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Active and online: Three case studies of learner engagement

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Much of the literature on flipped classrooms emphasises the physical classroom as the primary site for active learning, relegating the online environment to a place where content is delivered prior to students attending a workshop or tutorial. However, researchers have highlighted the rich opportunities for embedding interactivity in the online space and demonstrated positive impacts on the student experience. In this paper we discuss how interactivity was embedded in self-paced online modules as part of the redesign of three large courses at The University of Sydney Business School. In these courses, lectures were replaced with weekly, self-paced, media-rich online modules involving opportunities for active learning and immediate feedback. Course developments and impacts on student experience are presented through three mini case studies underpinned by evaluation embedded in a design-based research approach. The developments were conducted as part of a major strategic educational project in the Business School called Connected Learning at Scale (CLaS).

Keywords: active learning, interactivity, self-paced learning, immediate feedback

Introduction

Much of the literature on flipped classrooms focuses on the physical classroom as the primary site for active learning and feedback (Freeman et al., 2014), relegating the online environment to a place where content is delivered prior to students attending a workshop or tutorial (Abeysekera & Dawson, 2015). However, some researchers have highlighted the rich opportunities for embedding interactivity in the online space and have noted positive impacts on student engagement (e.g., Davis et al, 2018; Redmond et al., 2018; Snowball, 2014). Furthermore, online learning environments with engaging, purposeful activities that are designed for, and aligned with, course outcomes can play a significant role in student progress (Ogunyemi et al., 2022).

Active learning is typically defined as students engaging cognitively (Chi & Wylie, 2014; Robertson, 2018) and research tends to focus on motivational, behavioral and emotional perspectives (Redmond et al., 2018). There is a continuum of engagement modes in student learning from passive to active to constructive to interactive, with the latter mode resulting in the greatest level of learning (Chi & Wylie, 2014). Interactivity “requires the integration and mutual influence of three separate and distinct dimensions - the *technology* being employed, the *content* being communicated, and the individual *experience* and specific context under which a user encounters the technology and content during the communication event” (Gleason, 2009, p. 14). Studies on interactivity have demonstrated increased student satisfaction which can lead to substantial motivational and self-esteem benefits (Gleason & Dawes, 2012) along with improved persistence, and academic performance (Muir et al., 2022).

Based on a comprehensive investigation into the literature on active learning, Robertson (2018) developed an active learning framework of 12 key elements (pp. 37-41). Our study aligns closely with six elements from this framework as follows:

1. *Student-centred focus* - we know that each student has their own unique strengths, interests, and ways of learning. By empowering students to take an active role in their learning we can foster deeper understanding, critical thinking, and lifelong learning skills. As the educator moves from sole provider of knowledge to that of a facilitator, they support and encourage students' exploration and understanding (GAISE, 2016; Russell et al., 2009).
2. *Authentic tasks* - the goal of such tasks is to bridge the gap between theory and practice by giving students opportunities to apply their knowledge and skills in authentic, real-life contexts and prepare them for the

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- challenges they will face in their future careers (Hogg, 1991).
3. *Collaborative learning* - emphasises active participation, cooperation, and interaction among students, fostering a supportive learning community (Robertson, 2018). Collaborative learning can take various forms, such as group projects, discussions, problem-solving activities, peer teaching, and cooperative assignments.
 4. *Metacognition* - in its simplest form is thinking about thinking. It is a way for students to plan, monitor and evaluate their own understanding and performance, through guided reflection and self-assessment activities (Harvey et al., 2016).
 5. *Digital literacies* – while we often assume our students are proficient in the use of digital technologies, the reality is that often they are not (Kirschner & De Bruyckere, 2017). Access to technologies is not equitable across our student cohorts and therefore it is important to guide students in the effective and responsible use of digital technologies for learning, communication, information management, and problem-solving.
 6. *Continuous feedback* - involves regular communication and assessment of student work, providing constructive feedback, and facilitating opportunities for students to reflect, improve, and make adjustments in their learning (Snowball, 2014). This more frequent and timely feedback can take various forms, including written comments, one-on-one discussions, peer feedback, self-assessment, or rubric-based evaluations.

