Aligning and Combining: Using Webinars for Feedback in an Online Module in Postgraduate Up-skilling for Construction Professionals

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Aligning and Combining: using webinars for feedback in an online module in postgraduate up-skilling for construction professionals

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Abstract

The investigative case study presented here is an exploration of an online, multi-disciplinary, professional up-skilling module that seeks to understand how participants perceived an online delivery, feedback and constructively aligned assessment strategy. Initially a validated survey, and subsequently a purposefully selected group of four participants informed the outcomes of this study. The findings, in brief, noted that the structure of the online course was well received by the learners; with the key emergent themes focussing on the aligned approach to content, assessment and feedback as well as the flexibility the online (a)synchronous learning offered participants. Conversely, the use of webinars for feedback was found to be less popular than other aspects of the online delivery, attributed to poor internet connectivity experienced by some participants. The findings from this case study will help inform the designers of online modules in their choices of technologies appropriate to online delivery as well as offering recommendations for practice in online assessment and feedback.

Keywords: online learning, online assessment, upskilling, construction professionals.
Introduction

Research Context and Rationale

Almost 40% of energy demand within the European Union is accounted for by buildings through heating, cooling and other forms of energy use. The concept of Nearly Zero Energy Buildings (NZEB) derives from the need to greatly reduce this energy use, and its associated carbon emissions, to reach the targets agreed under the Kyoto Protocol (United Nations, 1998). The Energy Performance of Buildings Directive (European Union, 2010) sets high standards for energy efficiency in the European building stock to respond to Kyoto and, for the first time, defines NZEB. As such, there is a need for a new educational approach to upskill existing construction professionals in NZEB. Construction professionals can be defined as architects, engineers, surveyors and building managers who are involved in the design, construction or maintenance of buildings. Financial support for this ambitious upskilling project was provided under the recent MEEnS (Meeting of Energy Skills) H2020 funding call, and sought to reskill 1,200 building professionals in nine European countries (European Commission, 2014; Victor et al., 2017) and this is the context of the research described here.

Considerable scaffolding of learning is necessary to develop proficiency in the new skills involved for construction professionals (Wood, Bruner & Ross, 1976). Furthermore, the learning involved in NZEB upskilling can be viewed as threshold learning; which can be used as a lens to explore some of the difficulties encountered by learners with the complex material (Meyer & Land, 2003). In order to address these threshold concepts in an structured and constructed way, the Irish delivery of the MEEnS programme was developed using a novel digital learning ecosystem based on freely available cloud computing and social media technologies (Jackson,
This investigative case study firstly explores the impact of webinars for feedback within this novel ecosystem. In this case study, webinar, short for *web-based seminar*, is defined as a workshop that is transmitted over the internet using video conferencing software. Learners received live video from the tutor presenting aggregated and anonymised results of their formative assessment. The tutor explained common errors and answered questions submitted by learners via text visible to all participants. The learning ecosystem in this case is defined as a constructively aligned approach to the delivery, assessment and feedback of a completely online upskilling module involving the innovative use of web-based technologies.

*Research Question*

The research question that initiated and bounded this research was:

> What is the effect of the integration of synchronous feedback webinars on the student perceived experience of a socially constructed online post-graduate upskilling module in Nearly Zero Energy Buildings?

*The Irish legislative, political and economical context*

In general, building professions are designated to certify compliance with building regulations, backed by mandatory professional indemnity insurance and in Ireland three such bodies exist, architects, engineers and building surveyors (Government of Ireland, 2007). Following a strict code of conduct, including individual liability, and with absolute adherence to regulation implicit, with civil and criminal sanctions available in the event of failure (Government of Ireland, 1990). Currently, the Irish legal system is incapable of assigning liability based on responsibility and defaults to dividing liability based on insurance. Few states come close to this
extreme legal architecture for building regulations, and by extension, NZEB implementation. However, the Irish State has done little to test and prove the technologies required for NZEB in built exemplars and has fallen behind schedule in publishing details of NZEB regulations and updating guidance documents.

