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Equity through complexity: Inside the "black box" of the Block Model

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Abbreviations

ATAR	Australian Tertiary Admissions Rank
AVID	Advancement Via Individual Determination
COVID-19	2019 novel coronavirus
FYC	First Year College
NESB	Non-English Speaking Background
SES	Socioeconomic status [in the context of student demographics]
SES	Student Experience Survey [in the context of research instruments]
SET	Student Evaluation of Teaching
SEU	Student Evaluation of Unit
STEM	Science, technology, engineering and mathematics
TAFE	Technical and Further Education
TEQSA	Tertiary Education Quality Standards Authority
VU	Victoria University

Abbreviations are also used as pseudonyms for research participants:

A1, A2 … A11	Academics who participated in focus groups
L1, L2 … L7	Leaders who participated in interviews
S1, S2 … S10	Students who participated in focus groups

Executive summary

This study investigated an innovation in higher education that has achieved demonstrable results for equity students: the Block Model at Victoria University (VU). The study looked inside the "black box" of the Block Model, interviewing VU leaders, academics and students about why it has improved retention and learning. The findings show that the Block's impact comes not only from the Model itself, but from the complex context surrounding it. The study can help other universities recognise and manage complexity in equity-focused innovations.

Background

In the Block Model at VU, subjects are delivered one at a time in intensive four-week Blocks, instead of concurrently in semesters. VU introduced the Block Model for all first-year subjects in 2018, and is now expanding it across all higher education courses. Student retention and outcomes in first year have improved significantly since the Block Model was introduced, with the greatest gains in pass rates and learning achieved by equity students. VU enrols one of the highest proportions of equity students of all Australian universities.

The study focused on the impact of the Block Model on retention and outcomes for equity students in first-year science, technology, engineering and mathematics (STEM) subjects. STEM subjects face particular equity challenges, including under-representation of students from low socioeconomic status (SES) backgrounds. STEM subjects also have high potential for student-centred, inquiry-based learning, which is a feature of the Block Model design.

Method

The study commenced with quantitative analysis of student outcomes from two pre-Block and two post-Block first-year STEM cohorts. The analysis compared results for equity group students using student management system data (full student cohorts), and the Student Experience Survey. Equity students comprised around three-quarters of each data set.

The qualitative phase of the study comprised three components:

- Interviews with seven selected VU leaders involved in Block Model implementation
- Focus groups with 11 VU academics teaching first-year STEM subjects in Block Mode
- Focus groups with 10 students who completed first-year STEM subjects in Block Mode.

The qualitative data was analysed to explore hypotheses generated at the beginning of the study, about why the Block Model improved outcomes for equity students in first-year STEM. The hypotheses were based on literature, and practice expertise of the VU research team.

Findings

The quantitative phase of the study confirmed that the overall improvements in student retention and outcomes in the Block Model were also evident for first-year STEM subjects. It showed that fail grades had dropped by 9.2 percentage points from the most recent pre-Block (2017) to post-Block (2019) cohorts, dropping 9.8 percentage points for equity students. Student satisfaction in STEM had also improved from pre-Block to post-Block, with survey items relating to teaching quality showing a steady improvement from 2016 to 2019. The only survey item to decline for equity students in first-year STEM subjects in this period was the perception that the unit workload was manageable.

The qualitative analysis explored seven hypotheses about the Block Model's impact. Rather than aiming to confirm or refute the hypotheses, the analysis aimed to examine tensions and

different perspectives arising in the interviews on each theme; recognising that the path from educational innovation to improved student outcomes is seldom linear or straightforward:

1. *The Block Model is informed by a rigorous base of theory, evidence and reflection*

Although the Block Model is based on similar models from North America, the international evidence base required adaptation to VU's context. This involved consultation with VU staff, and drawing on equity-focused research, especially transition pedagogies (Kift et al., 2010).

2. *The Block Model is situated in a supportive organisational context*

The establishment of a separate, interdisciplinary First Year College (FYC) at VU is widely seen as critical to the Block Model's success. VU now faces the challenge of extending the Block Model beyond FYC, while sustaining the enthusiasm of the FYC approach. FYC was both an innovation to improve teaching, and a response to financial challenges facing VU.

3. *The Block Model prioritises strong relationships that enhance teaching and learning*

Improved relationships between academics and students were a strong theme in interviews, facilitated by smaller classes and intensive engagement. Compared to lectures, the Block enables students and academics to work collaboratively to achieve shared learning goals.

4. *The Block Model is being implemented by expert higher education practitioners*

FYC academics were selected because of their passion for teaching first-year students, and deliberately organised into a community of practice. FYC both activated existing VU teaching expertise, and established a space in which expertise is continually growing and adapting.

5. *The Block Model enables time to be used more effectively for learning*

Students and academics emphasised the benefits of focusing on one subject at a time, with many students saying this had reduced their anxiety about study. The intensity of the Block also necessitates well-planned pre-class activities, scaffolded assessments, and a constant pace of learning. The rapid pace of the Block is demanding for many students and staff.

6. *The Block Model involves engaging curriculum that builds skills for learning*

The Block Model required all units to be redesigned, with support from VU's Connected Learning team. Most STEM subjects have been successfully transformed to offer more action learning and engagement, and all are undergoing continual revision and renewal.

7. *The Block Model enables learning progress to be more actively monitored*

Students reported that getting results for their first Block after only four weeks increased their confidence. Innovative, regular assessment and feedback enabled students to demonstrate knowledge in diverse ways, although some challenges remain in calibrating assessment. The Block has also increased use of data by VU staff to monitor the impact of their teaching.

Discussion and conclusion

The Block Model at VU shows that innovation that improves outcomes for equity students is achievable, but that it involves considerable complexity. The principles of complexity theory help to illuminate what other universities can do, to achieve similar change: including creating opportunities for "bottom-up" ideas to emerge; utilising networks rather than siloes; and creating feedback loops at all levels of the organisation. VU's experience of the Block offers insights into how other institutions can manage complexity in their own innovations.

For policymakers, the Block Model shows the importance of regulatory environments that actively support innovation, especially as financial necessity generates more institutional experimentation. It reaffirms the importance of quality teaching, especially for equity group

students, and of actively involving academics in defining and improving their practice. For STEM, the Block shows how active learning can improve engagement and generate skills that are valuable for the workplace; and how interdisciplinary classes can break down the disciplinary segregation between students from different ability groups and backgrounds.

Equity through complexity: Inside the "black box" of the Block Model

As the COVID-19 pandemic ravaged the world, Australian universities were catapulted into an unprecedented period of rapid innovation. Despite their position at the intellectual and technology vanguard, innovation has been lacking in the history of Australian universities as institutions. Davis (2017) describes the "Australian idea of a university" as homogeneous in institutional design, with all universities similarly structured and targeting similar goals:

> *Essentially, only one institutional model is on offer, with providers ranked by prestige and age— rather than by a vibrant ensemble of competing visions, each striving to meet a particular set of interests and ambitions (Davis, 2017, p. 63).*

Davis argues that innovation simply has not been needed in Australian universities, as the existing model has attracted a strong student intake. This includes the many international students whose financial contributions have been a mainstay of institutional viability for many Australian universities (Hurley, 2020). One of the most painful impacts of COVID-19 on the Australian economy has been in stripping back income from international education.

Australian higher education now faces a period where it must innovate by necessity. The uncertain pathway out of the pandemic means that solutions will be experimental, and bold ideas may find their place. There are also new opportunities for greater equity in higher education participation, as institutions that have relied on international student intakes seek to broaden their domestic student base. As 2020 draws to a close, all of Australia's universities may be thinking seriously about how to reach a broader domestic student profile.

This study uses a specific recent university innovation – the Block Model at Victoria University (VU), implemented in 2018 – to generate insight to assist the university sector in this period of transformation. Even before the pandemic, the Block Model offered lessons for other institutions in responding to a diverse student intake, and using innovation in teaching and learning to narrow equity gaps in university participation, retention and attainment. In the post-COVID context, the Block Model provides a significant case study of how a successful innovation that departs from the standard institutional model can occur within a university. This study explores the factors that shaped the Block Model's achievability and impact.

It was never our intention to conduct this study during the time of a global pandemic, or specifically to study its effects. The massive disruption generated by COVID-19 has affected the project on several levels, from its impact on the research team and participants, to the emergence of new avenues for inquiry not anticipated in the original research design. As researchers, we have done our best to remain faithful to the original intention of the project, while staying open and adaptable to the remarkable opportunities for learning and discovery that the changing context has generated. We were fortunate that our action research methodology enabled us to remain responsive to changing times, and that many of our participants shared our enthusiasm for exploration and discovery. This introduction would not be complete without a heartfelt expression of our gratitude for their engagement.

This report begins by introducing the Block Model at VU, and its impact on learning outcomes for equity group students. It then proposes seven hypotheses about why these outcomes were achieved, based on literature and the practice knowledge of the research team (some of whom taught in first-year STEM Block Model courses). A theoretical framework is set out to frame the investigation of these hypotheses, which uses complexity theory to move beyond linear "cause-and-effect" explanations for the Block Model's impact on learning. This sets the scene for the data collection, which used an action research methodology involving interviews with VU leaders, first-year teaching staff, and students. The qualitative phase was supplemented by analysis of quantitative administrative data.

The findings are organised according to the seven hypotheses that were generated at the start of the study. Rather than confirming or refuting the hypotheses, the qualitative data is presented to show different perspectives and interpretations, drawing attention to the complexity of factors that have contributed to the Block Model's impact. The discussion interprets the findings through the theoretical framework, showing how the Block Model's design and implementation represents complexity principles in action. The report concludes with recommendations for increasing innovation and equity across the university sector.

The "black box" of the Block Model

The Block Model was introduced at VU for all first-year students in 2018. The Block Model enables students to compete one subject at a time, in intensive four-week blocks, rather than completing multiple subjects simultaneously over a semester. VU is the first Australian university to implement this model, and is now rolling it out for second-year and third-year subjects across all undergraduate degrees, and for post-graduate degrees from 2021.

In its publicity, VU attributes the Block Model (also called "Block Mode" or "Blocking" within the VU community) with dramatically increasing pass rates in first year subjects. On the VU website, first-year pass rates are cited as 87 per cent, or "up 13% on traditional model" (VU, 2020, n.p.). The website also claims that the Block Model "develops your confidence and independence as a learner and problem-solver", preparing students for their future careers.

Deeper analysis of this data suggests particular benefits for equity students. From 2017 to 2018, pass rates increased by 9 per cent for students in the highest socioeconomic status (SES) group, and 15 per cent for those in the lowest. Pass rates for students who were first in their family to attend university increased by 13 per cent, compared to 11 per cent for those who were not (Howe et al., 2019, p. 3). VU attracts high proportions of students from equity groups, relative to other Australian universities (McCluskey et al., 2019). These results suggested that the Block Model had potential as an innovation to improve equity in higher education, not only in improving retention and outcomes overall.

The improvement in VU first-year pass rates and grade distributions was sustained into 2019, with equity group students again showing stronger gains than the overall VU student population (internal VU data). Clearly, something was working. VU became increasingly confident marketing the success of the Block Model as a means of gaining advantage in the fiercely competitive university sector in Melbourne. Yet a deeper story was also developing, beyond the publicity. The Block Model was the visible signal of a much larger organisational change that was reshaping how VU enacted Davis' (2017) "Australian idea of a university".

VU already had a number of attributes that both enabled and necessitated innovation. It is a relatively small university, with around 20,000 undergraduate degree enrolments in 2019. It is relatively young, having achieved university status in 1990 at the time when Australia's binary system of universities and technical colleges was integrated (Williams, 1992). It retains a substantial vocational education and training (VET) component, known as VU Polytechnic, making it one of six "dual sector" universities in Australia that offer both VET and higher education. Its Act of Establishment commits it to serving the West of Melbourne – a large, high-growth outer suburban area with a strong industrial history – making it rare among Australian universities in serving a distinctive geographic community.

This study peers inside the "black box" of the Block Model, to discover why it has worked at VU, and what insights it can offer for university innovation. It is intended as a practical piece of research, to inform practice at VU and in the wider university sector. It is relational and action-oriented, situated within the collegial relationships between researchers and participants, and the collaborative enterprise that is at the heart of university work (Connell, 2019). It aims to extend this collaborative enterprise beyond the boundaries of a single institution, and offer benefits for others within the higher education practice community.

The focus of the study is first-year students in science, technology, engineering and mathematics (STEM). STEM subjects are recognised as important to Australia's future, and recent national policies in Australia to lower fees for STEM-related university courses are designed to attract more students into STEM disciplines (Science & Technology Australia, 2020). At the same time, STEM subjects have historically attracted relatively low proportions of students from equity groups, including Indigenous students and students from low socio-economic status backgrounds; reflecting equity gaps in STEM participation that begin in high school (Panizzon et al., 2018). If lower fees attract more equity group students into STEM courses, universities must be ready to support them to be successful.