Background

In this paper we address the conference theme of digital pedagogy by addressing the research question: how did the interactive elements embedded in self-paced online modules in the redesign of three large courses at The University of Sydney Business School impact on the student experience? In these courses, traditional lectures were replaced with weekly, self-paced, media-rich online modules with opportunities for active learning and immediate feedback to support the learning of core concepts and active rather than passive engagement (Beetham & Sharpe, 2013). Content in the modules was presented in smaller chunks which included brief case studies, short videos, pencasts, interactive diagrams and images, and self-check questions.

The developments outlined in this study were conducted as part of a major strategic educational project at the The University of Sydney Business School called Connected Learning at Scale (CLaS) (Wilson et al., 2021). The main aim of the CLaS project was to improve the student learning experience specifically in the area of building connections with discipline knowledge, with peers, with society and communities (Bryant, 2022). The project is underpinned by three pedagogical principles, the first of which focuses on information engagement. This principle acknowledges the collaborative nature of knowledge, emphasizing the collective co-design and interpretation of information. It involves drawing upon diverse perspectives, critiquing existing ideas, synthesizing research findings, theories, experiences, and practices to foster a comprehensive understanding.

Method

This study explores student perceptions of interactive online learning in three different courses, combining insights from design-based research with case study analysis. The project uses an iterative design-based research approach (Reimann, 2011) to guide course development, evaluation and research. We foreground the characteristics of design-based research as described by Wang and Hannafin (2005, p. 8) as pragmatic, grounded, interactive, iterative, flexible, integrative, and contextual. Our design-based research draws on theory and practice, connecting results to the design process and the specific setting. Research and practice are cyclical and adaptive, involving the active participation of all participants in the design process.

A case study approach has been selected to yield rich descriptions of the design cycles and results of embedding active online learning. Case study research, as an empirical inquiry method, suits investigating complex phenomena within real-life contexts, and is widely used in business and technology fields to generate practical and theoretical insights (Ebneyamini & Sadeghi Moghadam, 2018).

Embedding interactivity into self-paced modules – case studies

Below we present three mini case studies to demonstrate how active learning was embedded, each underpinned by the literature. Each case study provides an overview of how this was achieved, including the range of activity

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In a typical learning design sequence, students were prompted to think about their understanding of the topic, and then to 'Watch and learn'. Teachers then explained key concepts and business frameworks in concise, engaging videos (Humphries & Clark, 2021). Case studies and interviews with industry experts and student alumni captured diverse perspectives and real-life business challenges. For particularly complex or abstract concepts, simple interactivity was added. For example, students were given a branching scenario in the transport industry in which they made decisions about AI and self-driving vehicles, simulating business leadership dilemmas (see Figure 1 above).

Other exercises and interactive learning content were integrated with the digital learning environment, including quizzes, word clouds, polls, and online noticeboards, so students could apply their growing discipline knowledge to business scenarios. This afforded students opportunities to practice and apply concepts in a low-stakes, engaging way. Figure 2 below provides an example of an interactive on world population data from an authentic dataset that students manipulated to explore their assumptions about future megatrends in business.



Figure 2: Authentic, Interactive Content embedded from <http://ourworldindata.org>

Example 2: Reflecting and interacting with peers

After exploring the topic and applying their understanding, students were asked questions to reflect on these experiences (Harvey et al., 2016). Critical and ethical thinking around key business concepts was promoted via this reflection. Students received friendly suggestions and resources in automated feedback, which was designed to build their confidence and stimulate further reflection, rather than provide a single 'correct' answer. Where relevant, feedback included images and rich media for a more memorable learning experience (Velestianos, 2011). Optional discussion forums, embedded in situ with content, were also configured with prompts to generate peer reflection on business issues. For example, in Figure 3 below, students reflected on business theory around Corporate Social Responsibility (CSR) in the context of their experience with real-world food delivery services. Students then commented on these companies' CSR, comparing their responses with others, and 'liking' or further commenting on their peers' ideas.

