Flexible hybrid format in university curricula to offer students in-subject choice of study mode: An educational design research project

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Abstract

In a digital era where people may experience seamless control in determining their interactions with the world via analogue and digital modes, this paper challenges the need for a university-determined position on whether study need be designated as on-campus, online, or a predetermined mix of each. In a university in Australia, several subjects were designed in a flexible hybrid format where students were offered flexibility to create their own learning pathway via online or on-campus mode, changing as it suited and regardless of their original enrolment mode in the subject. The curriculum model was conceptualised and deployed using educational design research, involving three designed and taught subjects and a further two designed-only subjects (i.e. not yet taught) to help test the concept in contrasting contexts. Insights on the new model were gained from participating teachers, their students, and online analytics. Using the experiences of the trial as the basis of this discussion paper, one practical step and its related challenges are shared in working toward a hybrid pedagogy, with associated design principles extrapolated.

Keywords
higher education, flexible hybrid curriculum, personalisation

Introduction

The potential of hybrid learning is being increasingly recognised. Expectations for advancing hybrid learning experiences in higher education persist because of advancing technologies and "the teaching opportunities that they provide to instructors and the designers of the student learning experience" (Alexander et al 2019, p. 36). A recent EDUCAUSE report on technology trends in higher education positions the concept of hybridity as both an old and an emerging concept. This concept encapsulates the longstanding human ability to aggregate the virtual (unseen) and the actual as well as emerging educational experiences that blur differences when integrating physical and digital technologies (Alexander et al 2019). This aggregation tendency is especially evident among members of the current younger generation, who are less likely to view activities as different merely because the activity is digital or non-digital per se (Cormier et al 2019).

The term 'hybrid' is no longer synonymous with a blend or mix of modes in higher education, but a heterogenous single and seamless entity, a new thing (Pedersen, Nørgaard & Köppe 2018). By adding the concept of flexibility to hybrid learning, the student is in a position of choice to determine their learning journey through the physical and/or digital means on offer. Evidence of a step toward this transition is the emergence of 'flexible hybrid format' curriculum models presented in the literature. Such models provide students with choices to create their own journey through the learning spaces on offer, via online/off-campus and on-campus resources as it suits their needs. These models effectively allow students to form their own unique hybrid participation experience throughout a subject, navigating their choice of on-campus and online learning regardless of their original enrolment mode in the subject.

Notwithstanding, flexible hybrid models do not tend to currently offer the full gamut of the multifaceted pedagogical opportunities presented by hybrid pedagogy. According to Stommel (2018), hybrid pedagogy can involve intersections of physical/virtual learning spaces, on-ground/online classrooms, analogue/digital pedagogy—intersections which this paper focuses on as spatial and modal factors - but also academic/extra-academic space, institutional/informal education, machine/human interactions, use of/critical engagement with tools, disciplinarity/interdisciplinarity, performed/real selves, and more. The spatial and modal aspects of hybrid pedagogy feature in this paper specifically via the trial of a flexible hybrid format curriculum model challenging the traditional on-campus/online binary and university pre-set blends. The spatial and modal focus reflects the reality that addressing these aspects of flexible hybrid learning models are the 'low-hanging' fruit in the sense of being the easiest to test and address for potentially a very good return in terms of practical improvements for student learning. Further, given the full potential scope of the hybrid pedagogy concept is yet to be authoritatively defined and tested, any developments will need to be incremental rather than revolutionary. This is necessary in order to produce suggestions capable of being accepted and practically implemented by institutions, students and staff. As such, this paper records a further incremental step toward a hybrid pedagogy. In a broader sense, this incrementalism is also consistent with the reality that "the use of digital technology to widen the parameters of human interaction and knowledge production is still in its most experimental stage" (Morris 2018, p. 37).

Specifically, the flexible hybrid format curriculum model presented in this paper is one which was conceptualised and trialled (with the working title *StudyFlex*) in an Australian university. The trial utilised educational design research, cycles of ideation and design experiments, to create three designed and taught subjects and a further two designed-only prototype subjects to help test the concept in contrasting contexts. In presenting the responses of participating stakeholders, this paper contributes to the hybrid learning design discourse by providing practical insights into the design

challenges and potential benefits of flexible hybrid curriculum models. The results hint at the potential for such hybrid designs to create effective and powerful learning experiences through enhancing the capacity of students to access and participate in learning opportunities.

Flexible Hybrid Curriculum Models in The Literature

Although flexible approaches to learning have a long history, insofar as the choice of learning space is concerned, this has typically involved a dichotomous choice of enrolment in on-campus or distance/online learning, or a pre-determined blend of these. Historically, according to a report by The Hanover Research Council (2009), flexible or alternative learning delivery options flourished from the 1990s, with learning experiences growing in sophistication and customisation to promise innovative and effective study modalities. Notwithstanding, ten years since the Hanover report, the Open University's Innovating Pedagogy report identifies an increasing "demand for flexibility to accommodate the challenges students face in maintaining a life-work-study balance" (Ferguson et al 2019, p.30).

In response to this demand, flexible hybrid initiatives have begun to emerge. These initiatives move beyond dichotomous study mode choices and allow students to self-determine their learning pathway utilising various on-campus and online/off-campus resources. This student-driven hybridity is consistent with the approach of Pedersen, Nørgaard and Köppe (2018), who refer to hybridity as an amalgamation; not a blend but an opening of a new space - a "heterogeneous composite that combines different elements to create something other" which acknowledges "otherness and difference as something productive and of in-between spaces" (p. 229). By fostering a student-driven approach, flexible hybrid formats allow each student to create their own bespoke learning spaces, thus, "[c]hanging the locus of control from an externally perceived entity to internal for the learner" (Miller 2011, p. 451).

