ORIGINAL RESEARCH ARTICLE

How do higher education staff understand the terms hybrid, hyflex and blended learning? Choice, modality and uncertainty

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Many universities implemented blended and hybrid delivery for the first time during the COVID-19 pandemic, and as such, the use of terms that relate to various manifestations and implementations of blended learning has increased significantly by all higher education stakeholders. However, the meaning ascribed to these terms is often inconsistent and can lead to confusion, making it difficult to set expectations clearly for both staff and students. This study aimed to investigate how higher education staff understand and use these terms and to identify sources of confusion and barriers to adopting standardised definitions. We surveyed 152 higher education staff and asked them to provide definitions of each term as well as completing a categorisation task. An applied thematic analysis identified two factors that were present across definitions: choice (no choice, student choice and choice not specified) and modality (mixed but separate, dual delivery and mixed not otherwise specified). Our findings reveal significant discrepancies in understanding, particularly regarding hybrid learning, which was often conflated with other modalities and involved definitions where neither choice nor modality was clearly specified. Blended learning was most consistently defined and identified as involving separate online and in-person components with no student choice as to the modality in which they could engage with each component. Hyflex learning, despite being less familiar to many participants, was accurately associated with dual delivery and the maximum student choice. Our results underscore the need for clearer terminology and for all stakeholders to provide maximally descriptive definitions. The use of any broad category term should be accompanied by a specific definition that at minimum describes choice and modality, but where best practice would be to encompass additional information based on existing frameworks.

Keywords: hybrid learning; blended learning; hyflex; synchronous learning; asynchronous learning; online learning

Introduction

Forms of distance learning, with some aspects of learning and teaching happening at distance and some on campus, have been in existence throughout the higher education (HE) model, for example, The Open University in the UK has been evaluating some form of blended learning since the 1960s (Zawacki-Richter & Naidu, 2016). However, as Beckingham (2024) notes, whilst such models are not new, many universities implemented blended and hybrid delivery for the first time during the COVID-19 pandemic,

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and as such, the use of terms that relate to various manifestations and implementations of blended learning has increased significantly by all higher education stakeholders. Yet, there is recognition that terms such as blended, hybrid and hyflex learning are not being used consistently (Beckingham, 2024), and that this lack of a common language can contribute to poor understanding, implementation and a reduction of teaching quality (Quality Assurance Agency for Higher Education , 2020).

In response to this lack of clarity, a number of frameworks and standardised definitions have been proposed by leading sector organisations, such as Jisc's Beyond Blended report (Beetham & Macneill, 2023), AdvanceHE's Modes of Learning: a practice guide (Beckingham et al., 2022) and the QAA's Building a Taxonomy for Digital Learning (Quality Assurance Agency for Higher Education, 2020). In this paper, we contribute towards this discussion by empirically investigating how such terms are understood and used by those working in higher education. Rather than proposing an additional framework or set of definitions, our aim was to identify where confusion may stem from, and what barriers might exist to the adoption of standardised frameworks and definitions.

Blended learning is frequently discussed as being campus-focussed, with elements of technology-enhanced learning (TEL) being used as a supplement (Ginns & Ellis, 2007). The OfSs (2023) defines blended learning as 'learning that combines in-person delivery and delivery in a digital environment'. Whilst students tend to see TEL as a routine provision of their education (Conole et al., 2008; MacKay, 2019), post-pandemic, the proportion of blended learning has become something of a political football, and the OfS (2022) has leaned towards characterising blended learning as an educational experience students must be protected from, prevented or restricted.

Definitions of blended learning have become so broad that they can cover almost any form of TEL combined with campus-based learning (Hrastinski, 2019). Indeed, the crux of Beetham and Macneill's (2023) report is that post-pandemic, learning and teaching are always potentially blended, and so there is urgent need for greater nuance in our vocabulary. A key challenge to the standardisation of terminology is the range of factors involved. Beckingham et al. (2022) describe three modalities of learning – in-person, synchronous online and self-directed learning – that can be combined to provide a choice of time and place for educators and/or students. The first combination is hybrid learning, described as the 'deliberate integration of synchronous (online and in-person) and directed learning, used sequentially such that any one modality will be used at a given time'. The second is hyflex: learning that 'is offered in-person, synchronously online and asynchronously online, with students deciding how to participate'. It is worth noting that unlike blended or hybrid learning, hyflex as a term is unique in that it has a single traceable specific origin that borders on proprietary, being coined by Beatty (2008).