In response to this crisis, a series of Government funded upskilling courses for unemployed building professionals was developed by Irish Higher Education Institutes. Over time, those courses were modified in response to learner experiences, combined and expanded to establish a Masters in Energy Retrofit Technology. The expertise gained in establishing the MSc programme was instrumental in developing the subsequent Irish versions of the MEnS programme that is the basis of this study, hereafter designated as MEnS(Ire). The programme, allied with an innovative blended online delivery model, was designed for increased scale and rapid upskilling at minimal cost; both to the higher education institute and the participant, all the while cognisant of the needs of the mature online learners that undertook the programme.

*Literature Review and Theoretical Framework.*

*Moving assessment and feedback online to empower learning*

Locating learning within social relations has its origins with Vygotsky (1962) and in this classical learning theory was combined in both the delivery and feedback elements of the module. In this case study a ‘combined and aligned’ model was implemented whereby the quality of socially provided feedback was proportional to the dialogue between tutor and learner, rather than the extent of the dialogue (Northcliffe & Middleton, 2008). Although Orsmand and co-workers (2013) comprehensively review written, audio, video and peer feedback and feed-
forward techniques, they stop short of any exploration of interactive, group-based, feedback based on webinar technologies. Orsmand and colleagues’ proposed GOALS framework, intended as a template for feedback, misses a key benefit of organizing and communicating feedback via a webinar format: time saving. Furthermore, and echoing Vygotskian social learning theory, collectively experienced webinar-based feedback can also assist in developing a supportive community of online learners which is particularly beneficial for novice online adult learners (Brown, & Campione, 1994).

An aligned and combined approach to androgogical assessment

In order to appropriately align an androgoical approach to teaching, and to expand on Biggs’ Theory of Constructive Alignment (Biggs, 1996), Boud (1995) suggests to focus on competency assessment and authenticity in both the language and the situating of assessment practices. In this case study, the MEnS(Ire) programme incorporated a holistic approach to assessment, based on real world situations specific to the discipline involved, to empower the learners to become critical self-assessors (Boud, 2000). Additionally, the need for critical self-assessment was developed in all learners, to enable them to continue as lifelong learners (Nicol, 2010). This chimes both academically (Donnelly, 2014) and professionally as all Irish construction professional have a statutory requirement to remain up to date with developments in their profession. This life-long learning process is underpinned by mandatory CPD and annual registration within the regulated construction professions, managed by their respective professional registration bodies, and serves as the scholarly context of this case study.
An aligned and combined approach to androgogical feedback

The works of Nicol and Macfarlane-Dick (2006), Gibbs and Simpson (2004) and Hattie and Timperley (2007) informed the MEnS(Ire) approach to androgogical, webinar-based, feedback. These seminal works were synthesised (see Table 1) to enable and empower the already motivated adult learners. This webinar approach to feedback provision builds on Chi and co-workers (2008) proven benefit of sharing recorded (asynchronous) video feedback between a tutor and a single learner. Chi and colleagues observed that, if supported by peer-to-peer (synchronous) feedback between two viewers, feedback participants could demonstrate the acquisition of complex new learning, without additional tutor input. The webinar-based feedback model in this case study develops this approach further whereby the entire class shares the experience of a live tutor feedback. During this synchronous webinar based feedback, questions were participant-driven and based exclusively on a formative exercise participants had just completed. This feedback was saved as an online video, which was asynchronously accessible to all register learners on the programme.

An aligned and combined approach to androgogical content delivery

The theoretical framework that underpinned the design of the module was the use of assessment and social feedback as a learning support in an androgogical context. Gagne’s Nine Events (Gagne, 1985) and Biggs’ Theory of Constructive Alignment (Biggs, 1996) were used as practical approaches to achieve this. In Gagne’s model, feedback is central to reinforce and solicit correct performance. This is reiterated by Biggs’ Theory, wherein the critical link between learning outcomes, assessment and learning actions is established. This is of particular importance for the adult, online learners in this case study. Furthermore, Knowles (1984)
suggests that a different approach is required to engage the adult learner whereby an emphasis should be placed on task-based learning and problem solving as a ready means to exploit their existing reservoir of experience and their willingness to learn. In this case study the participants were self-motivated learners with a wealth of practice experience, some at the highest levels of their discipline, and therefore aligned to Knowles’ theory.

