA (2017) Distance and Online Learning. In: Kidd T and Morris L Jr (eds) *Handbook of Research on Instructional Systems and Educational Technology*. IGI Global, pp. 23–36. Available at: https://doi.org/10.4018/978-1-5225-2399-4.ch003.

Laaser W and Toloza EA (2017) The Changing Role of the Educational Video in Higher Distance Education. *The International Review of Research in Open and Distributed Learning* 18(2).

Lange C and Costley J (2020) Improving online video lectures: learning challenges created by media. *International Journal of Educational Technology in Higher Education* 17(16).

Letowski B, Lavayssière C, Larroque B, et al. (2019) An Open Source Remote Labo-Ratory Network Based On A Ready To Use Solution: Laborem. In: *12th Int. Conference of Education, Research and Innovation (ICERI 2019), Nov 2019, Seville*, Spain, 2019, pp. 5726–5731.

Lister P (2014) 21st Century Competencies and Communities in Higher Education. In: *Proceedings, ePIC 2014, Evidence Based Learning, Proceedings of ePIC 2014, the 12th International ePortfolio and Identity Conference*, London, 2014. Available at: https://doi.org/10.13140/RG.2.1.4663.2808.

Lister P, Cutajar M and Calleja J (2022) Reflections on Hybridity in the Malta Networked Learning Forum 2021. In: *Proceedings, 13Th International Conference On Networked Learning (Nlc2022*, 2022.

Martzoukou K, Fulton C, Kostagiolas P, et al. (2020) A study of higher education students' self-perceived digital competences for learning and everyday life online participation. *Journal of Documentation* 76(6): 1413–1458.

Masalimova AR, Ryazanova EL, Tararina LI, et al. (2021) Distance learning hybrid format for university students in post-pandemic perspective: Collaborative technologies aspect. *Cypriot Journal of Educational Science* 16(1): 389–395.

Mccourt Larres P, Ballantine J and Whittington M (2003) Evaluating the validity of self-assessment: measuring computer literacy among entry-level undergraduates within accounting degree programmes at two UK universities. *Accounting Education* 12(2): 97–112.

Mujica FA, Esposito WJ, Gonzalez A, et al. (2015) Teaching Digital Signal Processing With Stanford's Lab-In-A-Box. In: *2015 IEEE Signal Processing and Signal Processing Education Workshop (SP/SPE),*

pp. 307-312, Salt Lake City, UT, USA, 2015. Available at: https://doi.org/10.1109/DSP-SPE.2015.7369571.

Nadler R (2020) Understanding "Zoom fatigue": Theorizing spatial dynamics as third skins in computer-mediated communication. *Computers & Composition* 58: 102613.

Puma EGM, Mansilla EBR, Gonzáles JLA, et al. (2022) How universities have responded to Elearning as a result of Covid-19 challenges. *Periodicals of Engineering and Natural Sciences* 10(3): 40–47.

Reisdorf BC, Triwibowo W and Yankelevich A (2020) Laptop or Bust: How Lack of Technology Affects Student Achievement. *American Behavioral Scientist* 64(7): 927–949.

Renuga Devi C and Sarkar R (2019) Assistive Technology For Educating Persons With Intellectual Disability. *European Journal of Special Education Research* 4(3).

Şahin F, Doğan E, Yıldız G, et al. (2022) University students with special needs: Investigating factors influencing e-learning adoption. *Australasian Journal of Educational Technology* 38(5).

Santi EA, Gorghiu G and Pribeanu C (2020) Teachers' Perceived Self-Efficacy Concerning the Use of Mobile Technology in Education, Considering the "Working from Home. *Format. Revista Romaneasca Pentru Educatie Multidimensionala* 12(1Sup2): 157–166.

Santiago DE, Pulido Melián E and Vaswani Reboso J (2022) Lab at home in distance learning: A case study. *Education for Chemical Engineers* 40: 37–44.

Singar AV and Akhilesh KB (2020) Role of Cyber-security in Higher Education. In: Akhilesh K and Möller D (eds) *Smart Technologies*. Singapore: Springer.

Tan J (2012) *An Analysis of User Requirements for Virtual Classroom/Collaboration Software*. Cardiff University Information Services. Available at: https://orca.cardiff.ac.uk/id/eprint/51973/3/Jin%20Tan%20P12_016%20Report_final_06112012.pdf.

T.O.V.I.D. (2022) Teaching Online: Video Initiatives in Digital Education and Module Learning. *Erasmus+ Project*. Epub ahead of print 2022.

Yang J (2015) A Method for Evaluating Technology-Rich Classroom Environment. In: Chen G, Kumar V, Kinshuk H, et al. (eds) *Emerging Issues in Smart Learning. Lecture Notes in Educational Technology*. Berlin, Heidelberg: Springer.

Zwilling M, Klien G, Lesjak D, et al. (2022) Cyber Security Awareness, Knowledge and Behavior: A Comparative Study. *Journal of Computer Information Systems* 62(1): 82-97,.