Rather than using terms such as hybrid or hyflex, Beetham and Macneill (2023) describe four modalities – in-place synchronous, online synchronous, in-place asynchronous and online asynchronous – that are underpinned by six pillars or principles: place, platform, pace, support, blend, support and flexibility. Shifting from a limited set of terms to a more precise description of learning design using these modalities and pillars reflects the view that the complexities of blended learning and teaching have become too substantial to be captured by broad categorical labels. However, what may be gained in nuance may be lost in generalisability and widespread appeal, and it is unlikely that the use of a simpler set of categorical terms will cease.

To further muddy the waters, the Quality Assurance Agency for Higher Education (2020) offers a binary approach with two key terms, blended and hybrid. However,

the QAA definition of hybrid aligns with AdvanceHE's use of hyflex, that is, learning that is '…designed to be delivered both onsite and remotely, allowing students to move between the two methods of delivery seamlessly' (p. 3). This QAA definition of hybrid, at the time of writing, is reflected by institutions such as the University of Edinburgh, the University of Glasgow and the University of Oxford in their guidance, and here, we see a clear example of the potential cost of confused terminology. The design of hyflex learning, in which all modalities are offered simultaneously, and students have maximum choice and flexibility, has substantial workload and upskilling implications, compared to hybrid learning as described by AdvanceHE in which programme teams decide which elements are online or in-person. EduCause (2020) has a detailed guide on the implementation of hyflex approaches, and note that they are 'deceptively difficult' (p. 2) to do well, given the technological demands and the need to ensure equity in quality and experience across modalities.

If the regulator, the institution, staff and students all have different understandings of what constitutes hybrid learning, success becomes very difficult to achieve. Staff may refuse to engage in the belief that the requirements are greater than the institution expects, whilst students may not understand the flexibility that is on offer. The negative impact of the use of different terminology is noted in a report published by the Scottish Funding Council (2024) on the topic of digital and blended learning. The report highlights the confusion regarding the term 'hybrid' and that 'learners reported that despite the fact institutions advertise courses as delivered in hybrid or blended mode, learners did not always have a choice in how their course is delivered'. One of the key conclusions from their work is that learners struggle when terminology is used in a way that is unclear or inconsistent, and as such, clear definitions are an issue of inclusivity and accessibility.

In this paper, we aimed to investigate this lack of consistency empirically to identify how best to support and encourage alignment by surveying higher education staff as to their understanding and use of the terms blended, hybrid and hyflex learning.

Method

Participants, materials and procedure

Participants were first asked to provide their job role, teaching activity and location of institution. Following this, participants were asked to give their own definitions of the terms hybrid, hyflex and blended learning in an open text response, or to explicitly indicate if they were unsure of the meaning.

In total, there were 152 usable responses, that is, participants who completed questions beyond demographics. The majority of respondents were academics, with learning development/instructional support and professional services/administrative staff the second and third largest groups, respectively (see Table 1).

The majority of the sample (71%) indicated that they undertook teaching in their current role and were based in a UK higher education institution (67%).

Participants were then provided with 10 existing definitions (see Table 2) and were asked to select which term (hybrid, hyflex or blended) the definition best applied to. The definitions were chosen from a range of sources – HEI guidance pages, peer-reviewed academic literature and national bodies such as Jisc and AdvanceHE, to reflect the range of sources that stakeholders may engage with. To discourage participants assigning a category based on statistical reasoning, there were a different

Table 1. Sample demographics by job role.

Role	N	Percent
Academic	82	54
Learning development/instructional support	28	18
Professional services/administrative	17	11
Leadership	9	6
Technical/IT services	9	6
Other (please specify)	5	3
Library services	1	< 1
Student services	1	< 1

number of items from each category. The instructions explicitly stated that the items were not spread equally between the three terms, and that participants may consider different definitions to apply to the same term. The order of the items was randomised for each participant to prevent order effects.