STEM subjects are also a site of considerable potential for innovative, student-centred learning, to cultivate the dispositions such as creativity, collaboration and problem-solving that are essential to success in many STEM fields (Timms et al., 2018). These contemporary approaches to STEM learning contrast with tightly classified, traditional STEM curriculum, in which the student is positioned as "passive, obedient and patient" (Ulriksen et al., 2017, p. 437), rather than as an active participant in the learning process. More active engagement of students in STEM curriculum may offer benefits for equity and workforce preparation alike. As will be shown, active learning in STEM is a key component of the Block Model design.

Background and working hypotheses

Action research must be contextualised not only in relevant literature, but in the knowledge that is already held by practitioners in relation to the field of research (Craig, 2009). The first step in this study involved developing working theories in relation to the research question, to explain why the Block Model had improved outcomes in first-year STEM subjects for students from equity groups. Theories were derived from relevant literature, as well as insights from the members of the research team who were involved in Block Model teaching. These were distilled into seven hypotheses to be explored:

1. *The Block Model is informed by a rigorous base of theory, evidence and reflection*

   The design and implementation of the Block Model is itself a research-informed practice. Pedagogical theories reportedly in active use at VU include Kift's (2015) work on *transition pedagogy*, which emphasises intentional curriculum, tailored support and interdisciplinary partnerships in first-year university; Biggs' (2003) *constructive alignment* between higher education curriculum, assessment and teaching to achieve learning goals; and Fung's (2017) *connected curriculum* for higher education, which makes research and inquiry part of the learning process. The Block Model added structural innovation to these pedagogical approaches, drawing on Helfand's (2013) reinvention of the traditional university structure at Quest University in Canada. This study explored how the Block Model's evidence-based foundations were evident in practice.

2. *The Block Model is situated in a supportive organisational context*

   Efforts to improve outcomes for equity group students are most likely to succeed when they are aligned with the strategies and structures of the university (Devlin, 2013a). At VU, the Block Model occurred within a multi-layered process of organisational change, focused on improving student satisfaction, retention and success. The most significant change to occur alongside the Block Model was the creation of First Year College (FYC), an interdisciplinary college of teaching staff dedicated to improving the first-year student experience (McCluskey et al., 2019). The study considered the extent to which FYC and other overlapping organisational changes impacted on the Block Model's success.

3. *The Block Model prioritises strong relationships that enhance teaching and learning*

   As non-traditional university students become a new majority, greater attention is being paid to the relationships between students and academic staff. Felton (2019) calls for greater student agency in academic development, as being potentially emancipatory for

students and staff alike. Positioning learning as a "joint venture" between staff and students is particularly important for bridging the "socio-cultural incongruity" that can exist at university for low SES students (Devlin, 2013b, p. 947). Student-to-student relationships also matter, and active cultivation of these relationships during classes can be especially beneficial for working class students (Rubin, 2012), part-time students (Kember et al., 2001), and others facing barriers establishing a sense of belonging in the university environment. The Block Model enhances staff and student relationships through small class sizes and the sustained, intensive timetable. This is supported by close relationships between Block Model teaching staff, with FYC leaders having actively cultivated a sense of belonging and collegiality within FYC (Konjarski et al., 2019).

4. *The Block Model is being implemented by expert higher education practitioners*

   The quality of teaching and learning in any educational setting depends on the skills and dispositions of the teaching staff. In an influential report on quality in higher education, Gibbs (2010) observed that the reputational factors by which academic institutions and their staff are often evaluated have little impact on how much progress students make in their learning. For the Block Model, VU actively recruited "teaching-passionate" staff to FYC (McCluskey et al., 2019, p. 11), rather than recruiting solely for prestige or experience. Background information on FYC indicates that the brief was to create a college of "Type Three" practitioners: the type who privilege joint construction (rather than transmission) of knowledge, and who learn alongside their students (Peters & Armstrong, 1998, p. 79).

5. *The Block Model enables time to be used more effectively for learning*

   The amount of "time on task" is an important factor in learning. As the student body in Australian universities diversifies, more students are juggling complex demands on their time, including work, family life and community or sporting commitments. VU also attracts high proportions of "non-traditional" students (such as mature-age or first-in-family), who may face barriers or knowledge gaps in organising their time for study. Prior VU research on the Block Model has claimed that the four-week intensive structure "recognises, respects and accommodates the complexity of student lives", making the first year experience "predictable" and "manageable" (McCluskey et al., 2019, p. 14). At the same time, the intensive structure places high demands on staff workloads, especially in delivering assessment results in an extremely short timeframe (Konjarski et al., 2019).

6. *The Block Model involves engaging curriculum that builds skills for learning*

   The evidence base for the Block Model signals the importance of curriculum that places students at the centre, and supports them to make connections to enhance their learning across the entire university ecosystem (Fung, 2017). As well as connections to their chosen discipline and content, the relationships and organisational setting of the university also become part of the curriculum, including connections to other students, disciplines, and the wider community. Technology-enhanced learning is another important part of curriculum and pedagogy in the Block Model, becoming indispensable when COVID-19 struck. VU has supported FYC academics in the development of Block Model curriculum by establishing a dedicated Connected Learning unit, comprising professional staff who support academics in curriculum and pedagogy. VU has also incorporated explicit guidance about *how to learn* into FYC curriculum, drawing on the Advancement for Individual Determination (AVID) program at VU to upskill FYC staff.

7. *The Block Model enables learning progress to be more actively monitored*

   Student engagement and success in the learning process are heavily influenced by the goals that students perceive for their learning, and how their progress towards these goals is assessed. Biggs (2003, p. 3) argues "faulty assumptions about and practices of

assessment do more damage…than any other single factor" in misaligning teaching and learning in higher education. Students will orient themselves to tests or end-of-semester assignments if they are positioned as goals; conversely, students who experience real-time assessment aligned with learning goals will give greater priority to ongoing learning. The intensive structure of the Block Model enables greater visibility of both progress and learning gaps much earlier than the traditional semester model, improving opportunities to monitor learning for students and teaching staff alike. The intensive classes also lend themselves to innovative, real-time assessment, embedded within the learning process.

These seven hypotheses about the Block Model's impact framed the data collection and analysis. As an evidence base for each hypothesis already existed in the literature, the study aimed to examine the tensions and complexities within them; recognising that the path from educational innovation to improved student outcomes is seldom linear or straightforward.

Theoretical framework

Complexity theory is the lens through which the study explored the Block Model's design and implementation. Complexity has many definitions and applications, with this study adopting the general definition set out by Steele (2016, p. 5), of complexity involving "a recognition of the interconnectedness and interdependence of systems at multiple scales and an attempt to account for the dynamic, non-linear nature of the world around us". This enables the specific innovation of the Block Model to be situated in a wider dynamic context.

Complexity is well-established as a conceptual tool for thinking about how education systems innovate, especially in relation to schooling. Fullan (2001), for example, used it two decades ago to challenge the superficial appeal of surface-level educational innovations:

> *This is not a race to see who can become the most innovative… if meaning is easy to come by it is less likely to be powerful. Simple systems are more meaningful, but less deep. Complex systems generate overload and confusion, but also contain more power and energy. Our task is to realize that finding meaning in complex systems is as difficult as it is rewarding (Fullan, 2001, p. 12).*

This cautionary note resonated with this study, in that the superficial appeal of the Block Model as a breakthrough innovation belies the complexity of its context. The Block Model is best examined not as a discrete educational initiative, but as a major "tipping point" (Snyder, 2013, p. 12) in a complex adaptive process that is continuous and always incomplete.

In the current context of educational research, complexity theory disrupts expectations of a deterministic, linear relationship between an educational intervention and its effects on student learning. It invites a move "away from input-output 'black-box causal models'", and gives attention to "the specific, local linkages that actually interconnect actors, practices, and events across multiple levels of organisation" (Lemke & Sabelli, 2008, p. 122). It is therefore ideally suited to a study in which the "black box" itself is the object of investigation.

Complexity theory is especially useful for engaging with the "why" of a learning process. Johnson (2008) observes that complexity is necessary in explaining the reasons for changes in student achievement; a fact that is often overlooked in educational accountability systems. By focusing on "why", complexity theory is also useful for drawing wider inferences from the Block Model for other institutions embarking on a process of innovation, as it looks beyond the specific innovation to the enablers, contextual factors and relationships that surround it. The aspiration of this study is not for other institutions to adopt the Block Model as a specific innovation that "works", but to use it to understand how their own innovations may be successful, within the unique complexity generated by their students, staff and contexts.

Inequality is also complex, and social systems exhibit considerable complexity in the ways that different forms of inequality emerge and intersect (Walby, 2007). Research informed by complexity theory therefore has further value in helping educational institutions understand

and address inequality, both in the broader social context and within their own walls. Elton (2010, p. 645) sees complexity theory as a basis for universities to become more democratic and collaborative institutions, as complexity is by nature bottom-up. By attending to shifting power dynamics and their consequences for addressing inequality, this study aims to use complexity theory to highlight how the Block Model has improved student equity at VU.

Methodology

The methodology for the study is drawn from action research, in which researchers are immersed in the empirical field of research, rather than standing apart from it. Action research is well-established as a method of choice for education practitioners who aim to directly inform improvements to teaching and learning in a specific institution or context (Koshy, 2010). Action research in education is a dialogue between the practices of teaching and research, in which each remains distinct but complementary (Dowling & Brown, 2012).

Gibbs and colleagues (2017) reviewed the growing body of literature on action research in higher education, which they associated with increasing emphasis on teaching quality:

> *Evidence of how practice can be improved and its impact on the learning of students (and staff) is becoming critical to the changing character of higher education and its accountability to both government and students… [action research] as both a practice and a methodology can provide this evidence. (Gibbs et al., 2017, p. 14).*

While action research in education is often undertaken by individual practitioners, its application to higher education is increasingly occurring at the institutional level, blurring the boundaries between research, teaching and administration (Gibbs et al., 2017).

As all universities in Australia are constituted to undertake both teaching and research (Davis, 2017), they are well-placed to effectively research themselves. The team for this study comprised two VU research-only staff focused on education policy (Jackson and Hurley), and two VU leaders in primarily teaching-oriented roles (Tangalakis and Solomonides). As such, the project offered a novel variation on the insider-outsider collaboration model of action research (Herr & Anderson, 2005), as the research staff were both insiders to the institution, and outsiders to the teaching process. Power dynamics in this relationship run both ways: while the practice of research is privileged in the study, the value of the research will ultimately be determined by its usefulness to the practice of teaching.

These dynamics also informed ethical considerations in the research. The study formed part of a growing body of collegial action research within VU to investigate the Block Model and its impact. The focus on *why* the Block Model had achieved impact for equity group students in STEM was well-suited to a positive, collegial culture of inquiry, as it enabled successes to be celebrated alongside questioning of the underlying factors. The diverse roles of the researchers within the university enabled different dynamics to be created in interviews and focus groups, balancing “insider” relationships with the benefits of an “outsider” perspective.

Quantitative phase

The study began with quantitative analysis, to determine whether the overall increases in student outcomes and satisfaction that have been reported for the whole of VU were also evident for first-year STEM students, especially students in equity groups. As well as providing valuable framing for the study, this analysis also offered an opportunity to test new data systems that have been established by VU Data Insights for academics to use in research. In this way, the researchers became part of the organisational shift in VU towards evidence-informed practice – in keeping with the action-oriented aims of the study.

Two data sources were used. The first is VU's student management system, which contains:

- a range of variables pertaining to students, student characteristics, course and unit enrolment, and student results
- information collected at the time of enrolment, such as biographical details, prior educational attainment, admission details (such as basis for entry into course), citizenship status, and background information (such as whether the student has a disability and the language spoken at home)
- details relating to the student's course, such as their results and unit attempts, which is updated regularly while the student is enrolled.

The second source of data comes from the Student Experience Survey (SES). The SES is the major internal university survey to enable students to express their views about their experience in relation to subjects and teaching. There are two components to the SES: the Student Evaluation of Teaching (SET) and the Student Evaluation of Unit (SEU). The SET focuses on teaching aspects while the SEU focuses more on the overall student experience such as learning resources and workload expectations. Surveys were administered online each semester (2016/17) or Block (2018/19), with the aim of reaching all enrolled students.

This study uses a cohort analysis that separates students into two cohorts:

1. enrolled in first-year STEM subjects delivered in traditional modes (2016 and 2017)
2. enrolled in first-year STEM subjects delivered in block mode (2018 and 2019).

STEM subjects that were targeted for both phases of data collection are listed in Appendix 1.

