



# Navigating the Shift: Assessing the Online Learning Experience and Effectiveness for Construction Students During the COVID-19 Pandemic in New Zealand

Don Amila Sajeevan Samarasinghe<sup>1</sup> · Imelda Saran Piri<sup>2</sup> · Oisik Das<sup>3</sup>

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## Abstract

The COVID-19 lockdown in New Zealand forced tertiary education providers to rapidly transition to online teaching with minimal preparation time. Synchronous online classes were delivered using platforms such as Microsoft Teams and Moodle. This study explores the post-COVID-19 online learning experience of construction students, focusing on both the perceived effectiveness of online learning and students' overall experiences. It captures insights from students enrolled in the New Zealand Diploma in Construction and the Bachelor of Construction at a selected tertiary institution. Data were gathered through an online questionnaire (103 respondents) and a focus group interview with selected students (8 participants). Respondents highlighted several benefits of online learning, including the convenience of staying at home (69%), continuous access to online materials (69%), flexibility to learn at their own pace (64%), and the comfort of their surroundings (54%). However, challenges were identified, with the most common being a lack of interaction with peers (70%) and technical difficulties with IT equipment (54%). While no significant difference was found between face-to-face and online learning in terms of increasing knowledge ( $P=0.46$ ), students rated online learning as less effective for skill development ( $P<0.001$ ) and social competencies ( $P<0.001$ ). Students also reported being less engaged in online classes compared to traditional settings ( $P<0.001$ ). Despite these challenges, 73% of students found the online experience enjoyable. The study concludes that while students adapted to online learning and became more autonomous, they still valued face-to-face learning for skill development and social interaction. The findings suggest that a blended learning approach, combining online and in-person elements, could be a beneficial post-pandemic strategy to enhance student autonomy, motivation, and engagement.

**Keywords** Construction education · COVID-19 pandemic · New Zealand · Online learning and teaching

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Extended author information available on the last page of the article

## Introduction

The emergence of COVID-19 in late 2019 marked a global crisis impacting various sectors, with education taking a significant hit (Tarkar, 2020). Worldwide, schools, vocational institutions, and universities faced temporary closures to curb virus transmission (Aristovnik et al., 2020). In response, New Zealand implemented a health policy, including a tiered COVID-19 Alert System, enforcing lockdowns at heightened alert levels and prompting the closure of educational institutions (Cameron et al., 2022). New Zealand's proactive, science-driven health policy response played a pivotal role in shaping the impact on education during the COVID-19 pandemic (Kvalsvig & Baker, 2021). The country swiftly implemented lockdown measures to curb the virus's spread, leading to disruptions in traditional education settings. Recognizing the importance of education, particularly in challenging times, the government introduced specific regulations to ensure continuity through innovative means, including remote learning and digital platforms.

In the pre-pandemic era, New Zealand's educational landscape exhibited a noticeable trend towards the integration of emerging technologies, particularly through the proliferation of online digital tools aimed at enhancing pedagogical experiences (Qiao et al., 2021; Yates & Starkey, 2021). Notably, in construction education, New Zealand's approach was characterized by a multifaceted delivery framework designed to accommodate the diverse learning needs inherent to the discipline's practical nature. This typically included didactic instruction, hands-on training, and immersive learning encounters (Samarasinghe, 2019; Woodward et al., 2020; Samarasinghe et al., 2020a, 2020b).

Traditionally, in face-to-face instructional settings, students actively engage in lectures, workshops, and on-site visits to acquire theoretical knowledge and practical competencies. However, the advent of technological innovations has ushered in a new era, enabling the seamless integration of virtual simulations, such as Virtual Reality (VR), and multimedia resources into construction education (Samarasinghe et al., 2020b; Samarasinghe & Piri, 2022). These digital tools provide unprecedented flexibility and accessibility, allowing students to remotely access course materials and partake in interactive exercises to reinforce conceptual understanding.