Various flexible hybrid formats offering this type of student flexibility are reported in Australian studies. Earlier models offered the choice to move between on-campus and distance resources to progress through a subject. For example, in a biomedical science subject at University of Sydney (Lee, Weerakoon & Lingard 2003), and in IT at Flinders University (Goodwin & William, 2004), students could variously choose between practical notes/manual, CD ROM, and on-campus or videotaped lectures. More recent initiatives add the affordances of online Learning Management Systems (LMS). For instance, a "self-determined blended learning" model in human development (education) was piloted at an unnamed Australian university (de George-Walker & Keeffe 2010), where the LMS formed a required access point accompanied by student choice from an array of activity streams, variously supported by on-campus or recorded lectures, and multiple print and electronic resources. Beyond single-subject pilot projects in Australia, Southern Cross University implemented a substantial "converged delivery" initiative in 39 subjects across eight academic schools (Taylor & Newton 2013). Students could navigate their choice of on-campus and online learning spaces regardless of their original enrolment mode in the subject.

While it appears none of the reported Australian projects have extended beyond their respective pilot phases, similar initiatives have been implemented with apparent continuity in some United States institutions. Prime examples (see Table 1) typically offer as a minimum, student choice to navigate their pathway through on-campus lectures/classes and online lecture options, such as recorded and/or live-stream access, with most also offering some nuanced digital/physical choices of participation in learning activities beyond lectures. While some U.S. projects have coined specific nomenclature, such as *HyFlex* and *FlexLearning*, generic terminology of "flexible hybrid format"

(e.g. He, Gajski, Farkas & Warschauer 2015) is deemed suitably descriptive to apply to the format of StudyFlex offered in this paper.

Table 1: U.S. examples of flexible hybrid format

Flexible hybrid nomenclature	Subject or Discipline	Institute	Reference
HyFlex	Instructional Technologies*	San Francisco State University	Beatty (2014)
(nil)	Marketing	Unnamed university, US	Robertson & Kelly (2013)
FlexLearning	Health Policy Administration*	Penn State University	Yuskauskas et al (2015)
Mode Neutral	Public Administration: Methods	University of Illinois	Miller (2011)
Flexible hybrid format	Electrical engineering	Unnamed university, Western US	He et al (2015)
HyFlex derivative	Statistics	Unnamed university, Midwest US	Miller, Risser & Griffiths (2013)
HyFlex derivative	Statistics	University of Michigan	Miller & Baham (2018)

* Involving multiple subjects in the discipline

The U.S. studies report diverse patterns of student participation, suggesting multiple variables at play and, arguably, a need for further research. For example, Beatty (2014) notes that participation in smaller classes of 15-20 students saw more than half of the cohort on-campus, a third online, a low percentage absent, and overall around 10-15% of the student cohort switching between learning spaces. In contrast, online participation dominated in larger cohorts (in the range of 1,200 students) with 80-90% joining live lectures synchronously online, only 5-10% viewing asynchronously, and a similar proportion attending on-campus (Beatty, 2014). Another United States study suggests more balanced behavioural responses. Yuskauskas, Shaffer and Grodziak (2015) found approximately 35% of students across a number of subjects surveyed attended entirely on-campus, 25% participated only online, while 40% of students combined online and face-to-face learning activities.

The U.S. research extends to some examination of the reasons and attitudes underpinning and informing student participation in hybrid study settings. Reasons reported by students to elect to study online in the face of various unfettered study mode options included work commitments, weather conditions, avoiding long commutes or rushing between campuses, accommodating scheduling conflicts with other subjects or extracurricular pursuits, other difficulties attending class, and the need for sleep/rest, or that they enjoy online options, to stay more alert/focused, to be more comfortable, or they prefer face-to-face but it is nice to have a "back-up" study option (Beatty 2014; Miller & Baham 2018; Miller, Risser & Griffiths 2013). The most common reported reason for students choosing on-campus options in hybrid study settings was a preference for direct human interaction, especially with the instructor (ibid.). Some students also reported perceiving physical presence as fostering a more engaging experience (Miller, Risser & Griffiths 2013).

The behavioural responses reported in the U.S. studies are broadly reflected in the findings of a large Australian-based survey of university students (*n*=774) by Bailey et al (2018), which examined the

study mode decisions students make when enrolling in university. Overall, they found the highest-ranked influences involved teaching and learning factors (e.g. access to study resources, engagement with academic staff) and logistics (e.g. distance from campus, flexible management of work-life-study balance).

Trial Background and Methodology

Educational design research methodology informed the planning and execution of the StudyFlex trial and the associated data gathering. Educational design research is an iterative, evidence-based approach that involves non-linear cycles of analysis and exploration, design and construction, and evaluation and reflection (McKenney & Reeves, 2018). It stipulates that "practitioners and researchers work together to define problems, develop evaluation-research designs, collect data, consider the findings and then generate design principles", where these principles further refine the initiative under focus and contribute to wider technology enhanced learning principles (Phillips, McNaught & Kennedy 2012, p. 90). The iterative phases utilised in the trial were influenced by Reeves (2006). These comprised four iterative but non-linear phases: (1) Analyse and define the problem; (2) Conceive and develop the solution; (3) Test the design; and (4) Reflection; and simultaneously and progressively establishing design principles throughout.