Qualitative phase

Like most action research, the data collection methods used were primarily qualitative, with the aim of gaining insight into the research question from VU leaders, staff and students. Qualitative data collection occurred in three phases, with participants in each phase serving as "gatekeepers" for the next. After Phase 1, VU leaders helped to recruit teaching staff for Phase 2, who then assisted in identifying students for Phase 3. This enabled exploration of the Block Model in first-year STEM through a cascading set of connected perspectives:

- In-depth interviews (approximately 60 minutes each) with leaders within VU who were involved in the Block Model (n = 7), conducted in February 2020. These interviews were conducted by a member of the research team who was also on the VU Senior Leadership Group (Jackson), enabling them to take the form of a collegial reflection driven by shared interest in understanding and improving VU systems and practices. The leaders were identified as those with a significant role in the design and implementation of the Block Model, especially in STEM subjects. Two leaders interviewed were members of the research team (Tangalakis and Solomonides).
- Three focus groups of three to four first-year teaching staff, plus one lone interview where a participant could not attend at the scheduled time. These were conducted by the same researcher (Jackson), as a VU "insider" who did not have a teaching role, and could therefore explore the practice of teaching at VU from an "outsider" perspective, and were treated as an opportunity for collegial critical reflection and knowledge-sharing. The focus groups were conducted via videoconference for approximately 60 minutes each, during the first lockdown period in Melbourne. All academic teaching staff in first-year STEM subjects were invited to participate in the project, and 11 agreed to an online discussion. Focus groups were allocated according to the availability of participants, with a maximum size of four.
- Ten interviews with STEM students either currently in their first year at VU, or who experienced the Block Model in their first year. These were conducted by a member of the research team with teaching responsibilities (Tangalakis), to provide a familiar face to students with deep understanding of the teaching and learning process.

Students were selected by sending a short, anonymous reflective survey to all students enrolled in first- and second-year STEM subjects. A further five students enrolled in third- and fourth-year STEM subjects were invited by one FYC academic. The survey asked questions to identify equity group students, including “Are you first in your family to attend university?”, “Is English your second language?” and “Do you identify as Indigenous?” Students were also asked if they would be willing to participate in a focus group (of up to four students); and if they agreed, to provide their email address. Of the 10 students who completed the consent form to participate in a focus group, four students were currently in first year; five were in second year; and one was in fourth year, but had completed first-year Block Model subjects in 2018. Five were female and five male. Further details of the ten students interviewed are provided in Appendix 2.

Interviews were semi-structured, informed by the working hypotheses, but without explicitly asking participants to repudiate or confirm them. Instead, participants were invited to share their own views about why the Block Model was successful, with the researchers framing follow-up questions to explore emerging themes. In keeping with the principles of mutual benefit in action research, interviews and focus groups were designed to provoke reflection, not only to elicit information. The intention was for the staff interviews to take the form of a professional conversation in which a narrative about the phenomenon (the Block Model) is jointly constructed using the researcher and participants’ points of view (Gubrium et al., 2012). Feedback from some participants during interviews and focus groups – especially teaching staff – indicated that they valued this opportunity for collaborative reflection.

Interview transcripts were coded against the seven hypotheses, using a deductive approach that nevertheless remained open to “new and interesting things” (Linneberg & Korsgaard, 2019, p. 264). In particular, careful attention was paid to different perspectives, as a way of moving beyond the simplicity of deterministic hypotheses, and unpacking the complexity within each hypothesis from a range of different views. Beaulieu’s (2017) application of phenomenographic methods to action research was influential in guiding this approach, in which coding of qualitative data explicitly attends to difference, rather than unifying themes. Phenomenography is a useful method for investigating complex systems, by enabling subjective experiences of a particular phenomenon to be explored (Lizier, 2017).

Action research often has an emancipatory orientation, aimed at achieving transformation to practice that advances social justice (Gibbs et al., 2017). The Block Model itself may be seen as a practice innovation that advances social justice, given the disproportionate benefits apparent for equity group students. The goal of the study, then, was not so much to achieve a transformation to practice, but to interrogate one, to better understand how its contribution to social justice was achieved. This itself can inform further transformative practice, as the Block Model – like all innovations – continues to evolve and emerge.

Defining equity group students

Both phases of the research were concerned with the experience of equity group students at VU. The specific equity group categories considered in the study are documented in Table 1, showing the numbers of each group in the student management system data for first-year STEM subjects. Definitions of these groups are provided in Appendix 3. Many VU students identify as belonging to more than one equity group, meaning that the numbers in specific groups total more than the “all equity students” group. This also means that analyses of specific equity groups are likely to have high covariation, due to duplication of cases.

Table 1 shows that the majority of VU first-year students fall into one or more equity groups: the “all equity students” group constitutes around three-quarters of each cohort. Proportions of equity group students responding to the SES are similar, and shown in Appendix 4. For the quantitative data analysis, this meant that whole-university and equity group trends were similar, with wider variation emerging between specific equity groups. For the qualitative

data collection and analysis, it meant that comments made in relation to the whole student cohort often applied to equity group students too – as discussed in the findings below.

Table 1. Equity group students in student management system data

STUDENT MANAGEMENT SYSTEM DATA				
	Pre-Block cohorts		Post-Block cohorts	
	2016	2017	2018	2019
All students	**4,549**	**5,803**	**9,576**	**11,236**
All equity students	**3,472**	**4,261**	**6,956**	**8,504**
Equity groups				
Disability	283	272	532	681
Female in non-traditional areas	824	1,289	2,433	3,657
First in family	2,404	2,920	4,809	5,771
Indigenous	12	36	54	50
Non-English speaking background (NESB)	1,146	1,417	2,216	2,847
Low SES	748	871	1,342	1,437

As Table 1 shows, the number of STEM students at VU who identify as Indigenous is increasing steadily, and has more than quadrupled over the last four years. While the number of Indigenous students remains too low to enable meaningful quantitative analysis as a separate group, they are included in data for the "All equity students" category. None of the students who agreed to be interviewed indicated that they identified as Indigenous. The relevance of the Block Model for Indigenous students was not expressly canvassed in this study, and would be a worthwhile topic for future research, alongside other strategies at VU to improve participation, outcomes and cultural safety for Indigenous learners.

Findings

Quantitative findings – Improved student outcomes and experience

Findings from the quantitative analysis are presented first, to demonstrate the impact that the Block Model has had on first-year student pass rates, grades and satisfaction. These findings support previous published analysis (Howe et al., 2019), but focus on STEM subjects alone (see Appendix 1). They confirm that the overall trend in improved student outcomes is evident within first-year STEM subjects, as well as across the university overall.

The proportion of students passing first-year subjects is an important predictor of retention and success. Figure 1 shows students receiving a fail grade in first-year STEM subjects, for two pre-Block (2016 and 2017) and two Block (2018 and 2019) cohorts. Equity groups are ordered based on the size of the change from 2017 to 2019 (largest to smallest).

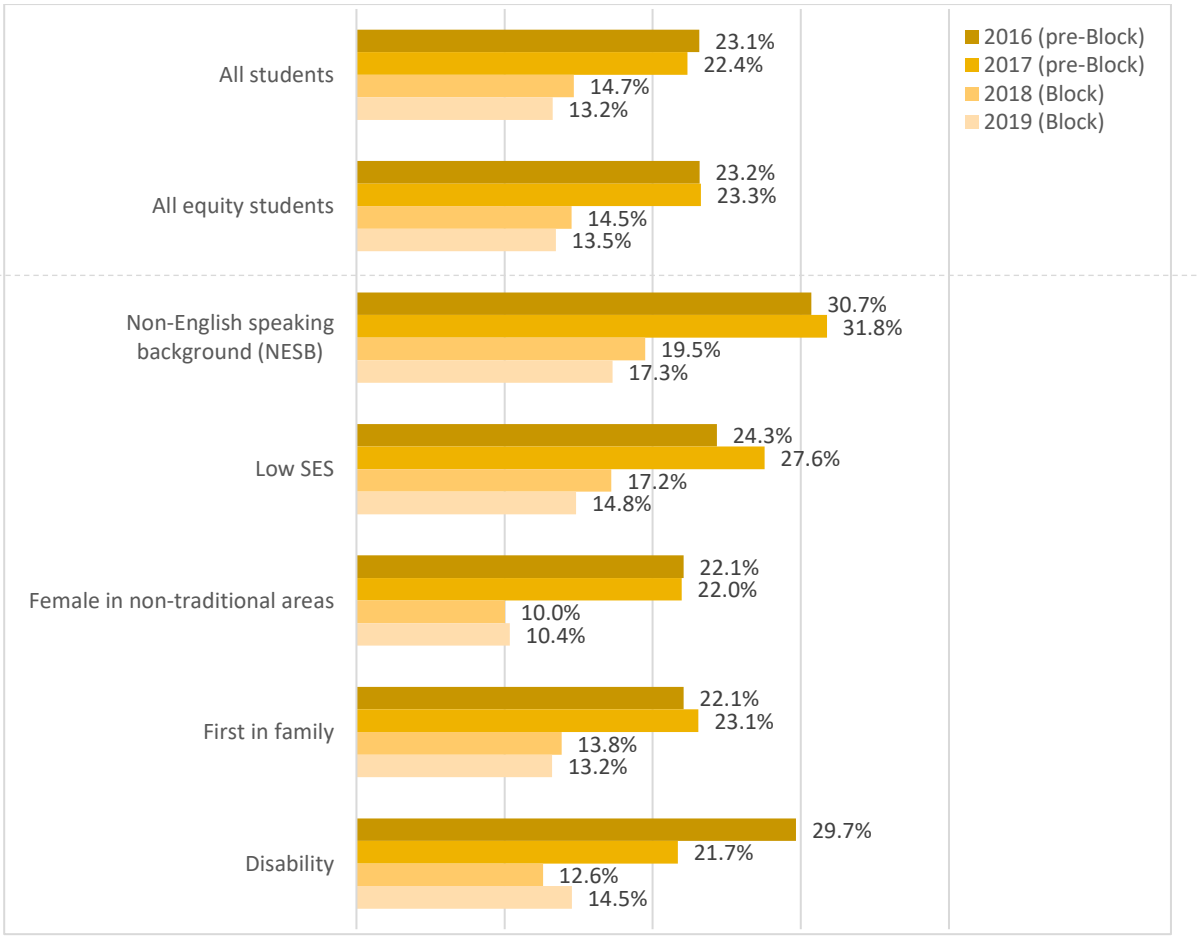

Figure 1. Proportion of first-year STEM students with a fail grade, by equity group

Figure 1 demonstrates a marked drop-off in the proportion of students failing first-year STEM subjects, replicated across both pre-Block and post-Block cohorts. The decline is slightly greater for equity group students than for the entire student population: from the most recent pre-Block (2017) to Block (2019) cohorts, fail grades dropped by 9.2 percentage points for all students, and 9.8 percentage points for equity students. Specific equity groups show larger decreases for the same period, especially NESB students (14.5 percentage points) who have the highest fail rates overall, and low SES students (12.7 percentage points).

Improving student success is not just about decreasing fail rates, but increasing learning. To investigate this, the study compared average marks in first-year STEM subjects for the same cohorts, for those students who received a pass grade.Table 2 shows the results. Only students who recorded a grade have been included in the analysis, which means students who withdrew from the subject before a final grade was awarded have been excluded.

Table 2. Average mark for first-year STEM students who passed unit, by equity group

STUDENT MANAGEMENT SYSTEM DATA					
	Pre-Block cohorts		Block cohorts		*Difference 2017–2019*
	2016	2017	2018	2019	
All students	70.2	69.4	72.4	71.2	+1.8
All equity students	70.2	69.4	72.4	71.4	+1.9
Equity groups					
Disability	71.3	67.9	72.8	70.9	+3.0
Female in non-traditional areas	67.8	69.4	73.0	72.2	+2.8
Low SES	69.9	69.2	71.5	71.1	+1.9
First in family	71.0	69.7	72.6	70.9	+1.1
Non-English speaking background (NESB)	69.8	70.2	71.3	70.6	+0.4

As with fail rates, improvement to student grades for the most recent Block cohort was slightly higher for equity group students (an increase of 1.9) than for all students (1.8). In contrast to fail rates, the increase is greatest for students with disability (3.0), and lowest for NESB students. This table also shows greater variability in the direction of change, with all groups showing a slight decline in overall grades from 2018 to 2019, sometimes returning to below pre-Block levels. This may be associated with the ongoing improvements to assessment practices in the Block, discussed later in this report.

The quantitative data also explored change in levels of satisfaction for equity group students in the SES data. Figure 2 shows the change across the same four cohorts in SES items (rated on a five-point scale) that were relevant to the hypotheses being investigated. Trends are not compared for equity and non-equity students, given the high proportion of SES respondents from equity groups (see Appendix 4). The aim of this graph is to show how equity students' experience of STEM subjects has changed, from pre-Block to Block cohorts.

The overall trend is a positive one across the majority of SES items, especially those related to the quality of teaching. All these items show a consistent increase in student ratings across the four years. Items related to overall unit quality have some fluctuation, although the most recent Block year (2019) is rated highest for almost all. This is likely to reflect early challenges in moving to a new delivery model, discussed in the qualitative results.

The one exception to this positive trend is student workload. Students' perceptions that the workload in their subject was "reasonable" declined sharply in the first year of Block Mode, and have not yet returned to pre-Block levels. This is consistent with the findings of the qualitative data, which found time use to be one of the most complex aspects of Block Model implementation. Overall, the quantitative data shows an overall improvement in equity students' outcomes and experiences in first-year STEM, and hints at some of the factors that may have contributed. These were explored more deeply in the qualitative phase.