Module implementation
The provision of distance learning leading to degree qualification is well established and dates back to correspondence courses offered by universities from the mid 1800s. Massive Online Open-access Courses (MOOCs) are a feature of the current educational landscape. The integration of summative assessment and webinar feedback as a support to learners in a wholly on-line module with online summative assessment is a contemporary approach. The strength of the alignment of formative assessment and webinar feedback leading to success at summative assessment is offered here as an explanation for the low drop-out rate experienced. For example, Onah and co-workers (2014) report 6% completion typical for online courses in contrast to MEnS(Ire), which delivered over 85% completion rates.
Table 1: A tabular overview of the assessment methodology developed and adopted in the MEnS(Ire) module. The table uses an adapted, themed, version of Gibbs’ and Simpson’s (2004) eleven conditions under which assessment supports student learning by way of comparison, and outlines how strategic approaches were adopted in the MEnS(Ire) module.

<table>
<thead>
<tr>
<th>Gibbs’ and Simpson’s (2004) Eleven Conditions.</th>
<th>Strategic approaches employed in the MEnS(Ire) module</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Quantity and distribution of student effort</strong></td>
<td></td>
</tr>
<tr>
<td>1. Assessed tasks capture sufficient study time and effort</td>
<td>All aspects of the lecture materials were examined in the summative assessment using computer-based multiple-choice questions to establish knowledge, skills and judgement using factual, scenario and project-based questions.</td>
</tr>
<tr>
<td>2. Assessed tasks distribute student effort evenly across topics and weeks</td>
<td>Weekly, or fortnightly, summative assessments were held after each module component, comprising a total of six summative assessments in an eleven-week period.</td>
</tr>
<tr>
<td><strong>Quality and level of student effort</strong></td>
<td></td>
</tr>
<tr>
<td>3. Assessed tasks engage students in productive learning activity</td>
<td>Collaborative formative exercises were completed and submitted by each learner following each set of recorded online video lecture materials, reading and practice with software (depending on assessment component).</td>
</tr>
<tr>
<td>4. Assessment communicates clear and high expectations to students</td>
<td>The assessment format and marking scheme used in the collaborative formative exercise was identical to that used in the subsequent summative assessment.</td>
</tr>
<tr>
<td><strong>Quantity and timing of feedback</strong></td>
<td></td>
</tr>
<tr>
<td>5. Feedback is provided regularly and in sufficient detail</td>
<td>The entire answers sheet to formative exercises were reviewed with learners using an interactive webinar format based in Google Hangouts. A graphic summary of percentage of correct and incorrect answers submitted was shared with learners using Google Forms. Typically, one hour of live feedback is provided for each hour of formative exercise.</td>
</tr>
<tr>
<td>6. The feedback is provided quickly enough to be useful to students</td>
<td>Feedback happened within 24 hours of formative assessment submission and at least 48 hours before summative assessment allowing time to develop correct understanding.</td>
</tr>
<tr>
<td>7. Feedback focuses on learning rather than on marks or students themselves</td>
<td>Marks are not awarded for formative exercises; however, learners could review their own submission against the correct answers as advised by the tutor and...</td>
</tr>
<tr>
<td></td>
<td>Feedback is linked to the purpose of the assignment and to criteria</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>8</td>
<td>Feedback is understandable to students, given their level of sophistication</td>
</tr>
<tr>
<td><strong>Student response to feedback</strong></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Feedback is received by students and attended to</td>
</tr>
<tr>
<td>11</td>
<td>Feedback is acted upon by students to improve their work or their learning</td>
</tr>
</tbody>
</table>
**Research Methodology**

A social constructivist ontological position was adopted in this research and lead to an interpretivist epistemology within an investigate case study methodology (Grix, 2002; see Figure 1). Mixed methods (Creswell, 2013) were used to explore the data to identify underlying ‘construction of “variables” which quantitative research seeks to correlate’ (Silverman, 2015, p.14; see Figure 2). A set of mixed methods research instruments were employed as they have previously been shown to be appropriate during the evaluation of evidence-based practices (EBPs) in “state-wide systems where relationships among key stakeholders extend both vertically (from state to local organizations) and horizontally (between organizations located in different parts of a state)” (Palinkas et al., 2015, p.1). In this case, the use of mixed methods instruments aligned the need to implement NZEB across all the Member States of the European Union, involving multiple stakeholders and organisations (vertically and horizontally).