Following this categorisation task, participants were asked which terms/categories they would use to describe different approaches to learning and teaching and about their experience and preferences for teaching in different modalities, although these questions are not reported in the current paper.

Design and data analysis

For the open text data, we employed an iterative process of applied thematic analysis (Guest et al., 2012). Initially, [EN] and [JM] read through all responses to familiarise themselves with the content and independently coded the data. This initial coding phase involved identifying key themes and assigning preliminary codes to the text segments using nVivo 14. Following this, [EN] and [JM] engaged in a discussion to compare their initial codes. Based on this collaborative process, the codes were reviewed and refined, grouping them into broader categories and sub-categories. EN then applied the finalised coding scheme to recode the entire dataset.

For the quantitative data, all analysis was conducted using R (R Core Team, 2023) and RStudio (Posit Team, 2024), and the packages tidyverse (Wickham et al., 2019), janitor (Firke, 2023), lme4 (Bates et al., 2015), emmeans (Lenth, 2023) and pROC (Robin et al., 2011). The data were analysed using a logistic regression model to determine whether the likelihood of participants providing an accurate response depended on the correct category of the item (hybrid, blended and hyflex), whilst accounting for the random effect of item.

A full model that included the fixed effect of item category and a random effect of item and a null model with only the random effect of item were fitted to the data. A likelihood ratio test was performed to compare the full model with the null model. This test assessed whether the inclusion of the correct category significantly improved the model fit. To explore differences between all category pairs, estimated marginal means (EMM) were computed. Pairwise comparisons were conducted, with Bonferroni adjusted p-values. The assumptions of the model were tested by calculating Cook's distance to identify any potentially influential observations. The area under the ROC (Receiver Operating Characteristic) curve was also calculated to assess the model's ability to discriminate between correct and incorrect responses.

Table 2. Definitions used in categorisation task.

Definition	Term	Source
…deliberate integration of synchronous (in-person or online) and directed learning. Programme teams decide which elements are delivered remotely and which require in-person presence.	Hybrid	AdvanceHE
…an instructional approach that combines in-person and online learning. Each class session and learning activity is offered in-person, synchronously online and asynchronously online. Students can decide – for each class or activity – how to participate.	Hyflex	AdvanceHE citing Milman et al. (2020)
…teaching and learning that combines in-person delivery and delivery in a digital environment.	Blended	Office for Students
…designed to be delivered both onsite and remotely, allowing students to move between the two methods of delivery seamlessly.	Hybrid	UofG (Academic & Digital Development. (n.d.))
…provides a combination of face-to-face learning and dynamic digital activities and content that facilitate anytime/anyplace learning.	Blended	Jisc (2020)
…no separation is made between digital and on campus student cohorts. Students are brought together by the way teaching is designed and students are able to move easily between digital and classroom-based learning activities.	Hybrid	University of Edinburgh (Institute for Academic Development, 2024)
…an educational model in which some students attend a lecture or seminar in-person as normal, whilst others join virtually from home. Lecturers therefore teach remote and in-person students at the same time using tools like Teams or Zoom. As a variation, lecturers may also work remotely to deliver sessions to students in a classroom and online.	Hybrid	University of Oxford (Centre for Teaching and Learning. (n.d.))
…students are typically given full control over their decisions to participate online or in the classroom. This provides them with the ability to make participation choices based on convenience, learning progress, social interaction preferences or other factors important to them at the time. Teaching staff, on the other hand, do not have choices about participation mode, since they have to provide both an online and a classroom experience supporting student learning.	Hyflex	Beatty (2019)
…refers to learning that integrates complementary face-to-face (synchronous) and online learning (asynchronous) experiences in service of intended learning objectives. All students are expected to undergo the same combination of online and in-person activities.	Hybrid	Columbia University
…students are given choice in how they participate in the course and engage with material in the mode that works best for them over the course and from session to session.	Hyflex	Columbia University

All analysis code and data are available at https://osf.io/huq34/

Analysis and results

Participant definitions – applied thematic analysis

One hundred and two participants provided open text responses, and all participants provided definitions for all three terms. The final coding scheme can be found in Table 3.