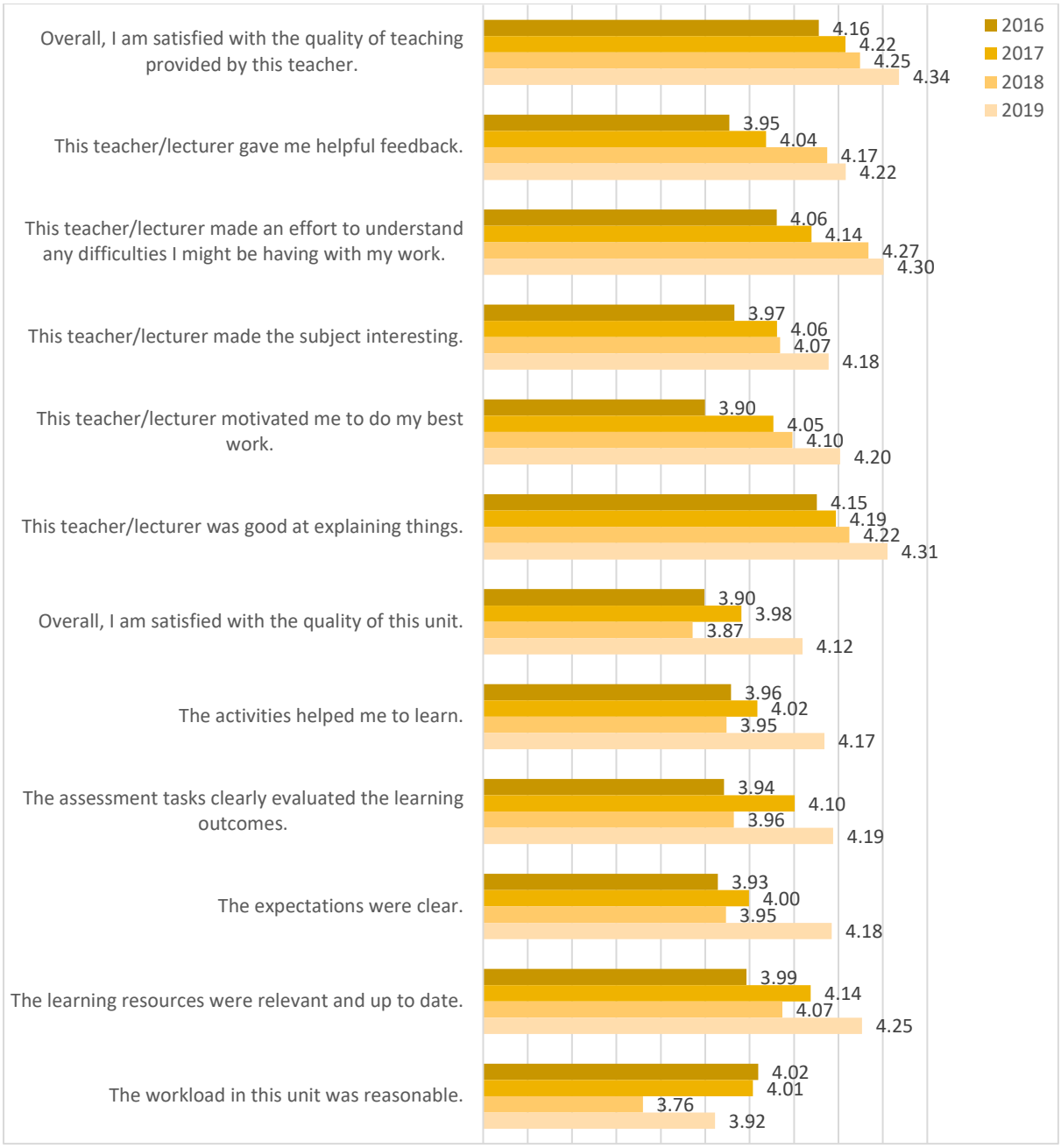

Figure 2. Average SES ratings for equity students in first-year STEM (five-point scale)

Qualitative findings – Opening up the "black box"

The qualitative data was used to investigate the factors contributing to these trends. The findings are organised according to the seven themes, using the hypotheses outlined above. For each theme, perspectives are presented from VU leaders, teaching staff and students, linking to insights from the quantitative data where relevant. This reveals the complexity in how these seven factors in the Block Model's success worked – both individually and in intersecting ways – to affect outcomes for equity group students in first-year STEM subjects.

As may be expected, the balance of evidence varied across the themes. VU leaders were more likely to comment on organisational factors, and the process by which the Block Model was designed and implemented. Teaching staff and students were more likely to comment on the lived experience of Block Model classes. Combining these perspectives offers insight relevant to all educational institutions, about how the intentions and decisions of leaders flow

through to the student and staff community. These ideas are elaborated later in the discussion of results, which draws lessons from the Block Model for university innovation.

Across all of the interviews with VU leaders and teaching staff, issues of equity did not emerge naturally in their reflections on the Block Model's success. Most often, their observations concerned factors that contributed to success for all students, and prompting from the interviewer was usually required to elicit ideas about why these factors may benefit equity group students disproportionately. There were two likely reasons for this: firstly, staff are not necessarily aware of which students fall into equity groups within their classes, so found it difficult to comment directly on specific cases or trends (discussed below). Secondly, as the quantitative analysis showed, most first-year students at VU fall into one or more equity groups (see Table 1) so equity issues are in fact "mainstream". This relatively unusual attribute of VU casts a powerful contextual shadow across the findings, as shown below.

1. The Block Model is informed by a rigorous base of theory, evidence and reflection

The first hypothesis for the Block Model's success is that it rests on a strong base of theory, evidence, and reflection on translating this evidence base into practice. As noted above, VU was already pursuing an evidence-based approach to first-year teaching before the Block Model and associated organisational changes were introduced. Analysis of interview data in relation to this theme therefore sought to find a distinctive evidence base for the Block itself.

A theme across interviews with VU leaders is that a "seminal moment" [L1] occurred in building the evidence base, when a senior leader shared David Helfand's TED Talk on designing a university for the third millennium (Helfand, 2013). As one leader said:

> *[L2]: We were…trying to work out what would be the distinctive point of difference that the First Year College could do other than it being a first year college. And that was when [L3] discovered the TED talks around Blocks. And I remember…we saw this and went "That's what we should do!"*
>
> *Interviewer: Just like that?*
>
> *[L2]: Pretty much just like that!*

Yet this was not a case of a single idea being adopted in isolation, but "the final piece in the jigsaw" [L1]. The Block Model within FYC gave a tangible shape to the evidence-based practice in first-year teaching and learning that had accumulated at VU over many years.

The FYC leadership team embarked on a tour of Colorado and Quest Universities, where the Block Model was already in place, to gather further evidence to inform their planning:

> *We looked at every aspect of it. We looked at the systems, we talked to the academics, we talked to the students, we sat in on classes. We just poked and prodded this thing that we thought was Block – and how does it work, and what were the challenges? And I think it was talking to the students in both those places that we realised "This really works – the students love it!" [L3]*

The evidence-gathering, TED-talk-inspired "road trip" [L3] more closely resembles the research and development activities of an industry innovator, than traditional research in a university setting. The instigator described herself as "a very social media literate person" [L3], frequently taking ideas from unconventional sources to inform her leadership and practice. This pride in departing from university norms emerged frequently in the study.

Even proven, evidence-based innovations require adaptation to local contexts. Prior to the overseas tour, the leadership team conducted a series of "town halls" within VU, seeking ideas to improve the first-year experience. While these generated an array of ideas and reflective discussions, one leader felt that they "weren't getting very far" [L3], with another reporting thinking: "This is great, but it's not really setting the world on fire" [L1]. Other ideas

from other institutions – such as a first-year preparatory course – were floated, and met with a lukewarm response [L3]. All four leaders who described this period conveyed a sense of determination to break the mould, and firm belief that "there has to be a better way" [L4].

Fitting the Block Model into VU's existing jigsaw of ideas required attention to equity issues. The VU leaders who visited Quest and Colorado were concerned that their students "were generally students from higher socioeconomic backgrounds", paying "megabucks" for the "authentic learning" experience that the Block provided [L3]. This contrasts markedly with the view of another leader, who saw the Block as a response to VU's student community:

> *Surely it's time that we drew a line in the sand and said 'We're not going to try and aspire to be like the other [universities]… We cater for a lot of students who live on this side of town…' And if that's what we need to do to put ourselves in the spotlight and [make] students' opportunities even better, then I'm totally for it. [L5]*

Ironically, the perception that the Block Model was an adaptive strategy for non-traditional students led some VU staff to see it as not for "*real* students"; despite it being derived from a premium model that students transfer from other prestigious universities to access [L3].

This made implementation of the Block Model at VU both evidence-based *and* experimental. "Like a good researcher", one leader had proposed that the Block Model was piloted in a few subjects initially [L3]. However, the financial impossibility of running multiple first-year models simultaneously meant that in the end they "just got on and started doing it" [L3].

As Block Model implementation progresses, the boundaries between organisational "R&D" and academic scholarship are blurring. In addition to the current study, the Block Model has generated a growing body of research into practice, both general and discipline-based. In interviews, several FYC academics mentioned sharing research on aspects of the Block Model at academic conferences; as well as drawing on the field of practice scholarship for insights into challenges they faced in the Block Model's implementation. One added that his disciplinary colleagues at his previous (elite Australian) university used to "look at him strange[ly]" if he wrote a paper on pedagogy, but that his recent scholarship on the Block Model had been well received by his STEM disciplinary colleagues internationally [A1].

In summary, the evidence base is an important part of the Block Model story, but reflection and translation to the local context are equally essential. FYC staff continue to engage with international pedagogical experts, as well as generating their own research, supported by data as discussed later in this report. As the Block Model expands beyond FYC across all VU year levels, new questions are arising about how "content-heavy" STEM subjects can be adapted for Block Mode without losing rigour [L5]. The Block also raises questions about the evidence base for traditional university teaching modes. As one leader joked, if you were teaching Block Mode and someone proposed traditional lectures and overlapping assessments as the best way for students to learn, "you'd think they were nuts!" [L2]

2. The Block Model is situated in a supportive organisational context

The second hypothesis concerns the organisational context into which the Block Model arrived. In interviews, all VU leaders and teaching staff firmly agreed that the concurrent implementation of FYC alongside the Block Model was critical to the success of both:

> *It's the First Year College that has actually provided the infrastructure and the culture that has enabled the [Block Model] to be successful. [L3]*

A third major element of the change was the Connected Learning team, a unit employing about 20 students and staff as "learning designers", to help teaching staff adopt the Block Model curriculum and pedagogy [L3]. There was an element of serendipity to this winning

combination, of being “in the right place at the right time”, resulting in “the convergence of a number of things that were happening that have eventually got us to where we are now” [L1].

The success was not just due to the initiatives themselves, but also their novelty. For one leader, the combination of the two initiatives created something distinctive and exciting:

> *[FYC leadership] deliberately set out to create something that did not look like anything in the university currently. So all of the roles had different names; all of the structure was different. It was a deliberate plan to make it look different to everything else. [L2]*

The promise of something new proved critical to attracting VU staff to FYC, who “didn’t really know what it was going to be, but they knew it would be different” [L2]. Interviews with FYC staff suggested that this reflected some dissatisfaction with the *status quo* in their teaching roles, but more strongly reflected an appetite for innovation. Despite being “very unclear in the beginning how it was going to work” [L7], they seized the opportunity to give it a try.

Other drivers for innovation were also evident at the institutional level. Leaders were candid about the financial difficulties VU had been facing, in part due to high first-year attrition:

> *We were at that stage several millions of dollars in deficit – this very significant failure rate in the first year. And our backs were to the wall, we didn’t think incremental improvement was what we needed. In fact, what we probably needed was something a little bit more revolutionary, rather than evolutionary [L1]*

Innovating in a financially-constrained environment itself was challenging, and funds were diverted from other strategic projects to resource the Block Model design [L1]. One leader noted that the Block Model and FYC were still running “on the smell of an oily rag” [L3], and could be even better with more resourcing. That said, financial constraints were largely framed as practical realities in the interviews, rather than frustrations. One leader rebuked colleagues who let financial constraints limit their aspirations for VU [L5]. Prior to COVID-19, enrolments were increasing, with the Block offering entry points throughout the year [L7].

Neither did VU leaders see students as the problem. One leader was emphatic that the changes to the university (Block Model and FYC) did not reflect an “equity” solution:

> *The Block Model certainly was not informed at all by the cohort. The First Year College may have been in response to the outcomes our cohort were seeing, but it was more about what is it that the university can do to improve the outcomes for our students rather than based on the students themselves. So we took it that the university was failing, not the students. And whilst we do have a particular demographic, we also have some very high-end students. And clearly what we put in place had to work for the high-end students as well [L2]*

The characteristics of VU students, and their relationship with the university, are explored further in the following section. In relation to the organisational context, this comment is an indication of VU’s willingness to own the problem, and call its own practices to account.