As educational design research involves key stakeholder input (McKenney & Reeves 2018), all teacher and student participants in the StudyFlex subjects were invited to provide input and/or feedback. As "design research yields knowledge in the form of design principles… [and] curricular products" (McKenney, Nieveen & van den Akker 2006, pp. 77, 87), a key part of the process was to inform specific design recommendations prior to scale-up considerations, and to "provide a basis for adaptation to other situations" (Gravemeijer & Cobb 2006, p. 45). Participant numbers were not intended to be statistically significant, but rather "offering a *thick* description of… the design experiment… describing details" from the participants, so "outsiders will have a basis for deliberating adjustments to other situations" (ibid.). A summary of stakeholder research participation is presented below in Table 2.

Table 2: Data collection range per subject

Subject	Cohort Size	Interview data		Student Surveys	LMS Access Analytics
		Teachers	**Students**		
BCC	32	*n*=1*	*n*=0	*n*=4	Whole cohort
PEN	32	*n*=1*	*n*=1	*n*=6	Whole cohort
QMH	22	*n*=1	*n*=1	*n*=9	Whole cohort
IAI	-	*n*=1	N/A	N/A	N/A
STC	-	*n*=2	N/A	N/A	N/A
Totals		**_n_=5**	**_n_=2**	**_n_=19**	

*The same teacher taught both BCC and PEN

Specifically, each teacher involved in the trial participated in a culminating one-hour interview to discuss the design of their subject. Teachers involved in both design and delivery discussed effectiveness, issues, student attendance/participation, and suggested improvements. The remaining teachers were asked to review their prototype subject designs, discuss what they saw as useful, suggest improvements, and to reflect upon using this subject design in their teaching practice.

Students were invited to participate in a 30-minute interview or complete a 10-minute anonymous online survey. To supplement this data, University ethics approval was also granted to permit

analysis of anonymous student LMS access data. Interview participation (teacher or student) was offered face-to-face or via web conferencing (*Zoom* technology). Each participant was asked if their session could be audio-recorded for transcription purposes. The survey instrument comprised a series of closed and open-ended questions where students could indicate their use of study choices offered in their subject, their preferences, suggestions, and whether they would recommend the model. These questions were designed to elicit short responses. The interviews were intended to promote deeper reflection and minimise the survey risk of obscuring individual voices and masking the likely complex interactions and attitudes underlying student participation trends (Bryson, Hand & Hardy 2009).

The Educational Design Process: The Trial and Discussion

The following sections present the educational design process, providing corresponding detail and/or data of the key phases of the StudyFlex trial. While the phases were iterative and occasionally oscillated, they are presented according to four phases modelled on Reeves (2006). As a discussion paper, the detail and data presented in the following sections are also discussed and aligned to respective design principles.

Analyse and Define the Problem

Broadly speaking, the StudyFlex project evolved from an initial awareness of the apparent incongruity between life outside of university where students can make regular and seamless shifts between online or physical and analogue or digital activities and the relative scarcity of subject learning designs aimed at accommodating similar fluidity. The underpinning design challenge of allowing students to decide their preferred or necessitated study pathway, from week-to-week or topic-to-topic, was in direct response to this reality – a reality in which bright line distinctions between online and physical activities are becoming rapidly outdated notions (Bevacqua & Colasante 2019), referred to elsewhere as an eroding wall (e.g. Miller 2011).

As such, the initial overarching design principles agreed to be incorporated into the initiative (Bevacqua & Colasante 2019, p. 14), and refined during the trial, included commitments to ensure all StudyFlex offerings had no compulsory on-campus or synchronous attendance requirements (i.e. could be completed entirely online and in flexible timeframes). Equally, trial subjects must include a range of optional on-campus activities. There was also a concern to ensure student flexibility was not unnecessarily fettered by competing student commitments and study mode constraints in other subjects not included in the trial. Hence, trial subjects were also designed in the current University LMS and delivered in existing on-campus study periods. For similar reasons, a longer-term aspiration to apply the StudyFlex design principles to entire degree courses was also flagged from the outset.

University practitioners (university teachers, senior administrators, teaching and learning specialists) were also asked to consider additional problems the model could address. The desire to eliminate duplication of subject offerings was strong among teachers who were coordinating subjects delivered in multiple separate online and on-campus instances to multiple cohorts. This objective heavily influenced the choice of subjects included in the initial phase of the trial.

The first tranche of subjects involved (see Table 3) were three postgraduate masters level subjects, including two computer science subjects and a health research subject. A further two subjects were also involved in prototype design experiments in the trial, a postgraduate humanities subject and an undergraduate health science subject, to further test the proof of concept.

Table 3: A summary of subjects involved in the trial

| Discipline	'Code'	Subject	Project involvement
Computer Sciences (postgraduate)	**BCC**	Blockchain and Cryptocurrencies	Designed and delivered (taught)
	PEN	Penetration Testing Principles	
Public Health (postgraduate)	**QMH**	Qualitative Methods in Health Research	
Humanities (postgraduate)	**STC**	Strategic Communications	Prototype design (to test model in other contexts)
Health Sciences (undergraduate)	**IAI**	Infection and Immunity	

Consistent with the aspiration to ensure course-wide flexibility for students noted above, two programs have subsequently been selected for course-wide StudyFlex redesign (one undergraduate and one postgraduate degree), with findings from the trial reported in this paper to be used to inform these larger projects.

Conceive and Develop the Solution

The trial subject designs comprised several core common features. These included regular study choice points, incorporated to facilitate student self-determination of their study mode from session to session. Allied to this were detailed navigation guides through the learning materials and student supports for each mode. The subjects were designed to ensure any mode-switching was intentional rather than inadvertent. This was achieved by including clear signposting (icons and text) at each choice point, which allowed students to easily bypass materials that were not relevant to their chosen pathway. However, if desired, students could access all materials regardless of the chosen mode. This latter characteristic was aiming at harnessing the long-recognised student tendency to "…add what is missing, they mix it with what they need, and they subtract what is not valuable. They socialise it. They find context" (Masie 2006 in de George-Walker & Keeffe 2010, p. 3).

