How to sustain a centralised approach to learning design

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Innovative changes to online teaching practices are becoming increasingly important with the rise of e-learning across the higher education sector. Such innovations ideally become part of teaching repertoires rather than reverting to prior approaches. This study investigated the sustainability of a centralised approach to online learning design. Of the 74 survey respondents, more than 70% described changes to their teaching or work practices, uptake of learning design tools or development of student-facing materials, and these changes were mostly reported as sustained. Changes to system-level supports were less common and less likely to be sustained. Free-text comments highlight the importance of adaptation, collaboration and iteratively developed learning design templates. These provide guidance on how to promote sustained changes to online teaching practice.

Implications for practice or policy:

- Outcomes for sustained changes to online teaching practice can be improved through innovations that are adaptable and collaborative and build educator capability.
- Learning design templates and resources can guide educators to develop their online teaching practice while allowing flexible and iterative implementation.
- Sustained changes to online teaching practices may be impeded by aging student-facing materials, withdrawal of support and unfeasible workloads.

Keywords: online learning design, sustainability, innovation, e-learning, higher education, qualitative

Introduction

The longstanding concern with sustaining online teaching innovation has renewed relevance as universities consider how to continue valuable institutional pandemic-initiated approaches to online teaching. Sustained changes to educational practice cannot be taken for granted. There is a tendency for innovative teaching practices to revert to previous modes of *business as usual* (Kottmann et al., 2020; McCowan et al., 2022; Offerdahl & Tomanek, 2011). Indeed, scholars have noted that digital innovations

in teaching can cement old educational ideas rather than producing new ways of working (Bearman et al., 2020; Selwyn, 2014). Ensuring that innovations are sustained over time is therefore necessary to ensure that the benefits of a particular project are not lost.

Research into sustaining online educational practices is several decades old. For example, about 20 years ago, Littlejohn (2003, p. 90) reported on the "Supporting Sustainable eLearning Forum" in the United Kingdom. A decade later, Stepanyan et al.'s (2013) review into sustainable e-learning categorised research into three domains, with research endeavours focusing on (a) resource management, such as cost-effectiveness and efficiencies; (b) educational attainment, in particular student success indicators such as attrition or skill acquisition; and (c) professional development, such as teacher development or cultural change. These are all clearly interconnected, but we suggest that the most significant marker of sustainable online teaching is sustained changes to teachers' educational practices. This is underlined by Sidhu and Gage's (2021, Abstract) recent study, which employed staff engagement as an indication of "adoption of teaching innovation over the long term" and concluded that faculty perceptions are as significant as institutional culture in sustaining e-learning adoption. However, this is a rare example of recent work. The current sustainable e-learning literature tends to focus on conceptions of environmental or social sustainability (Alharthi et al., 2019; Hamadi & El-Den, 2024), rather than educational concerns. Given the increasing shift to online learning post-pandemic (Guppy et al., 2022) and associated demands for greater investment in e-learning (Batanero et al., 2022), there are calls for more effective educational practices (Guppy et al., 2022). This requires a knowledge of what enables teachers to adopt innovative online educational practices and discourages them from returning to previous approaches.

The current study explored how a centralised approach to online learning design was sustained, with an examination of teaching practices after 4 years of a 5-year programme of institutional investment. We investigated what was sustained and how and why teachers may have chosen to continue or discard new approaches.

Conceptualising sustainability

Sustainability is a slippery term which has been understood in many ways. The change management literature discusses "diffusion of innovation" (Katz et al., 1963, p. 237), while from a teaching and learning regime perspective, sustainability is a practice-based approach occurring at a departmental level (Trowler & Cooper, 2002). Writing from the health sector, Scheirer (2005, p. 320) has conceptualised sustainable innovation with respect to programme funding: "What happens after the initial funding for new programs expires? Do the programs continue or end their activities or even expand to new sites or new beneficiaries?". Moore et al. (2017) have suggested that sustainability implies that changes can continue to occur, as long as they continue to produce benefits; and Greenhalgh et al. (2004) have suggested that ongoing adaptation by individuals, rather than rigid adherence to the original innovation, may be an indicator of sustainability. For the purposes of this paper, we define sustainability of a teaching innovation to be persistence past the initial "intervention", including how the innovation evolves within and beyond its original focus.