Table 4 indicates the number of participants that indicated they were not aware of each term. Whilst blended and hybrid were known to almost all participants, approximately 41% of participants were not familiar with hyflex prior to the survey.

There were also a small number of responses that did not provide a specific definition, but rather defined the term as a synonym of another term (see Table 5).

All other responses were then assigned two codes, one for Choice (no choice, student choice or choice not specified) and one for modality (dual delivery, mixed but separate and mixed but not otherwise specified (NOS)) and we calculated the distribution of the combination of the two codes.

For blended learning (see Table 6), the most frequent definition was mixed but separate delivery and no choice of modality (51%). An example of a blended definition in this category was:

> A style of learning/teaching that combines online and face to face learning at different times. For example, learners may watch a video explainer of a lab technique asynchronously then come to a physical lab at an appointed time to try the technique for themselves.

The second most frequent definition category was to specify neither choice nor modality, for example, 'A blended course is a course that combines synchronous and asynchronous learning experiences that take place in person and online'.

For hybrid definitions (see Table 7), the most frequent definition was dual delivery but with no specifics on student choice. An example of a definition in this category is 'Teaching simultaneously in-person and online, managing both cohorts at the same time. Ideally both cohorts would form one learning community, able to interact as if distance/space was not an issue'. As with blended learning, the second most frequent definition category was to specify neither choice nor modality.

Finally, for hyflex (see Table 8), the most frequent category of definition was dual delivery with student choice (50%). An example of a definition in this category is:

> Students enrolled as one cohort can choose between equivalent tasks and settings as they wish, depending on whether they want a synchronous physical attendance in a class, or an alternative online experience; students can move between these choices at will.

The second most frequent definition was dual delivery with choice not specified.

Table 3. Final coding categories and sub-categories.

Category	Sub-category	Category definition	Example participant response
Not familiar with term		Participant explicitly indicated they did not know term.	I haven't heard this term before.
Synonym		Term only defined as a synonym of another term.	Is it not the same as hybrid? Tend to be used as synonyms.
Choice	No choice	Whilst online and in-person methods may be used, students have no choice in which modality they engage with. This may be where specific activities are delivered only in a single modality, or where students have enrolled on an online-only course.	The instructor uses both online and in-person teaching – but not necessarily at the same time. All students are in class for in class stuff, or all online for online stuff.
	Student choice	Students can choose how to engage with the course. The intention is that all learning outcomes could be met either in-person or online. This does not necessarily mean dual delivery, for example, there could be separate versions of the course.	Students enrolled as one cohort can choose between equivalent tasks and settings as they wish, depending on whether they want a synchronous physical attendance in a class, or an alternative online experience; students can move between these choices at will.
	Choice not specified	Whilst the definition does not preclude student choice, it is not explicitly stated either way.	Mixture of online on-demand and live in-person delivery.
Modality	Dual delivery	The intention is that all learning outcomes could be met either F2F or online. This does not necessarily mean there is student choice, that is students may be assigned to specific modalities.	Teaching that is both online and in-person – like some people are in the room in person but others are joining via Teams.
	Mixed but separate	Both online and in-person methods are used but each relate to separate learning activities and/or materials. It is not possible to achieve all learning outcomes in one modality.	A mode of teaching where synchronous, typically in-person, lessons are combined with asynchronous online activities. For example, flipped learning or a live lesson followed by discussions on the VLE [virtual learning environment]
	Mixed but not otherwise specified	A mix of online and in-person methods are used, but there is no further detail as to whether these are dual delivery or separate components.	This class uses online, in-person and other tools (like discord).

Table 4. Responses indicating participants had not heard the term.

Category	Never heard term (%)
Blended	4
Hybrid	0
Hyflex	41

Table 5. Responses defining term as a synonym.

Category	Synonym definition (%)
Blended	5
Hybrid	2
Hyflex	1

Table 6. Choice by modality for blended learning definitions.

	Choice not specified (%)	No choice (%)	Student choice (%)
Dual delivery	3	1	0
Mix NOS	36	0	2
Mixed but separate	7	51	0

Table 7. Choice by modality for hybrid learning definitions.