What does strategy mean to you?

Before we discuss strategy further, a quick question. What comes to mind when you hear the word strategy? Take a few minutes to enter a word or two. Compare your answers to others. If you enter words already in the activity, these words will get larger. There's no right or wrong answer.

What is strategy?

Type your answer here... Submit

30 observations remaining

way to solve problem resources a defined goal business thinking achieving a goal business objectives
achievement insights of solution ways to win the c corporate objectives vision and mission
planned approach idea plan to win plan and idea long-term planning how to do winning game plan
long-term plan business plan decision making strategy business idea
thinking innovation planning plan blueprint goals to about drive achieve
a way of succeeding analysis mission plan approach commercial legend
idea success mission plan tactics objective forward thinking
goal conclusion mission/vision
goalways toward is long-term business idea, plan. method way to meet goals
sequence
methodology long-term, mission, plan, target a solution
critical approach a plan about goals
informed decisions set of decisions
corporate long-term business is planning critical approach ways set of decisions

Think critically

There are critiques of CSR when considering the operational and organisational aspects, which can be summarised and categorised as follows:

- What counts?
- Longevity of the change?
- How much counts?
- Who decides?

The organisational considerations include the ethics and legality of spending shareholders' money on ventures unrelated to an organisation's profitability and performance. For example we have to think about the point where CSR turns into poor financial management.

What do you think?

There's been a lot of news about the responsibilities of food delivery cyclists in the news.

Five food-delivery cyclists have died on Australian roads recently, four in Sydney. In your opinion, what are the Corporate Social Responsibilities of fast food companies?

Figure 3: Critical Reflection via Student-Generated Content

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Interaction data, and qualitative data from student and tutor feedback was gathered and analyzed over four semesters (two years) to iteratively improve the interactive design, in accordance with DBR principles (Reimann, 2011). During the 2020 lockdowns, students commented on the lack of guidance and informal learning opportunities online, missing the incidental ‘chats in the corridors’. As a result, synchronous one-hour informal learning ‘catch-up’ sessions were offered from 2021. In focus groups, students reported enjoying studying megatrends such as sustainability because it was perceived as more ‘related to the real world’ and ‘the online modules were pretty great to study and go at your pace’:

I learnt about strategy, let me think about what I know about businesses and apply what’s their strategy. I might be aware of businesses, but I’ve never consciously thought about this strategy, but now I am. Yeah, I guess, meets in the middle. But you’re definitely bringing knowledge outside of what’s written down on the modules, for sure (Student focus group).

In summary, learning design shifted from a didactic style of delivery to one where students were more engaged with business discipline knowledge and with each other, with opportunities to reflect on their learning and connect it to their own knowledge and experience of the wider world. Evaluation of the digital space yielded positive results but also a desire for even greater teacher presence in self-paced modules.

Case 2: Quantitative Business Analysis

Quantitative Business Analysis is another first-year core course in the Bachelor of Commerce program, with student numbers ranging from 800-1100 per semester. Developments in the course took place over three semesters. Previously, the course consisted of a two-hour live lecture, and a 2-hour workshop. Lectures were run in four streams to accommodate the large cohort. After an initial co-design workshop with key stakeholders it was decided that the first stage of development would focus on one week of the course to test the efficacy of some new active learning approaches. Developments were informed by research such as the GAISE (2016) report that provides a specific recommendation to foster active learning in first year statistics education (p. 18).