We conceptualise three aspects of a teaching innovation which may be sustained. We firstly consider how material artefacts that were made as part of the teaching innovation can be sustained through continued use. This includes both learning design tools such as templates or software, and student-facing unit materials (sometimes called subject materials) such as unit (or subject) content sites within the learning management system (LMS) and interactive resources. Next, we consider the teaching practices that are changed alongside the innovation – new principles or approaches adopted as a consequence of the innovation – while recognising that sustaining practice might occur differentially depending on staff role. Finally, we consider how the supports can be sustained; that is, the organisational structures surrounding the innovation, such as funding or staffing support.

The context of the innovation: A centralised approach to learning design (CloudFirst)

The CloudFirst project is a large-scale institutional project that provided a centralised approach for learning design within a large Australian university. As described elsewhere (Elliott & Taylor, 2019; Fox et al., 2021; Taylor et al., 2022), CloudFirst introduced a specific learning design: "an online curriculum spine consisting of a sequenced package of content (e.g., videos and teacher-generated text) interleaved with learning activities (e.g., quizzes and discussions) that were complemented by either synchronous online or on-campus active learning classes" (Elliott & Taylor, 2019, p. 179). The CloudFirst project commenced in 2018 as an evolution of a previous large-scale learning design intervention (see Bearman et al., 2021). It was funded for 5 years, concluding in 2022. Its initial introduction followed a deliberate grassroots engagement change management process, including introductory workshops followed by a structured co-design process. A central team of educational designers, academic developers, project managers and digital resource developers worked in partnership with faculty academics. To give an idea of the scale, in 2019 alone, there were over 12 staff working in this central team; numbers and composition changed from year to year.

The project was centrally funded and institutionally supported by the University Executive. Initially, the focus was on changing a single unit's content for immediate delivery, with dedicated support for the first release. Across the lifespan of the programme, the project team worked with over 100 staff across 16 courses, redesigning over 70 units; although in the first year of the pandemic, 2020, resources were diverted elsewhere to support the emergency remote teaching requirements. Over time, the CloudFirst project expanded to include staff capability-building. Significant resources were developed to teach the educational principles underpinning CloudFirst (Taylor & Elliot, 2020) and promote the use of the learning design templates directly to faculty academics, to encourage use beyond the immediate remit of the central team.

Methods

This study employed a staff survey to examine how the CloudFirst project was sustained over 4 years of its existence. We drew from a larger project investigating sustainability, which included one-to-one interviews, a literature review and the same survey addressing other, smaller, innovations. These are not reported here. Ethics approval was granted by the Research Ethics Committee of the participating institution (approval 21-162).

Participants

Within the larger project outlined above, we sought to contact all staff who were still employed within the institution. To give a sense of the scale, 723 emails were sent in total. Participants were identified in diverse ways. Central team participants with continued formal roles in CloudFirst were invited by a junior administrator, with permission from the CloudFirst governance structures. Faculty academics, such as lecturers, tutors and educational specialists, were identified either through their formal involvement or through their enrolment in the capability-building resources housed on the LMS and invited by a junior administrator. Participants could also invite other colleagues who might share involvement or interest. Thus, the faculty academic participants included those who were formally involved in the project, but also those who chose to employ CloudFirst resources and apply them to a unit beyond the remit of the project. Due to the snowball enrolment nature of the survey distribution, we cannot describe a response rate.