	Choice not specified (%)	No choice (%)	Student choice (%)
Dual delivery	44	1	12
Mix NOS	28	0	1
Mixed but separate	1	13	0

Table 8. Choice by modality for hyflex learning definitions.

	Choice not specified (%)	No choice (%)	Student choice (%)
Dual delivery	29	0	50
Mix NOS	13	0	7
Mixed but separate	0	0	0

Table 9. Participant responses to each category.

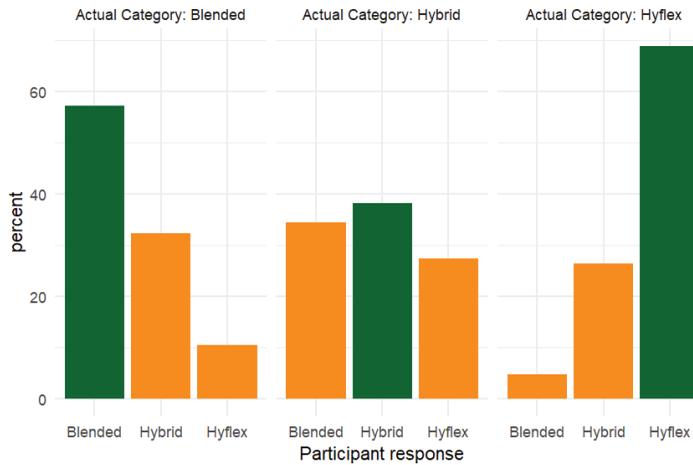| Participant response Correct category	Blended (%)	Hybrid (%)	Hyflex (%)
Blended	58	32	11
Hybrid	34	38	27
Hyflex	5	26	69

Figure 1. Correct category vs participant response. The bars in green represent correct answers, for example, if the definition originally applied to blended learning, the participant chose this as their response.

Categorisation exercise

As described in the Method, participants were given existing definitions and asked to which of the three terms the definition applied. Table 9 and Figure 1 show the percent of responses to each category. Definitions originally referring to blended learning were most frequently categorised correctly by participants, with 69% assigning hyflex definitions to the hyflex category. The majority of participants also accurately categorised blended learning, with 58% assigning the correct term. However, only 38% of hybrid definitions were categorised correctly with the remainder roughly split between blended and hyflex.

To account for the unequal number of items in each category and the potential influence of item-specific effects, a logistic regression model with a random effect for item was fitted to predict whether the participant response (correct/incorrect) could be predicted by the category of the original definition (blended, hybrid and hyflex). This model was compared to a null model containing only the random effect of item using an ANOVA and showed a significant improvement in model fit when adding the correct category predictor ($\chi^2(2) = 7.962$, $p = 0.019$), that is, participants' ability to correctly identify the different categories was different.

Pairwise comparisons using EMM and Bonferroni correction for multiple comparisons found no significant difference in accuracy between Hybrid and Blended definitions (Estimate = –0.802, SE = 0.439, z = –1.826, p = 0.203) or between Blended and Hyflex (Estimate = –0.509, SE = 0.480, z = –1.061, p = 0.866). However, the comparison between Hybrid and Hyflex was significant (Estimate = –1.311, SE = 0.387, z = –3.392, p = 0.0021) with participants more likely to correctly identify hyflex definitions compared to hybrid definitions.

Discussion

The results of both the open text definitions and the categorisation task align and provide an example of methodological triangulation (MacKay & Wu, 2024), and we will summarise the findings for each term in turn.

For blended learning, the majority of participant definitions were specific. Blended learning was defined as involving a mix of separate online and in-person components, and that students have little to no choice in the modality of engagement with each component. In the categorisation task, although it did not approach a ceiling effect, the majority of participants could correctly identify the blended definitions as such. The highest overlap in both tasks was between blended and hybrid with very little evidence that blended and hyflex would be confused as terms. Although consensus was relatively high, it is also worth cautioning that there was still significant variability in the expectations of blended learning, for example, a single instance of integrating digital activities into traditional teaching requires a very different skillset and workload than a fully integrated mix of online and face-to-face activities.