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**Figure 1.** A schematic representation of the key components relating to the adopted ontological position, indicating how the research question was situated within and educational variable and the correlated Irish State regulatory system of building controls.
**Mixed-Methods Research Structure**

- **Quantitative Data**
  - Questionnaire \( n=18 \)
  - Quantitative Analysis
  - Ethics Committee
  - ME&Sh2020 Survey \( n=71 \)
- **Qualitative Data**
  - Structured Interviews \( n=4 \)
  - Thematic Analysis
  - Data Validation
  - Thematic Analysis

**Figure 2:** A schematic overview of the ME&Sh(Ire) Research Structure outlining the three independent data sources for this study (1. Questionnaire, 2. ME&Sh(Ire) H2020 Survey and 3. Structured Interviews; located within the emboldened boxes), leading to an integrated narrative with two internal data validation exercises. The mixed methods instruments, and their interactions, are indicated.

**Ethical Considerations**

In all elements of data collection, analysis and dissemination strict ethical Institutional guidelines were upheld. The researcher was acutely aware of the position of power that was held as an ‘insider researcher’, and appropriate methodological approaches were adopted to minimise this (see **Study Delimitations**). The study was reviewed and approved by the DIT Institutional Research Ethics Committee (Approval Reference Number: 16-166).

**Study Delimitations**

This research primarily relates only to one cohort (Cohort 3) of the ME&Sh(Ire) module, and as a singular case study, no claims are made as to applicability of the framework developed in relation to other courses or to other methods of delivery. Whilst the framework may have wide-ranging applications; the system of assessment implemented in this case study is one part of a larger, systematically constructed, learning ecosystem, which is not examined here. No comparative analysis of learning outcomes was made, as the purpose of the research was to investigate and evaluate the learner perception of the utility of the assessment design in supporting their learning process. Finally, the researcher also delivered the content and
assessed the participants and thus an ‘insider researcher’ paradigm was adopted. This power relationship with the participants could lead to researcher bias and skewed data and, as such, appropriate methodology and simple additional steps were taken to minimize bias (e.g. surveys were completed anonymously and both surveys and interviews were undertaken after the assessment for the module was complete) and to enhance data conformity as part of a structured approach to data validity, reliability and research rigor. The benefit of the insider researcher role was considered an advantage to this research (Chavez, 2008).

**Research Methods**

*Questionnaire*

All participants \((n=37)\) in the MEnS(Ire) Cohort 3 (Academic Year 2016/2017) were invited to complete a questionnaire comprising thirty-nine questions. The questionnaire had previously been piloted and critically reviewed by independent departmental colleagues. The first sixteen questions related to the biographic, employment and educational status of the learner. The next eighteen related to their experience of the course, including specific reference to the use and evaluation of the webinar feedback, and were captured on 5-level Likert scale. There were three further open-ended questions, inviting participants to contribute written comments on their general experiences of the module. This will be referred to as the *Questionnaire* hereafter and those who returned a questionnaire as *Respondents* \((n=18)\).

*Questionnaire Data Validation*

The results of the Questionnaire were compared to a larger database of responses to a separate survey collected prior to this study. This data set comprised seventy-one returned questionnaires, from two separate MEnS(Ire) Cohorts (Cohort 1, \(n=34\), and Cohort 3, \(n=37\)).
In this survey there were fifty questions. The larger data set will be referred to as the MEnS(Ire) H2020 Survey hereafter, and where necessary identified as Cohort 1 or 3. Common questions in both MEnS(Ire) H2020 Survey and the Questionnaire were used for data validation purposes. Ethical restrictions arose with accessing the historical MEnS(Ire) H2020 Survey data set, as the material had not originally been collected for the purposes of this research. These ethical issues were considered by the Institutional Research Ethics Committee and permission granted, under strict conditions, to include this data set in this research. Those conditions related to the anonymization of data, the formalities of requesting access, the conditions of its use and secure data storage.