Appendix A

West Balkans Universities

WB1. University of Pristina in Kosovska Mitrovica (UPKM, Kosovo*)

WB2. International Business College Mitrovica (IBC-M, Kosovo*)

WB3. University of Montenegro (UoM, Montenegro)

WB4. University Adriatic Bar (AUB, Montenegro)

WB5. University of Mostar (SUM, Bosnia and Herzegovina)

WB6. University of East Sarajevo (UES, Bosnia and Herzegovina)

EU Partners

EU1. Universidad Politécnica de Madrid (UPM, Spain)

EU2. University of Malta (UMA, Malta)

EU3. University of Ljubljana (ULJ, Slovenia)

EU4. CESIE (CESIE, Italy)

Appendix B

A general questionnaire about digital learning

This questionnaire asks questions about you and digital learning at your university. We are interested in whether you feel ready to study or teach online, and your feelings toward online learning generally. We also ask about your digital skills, knowledge and experience, and about your access to and use of technical equipment. Everyone is asked the same questions regardless of age, where you live or your role at your university. The questionnaire should take less than 10 minutes and all your data is anonymised and completely confidential.

1. About You - A few questions about you

This helps us to know how different people think about aspects of distance learning.

1. Your name

2. Your email

3. Your gender

Mark only one oval

○ Male

○ Female

○ Prefer not to say

4. Your age group

Mark only one oval

○ 18-24

○ 25-34

○ 35-44

○ 45-54

○ 55-64

○ Over 65

○ Prefer not to say

5. What is your role at your university?

Mark only one oval

○ A student

○ Teaching staff

○ Academic support staff (Librarians, Learning Support, Academic Development or similar)

○ Other:

2. This section asks how you feel about online learning

This section asks some questions about how you feel towards learning or teaching online.

6. How do you feel about online education and digital learning? Select the option that best describes how you feel.

Strongly Agree / Agree / Undecided / Disagree / Strongly Disagree

− If I get problems using digital tools, I can usually fnd my way through

− Most things that one can learn online can be acquired from classroom lessons

- Digital tools and environments can provide interesting and imaginative ways for learning
- I feel hesitant using digital tools for online learning or teaching
- I feel very prepared for online learning or teaching
  - I regularly update my online teaching and learning activities using the latest applications
- Online learning increases student motivation
- Lecturers communicate more efficiently with students through online means
  - Students are more confident than lecturers with technology

7. How open are you to change in your study or work environment? Select the option that reflects your general opinion. *Always / Many times / Sometimes / Rarely / Never*

- I experiment with different digital tools in my classes
- I feel comfortable when using new digital tools in my teaching or study
- Teaching with technology is risky
- It is worth trying out new things with technology
- I am ready to dedicate more time to prepare for my class study or teaching
- I nd no problem nding time to learn about new digital tools
- Lecturers have to dedicate more time to prepare online teaching and learning

3. Digital devices, apps and software

This section asks a few questions about what you use in your daily life for working or studying at university, as well as generally.

8. Thinking about your general digital life, what do you use? Select Yes to anything that you have either used in the past or use now. *Yes / No*

- General digital devices (eg. laptops, chromebooks, smartphones, tablets, cameras, gaming consuls)
- Social media posting (eg. Facebook, Edmodo, MS Teams posting, Twitter)
- Online video or audio (eg. YouTube, Tik Tok, Snapchat, Soundcloud, Audible)
- Online media for images (eg. Instagram, Unsplash, Pixabay, Wikimedia)
- Messaging apps (eg. Twitter DM, WhatsApp, Facebook Messenger, Slack)
- Online knowledge resources (eg. websites, dictionaries, encyclopaedias etc.)
- Oce tools (eg. Microsoft 365, Google Apps, Open Oce etc.)
- Image editing (Photoshop, online image editing, other editing software)
- Video design or FX software (Video editing apps, After Effects, 3D design e.g. Maya or Cinema4D)

9. Thinking about your study or teaching life, have you ever used any of the following? *Select Yes or No to reflect your general use. Yes / No*

- Learning management system (eg. MS Teams, Moodle, Canvas, Blackboard, other)
- e-Portfolio (eg. WordPress, Blackboard or Moodle journals, Mahara, Pebble Pad, other blogging)
- Collaborative writing (eg. Collaboration Space in MS Teams, Google Docs, Wikis, Pressbooks, other)
- Quiz or Form Tools (eg. Quiz in MS Teams, Kahoot, Quiziz, Survey Monkey, Jotform, Google Forms)
- Interactive whiteboard (eg. Open Board, Google Jamboard, other)
- Immersive on-line environments (eg. Online museums or games, other augmented reality apps)
- VR units, robots, digital microscopes, virtual labs
- Video lecture capture (eg. Panopto, Echo360, other)

- Video 'live' lecturing (eg. Zoom, Canvas, Collaborate, other)
- Desktop video screen capture (eg. Screencastomatic, Zoom, Medial, other)
- Screen sharing (eg. Zoom, Google Hangouts, other)

10. Any other digital tools, software, platforms, digital tasks or activities in your study or teaching life you'd like to add? (Open ended)

4. Digital access and experience

This section asks a few questions about your access to digital devices and connectivity, how often you use them and how digitally experienced you consider yourself in using them.