For hyflex, the key takeaway is that a high proportion of participants had not encountered the term before taking part in the survey. However, despite this, those who did provide a definition generally did so with specificity, defining hyflex as dual delivery of content with maximum student choice about the modality of their engagement. Additionally, in the categorisation task, hyflex definitions were most likely to be identified correctly, suggesting that even though many people have not heard of the term, its meaning is somewhat transparent, perhaps reflecting the proprietary nature of Beatty's (2008) definition.

However, there was far less consensus and specificity regarding hybrid learning. The two most frequent categories of definition provided by participants in the open text responses did not specify student choice of modality. Additionally, in the categorisation task, hybrid learning had the lowest accuracy of all three terms, with responses spread across all three categories.

In summary, our findings suggest that blended learning as a term can be used with relative consensus, although greater specificity is always recommended. Although hyflex benefits from a relatively transparent meaning, fewer people are aware of it as a term and so it is difficult to encourage its general use and instead may be better considered a niche, proprietary term. Finally, hybrid learning as a concept is clearly problematic. Its usage is widespread but often comes with so little clarity that the meaning of hybrid is varied to the point that it is arguable whether it represents a meaningful or useful category.

Recommendations

Principally, we advocate for staff and students to be able to identify the system of learning and teaching they are engaged in. Being able to identify an educational system allows staff and students to seek out relevant support, plan appropriately and improve teaching quality (Casey & Wilson, 2005; MacNeill & Beetham, 2022; Quality Assurance Agency for Higher Education, 2020). There have been several attempts to provide standardised terminology through informed, theory-based understandings of pedagogy, from both education researchers and sector groups, but our findings demonstrate that staff understanding does not appear to be homogenous. This reflects common concerns in faculty development, particularly around the diversity of academic experience and difficulties supporting academics to engage with pedagogical recommendations, with academics perceiving conflict in their roles between teaching and research (Robertson & Bond, 2002), and staff in STEM fields often struggling to parse pedagogical language (Clancy, 2013; MacKay et al., 2022; Yore et al., 2004).

It is perhaps unlikely that the many and varied stakeholders involved in higher education can converge on a single understanding of each term. Instead, a more pragmatic solution may be to encourage moving away from the use of these broad categories in recognition that the possible options and combinations for how we design and deliver learning and teaching are almost infinite. Beetham and MacNeill's (2023) six pillars are essentially an expansion on our coding of Choice and Modality, and whilst the number of possible combinations is too large to be used as distinct categories, the pillars provide a clear framework to help institutions, learning designers and programme leaders explain to both learners and educators what is being asked of them. This more nuanced approach lacks the 'curb appeal' of a single reference that can provide a clear, uncontested definition of each approach, but this type of categorisation does not work in the real world, as seen in our results. Instead, stakeholders wishing to support students and educators need to find a framework that is practically supportive of existing concerns regarding the use of learning technologies. That said, it is also unlikely that the use of these categorical terms will go away, and therefore, a hybrid approach (no pun intended) may indeed be the most pragmatic. That is, our strongest recommendation is that the use of any broad category term should be accompanied by a specific definition that at minimum describes choice and modality, but where best practice would be to encompass the six pillars from Jisc.

Limitations

A potential limitation of our study is the imbalance in the number of items from each category in the categorisation task. This was done to avoid participants selecting their responses based on the assumption that there would be an equal spread between the categories, but given that there were more hybrid definitions than the other terms, this may have led to hybrid having lower accuracy due to participants assuming there would not be that many items assigned to one category.

However, we argue that this is unlikely to affect the validity of our results on several grounds. First, the logistic regression was significant after accounting for random item effects. Second, the results of the categorisation task align with the open text definition question – in both tasks, participants responses to hybrid definitions showed less consistency and specificity, and the categorisation task occurred after the open text responses to prevent priming. Third, if the increased number of items in the hybrid category led to lower accuracy, we might also expect to find that blended had a higher accuracy rate than hyflex; however, this was not the case.

Additionally, we have focussed on the educator perception of these terms. Given the UK's OfS concerns (OfS, 2022) regarding how these approaches to teaching may impact the student body, and the associated need to ensure that programme descriptions are transparent and accessible to students (CMA, 2023), characterising the prospective and current student understanding of learning modality is vital. This evaluation should also take into account the changing landscape of student recruitment, including how different demographic groups with historically poorer access rates to HE interpret and understand these terms.