Figure 1 below provides the basic prototype design. Once the model was conceived, this schematic formed a usual artefact upon which the initial design of each of the individual subjects was based:

Figure 1: Representation of the generic design concept
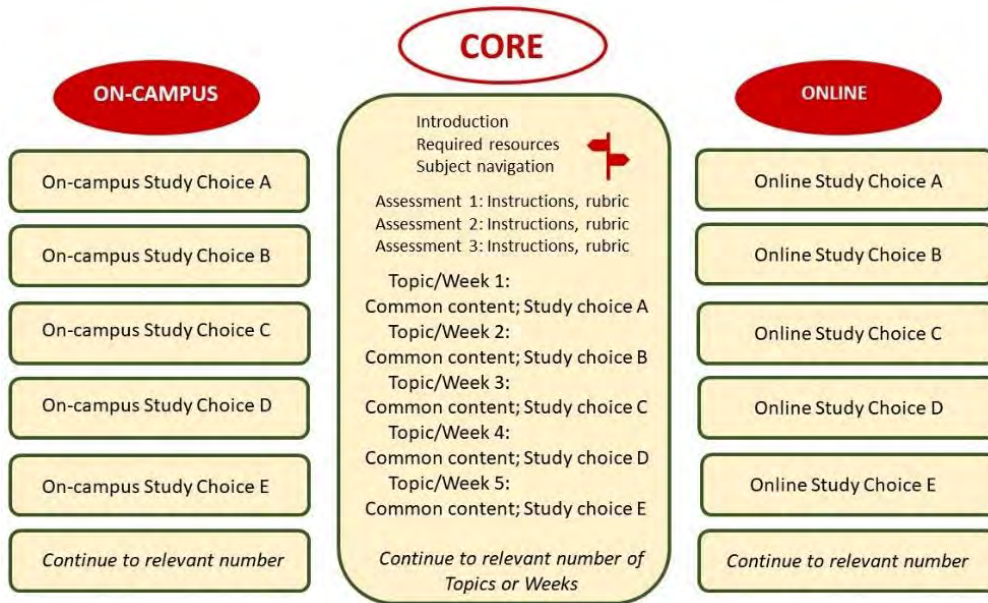
By way of example, the diagram below (Figure 2) shows how the basic model was applied in the prototype humanities subject. The arrows designate one of the many possible navigation pathways a student might create in combining core common LMS materials with on-campus and online study options:

Figure 2: Representation of the Strategic Communication (STC) prototype subject design
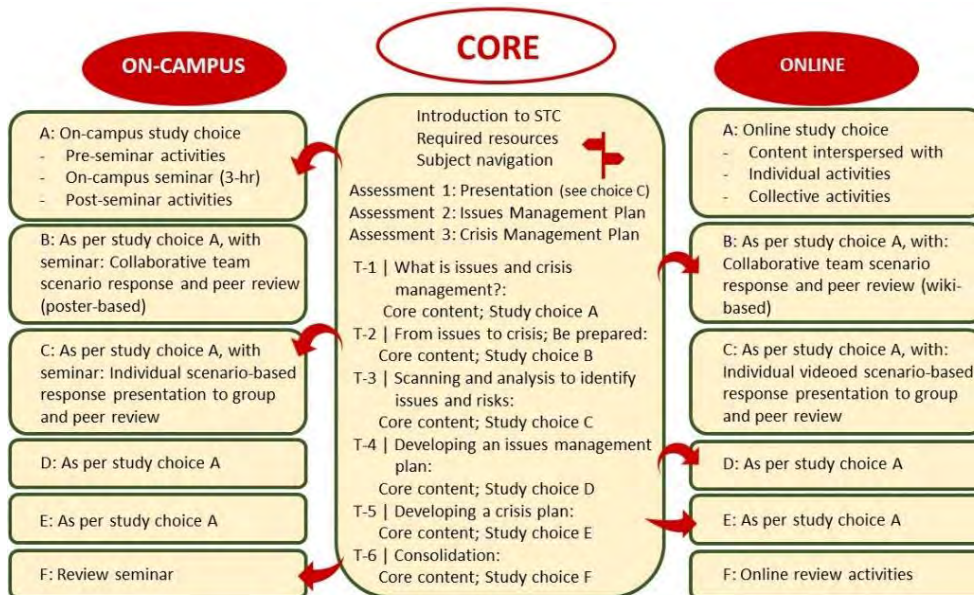
The specific subject designs were customised to fit each subject's disciplinary context, hence the two computer science subjects (BCC and PEN) were structurally quite similar to each other regarding IT laboratory needs but quite different to the public health subject (QMH) with a seminar focus. For the intensive IT experiences required for PEN, a bespoke virtual machine was created to enable off-campus simulation of a variety of penetration testing online environments and to support various real-world scenarios. A summary is provided in Table 4:

Table 4: Flexible hybrid format for designed and delivered subjects

Subject	Previous modes	Flexible hybrid format
BCC	Taught in two separate offerings: • On-campus 12wk semester • Online 6wk intensive	Combined 12-week, 12-topic semester: a) Single LMS site: all core material; guided navigation to study choice points. b) On-campus 2-hour lecture and 2-hour IT lab each week, each of which had: c) Online equivalent options. Students were also offered a 2-day residential intensive practical session toward the end of semester.
PEN	Taught in two separate offerings: • On-campus 12wk semester • Online 6wk	As for BCC above. *Plus*: the online equivalent options included preliminary set-up detail for a virtual machine for online completion of PEN lab exercises.
QMH	Taught in two separate offerings: • On-campus winter intensive • Online winter intensive	Combined 10-week, 9-topic Winter intensive: a) Single LMS site: all common material; guided navigation to study choice points. b) On-campus 10x two-hour intensive seminars*. c) Online topics of 10x learning cycles with activities of an equivalent nature to the on-campus seminars*. *Each mode: several weeks post-intensive to prepare and submit assessments.