Structured Interviews
Interviews were recorded with four purposefully selected learners from the graduated Cohort 3. The purposeful selection process was based on selecting volunteers according to the initial questionnaire response and their representative nature for each professional discipline within Cohort 3 (Silverman, 2010; see Table 2). In an attempt to ensure gender balance, a second female technologist was invited to take part in the interviews, but was unable to participate during the survey period, yielding an unbalanced 1/3 ratio of female to male informants. This ratio is, however, more representative of the gender balance among construction professionals in Ireland. Semi-structured interviews, which had been piloted and critically reviewed by independent colleagues, were digitally recorded and held via telephone or Google Hangout over a three-week period. Interviews typically ranged from sixteen to twenty-six minutes each and participants were encouraged to expand on their answers throughout their interviews. The recorded interviews were manually transcribed and the data anonymized to ensure the parties involved were not identifiable. References within the
transcripts to identifiable third parties were redacted. The qualitative data set was analysed via an initial semantic, and subsequent, thematic analysis.

Data Triangulation and Use.

Initial data analysis focussed on the comparison between the questionnaire data and MEnS(Ire) H2020 Survey data, and was undertaken to check for bias in the smaller questionnaire sample. The questionnaire data were also used to select a purposeful sample for follow-up interview from among those respondents who had indicated a willingness to take part in follow-up interviews.

Findings

Quantitative data analysis; validation of the collected data set

A 49% (n=18) questionnaire response rate was noted from MEnS(Ire) programme Cohort 3; with a full breakdown documented in Table 2.

Table 2. An overview table indicating the professional discipline breakdown of the questionnaire participants. Additionally, the number, gender and discipline breakdown of questionnaire participants that engaged with the follow-up, semi-structured interviews are noted.

<table>
<thead>
<tr>
<th>Breakdown of Sample (n=18)</th>
<th>Questionnaire respondents</th>
<th>Female interview volunteers</th>
<th>Male interview volunteers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architect</td>
<td>7</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Engineer</td>
<td>7</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Technologist</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Surveyor</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

A separate survey of participants had previously been undertaken as part of a compulsory reporting condition (referred to as the MEnS(Ire) H2020 Survey; Cohort 1, n=34 and Cohort 3, n=37). Following institutional ethical approval relating to the acquisition, use and storage of this historical data, matching questions in both surveys were identified and used to compare the data sets. The findings from six similar, or identical, questions Likert-scale
questions were compared between Cohort 1 and Cohort 3 (no historical MEnS(Ire) H2020 Survey data was available for Cohort 2) to validate the data set (see Figure 3). Differences are noted between the three data sets; however, in all questions display an overall trend of the positive sentiment outweighing the negative was observed (see Figure 4).

The online Summative Assessments were an effective means of consolidating learning as the module progressed. The live webinar format used for group feedback was helpful in correcting misunderstandings and clarifying online learning. The Google Forms used for formative assessment were helpful in showing me how I was progressing in my learning relative to other students on the course. The online formative exercises were an effective device for focusing learning. The course material was relevant and useful to me in my profession. The module was attractive to me because it was based on EU directives and national energy performance targets. The module was helpful in showing me how I was progressing in my learning relative to other students on the course.

**Figure 3:** An example of six of the comparable questions common to both the Questionnaire and the MEnS(Ire) H2020 Survey. The bar charts show the responses to the Questionnaire (n=18) based on a 5-point Likert scale: 1: Strongly disagree, 2: Disagree, 3: Neither agree nor disagree, 4: Agree, 5: Strongly agree.

**Figure 4:** Mapping of percentage positive (agree and strongly agree) learner sentiments expressed to questions that were common to, or similar in, all three modes of qualitative data collected based on Likert 5-point scale.
When plotted the data trend is consistent, indicating a similarity in perceptions expressed. The webinars are clearly identifiable as less supportive of learning than other aspects of the MEnS(Ire) programme. Data triangulation, using reflective journaling by the researcher and purposefully sampled semi-structured interviews, was employed to balance the possible bias introduced by the self-selecting nature of the questionnaire responses. Such surveys may attract participants who were polarised in their response (i.e. those that were very satisfied or those that were less than satisfied; Sax, Gilmartin & Bryant, 2003).