The implementation of the Block Model in the new FYC created an entity within the university that was conceptualised, organised and staffed differently from any other part of VU. This was remarkably successful in creating space for innovative thinking, and a sense of togetherness among FYC academics, as discussed later in this report. However, it has also created new challenges, as the Block Model is being extended to the broader university. What has begun as a distinctive first-year experience to improve retention and success is now becoming a distinctive model for the entire VU experience. Its ability to stand apart from VU business-as-usual is being eroded, as its impact on the university community widens.

Expansion of the Block Model will test its effectiveness independent of the FYC environment. Beyond first year, VU is structured in disciplinary colleges, rather than the interdisciplinary environment of FYC. Leaders noted that relationships between FYC and disciplinary colleges vary markedly between STEM disciplines; some readily engage in joint meetings and feel welcome in each other's classes, whereas other disciplines have expressed open opposition to FYC approaches and ideas. Tension seems highest in disciplines with strong professional accreditation frameworks, where specialist teachers have a close attachment to established disciplinary practice [L5, L6]. Although the Connected Learning team offers VU-wide support for Block Model implementation, some disciplinary staff can be mistrustful of curriculum and pedagogical advice from those who have not been practitioners [L5].

The scale-up of the Block Model within VU throws up insights for its potential adoption in other institutions. With VU's whole-of-university transformation still in its early days, many possible directions may still emerge. One leader suggested boosting collaboration between FYC and discipline colleges with "a formal structure that forces that to happen" [L6]. Another suggested extending the whole FYC-and-Block combination, to establish interdisciplinary colleges for second and third year academics too [L3]. Others within VU have taken an opposite view, questioning whether FYC itself will remain necessary now that the Block Model is universal across VU higher education courses [L3].

These options have implications for students too, especially those from equity groups who have benefited most from the Block Model and FYC combination. If scale-up of the Block Model does not include the elements that contributed to their success, there is a risk that VU's inclusive first-year experience will only delay barriers to learning, not overcome them. The interview data suggests that scaling up the Block in some STEM disciplines remains especially challenging, where hurdles or gatekeepers may limit the spread of innovation.

3. The Block Model prioritises strong relationships that enhance teaching and learning

Besides novelty, the Block Model and FYC shared another critical success factor: both actively transformed relationships between VU staff and their students. These changes were not just aspirations from leaders, but featured vividly in the lived experiences of staff and students alike. Besides the obvious structural change to how time is organised (discussed later in this report), strong relationships – whether *between* students and staff, or *among* them – were the defining feature of the Block Model for both students and academics.

Relationships between teaching staff and students were enhanced by the small Block classes. Several academics, like this one, contrasted this with first-year university lectures:

> *I think that's another difference in our Block and small classes, with students who have been to other universities who say "I never got to talk to anybody. You'd have to sit there in silence". And…the teacher was just miles away. You'd never actually get close to them. [A2]*

One student said the close relationships were "like high school", and created "a good feeling" in classes and around the university [S3]. Another commented "the professor knowing you inside out is very important because they would understand your circumstances" [S6].

Of course, small-group learning is not entirely absent in traditional university models, and some noted its similarity with tutorials [A3]; or Foundation Studies classes, which typically have small numbers of students [A4]. The difference with the Block was that academics were also immersed in the small-group format, for intensive periods with the same students.

Besides making learning more "enjoyable" [L7], the closer relationship has positioned staff and students as partners in the learning experience. A sense of reciprocity and shared effort was evident in many comments, captured by one academic with a Greek background:

> *In Greek we have this word which is "philotimo", which is hard to explain but where at the end of the day you show someone that you're going to really, really try your hardest to help them achieve their goals. There's a good opportunity that they're going to equally respect [you]… yes, we appreciate what you are doing here when we actually try our best as well. [A3]*

The sense of learning as a shared endeavour was also evident in some student comments:

> *It just wasn't like a job that you guys had to do and you're really invested and you wanted us to do well, you really did, and it was very clear from the very beginning. The expectations were clear and through your actions and just seeing it, you really wanted us to do well which was different. I did not get that at [elite university]. So it was a very different experience. A lot more interactive. [S1]*

As another staff member said, "if you don't have that [trust], it doesn't matter how good the unit is"; noting that "maybe [trust] had always existed", but was now more prominent [A5].

A related theme was the increase in help-seeking behaviours, as academics used their closeness to students to address learning needs on a just-in-time basis. The responsiveness of FYC academics to requests for help was frequently noted by students, including some academics coming early to class or staying late to offer extra support. Students' willingness to talk about receiving help suggests that help-seeking was normalised and non-stigmatised:

> *All we have to do is reach out and ask for help. And in terms of that, yes, the response was amazing 'cause like all the professors that I reached out for help, they were like fully into trying to help me a lot. I don't mind admitting that I need help. I received a lot of help including feedback for assignments. [S9]*

Help-seeking was also increased by the visibility of individual student needs, which might be less apparent to academics in traditional university lectures. These needs could relate to intrinsic challenges in learning, or to situations arising in students' lives. Some academics mentioned students who may have missed important assessments due to adverse events, if they had not built the closeness with teaching staff that enabled them to ask for help.

The academic-student relationship was also transformed at a more fundamental level. One leader contrasted being a "sage on the stage" with being "forced to deepen that interaction", and become "just the person in the room about whom the learning revolves" [L6]. Other leaders and academics described involving students in designing the learning process, also facilitated by the employment of current VU students on the Connected Learning team. This reflects the centrality of relationships to both student-centred curriculum and evidence-informed pedagogy – two other Block Model success factors explored later in this report.

Trusting students as partners requires teaching staff to genuinely believe in their capability. One of the strongest equity-related themes throughout the data was simply the need to take a positive view of students' potential. This was often identified as a mindset specific to VU:

> *Perhaps we have more empathy at VU, especially in the program where I taught before coming to First Year College, in the diploma pathway program. So, let's focus on what students can do and use that as a stepping stone, so that has spoken very well to me in Block Model. It has been one of my guiding principles that you set up something that students can do, so there is an emphasis on creativity, there is an emphasis on getting students to walk with their peers, and there is a very strong emphasis on the social aspect of learning – about working together and talking about it, and modelling, and all those things. [A6]*

This mindset was tested by the Block Model strategy of combining students from multiple disciplines into common first-year subjects, such as Anatomy. Wide disparities exist in average Australian Tertiary Admission Rank (ATAR) scores for students enrolled in different

STEM disciplines. Some staff had raised concern that combined classes would be "dumbed down" to the lowest common denominator [L5].

The counter-argument was that the mixed ATAR scores would "pull people up" [L5]. This depends on opportunities for students to "potentially teach each other" [A7], again emphasising the social dimension of learning. This learning may in fact go both ways – one leader observed that students who had done well at school sometimes found it harder to thrive in the Block environment, as it differed from their expectations [L2]. The student relationships built through collaborative learning were also seen as fostering a sense of belonging: "you see the friendships clicking left, right and centre, and it's so good" [A2].

Students' comments on the interdisciplinary classes were mixed. Some valued it – "I'd learn off their ideas and their way of thinking" [S1] – while another reported "carrying the team" in group work, because the content was less relevant to those from other disciplines [S3]. As might be expected, friendships were an important theme in students' comments, again with mixed experiences: one had remained with a similar cohort throughout their Blocks, and hoped the friendships would last when they entered industry [S6]; another actively kept in touch with like-minded students even when in different Blocks [S9]; while another commented that moving rapidly between Blocks had made it harder to make friends [S8].

Relationships between teaching staff outside of the classes contributed to the changes within them, again reflecting the interconnectedness of the FYC and Block Model reforms. All FYC academics spoke positively about the interdisciplinary community of practice:

> *It's a fantastic culture…When we get together, we just meet in people's offices, or in the corridor: "We've got this idea. Do you want to come on board" [L7]*

> *I mean, [before FYC], we were just doing our little Science bit, and I wouldn't even talk to people in Bio Med, so not even thinking of going further out, to Arts and Law and Business and things like that, and I have interactions with all those people these days. [A7]*

Alongside interdisciplinary collaboration, it was possible to detect a deeper respect for staff who had *themselves* come to academia from non-traditional backgrounds. One FYC academic spoke about the prejudice she encountered at an elite university: "Here's the girl from the western suburbs, but she's smart" [A2]. Overcoming the "urban legend" [L4] of low expectations in their own careers equipped them to do the same for their students.

In summary, stronger relationships were not just a by-product of smaller, intensive classes in the Block Model: they are the main vehicle through which enhanced learning occurs. The strength of the relationship between staff and students also rests on a predisposition towards strengths-based pedagogy, which the Block Model has activated. The strong interdisciplinary relationships between staff are also noteworthy, as they did not exist previously at VU, but have been facilitated by the FYC structure, along with the shared challenge of Block Model implementation. Relationships between staff are also creating interdisciplinary connections for STEM students, and disrupting ability-based hierarchies between STEM disciplines.

4. The Block Model is being implemented by expert higher education practitioners

The next hypothesis concerned the teaching staff themselves, and the skills and dispositions that they brought to the task of implementing the Block Model. For students, the quality of FYC academics was a defining feature of their learning experience. The many comments from students on teaching staff focused on personal qualities, like "considerate" or "helpful". This supports the quantitative findings, that equity students increased from pre-Block to Block on all measures of teaching quality. The largest increase was for the item "This teacher/ lecturer motivated me to do my best work", suggesting a connection between encouragement from teaching staff, and students' perception of the quality of their work.

The quality of teaching practice in FYC reflects the deliberate strategy to make a "student-first" mentality a top criterion for selection into FYC [L2]. This did not necessarily mean the most experienced or highest-profile teachers; FYC academics interviewed for the study ranged from those who had taught at VU for decades, to those who were new to teaching:

> *We've really got some of the best teachers in the university teaching in the First Year, which is precisely where they should be. You want your students who come in to get the best possible teachers, the best possible people. And it doesn't matter whether you're a Level A or E, you bring that level of experience and expertise and knowledge, and the students grow from it. [L6]*

Another leader noted the value of recruiting teaching staff who had recently been students, who brought a "student lens" to their work [L3]. As VU is a dual-sector university, FYC also recruited a number of TAFE teachers from VU Polytechnic. Because a teaching qualification is mandatory for TAFE, these staff brought insights into teaching and learning design [L2].

The elevation of teaching expertise has created a powerful sense of professional identity within FYC, distinct from traditional ways of being an academic. These contrasts arose often in interviews: whether in comparison to colleagues in VU disciplinary colleges who are busy "doing [disciplinary] research, and not really interested in the students" [L7]; or to the "experts" in "sandstone [elite] universities" who "aren't really teachers at all" [A5]:

> *Let's say you go to [names two elite universities] and have a class size of about 400. There is a group of those students that will pass that unit whether you're a terrible teacher or the best teacher in the world – they're going to learn on their own, and it's not about you, it's about them. [A7]*

Views differed among participants about the importance of disciplinary expertise, relative to teaching skills. One leader suggested that skilled teachers could transfer their skills quite readily across disciplines [L3]; while another was adamant that "it has to be both" [L6]. Students also have their own ideas about good teaching, which may be more instrumental and vocational than academic (Tomlinson, 2014). For example, one student commented on teachers being "really, really knowledgeable", but lacking "actual industry experience" [S5].

Another attribute identified in FYC academics was their openness to continuous learning. Many FYC academics are undertaking the Graduate Certificate in Tertiary Education, and FYC has offered a structured ongoing professional development program to enhance their teaching, including through the internationally-acclaimed AVID program. Increased teaching expertise can be counted towards promotion and career development for FYC staff [L5], expanding on how university careers have historically been defined and remunerated:

> *I think a good academic is someone who is constantly reflecting on their practice and looking at improving what they do and innovating what they do in all aspects of their role – so that's in teaching, that's in research, that's in scholarship, and I think it's also in professional collaboration. And that's really what we're really trying to do. We're trying to keep them creative and continue to give them opportunities so they can develop their career in ways that will suit them [L2].*

At the same time, teaching excellence is seen as a collaborative rather than competitive endeavour, and FYC staff are encouraged to share and critique each other's practice [L1].

This enthusiasm for experimentation and professional learning equipped FYC to weather the storms of COVID-19. FYC staff interviewed in the heart of the pandemic were supporting each other through the challenges, and enjoying trying new teaching strategies online:

> *This could be a new future direction. I think I would love to try. For myself, I actually have started thinking of new initiatives for teaching practice which I thought would not be possible in a physical class. [A8]*

One FYC academic wryly observed that COVID-19 had simply accelerated the process of continual innovation occurring naturally in FYC, in that most teaching staff would change something themselves, “if we are left to do the same thing over and over again” [A9].