Survey design

Sustainability was initially conceptualised as comprising the following four facets: teaching sustainability, materials sustainability, structural sustainability and student sustainability. The survey offered different options depending on whether a participant was from the central team or a faculty academic, and whether they felt their practice had changed. Staff noted that they could not meaningfully comment on how students sustained learning beyond a unit, so we do not include this aspect. We thus outline below

three facets – teaching, materials and structural sustainability – and which participant groups were invited to respond.

Teaching sustainability
This facet considers perceptions of the extent to which staff sustained changes to their practices due to their engagement with CloudFirst. We report this from two perspectives:

(1) faculty academics' perceptions of changes to their teaching practices and the extent to which this change was sustained; and
(2) the central team's perceptions of changes to their work practices and the extent to which this change was sustained.

Materials sustainability
This facet considers perceptions of the extent of:

(1) faculty academics' adoption of new learning design tools, such as templates or software, and the extent to which this was sustained beyond the initial development; and
(2) faculty academics' development of new student-facing materials as part of the CloudFirst project and the extent to which these were sustained beyond the initial development.

Structural sustainability
This facet considers perceptions of faculty academics about how structures such as human and physical resources changed, and to what extent these were sustained beyond the initial development.

Respondents were asked, with respect to the above, the following items:

(1) a question about whether they had changed their practice, with possible responses of "yes", "no" or "unsure";
(2) an open-ended invitation to describe how they had changed their practice;
(3) Likert-scale items about how changes to the practice were sustained, with a Likert scale of *strongly agree*, *agree*, *neither agree nor disagree*, *disagree*, *strongly disagree* and *not applicable* (these items are reported in full in the results); and
(4) an open-ended invitation to add any other comments on the sustained nature of these changes.

Data analysis

The relevant subset of survey responses – those provided by faculty academics and central team members regarding the CloudFirst project – were extracted from the broader survey data set. For each perspective identified above, we reported the percentage that described some change to practice. Open-text responses regarding the nature of this change were then de-identified and thematically analysed by PM following Patton (2002), by which we mean inductively seeking overall patterns of response. We clustered the Likert scales into what we call "% favourable"; we took as the numerator the combined numbers of *agree* or *strongly agree* responses and divided this by the overall response rate for that particular item. We again used thematic analysis to group open-text responses regarding the sustainability of the change. Where possible, we employed respondents' own quotes to represent these thematic patterns.

We calibrated this analysis by comparing this item-specific response against an overall thematic analysis by BF, which sought patterns across all the responses and within the raw data.

Results

For the survey subset concerned with the CloudFirst project, there were a total of 74 responses – 52 faculty academics and 22 central team members. The spread of academics across faculties was relatively even, with 11 from Arts and Education; 14 from Business and Law; 14 from Health; 12 from Science,

Engineering and Built Environment; and one who worked across multiple disciplines. It was more common for central team members to work across multiple disciplines, with 14 respondents indicating this work practice, while four central team members were from Arts and Education and four respondents did not indicate their faculty. Faculty academics also reported the number of trimesters they had been involved with CloudFirst (Table 1). Most respondents had been involved with the project for 1 or 2 trimesters, with a small number involved for 9 or more trimesters; four declined to provide an answer.

Table 1
Number of trimesters of involvement with CloudFirst by faculty academics (n = 52)

Number of trimesters	Number of responses
1	10
2–4	30
5–7	2
8–10	4
More than 10	2
No answer	4

We present each area of focus in terms of whether the respondents enacted some kind of change as a consequence of CloudFirst, followed by how relevant participants reported such changes were sustained. We follow this with an overall thematic analysis across the data set of enablers and barriers to change.

Faculty academics: Uptake of new teaching practices and how these were sustained

There were 42 faculty academic respondents to this section of the survey. A total of 83% (35/42) reported that their teaching practices changed following engagement with CloudFirst, while the remainder were unsure or reported that their practices had not altered. Comments centred around improved facilitation techniques, evolved unit or course structures, new digital learning materials and enhanced teaching principles. Academics described growing awareness of "good practice for assessment, unit site layout and providing information", as well as "organis[ing] content differently" and changing "the way lectures and seminars are used".