*Qualitative data analysis; addressing sampling bias*

Initial semantic sentiment analysis of the four semi-structured interview transcripts was conducted to identify emergent areas for exploration in a subsequent detailed thematic analysis (Boyatzis, 1998). The data were annotated and arithmetically counted to record instances of positive or negative sentiment expressed in relation to the central topic aligned to the underpinning research question, the webinar feedback process; and three related sub-topics; i) the course structure, ii) the formative exercises, and iii) the summative assessments. Other topics present in the data, for example the use of the Google Community, were annotated for consistency and to ensure no part of the data set was excluded (see Figure 5). The resulting filtered semantic analysis was tabulated and recorded as a count of the negative and the positive sentiments expressed under each of the four criteria. The sum instances of negative and positive sentiments yielded a relative rating for each criterion. Although relating to a different sampling methodology (volunteered written questionnaire response, rather than transcript of interview) the analysis allows for overall trends in the data to be compared, and therefore confirm the purposeful sample approach employed produced a representative sample via comparison to an arbitrary scale.
Semantic analysis of survey and interview data

Figure 5: Histogram of informant and respondent sentiment. The values are derived from the sum of positive (+1), negative (-1) and neutral (0) sentiments expressed using a manually coded sentiment analysis of structured interview transcripts. The long-form questionnaire data was coded in the same way to generate a comparison and confirms the webinar as the least popular of the four components analysed in both interview and questionnaire datasets.

The interview participants (n=4) collectively rated course structure most positively, the formative exercise next, the summative assessment next and webinar least favourably. The same pattern was established in the questionnaire data. The analysis is not sufficiently robust to draw any conclusions beyond that overall ‘order of merit’ rating and that both structured interview and questionnaire data sets agree. The initial sentiment analysis suggests that the purposeful sample is sufficiently representative of the respondents to the questionnaire to be worthy of further analysis via a deeper thematic analysis approach.

Qualitative data analysis; exploration of key emergent themes

Braun and Clarke’s (2006) six-step approach to thematic analysis was employed to examine and interrogate the interview data in depth. This approach led to two key emergent themes related directly to the research question and are discussed in detail below.
Theme One – Time Constraints

Time constraints were a consistent theme and were negatively experienced by all participants. Furthermore, time constraints underpinned other themes, for example, the need to have assessments and webinars timetabled was perceived as an intrusion into family time. Having fixed points in the timetable; whether for live webinars, in-college workshops or time-limited online assessments were considered an inconvenience. This is despite these events being scheduled outside of normal working hours, on weekday evenings. All the participants interviewed were in full time employment; two had multiple employments in part-time education and in practice. Three of the four referred to childcare issues as an additional time constraint. All informants valued the ability to access the recorded webinars and lecture materials asynchronously via online recorded video, with some referring to using mobile phones for this activity.

Theme Two – Broadband Connectivity

Broadband connectivity issues emerged as a key theme of interest during thematic analysis and directly relates to the research question. Most of the learners on the programme were not based in Dublin or a regional city, and the quality of broadband outside of these urban areas is unreliable. In contrast, Dublin City and other cities in Ireland have very good broadband services available (Department of Communications, Climate Action and Environment, 2016). However, the qualitative data analysis was surprisingly uniform: a majority of learners experienced broadband issues, regardless of their location. When asked if they had experienced broadband issues the following response was typical:

“Yes, I did. A lot. The webinars on the Wednesdays, in particular the [redacted] ones, were very bad, so that in the end I was just putting in a lot of effort to have one hour
available - in a critical time for family - and then at the end of the hour we were still trying to connect. So, this was really the biggest problem.” (Surveyor)

This strong thematic trend was somewhat masked in the questionnaire data given that the main connectivity issues focused on an elective component, which was delivered remotely by a tutor who was located in an area of poor broadband connectivity.

Whilst relating to the broader learner experience, broadband issues, are outside the focus of this paper; however, a functioning broadband connection is a prerequisite to the coherent delivery of online courses (Philip, Cottrill & Farrington, 2015). More generally, it may be that the underlying broadband difficulties were responsible for exaggerating time pressures noted in Theme One;

“… a lot of effort to have one hour available …”

and this exaggerated the relative unpopularity of the webinars

“… webinars … were very bad …”