Overall, there was consensus across all interviews that FYC staff were embodying the goal that VU has set for them: “You are the university. Be fabulous” [L3]. This was more than a set of knowledge and skills, but a combination of “energy and engagement and caring” [L3]. The transfer of energy and enthusiasm from teaching staff to students was a clear, simple factor in the Block Model’s success. For equity group students, the teaching staff embodied a highly motivating university environment that welcomes, supports and believes in them.

Yet the culture and capability of FYC staff – described by one senior leader as “the happiest group of people I've come across in an academic setting” (Garfield, 2019, p. 1) – did not emerge by accident. There was some initial “grumbling” from late adopters, who have since been brought on board using evidence of the Model’s impact [L4]. Resistance to new teaching strategies is most likely to arise where a view exists that “students are an inconvenience”, taking time away from important research [L3]. VU faces challenges in sustaining the “fabulous” culture that has been created in FYC, while remaining open to critique and contestation about the Block Model as it expands. For the passionate teaching staff in FYC, a further challenge exists in sustaining their energy in the face of demanding workloads – another striking feature of the Block Model, discussed in the next hypothesis.

5. The Block Model enables time to be used more effectively for learning

The most obvious change under the Block Model is how time is organised. Its design is intended to ensure that time is used more effectively for learning, as one leader explained:

> *One of best, most cost-effective things you can do in terms of improving the atmosphere of students is getting them to spend time on task and time on the right things. [L1]*

The leader added that poor time use in universities was not necessarily a problem located within students (as is implied by a focus on “time management” skills), but arising from how university learning is structured. If students are placed under stress to deliver multiple assessments simultaneously, they will do the bare minimum to survive, often involving memorising or “regurgitating” content. If they experience learning as focused, purposeful and continuous, they will engage with content in more meaningful ways [L1]. One student observed that “where I studied before, they’re basically assessing your memory and not your knowledge”, and attributed the higher grades they got at VU to the different approach [S4].

In most interviews, discussions of time use focused on doing “one subject at a time” [L6], rather than how time was organised within classes (the latter is addressed below, in relation to curriculum and assessment). This was a standout benefit for all students interviewed, often associated with reduced anxiety and stress, and increased focus and engagement:

> *Because I can compare it to my other studies at VU, which wasn’t in the Block Model, I just feel like it's so much – not lighter, I would say with a workload, but you can focus on one subject at a time which looks like a bit of a relief. I feel like when you do one thing at a time, you learn better as well. [S10]*

Several students contrasted the Block Model with their Year 12 experience at school, with one identifying the pressure of concurrent subjects as the reason she did not finish high school [S7]. One leader noted that this was especially beneficial for subjects like engineering and physics, by enabling students to master theory before they were asked to apply it [L2].

The benefits of doing subjects consecutively rather than concurrently were practical as well as cognitive. One FYC academic saw the traditional semester model as highly inefficient:

> *With one unit at a time, you're not trying to be pulled three different ways, where – in the old model – you might have the first eight or nine weeks where there is really nothing to do, and then suddenly all hell breaks loose for the three weeks when you're trying to rush and do four or five things at the same time. [A7]*

Another reported frequently losing students from class when assignments for concurrent subjects were due, whereas attendance in Blocks tended to be more sustained [L6]. One commented that his subject – maths – tended to be the "lowest priority" for many students, but that "excuses for not doing work" had notably decreased under the Block Model [A4].

The relationship between time use inside and outside of classes was another important theme. Many VU students work alongside studying, and mature students may have family responsibilities to juggle as well. Teaching staff saw the Block as benefiting these students, by concentrating classes into predictable times [L6]. One leader advised that FYC subjects reduced travel time by giving students more choice about which campus they attended [L5].

On the other hand, expectations for work outside of classes could be high: the intensity of Block Mode often requires learning to be done outside of class. Academics generally never did work within classes that could be done at home, to maximise in-class learning. One academic noted that "it gives them an extra push, that they realise they have to do some preparation before coming to class", and that increasing the proportion of students who completed the pre-class activities was a goal that her classes worked on together [A10].

The overall impression of Block Mode was one of productive but relentless activity. This emerged in further comments from students, about the demands of their workloads:

> *Some of the more intensive subjects, it can be a bit hard to keep up with some of the assessments, especially if you have some weak points. So math is definitely one of my weak points, for instance, and in the algebra and calculus ones, I struggled on that one. [S1]*

This supports the quantitative data, in which the only item on which satisfaction had declined for equity group students, from pre-Block to Block, was: "The workload in this unit is reasonable". This was a notable outlier when all other satisfaction indicators had improved.

Student workload also varies widely between STEM units. Describing the newly "Blocked" courses in second year, one leader contrasted "content-heavy" subjects with those that were more manageable. He advised that one student had logged his hours for two contrasting subjects, and found that they differed by "a factor of six", taking into account within-class and outside-of-class study. While differing workloads across subjects are hardly a new concern, these differences may be more intense when subjects are concentrated. When students miss a "content-heavy" class, their ability to catch up "is compromised greatly" [L5].

It is not only students who are feeling the squeeze. Teaching staff described the Block Model implementation process as incredibly intensive – "everyone was stressed" [L7] – and some FYC course design issues remain unresolved, even as the Block is rolled out more widely. The need for continual assessment was by far the biggest contributor to the frenetic pace:

> *The only time the marking is down is in between Blocks. In the past it was around Week 3 – you had a weekend where you had to do some stuff; around Week 9; and then Week 12. Whereas now it's just constant. You're pretty much marking all the time. And our classes are 35 – and so when you've got everyone who turns up, everyone who submits, you've got 70 assignments that you have basically three days to mark as well as teach the classes, so that is really hard. [A2].*

One benefit of the intensity is in effectively forcing staff to implement innovative assessment, rather than holding to previous labour-intensive models [L2]. At the same time, one leader raised concerns that it left no time for issues of academic integrity to be investigated [L6].

The intense teaching workloads arise in part from the organisational context of the Block Model's design. One leader advised that the creation of FYC and redesign of teaching workloads under the Block was a solution to an industrial *impasse*, in that VU needed to increase teaching hours but did not have the resources to achieve this in the conventional model [L3]. The teaching-only positions in FYC offered a career pathway for the kinds of staff who would help the Block Model succeed, while also increasing overall productivity.

The interviews created the impression of an institution running at exhilarating speed, fuelled by a sense of purpose and visible progress along the way. This seems equally true for both students and FYC staff: use of real-time data (discussed below) creates a powerful sense of forward momentum in the learning process. Yet the model also shares many qualities of the "slow university" that Treanor (2009, p. 1) imagines, with time for staff and students to share learning and discuss ideas, both inside and outside the classroom. This opens possibilities for interpreting the Block Model as either a managerialist reform, which moves students rapidly through lock-step processes; or a transformative reform, which empowers them.

Perceptions of time use are highly subjective, and can vary across disciplines. The four-week Blocks may be more effective for STEM subjects where sustained repetition and clinical practice is required [A8]; but less effective for subjects that require time for key concepts to settle in. Students noted differences in how well subjects had adapted to Block Mode, from those that were "seamless" and "really logical"; to those that appeared to be "disjointed" or "only scratching the surface". The sequencing of Blocks also mattered for learning: some students preferred to have similar Blocks occur consecutively, complaining that content could easily be forgotten in the gaps. In contrast, one said that the intensity of the Block had vastly improved how much they remembered, even into second year [S2].

6. The Block Model involves engaging curriculum that builds skills for learning

Time use is not the only organising principle for Block Model curriculum. Implementation of the Block Model and FYC has also involved a focus on student-centred and inquiry-based learning. One FYC academic described how he used small-group inquiry projects:

> *[Groups] can choose anything that covers something in that unit's topic. And we get very wide things. So in this Block, we got people doing anything from new viruses to bushfires, ecology, biosphere through to predator prey interactions, the rise of allergies and things. They can tailor some of their learning to what they're focused on, and that seems to keep them engaged and involved [A7]*

The changed relationships between teaching staff and students form a large part of the student-centred curriculum model, positioning students as co-creators of learning. This does not mean that teachers are passive: one student noted that the lack of lecturing did not give teaching staff licence "not to do anything", but that "really good teachers" used it as a chance to "cover all bases of learning, like visual and getting you to talk with other people" [S7].

The focus on students was assisted by the reduction in the number of first-year subjects, combining subjects taught across multiple courses into interdisciplinary classes. This forced teaching staff to focus on the *students* that they were teaching, rather than the *content:*

> *So, therefore, the academics need to get a sense of – rather than just thinking "These are my traditional medicine or bio-medical students or my nursing students" – they have to think, "well, who's in this class"… getting the academics to actually understand the students, and the students' perspective, and thinking of different ways of actually engaging that student in learning this discipline or this content or this theory required a different way of thinking. [L3]*

Combining students from different STEM courses into interdisciplinary classes also supports collaborative inquiry, as students can explore topics from differing points of view [L5].

These conceptual shifts set the scene for myriad day-to-day curriculum innovations. One leader reported seeing "incredibly innovative" curriculum in FYC, such as taking students off-site to learn in authentic contexts; made possible by the Block structure [L6]. Another joked that she felt "like a schoolteacher" in her efforts to engage students, drawing inspiration from the internet, household objects ("putting Glad Wrap on a muscle"), or from students' own ideas [L7]. While many teaching staff used innovative strategies previously, the consensus was that the Block encouraged more such experimentation, to respond to student interests and iterate improvements across consecutive Blocks. Decreased use of textbooks was another benefit noted in some subjects, reducing cost pressures for students [A2].

Another key component of Block Model curriculum is an explicit focus on learning skills. One leader who had been involved with the AVID program at VU for some time suggested that it should be the "first thing" for FYC staff to learn, as it provided a set of tools to better engage students across all disciplines [L7]. Another designed assessments so students would "learn how to learn", rather than "regurgitate" content: "can they go from what we've told them – so go from X – can they get to Y?" Like most teaching strategies identified in interviews, these were not directed specifically at equity group students, but were likely to benefit them.

The last critical change in the Block Model was the growth in digitally-supported learning. The Connected Learning team was instrumental in supporting all FYC staff to move their content onto the Learning Management System (LMS). This proved invaluable in 2020, as COVID-19 forced all learning into the online environment. FYC staff were mostly positive about the online environment: benefits in reducing commuting time for students were raised more frequently than the challenges of unequal access to technology. Many saw the future of university as involving blended learning, rather than a return to face-to-face delivery.

While more flexible, inquiry-based learning offered many benefits for equity group students and others, specific barriers were evident in relation to STEM. One leader commented that many of the courses that retained an attachment to "the textbooks, the diagrams and the telling" were in STEM disciplines; and that STEM courses were also yet to fully embrace "the affordances of digital technology" [L3]. This observation did not apply across all STEM courses – some were "doing it really, really well" [L3] – but suggests that some attributes of STEM teaching may be resistant to more inclusive approaches. This is despite inquiry-based learning itself being associated with effective STEM teaching and learning, by fostering the skills for exploration and discovery in rapidly-changing science and technology fields [L1].

7. The Block Model enables learning progress to be more actively monitored

The final hypothesis to explain the Block Model's success concerned new approaches to student assessment. The student-centred approach to curriculum design was anchored in a more purposeful approach to assessment, recognising that what is assessed will be a key driver of what students will choose to learn [L1]. This resulted in a move away from exams:

> *STEM has traditionally been examination based. And the idea is that you remember lots of facts and you regurgitate them. And I think that with very few exceptions, we've removed exams out of our STEM units. [L2]*

Instead, students undertake assessment tasks that require them to apply STEM knowledge and skills, such as oral or laboratory-based assessments, which are "closer to the sorts of work they would do in a workplace, rather than the pressurised one-on-one exam" [L2]. One FYC academic described moving to "smaller in-class tests" and a "problem project", which was a response to "the fact that some students would have a nervous breakdown because they were having a test or an exam" [A4]. The mixed forms of assessment offered more options for students to gain marks, and to work at their own pace and level of confidence.

The Block Model has also changed the assessment cycle. The rapid four-week Block means that students receive results for their first subject earlier, enabling them to "get a result straight away" [A5]. This was a benefit identified by students too, with many saying that their marks had exceeded their expectations. It was especially important for those who had been out of study or previously unsuccessful, and who had doubted their ability to succeed:

> *When I saw my marks come through and they were the unexpected high marks, it was very motivating 'cause it gave me that confidence, it's possible, you can do it, so just keep it up, keep up the work, keep doing what you're doing. [S1]*

> *I've actually done a lot better than what I expected. Considering that I haven't studied science in over 10 years before this has actually been a really good experience. [S2]*

> *Definitely [getting good grades in] chemistry was a surprise 'cause I remember myself when I was in the 11th or 12th grade… I really didn't like it. [S9]*

Some commented that it also helped them cope with their less successful experiences:

> *The fact that it's four weeks, and then you can be like, "Yeah, I've done that subject. Next one," or if you did bad on a subject or something, you can be like, "Well, that's out of the way now. Let's just focus on a new one". [S7]*

One FYC academic identified this as a factor in building student resilience and retention:

> *I think resilience is a thing we see with a lot of the students, and I think that the ones that would normally struggle because of the length of time [in Semester model]; and the greatest thing that happens, I think, is that most of our students pass Block 1, they get a little bit of confidence. They go "I can do this". [A4].*

His FYC colleague responded to this with a word of caution, that "students who should not have passed Block 1 did", and "thought they knew more than they did" [A2]. A tension was evident between enabling early wins, and maintaining realistic expectations.