The additional prototype designs enabled testing the initiative with teachers in other disciplines to draw out further efficacy issues and design principles. The health science subject (IAI) allowed for consideration of the complexity of science laboratory-based learning spaces in the model, while the humanities subject (STC) explored social constructive experiences, such as group responses to a crisis scenario which challenges the students to collaborate in authentic strategic communications workgroups to analyse an issue or crisis that has occurred and to build a response artefact of a poster (on-campus) or wiki (online) with intergroup peer review. Both subjects offered multi-week topic-based approaches rather than weekly structures. See a summary in Table 5 below:

Table 5: Prototypes developed for flexible hybrid designed-only subjects

Subject	Existing mode/s	Design work for flexible hybrid format
STC	Taught in two separate offerings, by different teachers: • On-campus 12wk semester • Online 6wk intensive	Prototype created for a combined 6-topic (2-weeks each), 12-week semester: a) Single LMS site: all common materials, activities and guided navigation to study choice points. b) On-campus fortnightly optional attendance to scheduled 3-hour seminars (shared teaching), each of which had: c) Online equivalent options include social constructivist activities in each topic.
IAI	Taught in one offering: • Online 12wk semester Scientific practical exercises: DIY (low take-up), or image-based walk-throughs.	Prototype design for a combined 4-part, 12-week semester: Design focussed on (i) rearranging topics into related collections, forming 4-parts of 2-4 topics each, and (ii) conceiving how to transform associated science lab learning experiences into equivalent on-campus and online exercises, and how to incorporate this equitably to students based at various campuses.

Test the Design – Student Socio-Cultural Insights

The student survey responses expose a range of socio-cultural influences on student study mode choice. These were particularly evident in the expressed preferences to engage online in the subjects. Key among these were work commitments, distance from physical campus location and an associated desire to avoid travel time. In the case of one student, the preference to study online stemmed from recent motherhood and difficulties in sourcing childcare to enable physical class attendance. These types of responses broadly echo the findings in the U.S. hybrid study mode studies cited earlier in this paper (e.g. Miller, Risser & Griffiths 2013).

The most pertinent insights, however, relate to the attitudinal responses to the flexibility to accommodate a range of personal pathways throughout the enrolment period. The main themes which emerge are an appreciation of having a "back-up" option in the event of changes in lifestyle or personal circumstances affecting study plans, allowing students to "keep up". This advantage was evident across student cohorts, for example:

> *Sometimes you cannot attend classes, and the online choice gave me the chance to learn despite missing the class. The course structure and content for online study was very user friendly and helpful.* (BCC student)

> *If you could not personally go to class on a certain week, you can check it online.* (PEN student)

> *I was able to attend face-to-face classes, but it was good to know the option was there to keep up with the content online if any conflicts came up.* (QMH student)

Online students also appreciated the option of attending on-campus and the provision of quality online materials, thus providing an equivalent learning experience to those studying on campus, and the ability to interact with both online and on-campus students.

Overall, 17 of the 19 student survey respondents agreed the choice of study mode was helpful for their learning. Three quarters also recommended adopting this approach in other subjects and/or extension of its availability to other students. Only two students did not recommend it at all, both

online QMH students. Unfortunately, these students did not provide any insight into the reasons for this conclusion. Both interviewed students agreed the approach was helpful and would recommend it for other students and other subjects.

The in-depth interviews revealed two contrasting student views of the multiplicity of personal factors influencing student behaviours and preferences. For the QMH student, Carrie, the overriding fact that she was residing overseas meant that all her subjects were chosen with online availability foremost. However, Carrie also worked full-time and noted that, therefore, even if living locally, "attending daytime sessions during the week is impossible" except for potential participation in synchronous web-conference sessions that she might be able to participate in from her workplace in local time zones.

The second view revealed the attraction of flexibility to accommodate more voluntary life-style choices and study attitudes and preferences. Again, the motivators were multi-faceted. The PEN student, Joe, appreciated the ability to balance his self-reported desire for a manageable load with his preferred sleep and study patterns and his intrinsically variable motivation levels to attend physical classes:

> *I wake up and I'm like, "do I really want to go to class today?" ...I could do it online after two hours of more sleep. So, that's the free choice that's really interesting... I intended not to have too much load on me but as I was free, and I was paying for it, so why not come on campus... I really liked the professor as well... that's why I have the motivation to come to class every week.* (Joe, PEN)

The two students interviewed either completed their subjects completely online (Carrie, QMH) or opted in to all on-campus sessions (Joe, PEN), but also appreciated the idea of having an alternative option. For example, Joe liked the "sense of comfortability that if something unfortunate was to happen… you always have this option to not go to class rather than the pressure of attendance."

Overall, the students tend to confirm the range of socio-cultural factors that influence student participation. While some decision-making was based on personal preference (e.g. prefer one mode or like the teacher), there were some fundamentally inflexible reasons preventing on-campus participation, such as location, work, or interruptions to study. Kahu (2013) collectively refers to factors such as these as "lifeload" and characterises this as "a critical factor influencing student engagement" (p. 767).