Finally, it is possible that the definition adopted by each participant's institution influenced their responses. Whilst we reviewed a number of institutional definitions in selecting stimuli, we did not do so systematically and so have no estimate of the proportion of institutions that have adopted each definition. This would be useful

additional context and provide further evidence on the scale of the inconsistency at an institutional level, as well as allowing an investigation of whether individual staff understandings are shaped by their institution's use of terminology.

CReDiT statement

EN: Conceptualisation, Methodology, Formal analysis, Investigation, Writing – Original Draft, Writing – Review & Editing, Project Administration, Supervision.

BH: Formal analysis, Investigation, Data Curation, Writing – Original Draft, Writing – Review & Editing.

JRDM: Conceptualisation, Formal analysis, Writing – Original Draft, Writing – Review & Editing.

References

Academic & Digital Development. (n.d.). *Learning and teaching meta-definitions at the University of Glasgow*. University of Glasgow. Retrieved from https://www.gla.ac.uk/myglasgow/learningandteaching/blendedteaching/definitions/

Beatty, B. J. (2008). *Using the HyFlex course and design process*. Retrieved from https://online-learningconsortium.org/join/using-hyflex-course-design-process/

Beckingham, S. (2024). Re-defining modes of learning. In G. Ó Súilleabháin, D. Lanclos, & T. Farrelly (Eds.), *How to use digital learning with confidence and creativity* (pp. 168–177). Edward Elgar Publishing.

Beckingham, S., Beggs, R., Hinton, D., Varga-Atkins, T., & Watson, D. (2022). *Modes of learning: A practice guide*. In K. Hack (Ed.), AdvanceHE. Retrieved from https://www.advance-he.ac.uk/knowledge-hub/beyond-flexible-learning-practice-guide

Beetham, H., & MacNeill, S. (2023). *Beyond blended: Post-pandemic curriculum and learning design lessons from the higher education (HE) sector*. Jisc. Retrieved from https://www.jisc.ac.uk/reports/beyond-blended

Bates, D., Maechler, M., Bolker, B., & Walker, S. (2015). Fitting linear mixed-effects models using lme4. *Journal of Statistical Software, 67*(1), 1–48. https://doi.org/10.18637/jss.v067.i01

Casey, J., & Wilson, P. (2005). A practical guide to providing flexible learning in further and higher education. QAA Scotland. Retrieved from http://qmwww.enhancementthemes.ac.uk/docs/publications/a-practical-guide-to-providing-flexible-learning-in-further-and-higher-education.pdf

Centre for Teaching and Learning. (n.d.). *What is hybrid teaching?* University of Oxford. Retrieved from https://www.ctl.ox.ac.uk/what-is-hybrid-teaching

Clancy, D. M. (2013). *Personal epistemology and its influence on teaching and learning in higher education*. Doctoral dissertation, Bangor University. Retrieved from https://research.bangor.ac.uk/portal/files/20571872/null

Competition & Markets Authority. (2023). *UK higher education providers: Advice on consumer protection law – Helping you comply with your obligations*. National Archives. Retrieved from https://assets.publishing.service.gov.uk/media/6475b2f95f7bb7000c7fa14a/Consumer_law_advice_for_higher_education_providers_.pdf

Conole, G. et al. (2008). "Disruptive technologies," "pedagogical innovation": What's new? Findings from an in-depth study of students' use and perception of technology. *Computers and Education, 50*(2), 511–524. https://doi.org/10.1016/j.compedu.2007.09.009

Educause. (2020). *7 things you should know about the HyFlex course model*. Retrieved from https://library.educause.edu/-/media/files/library/2020/7/eli7173.pdf

Firke, S. (2023). *janitor: Simple tools for examining and cleaning dirty data*. R package version 2.2.0. Retrieved from https://CRAN.R-project.org/package=janitor

Ginns, P., & Ellis, R. (2007). Quality in blended learning: Exploring the relationships between on-line and face-to-face teaching and learning. *Internet and Higher Education, 10*(1), 53–64. https://doi.org/10.1016/j.iheduc.2006.10.003