A similar tension exists at the transition to second year. One leader reported that he was watching "like a hawk" for students entering second year STEM subjects underprepared, but had so far not observed any cause for concern. Another reported "a cynicism around what assessment looks like in FYC" among some staff teaching higher-level subjects, associated with limited understanding of authentic assessment. He noted that higher second-year failure rates in second year could equally be due to issues with second-year assessments [L5].

Authentic assessment can generate bemusement for students too. One student reflected on the "zombie apocalypse", an imaginative, interactive assessment for Biomedical students:

> *I remember the zombie apocalypse – I was actually surprised after I saw the descriptions, instructions 'cause it was a first assessment that I've ever seen like first sort of kind of thing, and at first I was like, "Hmm, why are we doing this?" But after I did that, like now I can strongly say that I understand about the immune system really well compared to others. So, yeah, I loved that part. [S9]*

Others identified assessment as a strength of the Block Model, in having regular, diverse opportunities to demonstrate their learning, rather than "having to worry about end of semester exams and having to think about something you learnt 10 weeks ago" [S8].

These insights signal the complex role that assessment plays in student learning, from its primary task of measuring learning, to defining the student's relationship with the university. More frequent assessment also had an impact on students' habits and mindsets:

> *It's a really quick paced unit. There are 14 assessment tasks. There's no time to muck around… So I believe we've been able to get into the mindset, get into the*

> *work ethic, and hey, if you want to do good in this unit, you need to attend to some stuff, and you can't spend 12 weeks thinking about it. You've got to think about it right away. [A11]*

Students' comments reinforced this shift: one commented that "Those assignments forced you to spend time… 'cause if you don't put time and effort on it like you won't understand and finish it fully" [S9]. Another appreciated the clear relationship between class work and assessment, in that "everything that we learnt in the class is all assessed" [S3].

Transparency and trust were highly-prized attributes of assessment for several FYC staff – at least one used rubrics rigorously to avoid any "trickery" [A5]. Engagement in assessment mattered too, with one leader reflecting: "as a consequence of doing that assignment, how does the student feel afterwards?" [L1]. All staff were attuned to the fragility of student confidence, which is heightened for vulnerable and non-traditional students. The importance of feedback was evident in interviews with students, with those who had received regular feedback valuing it highly; and others expressing a wish for feedback to be more detailed.

All FYC staff were also avid users of university data to monitor their own performance. One reported seeing the fail rate halved in a course that was "considered hard" [L7]; another shared data showing that satisfaction rates in one of his units had doubled in the Block. He was seeking students' advice on further improvements, and setting new targets for increasing his student satisfaction levels. This included disaggregating data to focus on specific equity groups; for example, he had noticed that satisfaction had increased for NESB students, and "plateaued" for others, so was reflecting on the reason [A6]. Another compared results for high- and low-ATAR students in one of his units, and found that while high-ATAR did "a bit better", "it's not that the others are *that* far behind" [A11].

Evidence-based practice by individual staff mirrors the evidence-based approach that VU has taken to Block Model implementation. One leader described in detail the effort that the university has made to ensure that data is available to monitor the Block Model's impact. VU's Data Insights team has created new data infrastructure to enable timely monitoring and reporting of assessment data, enabling the decisive evidence of the Block Model's impact to emerge:

> *By Block 3, we had enough data to say students are doing better, low-SES students and [NESB] were being lifted… It was like "Oh my God, it works" – I had tears in my eyes. We all had tears in our eyes, because we'd put so much effort into getting it started, and it took so much effort across the university [L4]*

This monitoring occurred alongside other data-driven interventions to lift retention rates, including identifying students who had not engaged and withdrawing them before census date [L4]. The movement of FYC units online greatly improved monitoring of student engagement, and analysis of the factors that were "red flags" for potential failure.

The focus on continuous monitoring and assessment in the Block Model underscores other success factors with a visible, real-time evidence base. The regular assessment supports the Block's focus on improving how time is used for learning, and the relationships between students and staff. It also creates appetite to keep building the evidence base for the Block Model and new pedagogical strategies, and a number of leaders and academics expressed a wish that they could have more time to create evidence-informed changes to curriculum design. Notably, academics and students shared a desire for specific, regular mutual feedback, reinforcing the basis of the pedagogical relationship as equal partners in learning.

Discussion

The interviews with VU leaders, staff and students broadly supported the seven hypotheses that were generated at the start of the study, about reasons for the Block Model's success. The Block Model itself, along with the First Year College into which it was first introduced,

was designed to prioritise teaching and learning strategies with proven effectiveness for student engagement. The disproportionate benefits for equity group students were perhaps not a function of the strategies themselves, which were seen to benefit all students equally. Instead, it may be that equity group students will benefit most from any transformation of the university experience that reduces reliance on the learning skills – or cultural capital – that students bring with them. Put simply: if universities actively *teach*, all students can learn.

While this observation accords with the stronger emphasis on teaching that has accompanied the expansion of higher education, it does not in itself provide new insight into tackling inequality. A more interesting feature of the Block Model at VU is the simple fact that a major transformation that improved results for equity group students has been successfully achieved. This would be less remarkable if the Block Model was merely a reorganisation of the university timetable, but this report has shown that it has actually involved a shift in emphasis towards teaching that is fundamental to what the university does and values. It begs the question: how could such a shift in emphasis be achieved elsewhere?

By looking inside the "black box" of the Block Model, this study has revealed the layers of complexity involved in the Block Model's design and implementation. Complexity theory shows that these layers are not peculiar to the Block Model experience, but instead reflect elements that are common to the complex process of organisational change. Making connections between the Block Model experience and the theoretical framework enables lessons to be drawn about complexity, which may also be applicable to other institutions.

Siemens and colleagues (2018) describe five principles of complexity theory, as it may be applied to the leadership of change initiatives in contemporary university contexts:

1. ***Networks*** – Dealing with complexity involves calling on the networks that underpin society and the education system. According to Siemens et al. (2018, p. 30), universities have not been set up to use networks effectively. Despite widespread willingness on the part of academics to engage in wider networks, structural barriers disincentivise knowledge-sharing between institutions and within them. Faculties, for example, potentially impede "cross-fertilization of ideas between disciplines".

   In contrast, the black box of the Block Model contains networks aplenty. The creation of FYC was a deliberate strategy to break down barriers between faculties, and the resulting distributed leadership has re-energised both innovation and job satisfaction. Beyond FYC, the Block Model derives its design from connections with other institutions; social media; within-VU "town halls" to co-design university reform; and ongoing engagement with disciplinary and pedagogical research. Students are also connected into interdisciplinary networks, preparing them for complex workplaces.

2. ***Emergence*** – Solutions to complex issues arise from an aggregation of influences, not from any single "command and control" model of university administration (Siemens et al., 2018, p. 31). Leading universities in times of complexity involves balancing the *administrative* functions that provide stability, and the *adaptive* functions that require multi-faceted, institution-wide, bottom-up responses.

   The findings of this study show that the Block Model was both planned and serendipitous, and that both administrative and adaptive functions contributed to its success. The space to pursue innovation was created by administrative pressures, as VU faced intractable challenges in its budget and industrial arrangements. The solutions that emerged arose from its adaptive functions, and the ability of a dynamic group of leaders to piece together multiple reform directions into a coherent whole. Like most emergent reform, the Block Model was "greater than the sum of its parts", and no single leader had envisaged it in its entirety (Siemens et al., 2018, p. 32).

3. ***Self-organisation*** – This relates to how a university is structured, and opportunities for self-driven networks to form, from which ideas emerge. It concerns the *conditions* in which networks are created and emergent solutions arise. Incentives and opportunities to self-organise stimulate the "chaotic creativity of the masses", while still providing spaces for leaders to guide and intervene (Siemens et al., 2018, p. 34).

   In this study, "chaotic creativity" emerged as the fuel in the engine of the Block Model and FYC reforms. The enthusiasm of teaching staff in describing their bold ideas was palpable, and student feedback indicated that this also permeated their classes. The focus on building an innovative culture in FYC contributed to this energy, as did the sheer necessity of innovating to meet the Block Model's demanding timeframes. The Connected Learning team added another condition for self-driven innovation, by ensuring that teaching staff felt supported and guided in trying out new approaches.

4. ***Feedback sensitivity*** – Siemens et al. (2018, p. 36) described this, in academic environments, as involving "intentional development of numerous feedback mechanisms that are grounded in sense-making theory and anthropological methods to provide the clearest insights for cultural change". Although sense-making from data is core business for research academics, universities are not necessarily data-driven organisations when it comes to their own practice and continuous improvement.

   Sensitivity to feedback is a strong theme in this study, on the part of students and teaching staff alike. This is perhaps generated less by a shared passion for data, as by a shared experience of embarking on a process in which the outcomes were not assured. When traditional students attend a traditional university, both academics and students share a common expectation of both the learning process and its outcome; assessment is a means of certification rather than exploration. In FYC, many students have taken a "leap of faith" that they can be successful at university, just as academics have taken a similar leap that they can teach successfully. This gives feedback a vital role, not only in informing the experimentation in which both are engaged (as learners and teachers); but in building confidence and resilience.

5. ***Agility*** – This relates to a system's "ability to absorb unintended consequences without catastrophic failure" (Siemens et al., 2018, p. 36). Universities themselves have limited ability to adapt, as they are situated in complex regulatory and social systems. In 2020, COVID-19 has put agility to the test across the university sector.

   This study did not set out to investigate the effects of the Block Model on agility at VU, but valuable insights nevertheless emerged, as FYC academics weathered the major disruption of the COVID-19 pandemic. The interviews with academics and students indicated that many of the success factors in the Block Model had supported a successful transition to online learning; notably the strong relationships, openness to experimentation, and culture of working together to solve problems from the bottom up. Universities will continue to face unprecedented challenges in the post-pandemic context, including significant changes to their student intake, due to the decline of international student enrolments and disruption to the labour market. Increased agility will be essential, to manage this complexity most successfully.

Interpreting the findings of this study through the lens of complexity is particularly useful in understanding the impact of the Block Model on addressing educational inequality. Equity group students are not homogeneous – as a cohort, they are defined by their *difference* from the "traditional" student cohort, rather than by a single point of commonality. Meeting the needs of equity group students is therefore not a linear process of finding "what works" and delivering it. It is an adaptive exercise in managing the complexity of diverse student needs.

The success of the Block Model in improving outcomes for equity group students is perhaps best explained by the way it puts the principles of complex systems into action. This study has described the successful application of these principles in the STEM disciplines at VU, where equity challenges are greatest, but they may equally be applied to humanities or other disciplines. Complexity itself is a concept that emerged from the physical sciences. This suggests that further opportunities may exist not only to understand STEM teaching through the lens of complexity, but to teach an understanding of complexity through a STEM lens.

Conclusion and recommendations

This study has shown that the apparent simplicity of the Block Model at VU – restructuring semesters into four-week, single-subject Blocks – conceals multiple layers of complexity. The Model's success in improving retention and success, especially for equity students, has occurred as the result of a combination of factors, both within classes and at institutional level. Each of these factors itself resists direct replication, as they each require multiple factors to be held in tension: including balancing a dedicated FYC with a whole-of-university focus; balancing evidence with local pragmatism; balancing effective time use with manageable workloads; and balancing rigorous and authentic assessment. The architects of the Block Model are to be commended for bring these tensions into alignment.

This complexity must continue to be managed, as the Block Model moves into its next phase. VU will face challenges in maintaining the unique energy of FYC as the Block Model is rolled out more widely across the university, and as challenging workloads take their toll. The wealth of pedagogical experimentation and professional learning that has occurred in the initial years of the Block Model must become part of the knowledge base of the entire university, and FYC and other academics need opportunities to translate this practice knowledge into scholarship. There also remain questions about how teaching is recognised, developed and prioritised at VU, alongside other research and scholarship activity.

It is hoped that other universities can also benefit from VU's experience, in the spirit of knowledge-sharing that is necessary to create a higher education sector that supports equity students effectively (Zacharias & Brett, 2019). This study shows that there are many elements of the Block Model that have contributed to its impact, including the creation of a dedicated FYC staffed by academics with a passion for teaching first-year students; a culture of interdisciplinary collaboration with expert curriculum and pedagogical support; and adoption of active learning pedagogies. None of these ideas are ground-breaking alone, and universities may consider which combination may best suit their students and their context.

The broader learning from this study concerns the way that universities can innovate to meet challenging circumstances, and the possibility that such innovation can contribute to student success (not just institutional survival). This may be an especially important lesson in the post-COVID context, as all Australian universities face the need for a "strategic reset", in which "nothing short of significant reconsideration of purpose, position, strategy, culture and business model is required to secure a sustainable future" (Betts, 2020, p. 1). Even before COVID-19 struck, improving outcomes for equity group students was "not only a matter of social justice" but "an increasing financial necessity" (Naylor & Mifsud, 2019, p. 2). In the post-COVID-19 world, no university can afford to fail to cater to a diverse student base.