Of these 35 faculty academics who reported taking up new online teaching practices, many continued to answer questions about how they sustained this change. Reponses ranged from a maximum of 30 participants to a minimum of 28 participants (or 54% of the total respondents who responded to the question about uptake of change and 80% of those who reported a positive uptake) – see Table 2.

Table 2
Sustained use of new teaching practices by faculty-based academics

Item	Favourable (strongly agree + agree)
I have or would like to return to many of my original teaching practices	18% (5/28)
I have changed my overall approach to teaching other units or courses, following enhanced or new teaching principles promoted by the project	66% (19/29)
I have significantly adapted teaching practices based on those promoted by the project	59% (17/29)
I continue to use most of the new teaching practices promoted by the project	93% (28/30)

Academics reported that changes to their online teaching practice were largely sustained following their involvement with the project, with less than a quarter of academics reporting that they wished to revert to previous practices. Academics described presenting content in "new ways" and via "new technologies" such as video resources, interactive polling and collaborative online spaces. Academics also reported a

shift to facilitation practices that enhanced student engagement and "help[ed] students to be proactive learners". The project's lasting impact was summarised by one academic as a "[n]ew philosophy of teaching online".

Although academics were broadly positive about the ongoing impacts of their engagement with the project on their teaching practices, many also noted that the project's learning design principles were not entirely novel for them. Many academics reported that pre-existing knowledge or skills had supported them in implementing changed teaching practices. As one academic observed, "these changes are influenced by broader factors [than the project]". Additionally, there were notes of caution around the sustainability of changed teaching practices: for instance, that changing teaching practices "took enormous amounts of time", often beyond workload allocations, and that they received insufficient support from the central team to develop their teaching or learning design.

Central team: Uptake of new work practices and how they were sustained

There were 22 central team respondents to this section of the survey. A total of 86% (19/22) reported that their work practices changed following engagement with CloudFirst, while the remainder were unsure or reported that their practices had not altered. Changes for the central team included new ways of creating digital learning materials and expanding teaching principles. Members of the central team described acquiring "new ways of creating digital learning materials". Project staff referenced a range of new teaching approaches – from design thinking and constructive alignment to students as partners – and reported "enacting new principles" of teaching and learning design. This development of new work practices was not seen as one-time or static, but rather as "constantly evolv[ing] with each subsequent iteration of the project".

Of the central team respondents who reported taking up new teaching practices, many continued to answer questions about how they sustained this change. Responses ranged from a maximum of 15 participants to a minimum of 14 participants (64% of the total respondents who responded to the question about uptake of change and 74% of those who reported a positive uptake) – see Table 3.

Table 3
Adoption and sustained use of new work practices by central team

Item	Favourable (strongly agree + agree)
I prefer my own way of doing things rather than the approaches within the project	0% (0/14)
I have significantly adapted my approach to teaching and learning, based on participation in the project	87% (13/15)
I continue with most new work practices	87% (13/15)

Central team respondents commented positively about the long-term impacts of the project on their work practices. Enhanced collegiality and collaboration, both within the central team and across the institution, was identified by several members of the central team as influencing changed work practices. Central team staff deeply valued their central team colleagues, reporting on "amazing support" within the team. The central team also recounted "making new connections" and described the project as "help[ing] to bridge the two worlds" between professional and academic staff within the central team. Processes were also identified by several central team members as being "constantly refined" or "customised"; as a central team member noted, "There is no one size fits all model".