Guest, G., MacQueen, K. M., & Namey, E. E. (2012). *Applied thematic analysis*. SAGE Publications, Inc. https://doi.org/10.4135/9781483384436

Hrastinski, S. (2019). What do we mean by blended learning? *TechTrends, 63*(5), 564–569. https://doi.org/10.1007/s11528-019-00375-5

Institute for Academic Development. (2024). *Hybrid learning and teaching*. University of Edinburgh. Retrieved from https://institute-academic-development.ed.ac.uk/study-hub/learning-resources/hybrid-learning-and-teaching

Lenth, R. (2023). *emmeans: Estimated marginal means, aka least-squares means*. R package version 1.8.7. Retrieved from https://CRAN.R-project.org/package=emmeans

MacKay, J. R. D. (2019). Show and "tool": How lecture recording transforms staff and student perspectives on lectures in higher education. *Computers & Education, 140*, 103593. https://doi.org/10.1016/j.compedu.2019.05.019

MacKay, J. R. D., Bell, C. E., Hughes, K., et al. (2022). Development and evaluation of a faculty based accredited Continued Professional Development route for teaching and learning. *Journal of Veterinary Medical Education, 49*(6), 759–769. https://doi.org/10.3138/jvme-2021-0019

MacKay, J. R. D., & Wu, S. (2024). Educational research. In K. Fogelberg (Ed.), *Educational principles and practice in veterinary medicine* (1st ed., pp. 415–458). Wiley Blackwell.

MacNeill, S., & Beetham, H. (2022). *Approaches to curriculum and learning design across UK higher education*. Jisc. Retrieved from https://www.jisc.ac.uk/reports/approaches-to-curriculum-and-learning-design-across-uk-higher-education

OfS. (2022). *Blended learning review*. Retrieved from https://www.officeforstudents.org.uk/media/7626/blended-learning-review-panel-report.pdf

OfS. (2023). *Protecting students as consumers*. Retrieved from https://www.officeforstudents.org.uk/media/8324/insight-brief-19-protecting-students-as-consumers.pdf

Posit team (2024). *RStudio: Integrated Development Environment for R*. Posit Software, PBC.

Quality Assurance Agency for Higher Education. (2020). *Building a taxonomy for digital learning*. Retrieved from https://www.qaa.ac.uk/docs/qaa/guidance/building-a-taxonomy-for-digital-learning.pdf

R Core Team. (2023). *R: A language and environment for statistical computing*. R Foundation for Statistical Computing. Retrieved from https://www.R-project.org/

Robertson, J., & Bond, C. H. (2001). Experiences of the relation between teaching and research: What do academics value? *Higher Education Research & Development, 20*(1), 5–19. https://doi.org/10.1080/07924360120043612

Robin, X., Turck, N., Hainard, A., et al. (2011). pROC: an open-source package for R and S+ to analyze and compare ROC curves. *BMC Bioinformatics*, *12*, 77. https://doi.org/10.1186/1471-2105-12-77

Scottish Funding Council. (2024). *The future of learning and teaching: Defining and delivering an effective and inclusive digital/blended offering*. Retrieved from https://www.sfc.ac.uk/wp-content/uploads/2024/02/The-Future-of-Learning-and-Teaching-1.pdf

Wickham, H., Averick, M., Bryan, J., Chang, W., McGowan, L. D., François, R., Grolemund, G., Hayes, A., Henry, L., Hester, J., Kuhn, M., Pedersen, T. L., Miller, E., Bache, S. M., Müller, K., Ooms, J., Robinson, D., Seidel, D. P., Spinu, V., … Yutani, H. (2019). Welcome to the tidyverse. *Journal of Open Source Software, 4*(43), 1686. https://doi.org/10.21105/joss.01686

Yore, L. D., Hand, B. M., & Florence, M. K. (2004). Scientists' views of science, models of writing, and science writing practices. *Journal of Research in Science Teaching, 41*(4), 338–369. https://doi.org/10.1002/tea.20008

Zawacki-Richter, O., & Naidu, S. (2016). Mapping research trends from 35 years of publications in distance education. *Distance Education, 7919*(July), 1–25. https://doi.org/10.1080/01587919.2016.1185079