The overarching goal of construction education remains steadfast: to equip students with the requisite knowledge, skills, and experiential acumen essential for navigating the dynamic and demanding construction industry. However, it is important to note that prior to the pandemic, online learning in construction education received limited emphasis. Educational stakeholders, focused on prioritizing hands-on practical components, were reluctant to adopt online modalities, citing their perceived inadequacy in delivering authentic experiential learning (Zou, 2007). Consequently, the uptake of online learning methodologies was slow, both among educational institutions and students.

The onset of the COVID-19 pandemic, however, precipitated an unprecedented paradigm shift, compelling the educational community to swiftly pivot toward

remote and online teaching modalities. This global exigency accelerated the pre-existing trend towards embracing digital learning platforms within the construction education field.

The government advocated for a proactive shift to online learning to ensure continuity during closures, leading to a sudden and challenging transition (Flack et al., 2020). The level of expertise among educational staff in navigating the new technological environment varied, highlighting the need for ongoing professional development. This shift affected both students and teachers, disrupting the gradual integration of online tools into traditional teaching methods. The "new normal" emerged, requiring safety measures such as social distancing, hygiene protocols, and online learning (Alshwiah, 2021). Teo et al. (2021) highlight the challenges faced during this transition, with teachers, particularly older generations, having to adapt to online tools, while students encountered difficulties related to access to tailored materials and electronic devices. Given the foundational role of student-centred learning (Gibbs, 1981), understanding students' perspectives during this transition is crucial. Student-centred learning emphasizes tailoring education to individual students' needs to enhance the overall learning experience (Brandes & Ginnis, 1996). A comprehensive understanding of the shift from face-to-face to online learning is vital for designing professional development courses to support effective teacher transition (Lockee, 2021).

As the educational landscape grapples with the repercussions, rigorous research is essential to evaluate the efficacy of online learning strategies (Tesar, 2021). Understanding these strategies' strengths and limitations not only informs future crisis responses but also contributes valuable insights to the evolving educational paradigms amid global challenges. This research, conducted at a tertiary education provider in Auckland, New Zealand, aims to gather feedback from construction students on the transition from classroom to online learning during the COVID-19 pandemic. The present study, also conducted at a tertiary education institution in Auckland, New Zealand, is dedicated to examining the ramifications of the pandemic on students' educational journeys during this unparalleled period. This institution is renowned for offering a comprehensive Bachelor of Construction, a three-year program, and the New Zealand Diploma in Quantity Surveying, a two-year program. Both qualifications emphasize practical learning components, including the use of project management tools and cost-estimating applications. Additionally, these programmes include experiential learning opportunities such as immersive construction site visits and sessions featuring industry experts as guest speakers. This educational framework aligns closely with similar curricular models adopted by other esteemed educational institutions across New Zealand (Samarasinghe, 2019; Harfield et al., 2007).

Utilising a questionnaire survey and a focus group interview, this research uniquely contributes to the literature by examining the broader landscape of learning during the pandemic. The study serves as a paradigmatic examination, discerning and interpreting the challenges faced by students navigating the complexities of online learning in the wake of the COVID-19 crisis.

## Online Learning Evolution

Over the past decade, the surge in online education's popularity, facilitated by the World Wide Web, has reshaped the educational landscape (Sun & Chen, 2016). Online teaching and learning have become integral components of distance education, surpassing the growth rate of conventional tertiary education (Stone & Perumean-Chaney, 2011). The influx of various online tools, such as Moodle, Canvas, ClassDojo, Peardeck, and others, has empowered educators to seamlessly integrate technology into their teaching methods (Herrador-Alcaide et al., 2020). Termed a "perfect e-storm" by Kim and Bonk (2006), this rapid integration of online tools combines pedagogy, student needs, and modern technologies. Against this backdrop, it is crucial to assess the effectiveness of online education in comparison to traditional classroom settings and devise strategies to enhance its efficiency. This evaluation is particularly significant in understanding the experiences of construction students during the COVID-19 pandemic in New Zealand (Junus et al., 2021).