11. What types of technology devices do you have at home? Tick all that apply.

- □□Desktop computer
- □□Laptop computer
- □□Smartphone device
- □Tablet device
- □□Other (eg. Gaming console or Smart TV)
- □□None

12. For the following technologies please indicate how often you use each.

Mark only one oval per row. Everyday / Often / Once a week or less / Never

- Desktop or Laptop computer
- Smartphone
- Tablet
- Other (eg Gaming console or Smart TV

13. Do you have Internet and/ or WiFi access at home? If so, how is it provided?

Mark only one oval per row. Full home coverage / Partial home coverage / Don't have

- Telephone landline
- Cable Satellite
- Mobile (wifi)

14. How do you consider your level of knowledge in using a computer / laptop / tablet / other digital device.

Mark only one oval per row. Everyday / Often / Once a week or less / Never

- Desktop or Laptop computer
- Smartphone
- Tablet
- Other Devices

5. Digital skills and knowledge

This section asks a few questions about how skilled and knowledgeable you are with using digital tools, apps and online features and functions. There are five areas, with a few statements for each: Information, Communication, Content, Safety and Problem Solving.

15. Digital skills: Information. Please tell us about your skills and experience.

Mark only one oval per row. Usually / Sometimes / Not very often / Not at all

−□□□I can look for information online using a search engine.

−□□□I know not all online information is reliable.

−□□□I can save or store files or content (e.g. text, pictures, music, videos, web pages) and retrieve them once saved or stored

16. Digital skills: Communication. Please tell us about your skills and experience.

Mark only one oval per row. Usually / Sometimes / Not very often / Not at all

− I can communicate with others using mobile phone, for video calls, e-mail or chat

− I can share les and content using simple tools

− I know I can use digital technologies to interact with services (e.g. governments, banks, hospitals).

− I can use social networking sites and online collaboration tools.

− I am aware that when using digital communication, some rules apply (e.g. politeness, privacy and safety)

17. Digital skills: Content Creation. Please tell us about your skills and experience.

Mark only one oval per row. Usually / Sometimes / Not very often / Not at all

− I can produce simple digital content (e.g. text, tables, images, audio les) in at least one format using digital tools.

− I can make basic editing to content produced by others.

− I know that content can be covered by copyright.

− I can apply and modify simple functions and settings of software and applications that I use (e.g. change default settings).

18. Digital skills: Safety. Please tell us about your skills and experience.

Mark only one oval per row. Usually / Sometimes / Not very often / Not at all

− I can take basic steps to protect my devices (e.g. using anti- viruses and passwords)

− I am aware that my credentials (username and password) can be stolen

− I know I should not reveal private information online

− I know that using digital technology too much might affect my health.

19. Digital skills: Problem Solving. Please tell us about your skills and experience.

Mark only one oval per row. Usually / Sometimes / Not very often / Not at all

− I can find support and assistance when a technical problem occurs or when using a new device, program or application.

− I know how to solve some routine problems (e.g. close program, re- start computer, re-install/update program, check internet connection).

− I know that digital tools can help me in solving problems. I am also aware that they have their limitations.

− When confronted with a technological or non- technological problem, I can use the digital tools I know to solve it.

6. Video and multimedia in digital learning

20. Using video and multimedia content in education - what is your opinion on the following statements?

Mark only one oval per row, Strongly Agree / Agree / Disagree / Strongly Disagree

− Live streaming of the lectures is suitable for teaching or study

− Recording of the lectures performed in classroom is suitable for teaching or study

− Recording of the micro lectures (short digital learning content) in advance is suitable for teaching or study

− My broadband network access is sufficient to participate in the live video lectures session

− I prefer downloading lectures for subsequent watching

21. Using video for communication – what is your opinion on the following statements?

Mark only one oval per row. Strongly Agree / Agree / Disagree / Strongly Disagree

− My broadband network access allows me to perform video communication with teachers or peers

− Video meetings and video based collaboration with peers is suitable for teaching or study

− Video communication with teachers/students would enhance teaching or study

− I prefer active participation in video sessions with teachers/students (video, audio) to passive following of the lectures

7. Thank you for taking part

We appreciate your time telling us about your skills, experience and general feelings toward digital learning.

22. Permission & confidentiality - please agree to us using your data in our research and work about distance learning at your university. We will anonymise all * data from personal identifiable information, to ensure your confidentiality.

○ Yes, I agree.

○ No, I do not agree.