The prototype was an online module developed in the Learning Management System (Canvas) to support a live lecture on Organizing and Visualizing Data, and it was designed to ensure multiple opportunities for students to actively engage in the material throughout the lecture. That is, lecturers used the module to guide the structure of the lecture, pausing at defined points during the session so the students could actively engage with the material and connect with other students. For example, students had the opportunity to share their opinions and test their understanding via polls, questions (e.g., MCQs and ‘drag and drop’ activities), and reflective activities.

While previously lecturers would have presented slides to introduce students to the various chart types used to organize and visualize data, the prototype module brought the chart types together in a comprehensive diagram that students could interact with, in class, after the lecture for revision purposes, and to support their assessments (see Figure 4 below). As noted by one student,

... you can click on it, and you can actually see what the description was. As opposed to reading through – if there's 20 graphs, there would be 20 [slides] in the lecture to scroll through. Whereas if I want to just find ‘what do I need a bar chart for’ I just click on that picture, and it tells me a description of it. (Student focus group)

The interactive diagram provided examples of the different chart types, and all chart examples used data related to a local and global challenge that students could relate to (plastics usage and production) and linked students directly to ‘how to’ guides for generating the various chart types. The implementation of the prototype was evaluated via a student survey, and student and staff focus groups. The data provided important insights into the way students and staff experienced the online activities and was used to inform future developments including the choice of tools and how they were integrated to support activity.

The next phase of development included the design and implementation of twelve new online modules. Students completed the modules at their own pace each week before attending synchronous workshops. Module page sequence and layout was modelled on the approach described in Case Study 1. Below are examples of two active learning opportunities for students in the modules.

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Figure 4: Chart Types Presented in Interactive Format and Second-level Example of One Chart

Example 1: Polling

Polls were included in the online modules at certain points to encourage students to think critically about the content, exercise their judgement, and get a feel for the opinions of other students in the cohort. Figure 5 below shows an example of several polls included in the module on Organizing and Visualizing Data.



Figure 5: Examples of Polls Embedded Within a Weekly Module

Students were asked to compare the presentation of data across graph types. While there was no right or wrong answer, students needed to examine the graphs carefully to compare strengths and weaknesses. Once they chose the graph they preferred, responses from the rest of the cohort were revealed. Students felt the polls assisted their concentration: ‘Even though you’re still staying on topics, you get a little bit of a rest of your brain and then can continue concentrating on the other stuff afterwards’ (Student focus group). They also found seeing other students’ responses helpful: ‘so you can see who responded with pie, who responded with bar... you can just rethink why did I choose pie or why did I choose bar if the majority chose this?’ (Student focus group).

Example 2: Student survey to generate data for exploration in workshops

A key outcome of the co-design workshop at the beginning of the development process was the suggestion to use student-generated data to create a large data set that students could then explore in workshops to support their learning of key statistical methods. This initiative resonated with the GAISE (2016) recommendation to “take advantage of large classes providing opportunities for large sample sizes for student-generated data” (p. 19). The original module prototype described above included a student survey in Week 2. This was moved to Week 1 in subsequent iterations and used more readily. The inclusion of the survey in the module supported the goal of moving away from the use of many ad-hoc examples towards providing a comprehensive data set that students could revisit repeatedly through the semester. This approach is supported by Brown (2019) who emphasizes that more questions and fewer contexts for introductory statistics courses allow connections to be made between the context and the statistical tools used. Researchers have argued that when students have opportunities to generate their own data, they gain experience in skills such as asking questions, defining problems, formulating hypotheses and analyzing and communicating findings (Hogg, 1991). Such data allows students to take more of an investigative approach to learning key statistical methods (GAISE, 2016), provides an opportunity to gain firsthand experience issues that emerge in the process of data collection and analysis (Smith, 2017), and promotes the development of statistical thinking (Cumiskey et al., 2020). The inclusion of

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the survey in the module provided an important link between the online pre-work and the activities completed by students in the workshops. Survey data revealed that working on the student-generated data set helped students feel engaged in the process of data analysis, and 92% indicated that simply completing the survey gave them insights into the process of data collection.