Thus, to the extent that models such as StudyFlex can assist in easing "lifeload", they can significantly enhance student learning and create more interconnecting and bespoke learning spaces for all students. However, our trial suggests these potential benefits are likely to be more muted for students labouring under the types of inflexible structural challenges than they are for other students. For example, one key benefit emerging from our data was the comfort of having an online "back-up" for those students who otherwise preferred and intended to attend on-campus learning opportunities. Students confined to online participation by inflexible socio-cultural factors are unlikely to realise such benefit.

Test the Design – Student Participation Behaviours

The most detailed student-generated insights gleaned from the StudyFlex trial related to student participation behaviours. This is due to access to cohort-wide LMS logs to complement student survey responses and teacher interview observations.

Insofar as the survey results are concerned, students self-reported both their expected and eventual study access behaviours. Almost one-half of respondents (n=9; 47%) expected to utilise all on-campus sessions, and a minority expected to study all online (n=2). Around one-quarter expected to take advantage of mixing modes (n=5), while three students were non-committal. When asked to compare their actual study patterns with their original intentions, over one-third of student responses (six out of 16 who committed responses: 37.5%) across the subjects reported variation from expectations to actuality, of which four students used more online options than expected, and two attended more on-campus options than originally intended. This trend approximately aligns to what Beatty (2014) reports on participation in small-sized HyFlex classes.

The activity logs from the respective subject LMS sites tell a wider picture of student participation behaviours, as represented by the graphs to follow (Figures 3, 4 and 5). For BCC, Figure 3 illustrates that online content (black dashed line) was accessed in the LMS far more frequently than on-campus support materials (black solid line). In several weeks (1-2, 3-4, 7-8, 8-9 and 9-10), increases in one study mode corresponded with decreases in the other mode (opposite movement between red solid and dashed lines) suggesting some degree of change by students.

Figure 3: Trends of BCC student access to face-to-face (F2F) and online materials in the LMS
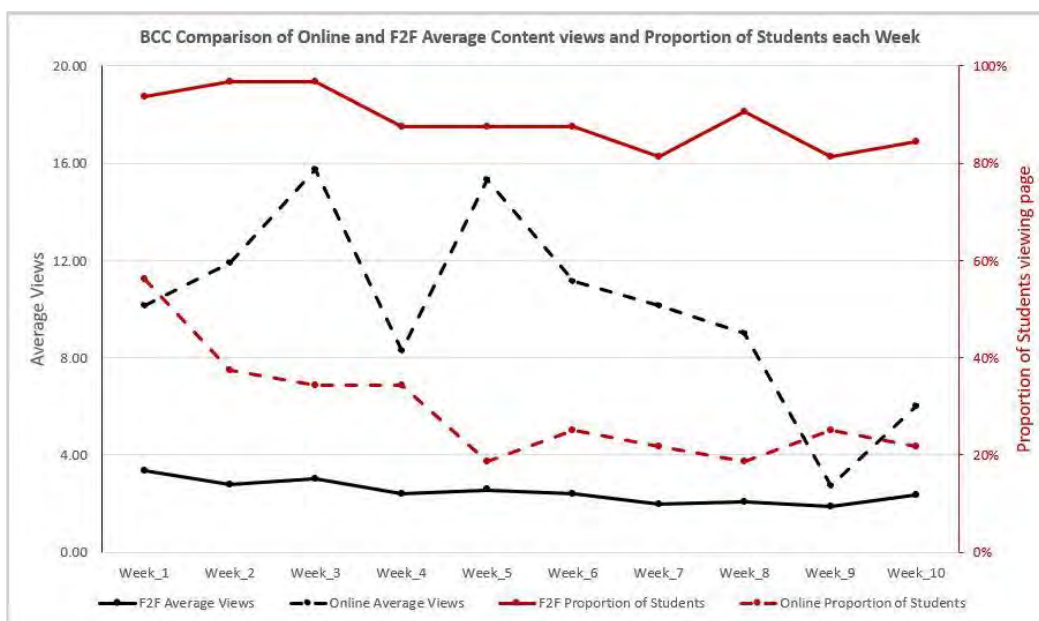

For PEN, Figure 4 illustrates that, like BCC, online content was accessed far more frequently (black dashed line) than on-campus support materials (black solid line). Weeks 3-4, 4-5 and 10-11 indicate increases in one mode corresponding to decreases in the other mode suggesting some degree of change (red solid and dashed lines). Compared with BCC, more students switched between modes in PEN although it is unclear why this was the case.