Faculty academics: Development and sustained use of student-facing materials

There were 43 faculty academic respondents to this section of this survey. A total of 88% (38/43) reported that they had changed their student-facing materials following engagement with CloudFirst, while the remainder were unsure or reported that their materials had not altered. Student-facing materials

developed for the project were primarily unit site redesigns, based in the LMS. Alongside broad redesigns of unit sites and learning activities, newly developed teaching materials included the integration of media such as videos, podcasts and interviews with industry experts; the addition of interactive learning activities such as live polling and quizzes; and updated content presentation. In reference to these newly developed materials, one academic reported that their team had "added in excess of 100 digital interventions in our course".

Of the faculty academics who reported changing their student-facing materials, many continued to answer questions about how this change was sustained. This ranged from a maximum of 34 responses to a minimum of 30 responses (70% of the total respondents who responded to the question about development of student-facing materials and 79% of those who reported developing new materials) – see Table 4.

Table 4
Sustained use of student-facing materials

Item	Favourable (strongly agree + agree)
The materials did not continue to be useful past the initial period of my engagement	17% (5/30)
I adapted the materials developed as part of the project and continue to use these adaptations	90% (27/30)
I continue to use teaching materials developed as part of the project without much change	82% (28/34)

Although the responses in Table 4 suggest the continued usefulness and ongoing adaptation of student-facing materials developed during participation in the project, evidence of sustained use of the materials was less apparent in open-text responses. For instance, academics recognised that "adjustments" and "[m]aintenance" of materials would be required, noting that "[t]his is always the case with learning materials" or that they had "intentionally designed [materials] to have a 'long shelf life'". Similarly, concerns around sustainability were flagged by the small number of academics who reported challenges in implementing project-aligned student-facing materials in their units. The concerns cited often looked forward to future scenarios: for instance, incompatibility with on-campus delivery, insufficient workload allocation and media resources quickly becoming outdated.

Faculty academics: Uptake and sustained use of learning design tools

There were 47 faculty academics respondents to this section of the survey. A total of 72% (34/47) reported adopting new tools, platforms and templates offered by the CloudFirst project. This included uptake of new templates for unit sites and/or planning worksheets. For example, one academic reported "I used templates (unit design template, activity sequence template, content template) to help me structure and organise my learning materials (and my thinking)". There were reports of using new software tools – for example, tools that supported shared visualisations or building interactivity. There were also negative responses; for instance, academics commented that they preferred alternative software or had found templates either too difficult to use or too simplistic.

Of these faculty academics who reported taking up new learning design tools, many answered at least one question about how or if this change was sustained. This ranged from a maximum of 30 responses to a minimum of 27 responses (57% of the total respondents who responded to the question about uptake of change and 79% of those who reported a positive uptake) – see Table 5.

Table 5
Academic adoption and sustained use of tools, platforms and templates

Item	Favourable (strongly agree + agree)
The platforms or templates did not continue to be useful past the initial period of my involvement	15% (4/27)
I have adapted platforms or templates developed for this project and continue to use these adaptations	85% (23/27)
I continue to use platforms, templates or resources developed for this project without much change	70% (21/30)

Participants described sustained use of tools, platforms and templates beyond their formal involvement in the project. Academics reported that the resources offered by the project were a "[g]reat way to transform and update [their] unit" and that "design and templates" had been "incorporated into my unit sites over time".

Faculty academics: Perceptions of changes to systems, supports and structural resources and whether these were sustained

There were 41 faculty academic respondents to this section of the survey. A total of 63% (26/41) noted that new system-level resources were provided. Respondents noted the provision of technical assistance to design content – such as video production and editing, graphic design, or support with interactive learning elements and interfaces – as a key support. Academics also acknowledged the central team for their "amazing" support and encouragement.

Of these faculty academics who reported new system-level resources, most continued to discuss how these had been sustained. This ranged from a maximum of 24 respondents to a minimum of 23 respondents (56% of the total respondents who responded to the question about uptake of change and 88% of those who reported a positive uptake) – see Table 6.