Case 3: Accounting, Business and Society

Accounting, Business and Society is also a core first-year course in the Bachelor of Commerce program. The course introduces students to the fundamentals of accounting from a user perspective. There are approximately 1,500 students each semester with an even mix of local and international students. Prior to being redesigned, this course included a two-hour recorded lecture that was made available to students through the LMS, and a 2-hour synchronous workshop delivered through Zoom each week. Core concepts were taught in the lecture using pre-made diagrams and charts, and students were required to work through the questions in the textbook on their own. The new course design was driven by the need to provide support to students studying online due to the COVID-19 restrictions on in-person teaching and learning. The course was reimagined for an alternative online delivery mode through the creation of self-paced online modules. One of the main features of this course was the integration of pencast videos to teach core concepts, which is described in detail here as it formed the basis of how students interacted with the content.

Example 1: Pencast videos

The content in this course was presented in a multimodal format which included a variety of text, diagrams, short videos and self-check interactive elements to allow students to test their understanding of core concepts. Upon consultation with course coordinators and the teaching team, two key issues were identified. Firstly, past students often had difficulty grasping the core concepts in the course, and secondly, the course had a considerable failure rate. The teaching team noted that a common feature of many lectures in accounting involves the lecturer drawing over diagrams and freehand writing formulas while providing verbal explanation, and that this often helps students better grasp the core concepts. Some previous studies reported that students' exam performance increased significantly after incorporating pencast style videos in a course (Roberts et al., 2018). We determined that incorporating pre-recorded pencast videos into the self-paced online modules could provide scaffolding that would support students' learning of core concepts and may prepare them better for the final exam.

A total of 42 short videos were recorded, and two thirds of them included a pencast element. There were three types of videos, 1) the lecturer talking facing the camera, 2) the lecturer talking facing the camera with the addition of some visual elements including freehand writing and drawing appearing on the side of the screen, and 3) the entire video comprising freehand writing and drawing. The freehand drawing was produced with a blank screen or over an image or diagram (see Figure 6 below).

The process required close collaboration between the educational developer, course coordinators, and media team. Videos were recorded in the school's on-site DIY recording studio. The main tools for the pencasts included a Wacom touchscreen pen display and the recording platform Open Broadcaster Software (OBS), which is open source. The teaching team needed to prepare the content, including a script, slides, diagrams and images that could be used in the lesson. The teaching team initially received support from a member of the media team but over time were able to record the videos unassisted.

The advantage of a pencast video, sometimes also referred to as a digital ink or chalk-talk video, is that it enables the student to follow the development of a concept step-by-step and at their own pace (Roberts et al., 2018). Students can play these videos anywhere and anytime, watch them multiple times as needed, and pause and take notes while watching. The pencast videos were much shorter than the previous two-hour recorded lectures, each between 5 and 15 minutes. Research shows that mini-lecture style videos help reinforce students' understating of course content (Berg et al., 2015). The pencast videos were used to highlight the most important elements so students knew what to focus on. The information was segmented and chunked to help manage information flow, and by combining auditory and visual channels it was possible to illustrate concepts that would be difficult to communicate in words alone (Brame, 2016).

The pencast videos were not intended to be use as stand-alone resources. They were part of the overall design,

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which provided students with the opportunity to engage with the multimodal content and then test their understanding through a variety of methods, including short unassessed quizzes, exploratory cases, and discussion with their peers on an embedded Padlet. In this way, the new design linked the content, review, and practice within the module to scaffold students' learning. Each pencast video was packaged with interactive questions (see Figure 6 below), as this can enhance memory and strengthen students' ability to use the recalled information (Brame, 2016).