Figure 4: Trends of PEN student access to face-to-face (F2F) and online materials in the LMS
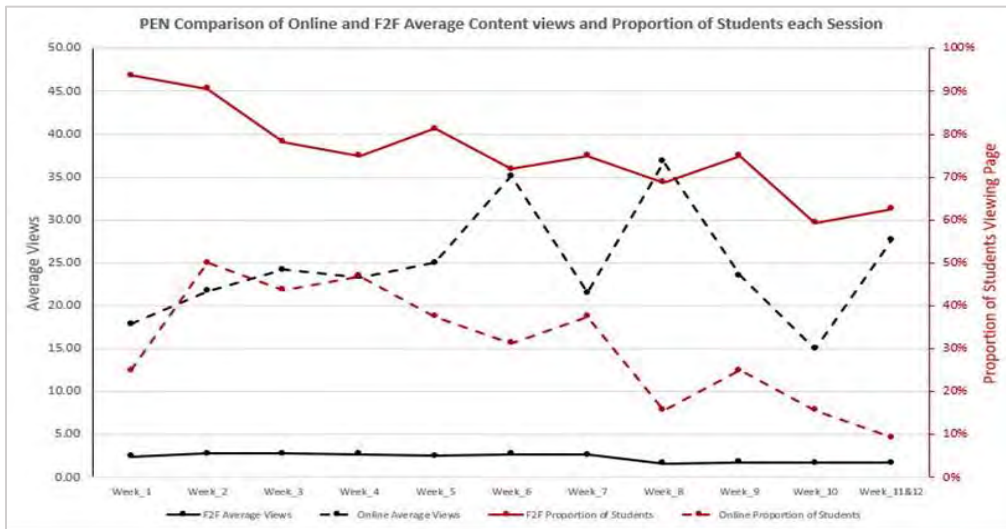
Insofar as QMH was concerned, Figure 5 illustrates online content was accessed more frequently (black dashed line) than on-campus content (black solid line), but the difference was not as dramatic as in PEN and BCC. There was an increase in on-campus activity (red solid line) corresponding to a decrease in online activity (red dashed line) in sessions 3-4 indicating some degree of mode switching.

Figure 5: Trends of QMH student access to face-to-face (F2F) and online materials in the LMS
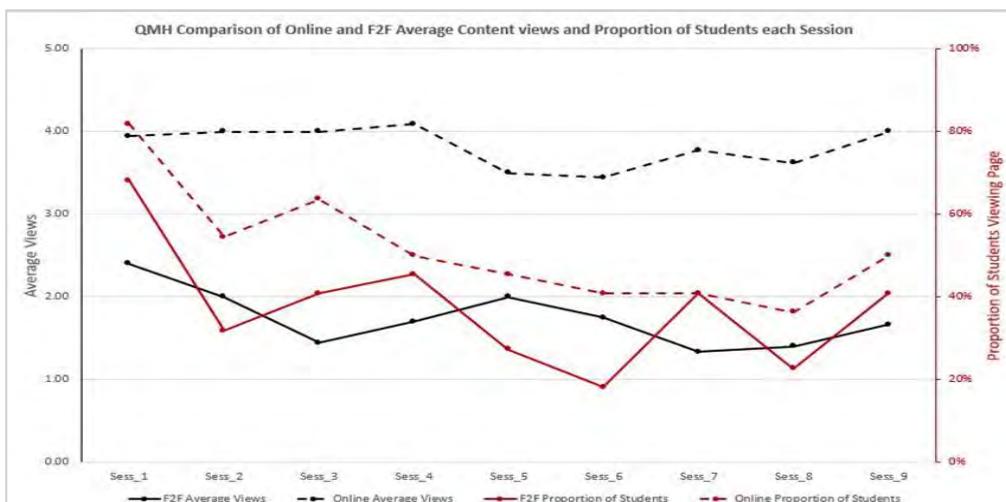
The scales in the preceding three graphs show average views of online content (black dashed lines) have a higher range in PEN (15-37 views per student per week), second highest in BCC (3-16), while the average number of views per QMH student per week of online content hovers around four.

This may reflect the content-heavy nature of the two computer science subjects, especially the highly technical nature of PEN, compared to the process-oriented focus of the health research subject.

Some students utilised both modes simultaneously as proven by adding the dashed and solid red lines within each of Figures 3, 4 and 5, which periodically sum to over 100% of students in each subject who access either or both modes. In the Yuskauskas, Shaffer and Grodziak (2015) study, some students completed "both online and face-to-face coursework in order to get help when needed in learning the material" (p. 524).

From a teacher's viewpoint, Sebastian explained classroom participation trends. For PEN, students attending primarily on-campus "were never away for more than two weeks… almost every alternating week I had pretty much everyone in there. So, it was… consistent throughout semester." However, this meant the lab sessions for PEN had outgrown single on-campus lab capacity when they became popular (compared to the virtual labs), meaning he had to "run an additional lab session." He explained that PEN had a "much strong[er] focus on the practical aspect. BCC we had… enough numbers to break them into two, but there was never a need because the labs were always not so well attended" (Sebastian). Beatty (2014) found that most students in larger HyFlex classes participated synchronously online, which enabled timetabling of smaller venues than a large class cohort might otherwise suggest. While BCC and PEN were not large cohorts, BCC could achieve some facility efficiencies from students opting in only irregularly for on-campus options.

For QMH, Max was aware that some of his online students "would love… [to participate] face-to-face… but it's just not feasible." He noted participation trends of either all online or all on-campus, albeit with some notable movement of on-campus students to online at times of need.

Regarding analytics, it has been recognised that attendance data mechanisms are less than ideal for measuring participation in flexible hybrid formats and that more sophisticated measures are required (He, Gajski, Farkas & Warschauer 2015; Miller, Risser & Griffiths 2013). The limitations of the LMS access analytics in the StudyFlex trial appears to confirm the accuracy of such propositions. Contemporaneous measurement of student participation in flexible hybrid studies would be one useful improvement. Longitudinal data on hybrid learning behaviours would also provide helpful insights. For example, this would help institutions to forward-plan on matters such as learning space bookings, resourcing and timetabling – making them more receptive to future hybrid learning initiatives.

The design principle that emerges is the need for continuing efforts to embed increasingly sophisticated mechanisms into designs for capturing analytics to ascertain student participation and learning behaviours in flexible hybrid learning settings. However, perhaps some unpredictability and variability in student participation trends should be expected upon enabling individual choice via hybrid subject design. In the context of individualised learning offered to diverse, unique students, Crosslin (2018) has observed that "scattered" results are realistic when enabling personalised customisation.