Table 6
Provision and sustainability of systems, supports and structural resources reported by academics

Item	Favourable (strongly agree + agree)
There are now insufficient systems, supports or resourcing to continue with how the project was or what I'd like to do	46% (11/24)
Systems, supports or resourcing has changed but I'm satisfied with their current level in terms of supporting my teaching	57% (13/23)
Systems, supports or resources will continue as they were in the project into the foreseeable future	46% (11/24)

Academic staff highlighted difficulties in accessing support once their formal engagement in the project had ended. Academics described this support as "one-off", "reduced dramatically" or initially excellent but now "baseline and in some cases none". There was a preference for guidance above resources, for example, a wish for "personal guided support and time … (NOT multiple videos that have to be found and watched to self-learn)". Academics cited staffing changes and "loss of capacity" as reasons for the reduction in support provided by the project.

Discussion

This study considered the sustainability of changes made by academics when engaging with a centralised teaching innovation promoting well-designed, interactive online teaching. It investigated how online teaching practice was sustained past the initial intervention: most of the academics who had been teaching on the CloudFirst programme had done so for two or more iterations. More than 70% of

respondents described changing their teaching or work practices, student-facing materials or learning design tools. Of those who changed their practice, most sustained these changes in some way. For example, there was a 93% favourable response rate from faculty academics who responded to the question about sustaining changes to their teaching practice. However, only around 60% of respondents reported new structural supports; these respondents were also much more ambivalent about how such supports had been maintained, although a majority felt that these were sufficient to continue with their work. Thus, our findings describe a centralised online teaching innovation that was strongly sustained in terms of what people did and the materials that they made, but less so with respect to the systems, supports and resources underpinning these changes. Moreover, we note that sustainability here included an evolution beyond the project. Survey responses indicated that academics were adapting teaching practices and templates. A majority of those who reported sustaining new approaches to teaching also indicated that they "changed [their] overall approach to teaching other units or courses, following enhanced or new teaching principles promoted by the project". That is, they not only sustained their teaching practice in their original units but they also disseminated it further to other aspects of their teaching, particularly employing the learning design tools to enhance additional unit sites and activities.

What characteristics of the innovation supported this sustainability? We describe the practical enablers in Table 7. Key insights are both reflected by the broader literature and offer original contributions from this study. Firstly, participant responses reflected the emphasis on the evolving nature of the innovation. This aligns with Greenhalgh et al.'s (2004, p. 596) proposal that "reinvention" is an integral part of sustainability that it allows adaptation to local contexts, which is echoed in other studies of educational innovation (Foote, 2016). Secondly, there was a sense, particularly from the central team, of a highly collaborative interdisciplinary approach: "bridging of the two worlds". This emphasis on teamwork and collaboration reflects other studies of sustainable innovation in higher education (Kiteley & Ormrod, 2009; Treleaven et al., 2012). What is most striking about this project, however, is provision of learning design materials to develop unit sites and, through these, educator practices. The templates and resources were made available both through focused support but also through a programme of capability-building. Thus, there was a means to operationalise the presented teaching principles, and this allowed, as a participant described, the new design approach to be "incorporated into my unit sites over time". This suggests that such templates are at the right level of granularity to allow lecturers to contribute their own ways of thinking (Bearman et al., 2021). A combination of the deliberate strategy of focusing on capability-building, iteratively and collaboratively adjusting templates and materials to suit staff, and an investment of over five years may therefore be the fundamentals that support sustainability. The time length is, we suggest, significant: without it, the programme cannot collaboratively adapt to and evolve with participants.

Participants also reported factors impeding sustainability (see Table 7). There were concerns about the aging of student-facing materials; these seemed to run alongside reports of the insufficient nature of ongoing support. In addition, for some, the imposition on workloads appeared unfair, if not unsustainable, with reports it took considerably more effort than time allocated. Moreover, not all academics were happy with self-guided learning once the investment receded. There was a sense of discontent with the withdrawal of supports, such as video production or one-to-one learning design development, and, some viewed online training resources and templates as an inadequate replacement for previously accessed intensive support.