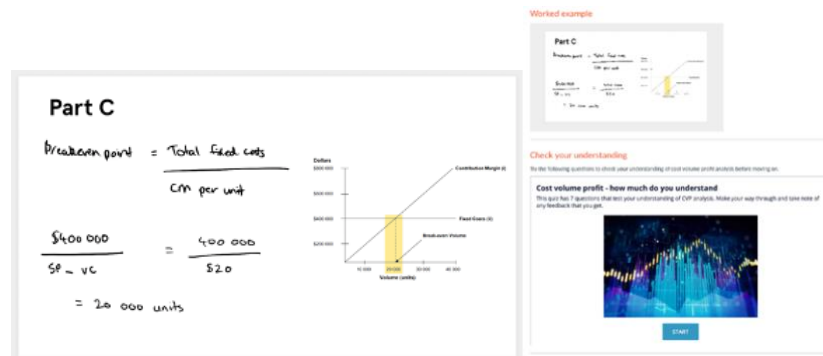


Figure 6: Pencast Video Packaged with a Quiz

The students felt that the new format was much better than the way the course was taught previously. One student who repeated the course in a subsequent semester noted how different it was and commented: 'I'm really enjoying it and the modules are so much better. Last sem we had huge 2 hours videos, and it was just so boring and hard to keep up. 150 times better the way it had been reconstructed.' (Student focus group). Students in the focus groups found the short pencast videos and the accompanying self-check quizzes 'much more motivating', 'way more interactive' and 'the best you're going to get' when studying online. Student failure rates also decreased considerably following the redesign of the course.

Discussion: Impact on student experience

The case studies and examples presented above show that multiple approaches and tools were used to embed interactive elements and active learning into these courses (Robertson, 2018). The substantial collaborative design work, which was comprehensively evaluated in *The Future of Business* (Case Study 1), provided an effective blueprint for other courses to follow and build upon. The interactive elements in all three courses were evaluated through student surveys and focus groups. Overall, the data across the courses suggested that the inclusion of interactive elements had a positive impact on student experience. Through our DBR approach (Reimann, 2011), the evaluation of each iteration of these courses allowed insights to be gained about the sequence and type of interactive elements incorporated, and for refinements to be made over time. For example, student feedback provided important insights into the appropriate number of interactive elements to include in a module, the level of detail required in the immediate feedback provided in activities, which types of interactive elements were most helpful for learning, and which ones were most effective for teaching and learning at scale. Student feedback suggested that opportunities to interact with content in a variety of ways supported their critical and reflective thinking (Harvey et al., 2016; Muir et al., 2022; Robertson, 2018). It also provided insights into barriers to engagement in active learning such as fatigue in the online environment, and sometimes students associated the increased cognitive effort required of active learning with a poorer experience (Deslauriers et al., 2019). Students also desired a greater degree of teacher presence online.

As suggested by Gleason (2009), when considering interactivity, it is important to consider the integration between the technology, the content being delivered, and the students' individual experience and context in which they encounter the technology and content. The case studies presented in this paper are consistent with other studies on interactivity that have demonstrated increased student satisfaction (Gleason & Dawes, 2012; Muir et al., 2022). In addition to the positive results found in targeted student surveys and focus groups, the standard end of semester student surveys demonstrated an increase in student satisfaction scores from 3.57 to 4.24 (out of 5, averaged across the three courses).

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One area for future research is to evaluate the sustainability of these online interactive modules on a longitudinal basis (Huber & Shalavin, 2018). Course coordinators and teaching teams require sufficient digital literacy capabilities to be able to maintain and update them. Training and support need to be embedded in the design process to ensure the sustainability of such approaches.

Conclusion

Our findings suggest that while the focus of (inter)active learning in blended and flipped classroom models is often in the classroom (or in synchronous learning sessions), there are substantial benefits to iteratively incorporating and evaluating active and interactive elements into self-paced online modules to engage students, improve their experience, and support their connections to discipline knowledge. Care must be taken however to ensure educators are supported to develop their own digital literacies to enable sustainability and ongoing maintenance of their interactive online modules.

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People, Partnerships and Pedagogies

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