Reflection and Further Design Principles

Teachers involved in the StudyFlex trial offered several reflections which are also translatable into basic design principles. Whilst overwhelmingly positive about the trial, teachers flagged some challenges and conditions. These included difficulties in anticipating and sensibly managing on-campus attendance numbers, which extends from Sebastian's (BCC, PEN) IT laboratory cohort sizes in the previous section. Gabrielle (IAI) anticipated problems catering for unknown numbers of on-

campus students when science laboratory technicians need to prepare equipment in advance. If expecting "30 students on campus, but then everyone changes their mind" there would be waste, workload and cost consequences. Emma (STC) voiced similar concerns regarding anticipating and preparing for face-to-face students. She queried, "is there a critical mass of students who need to say that they're coming along to a session before it will run?"

Related concerns extended to teaching workload in flexible hybrid subjects. For example, Max (QMH), said he felt a doubling of effort on being attentive to students in both modes, saying "even though I'm only teaching it as one subject, it really is like I'm teaching it twice." Sebastian (BCC, PEN) experienced an increased workload for PEN when the on-campus labs outgrew a single lab session, but also because he agreed to individual consultations with students who missed classes while inherent efficiencies might be found in directing students to the equivalent online learning options.

All of this adds support to the design principle at the end of the previous section, regarding the need for longitudinal maturation of hybridity data capture. However, it also suggests a need for professional development centring on enhancing skills in designing and delivering flexible hybrid formats with any scaling up of such models. The FlexLearning initiative (Yuskauskas, Shaffer & Grodziak 2015) included a structured approach to faculty development, requiring two units of study to be completed for eligibility to teach in the format. Such training should extend to educating teachers on how to maximise the efficiencies possible without compromising student flexibility. The key design principle that emerges can be expressed as the need to design and deliver targeted staff capacity building to promote effective teaching in flexible hybrid formats and maximise efficiencies.

Student support was raised as a conditional issue by teachers, whether it was students understanding how to navigate the StudyFlex format through to taking responsibility for their own learning choices. For example, Emma, (STC) noted how some regular online students have difficulty with basic LMS navigation, making her cautious that students could handle "the complexity of having to make these choices"; students "could inadvertently miss things." Beyond the navigation, not all students may grasp the "responsibility for the choices that they make", for example, how they best learn or how they can best take advantage of either or both modes; "there's some work to be done right at the start when people are introduced to this way, to support them making those choices and developing that reflective practice" (Emma). This work is essential to minimise the risk of students drowning "in a sea of possibilities" (McDonald 2008 in De George-Walker & Keeffe 2010, p. 3).

These observations are consistent with an understanding that changing instructional methods and modes in tertiary institutes change the student learning experience, requiring a variety of active and aggressive support mechanisms to help students achieve within changing conditions (Miles & Foggett 2016). A dedicated familiarisation module would be ideally placed within or prior to their first StudyFlex subject undertaken. Ideally, support structures should be based on an understanding of key student socio-cultural pressures and perspectives to best underpin facilitating student participation (Kahu 2013). In addition, such a model would need to be based on an understanding of particular student proficiencies and attitudes to various digital technologies – a matter which was not included in the pilot study but would be an essential inclusion in any future trials. The design principle that emerges can be expressed as a need to design, develop and implement a specific student orientation module – available and promoted to students the first time they encounter a flexible hybrid subject – to help students maximise their access to learning and generating their learning pathway.

Conclusion

The insights provided by students and teachers involved in the project and the LMS data provided a basis for reflection and development of several design principles, as noted progressively in this paper, suitable to be incorporated in any future trial of hybrid learning designs similar to StudyFlex.

The key general driver for the StudyFlex initiative was to explore ways to eliminate increasingly outdated artificial distinctions between online and on-campus study spaces to reflect broader societal and technological changes and student demands for greater flexibility in forging their own pathways through the resource options available. The trial discussion, insofar as it confirms a positive student reception to the initiative, begins to answer this call for confirming the potential value and viability of such initiatives. This potential has been exposed by the global COVID-19 pandemic, which has seen universities scramble to introduce initiatives geared at providing maximum flexibility to accommodate the needs of affected students and staff. This crisis has fundamentally and abruptly altered the business case for universities to tackle the pedagogical, and administrative complexities and associated costs inherent in the early adoption of flexible-hybrid learning approaches such as those trialled in the StudyFlex initiative. In this respect, the current challenges being faced by the tertiary education sector may serve to hasten the evolution and implementation of flexible hybrid learning as an accepted contemporary educational design approach.

Notwithstanding, the limitations of this discussion, particularly in terms of the small-scale of the trial and the consequential limited data from which any conclusions derived, should not be ignored. The results are, however, broadly consistent with the available research studies to date both in terms of the specific findings as well as through confirming the complex array of interconnecting factors that in turn influence student attitudinal and behavioural responses to the flexibility afforded to them by hybrid learning spaces. This complexity warrants dedicated further attention and the findings of the StudyFlex trial reported in this paper serve to advance and amplify that need.

The discussion also raises broader challenges, particularly concerning the limits on the ability of such initiatives to benefit students labouring under relatively fixed socio-cultural influences in their lives. Further, the potential benefits of flexible hybrid learning initiatives are unlikely to be fully realised without students and teachers alike being comprehensively educated in the potential of hybrid models to enhance student learning. This proposition holds even when, as in this case, the model contemplated is only one which takes relatively small incremental steps toward fulfilling the broader vision of hybrid education as a "heterogeneous composite that combines different elements to create something other, that is not a new blend but a new breed" (Pedersen, Nørgaard & Köppe 2018, p. 229 italics removed).

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