This study highlights additional questions about teaching innovation and sustainability. Firstly, staff reported that they came with pre-existing skills, particularly in online teaching, which could be built on. This suggests that it may be helpful to focus on those who have an interest in innovating and to recognise pre-existing knowledge – but it also provides the challenge of how to disseminate innovation beyond those who are already enthusiastic. Secondly, the findings highlight the potential value of capability-building. We can speculate that one of the successes of capability-building in this programme, which appeared more effective than a typical faculty development programme, is that staff were working on something as a piece of work. This resonates, to use community of practice parlance (Wenger, 1998, p. 77) as a "joint enterprise". As Wenger (1998, pp. 77–78) suggested, such joint endeavours include a

"collective process of negotiation"; it "belongs to [the participants] in a profound sense"; and there are "relations of mutual accountability". Thus, developing future online teaching practices may be promoted by an academic development process, through a process of collaboratively working with experienced learning designers on student-facing materials, that requires commitment from both parties. Finally, this study underlines the challenges of workload and resourcing. At the time of survey, this programme was in its last phases; some who responded to the survey would have had no direct support, but the programme was still in existence. It remains to be seen how much has been sustained, and in what form, years down the track.

Table 7
Summary of practical insights

Enabling preconditions (common to many such projects)	Enabling factors specific to this project	Limiting preconditions (common to many such projects)	Limiting factors specific to this project
• Institutional support • High levels of resourcing • Clear vision as learning design-led intervention	• Length of time • Collaborative emphasis • Iterative approach to templates • Capability-building	• Heavy associated workloads • Insufficient support (i.e., for academics to make videos or interactive elements themselves)	• Aging of materials without means of revising • Academics wishing for support to continue rather than developing their own capabilities

Limitations

Given the number of people who were directly and indirectly involved in CloudFirst, it was not possible to calculate a population size and thus a response rate. However, given our knowledge of its uptake, we regard the response rate of the central project team as almost complete, and of the faculty academics as being a sizeable, if not an enumerable, proportion of eligible staff. Approximately 20% of respondents had used CloudFirst only for 1 trimester and thus were less able to comment on sustained practices. Due to the limitations of any survey approach, reasons for sustaining practice are based on self-report and interpretation rather than observation, and without student perspectives we cannot discuss impact on learning. However, we balance this against a carefully conceived notion of sustainability, separating out materials, practices and resources, and a survey that distinguished between practice change and sustaining this change.

Conclusions

Sustaining change to how academics conduct online teaching requires more than set and forget. The analysis in this paper presents evidence to support the contention that investment in improving online teaching can lead to sustained change, particularly with respect to student-facing materials and use of learning design tools. Key features appeared to be investment over at least 4 years, with an approach that promoted iterative adaptation and collaboration, and through engaging with staff who are already knowledgeable about learning design. We suggest that adjusting templates and resources to suit faculty may be particularly useful in promoted sustained changes to online teaching practices. There are still some challenges that remain, including oversized workloads and sustainability without ongoing investment; respondents underlined challenges in sustaining changes at system, support and structural resources level. However, if future work deliberately targets sustainability, it may be that these challenges can be met.

Author contributions

Margaret Bearman: Conceptualisation, Investigation, Writing – original draft, Writing – review and editing; **Paige Mahoney:** Formal analysis, Writing – original draft, Writing – review and editing; **Harsha Chandir:** Conceptualisation, Data curation, Investigation, Writing – review and editing; **Christine Contessotto:** Conceptualisation, Investigation, Writing – review and editing; **Matthew Dunn:** Conceptualisation, Investigation, Writing – review and editing; **Fiona McKay:** Conceptualisation, Investigation, Writing – review and editing; **Brandi Fox:** Formal analysis, Data curation, Investigation, Project administration, Writing – review and editing.

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