Conclusions

In this investigative case study, the findings indicate a strong learner support for the method of delivery, as well as the formative and summative assessments (i.e. Google Forms with multiple choice and open submission answers). However, the support for the webinar based feedback approach (i.e. a webinar with Google Forms aggregated results screen-sharing and discussion) was not as well received, with the primary reasons being poor broadband connectivity and timing. These impacted the learner experience of the interactive webinar delivery, and compromised student perceived benefit and was, therefore identified as an issue that needs to be resolved in the future delivery of the module.
In order to support a flexible approach to learning, the need for asynchronous delivery (i.e. synchronous webinars supplemented by recorded video lectures and webinars) was considered important to allow learners to manage their studies in the context of busy working lives. Fixed timetabled elements, such as webinars and timed-assessments were, for some, an unavoidable imposition rather than an attractive feature allowing for shared learning. This indicates that the needs of already highly motivated independent learners are different to those of learners who would benefit from the community of fellow learners. The social media functionality of the Google Suite means that mobile access to webinars, course materials, assessments and the online community is seamless despite the MEnS(Ire) module being the first experience of social media some participants.

Overall, this cloud-based mobile technology holds benefits for both learners and tutors. For example, the delivery mode allowed important parts of the programme to be delivered by expert tutors located in outside the country. Furthermore, students submitted formative exercises whilst travelling or on holiday, with at least one using a mobile phone for such activities. A follow-on paper will examine in depth the online formative and summative assessments; however, in brief they were found it robust, popular with learners and supportive of learning.

The building professions are notoriously unrepresentative of wider society and thus andragogy holds potential for reaching out to under-represented groups. Within this professional group, those that take time out of their career for family or other personal reasons are particularly at risk of losing the latest professional competencies. Online, collaborative learning, enabled by appropriate connectivity and sympathetic scheduling, will empower building professionals to upskill in key areas, such as NZEB, and successfully
return to their professions in later life. Finally, given the large pool of technically competent people required to deliver NZEB, which far exceeds the capacity of the existing building professions, there may be no other approach capable of delivering on the ambition of the Energy Performance of Buildings Directive.

**Further Research**

The impact of broadband connection quality on learning outcomes, as noted in this study, warrants further research. The impact is pervasive within this study, but is most problematic in learner interaction with their learning materials, tutors and their interaction with fellow learners, particularly in the synchronous webinars. Research to establish the minimum acceptable threshold for broadband connectivity would be important.

This model of delivery is particularly successful in up-skilling building professionals that had taken time out from their profession, in NZEB and therefore warrants further research, possibly in consultation with representative professional bodies. It holds potential for integrating professionals in many different building professional fields back into the labour market after a career break.

The learning ecosystem outlined in this paper has application in many different disciplines and modes of delivery. It can be adapted in response to continuous feedback from the student and tutors resulting in continual innovation. Future, on-going, action research would benefit from carefully designed comparative studies and, particularly, longitudinal studies; however, the rapid pace of change in online delivery may present a challenge in the design of such studies.
Recommendations for Practice

1. Any educational institution intent on providing online upskilling to professionals will need to ensure that its technical infrastructure is in place and adequate to deliver upload speeds sufficient to stream video to the web. This research finds that any digital infrastructure is only as good as its weakest link.

2. Care needs to be taken to externally align graduate attributes with the needs of the market and then to internally align learning outcomes with assessment methods to underpin the learning contract. Gibbs and Simpson’s Eleven conditions (2004) were found to be particularly helpful in designing the internal alignment and could be more widely used in the design of assessment in postgraduate education.

3. Reverse-engineering of the course contents and delivery methods will be required in the conversion of existing courses to online courses. Part of this optimisation is the requirement of a form of assessment that achieves high levels of learner acceptance in order to achieve high levels of student retention. It is not a case of replacing physical paper assessments with online assessments.

4. Assessment processes in deliberately designed online courses are amenable to the use of artificial intelligence and machine learning to identify the person taking the assessment, ensure the validity of the assessment process and to impartially and efficiently assess student performance. Although not deployed in this research project, these technologies hold the prospect of overcoming the time intrusion of assessment, which was perceived to be particularly intrusive by the professionals undertaking this upskilling.

5. Finally, a more discipline-specific recommendation. The professional upskilling imperative necessary to achieve the ambitious energy performance standards of European Union policies cannot be delivered in time using the existing professional
educational infrastructure. Further research is required to identify the threshold concepts involved and to develop strategies to overcome existing professional silos, technological unfamiliarity and upskilling cost, all of which currently stand in the way of delivering the EU climate change targets.

Data Availability
The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest
The authors declare that there is no conflict of interest regarding the publication of this paper.

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Supplementary Materials
There are no supplementary materials.
References