This study provides hope that such innovation is possible, where there is the capacity within an organisation to unleash the capability by which complexity can be managed and innovation brought to life. The principles of complexity illustrated in this paper – networks, emergence, self-organisation, feedback sensitivity, and agility – are already present in many universities, and COVID-19 may have created an impetus to bring them to the fore. The recommendations of this study for higher education policy are aimed at creating space for this capability to flourish, so that the Block Model can become one among a smorgasbord of innovations to help Australian students from all backgrounds achieve their study goals.

Recommendation 1: Actively encourage innovation through higher education regulation

The innovation that occurred at VU was a response to a clear need to improve the institution's outcomes for students, given even greater urgency by financial necessity. It is therefore a valuable case study for improving risk-based regulation in tertiary education, as it replaced one serious risk (declining outcomes) with another (a new, experimental delivery model). The response of the regulator to this decision can be seen as a test case for how well the Australian regulatory landscape for higher education enables innovation.

Australia's higher education regulator, the Tertiary Education Quality Standards Authority (TEQSA) has actively sought to improve on the "command and control" model that has characterised higher education regulation in the past (Lee Dow & Braithwaite, 2013, p. 42). It aims for "respectful partnerships" with providers, recognising that "innovation often involves a degree of risk taking" that cannot be fully eliminated (TEQSA, 2021, n.p.). TEQSA's commendation of the Block Model in its 2020 renewal of VU's registration suggests openness to experimentation; provided that it is implemented effectively (TEQSA, 2020a).

There nevertheless remains scope for TEQSA to be more actively involved in stimulating innovation, rather than endorsing it after the fact. A 2017 review found that while higher education regulation in Australia did not stifle innovation, it also did not encourage it. Providers suggested that TEQSA develop "a mechanism that encourages mature higher education providers to negotiate with TEQSA to trial controlled innovations (with respect to pedagogy, course structure and delivery)" (Deloitte Access Economics, 2017, pp. 52–53). A more active role for TEQSA in encouraging innovation and risk-taking was also suggested in 2019 consultations about TEQSA's role (Australian Survey Research, 2019).

The financial crisis for Australian universities generated by COVID-19 is likely to see more institutions willing to push through inertia and try new ideas. TEQSA's partnership approach to regulation positions it well to provide guidance to universities facing the need to innovate, but whose leadership teams may be unsure how to manage the balance between quality assurance and risk. TEQSA has already begun supporting the sector to learn from the transition to online learning (TEQSA, 2020b), and may have a role in promoting best practice in managing the complexity involved in achieving broader institution-level adaptations.

Recommendation 2: Promote quality teaching in higher education

The importance of quality teaching to student success in an inclusive higher education sector has been recognised since Australia set targets for widening university participation over a decade ago (Blackwell, 2009). Yet university rankings continue to be primarily based on research output (Bexley, 2015), leading to a privileging of research as a higher-status activity. While it is beyond the scope of this paper to explore this research-centred culture in detail, its influence was evident in many of the interviews conducted for this research.

COVID-19 has exposed the financial vulnerability of the teaching-and-research model in Australian universities, and is expected to lead to an increase in teaching-only academic positions (Norton, 2020). While these positions remain controversial in the sector, they may create opportunities for teaching excellence to be recognised and rewarded, if reforms to promote teacher quality can be designed in consultation with practitioners. Such reforms may be supported by university performance measures that take into account the gains that students make in their learning, not just raw academic results (Harvey et al., 2018).

Recommendation 3: Promote interdisciplinary, active STEM learning

Universities have a critical role in building the workforce that will drive Australia's economic and social recovery. Participation in STEM subjects is not only essential for growing the next generations of health professionals, industry innovators, technologists and scientists, but also for fostering the scientific literacy that all societies will need to thrive in a future defined

by further climate, health and technological upheavals. This broad base of STEM skills is arguably better supported through interdisciplinary learning and inquiry-based pedagogy, than the traditional disciplinary structures through which STEM has been taught.

Interdisciplinary learning is gaining traction in Australian universities, especially in areas that transcend disciplinary boundaries, such as environment and sustainability (Abbonizio & Ho, 2020). In part, this reflects increasing external influences on university curriculum, and the need for universities to maintain relevance and engage with the “big problems” facing society (Millar, 2016, p. 472). The success of the interdisciplinary FYC model at VU raises questions about broader possibilities of interdisciplinary learning, including at higher levels. Interviews for this study suggest that maintaining a strong sense of academic identity for disciplinary experts may be an important factor in the success of interdisciplinary approaches.

This study also suggests that interdisciplinary approaches offer a further equity benefit, in breaking down the segregation of students by background and ability level across different STEM disciplines. Australia has one of the most socially segregated school systems in the world (Bonnor, 2019), which flows through to segregation in higher education. VU’s progress in creating a more inclusive first-year model points to possibilities for the sector on a wider scale.

This study leaves many questions unanswered about the Block Model, and higher education innovation more broadly. It has not explored the impact of the Model outside of STEM, or its impact on student retention and outcomes beyond first year. The active curriculum invites many further questions about how diverse students are included and empowered, and how cultural perspectives from Indigenous students and those from other cultural backgrounds are integrated into STEM curriculum. The policy context also warrants further attention, to identify how the system structures that hold the dominant model of an Australian university in place can be stretched or reconfigured to support equity-focused innovation. A related area for further research concerns university organisation and management, particularly in relation to staffing arrangements that allow excellent teaching and scholarship to thrive.

By exploring the “black box” of the Block Model, this study has shone a light on the complex systems in which higher education innovation occurs. Its key message is that transforming outcomes for equity group students is possible; but not without creativity, collaboration and a strong base of organisational support. Such change also requires ongoing openness to reflect and rethink the practice of higher education, and to engage actively with students and colleagues as partners in the shared enterprise of learning. In summary, the Block Model demonstrates many qualities of effective teaching and learning that are common across equity-oriented educational environments. It is remarkable not so much as a new practice, but as a unique convergence of circumstances that has made best practice possible. It may be hoped that the disruption of COVID-19 will allow more such convergences to emerge.

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Appendix 1. STEM subjects In First Year College

Code	Subject title	STEM category
EEC1103	ICT IN EDUCATION FOR THE 21ST CENTURY	STEM for teachers
EEC1106	TEACHING PRIMARY MATHEMATICS 1	STEM for teachers
EEC1107	EDUCATING FOR STEM	STEM for teachers
EEC1109	NUMERACY FOR EDUCATION	STEM for teachers - Maths
HBM1001	ANATOMY AND PHYSIOLOGY 1	Science
HBM1002	BIOLOGICAL SYSTEMS	Science
HBM1101	GENE AND EVOLUTIONARY BIOLOGY	Science
HBM1202	ANATOMY AND PHYSIOLOGY 2	Science
HFB1207	PRINCIPLES OF DRUG ACTIONS FOR HEALTH PROFESSIONALS	Science
HHH1001	MATHEMATICS AND STATISTICS FOR BIOMEDICINE	Maths
NBC1101	MATHS FOR BUILDERS	Engineering - Maths
NBC1103	BASIC STRUCTURAL MECHANICS	Engineering
NBC1104	STRUCTURAL PRINCIPLES IN CONSTRUCTION	Engineering
NBC1111	FUNDAMENTALS OF BUILDING CONSTRUCTION	Engineering
NBC1112	BUILDING SCIENCE	Engineering
NBC1113	MEASUREMENT AND ESTIMATING	Engineering
NBD1100	BUILT ENVIRONMENT COMMUNICATION AND SKILLS	Engineering
NBD1101	BUILDING DESIGN DOCUMENTATION	Engineering
NEF1102	ENGINEERING PHYSICS 1	Engineering - Physics
NEF1103	ENGINEERING AND THE COMMUNITY	Engineering
NEF1104	PROBLEM SOLVING FOR ENGINEERS	Engineering
NEF1201	ENGINEERING MATHEMATICS 2	Engineering - Maths
NEF1202	ENGINEERING PHYSICS 2	Engineering - Physics
NEF1204	INTRODUCTION TO ENGINEERING DESIGN	Engineering
NEF1205	ENGINEERING FUNDAMENTALS	Engineering
NEM1001	ALGEBRA AND CALCULUS	Engineering - Maths
NEM1002	STATISTICS FOR DECISIONMAKING	Engineering
NIT1101	WEB DEVELOPMENT AND CMS	Information Technology
NIT1102	INTRODUCTION TO PROGRAMMING	Information Technology
NIT1103	COMMUNICATION AND INFORMATION MANAGEMENT	Information Technology
NIT1104	COMPUTER NETWORKS	Information Technology
NIT1201	INTRODUCTION TO DATABASE SYSTEMS	Information Technology
NIT1202	OPERATING SYSTEMS	Information Technology
NIT1203	INTRODUCTION TO PROJECT MANAGEMENT	Information Technology
NIT1204	WEB APPLICATION AND SERVER MANAGEMENT	Information Technology
NSC1210	SKILLS FOR THE SCIENTIST	Science
RBF1150	GLOBAL ENVIRONMENTAL ISSUES	Science
RBF1310	BIOLOGY 1	Science
RBF1320	BIOLOGY 1	Science
RBM1100	FUNCTIONAL ANATOMY OF THE TRUNK	Science
RBM1174	HUMAN PHYSIOLOGY	Science
RBM1200	FUNCTIONAL ANATOMY OF THE LIMBS	Science

RBM1518	HUMAN PHYSIOLOGY 1	Science
RBM1528	HUMAN PHYSIOLOGY 2	Science
RCS1601	CHEMISTRY 1A	Science
RCS1602	CHEMISTRY 1B	Science
SCL1002	EXERCISE PHYSIOLOGY	Science

Appendix 2. Characteristics of students Interviewed for the study

Are you first in your family to attend university?	Is English your second language?	Current course	Current year of course	Other information
No	Yes	Bachelor of Biomedicine	1	Mature age; second degree but first at VU
Yes	No	Bachelor of Biomedical Science	1	Mature age; third degree but first at VU
Yes	No	Bach of Construction Management	2	
No	Yes	Bachelor of Information Technology	2	Hated school, didn't do well in VCE
Yes	No	Bachelor of Science	2	Loved school
No	Yes	Civil engineering	2	International student
No	Yes	Bachelor of Engineering (Honours)	4	International student
No	Yes	Bachelor of Biomedical Science	2	Mature age; studied elsewhere previously
No	No	Bachelor of Science	1	Did not complete year 12; non-traditional area
No	No	Bachelor of Human Nutrition	1	Mature age

Appendix 3. Definition of equity group students

GROUP	DEFINITION
All students	All students regardless of equity status.
All equity students	All students who are categorised in one or more equity group.
Disability	Student with a disability or medical condition that impacts their studies. Categories for disability can include: • Vision • Physical • Mobility • Mental illness • Medical • Learning • Intellectual • Hearing • Brain impairment • Other
Female in non-traditional area	Female student enrolled in the natural and physical sciences; information technology; engineering and related technologies; architecture and building; agriculture, environmental and related studies; management and commerce; and the narrow field of education (economics and econometrics).
First in family	Students coming from families where no one has attended university studies before them.
Indigenous	Student who identifies as Aboriginal or Torres Strait Islander.
Low SES	Student who meets the NCSEHE definition of Low SES: *Socioeconomic status (SES) in Australian higher education is determined using a student's residential address. The SES of an individual student is proxied by the SES of the area in which they reside, known as the Statistical Area 1 (SA1), which is typically smaller than a postcode.* *The Australian Bureau of Statistics (ABS) uses census data on household educational and occupational status to construct the Socio-Economic Index for Areas – Index of Education and Occupation (SEIFA). Each SA1 in Australia receives a SEIFA score which is standardised against a national mean of 1000. All SA1 areas in Australia are then ranked on the basis of their SEIFA scores. Low SES students are defined as those students who live in the bottom 25 per cent of SA1 areas in this ranking.*
Non-English speaking background (NESB)	Student who speaks a language other than English at home.

Appendix 4. Equity group students in Student Experience Survey data

STUDENT MANAGEMENT SYSTEM DATA				
	Cohort 1 (pre-block)		Cohort 2 (block students)	
	2016	2017	2018	2019
All students	**1,052**	**1,646**	**2,742**	**4,186**
All equity students	**872**	**1,237**	**2,006**	**3,211**
Proportion of equity students	*82.9%*	*75.2%*	*73.2%*	*76.7%*
Equity groups				
Disability	97	109	174	301
Female in non-traditional areas	270	694	940	1,585
First in family	610	802	1,352	2,145
Indigenous	Less than 5-	Less than 5	Less than 5	Less than 5
Non-English speaking background (NESB)	251	330	587	993
Low SES	140	265	394	540
All students	1,052	1,646	2,742	4,186