## Online Learning Impact on Construction Education

The shift to online learning amid the COVID-19 pandemic has profoundly impacted construction education, making it critical to evaluate this experience for construction students in New Zealand (Samarasinghe et al., 2020a). The asynchronous nature of online learning, which provides flexibility for students (Dumford & Miller, 2018), aligns with the theme of navigating a transformative shift. Tailoring learning to students' lifestyles enhances its appeal, particularly for those balancing part-time or full-time employment (Roslin et al., 2022), reflecting the current state of construction education. The cost-effectiveness and broader reach of online dissemination (Means et al., 2009) parallel the challenges posed by the pandemic and highlight the need for an effective online learning experience.

Enhanced communication through online tools, fostering inclusion, autonomy, and collaboration (Ahern & Repman, 1994; Turner & Paris, 1995), directly addresses the challenges construction students face in a virtual environment. Evidence suggesting that online learning can outperform traditional methods (Lohr, 2009; Means et al., 2009) emphasizes the importance of an effective online learning experience during the pandemic. In alignment with Kolb (1984)'s learning cycle, online education gives students greater control over their construction education, helping to cultivate contemporary knowledge (Eastmond, 1998; Sloboda, 2005). Studies by Samarasinghe (2019), Woodward et al. (2020), and Yen (2020) on the flipped classroom model in online settings reinforce the need for effective strategies to navigate this shift, which aligns with the overarching theme of the research.

Furthermore, the benefits of teaching online, as outlined by Lowes (2008), highlight the importance of evaluating online learning for construction educators.

Practical recommendations by Stone and Perumean-Chaney (2011) for integrating online benefits into traditional classrooms connect directly with the goal of evaluating online dynamics in construction education. Reflective practice, the use of digital tools, and continuous evaluation to increase efficacy in knowledge transmission (Kreber et al., 2005; Schön, 1987) are vital components in assessing the online learning experience of construction students during the COVID-19 pandemic.

## Challenges in Implementing Online Learning

Despite the acknowledged benefits of online education, several challenges impede its widespread adoption. Resistance from older teachers, budget constraints, and limited access to digital tools in less developed nations present significant obstacles (Kim & Bonk, 2006). Studies by Bhuana and Apriliyanti (2021) and Ruth (2018) emphasize the increasing workload for teachers, highlighting the urgent need for additional support and training. Law et al. (2023) found that traditional teachers may resist the transition due to a lack of familiarity with digital platforms, which could impede effective policy changes. Research-focused institutions may also face challenges, as instructors prioritize research over teaching, contributing to the intensified workload associated with online teaching (Bower, 2001). Students in practical fields may find online education less appealing due to the absence of hands-on experiences (Gillett-Swan, 2017).

Despite these challenges, Appana (2008) demonstrated diverse outcomes in the effectiveness of online education compared to traditional methods, revealing both challenges—such as increased teacher workload—and potential benefits, including greater flexibility and accessibility for students. Recommendations for enhancing online teaching during the COVID-19 era include incorporating independent study activities, utilizing digital tools for assessments, and integrating virtual reality technologies (Das & Ramakrishna, 2020). Collaborative online course designs with tools like blogs and podcasts have also been suggested (Baggaley, 2003; Lamb, 2004; Partlow & Gibbs, 2003; Sloan, 2005). Fostering critical thinking through data analysis and interactive assignments is essential for creating effective online courses (Kim & Bonk, 2006). In navigating these challenges, it is imperative to strike a balance that ensures effective online education while addressing the associated difficulties.

## Research Methods

The current study employed a mixed-method approach to gain a comprehensive understanding of the research problem, allowing for a holistic examination of the relationships between the identified variables. Combining quantitative and qualitative methods provided a deeper understanding based on both current and prior research. Two sets of data collection procedures were used: an online questionnaire survey for quantitative data and a focus group interview for qualitative insights. The survey findings informed the structure of the focus group interview, enabling a method triangulation approach

to enhance the depth and reliability of the analysis. By utilizing methodological triangulation, which incorporates a literature review, questionnaire survey, and focus group interview, the study enriches the analysis and interpretation of findings by merging data from multiple sources. This approach broadens the researcher's perspective, facilitating a thorough examination of the multifaceted issues associated with the studied phenomena (Bekhet & Zauszniewski, 2012). Through this methodology, the study aims to achieve a comprehensive understanding of the effectiveness of post-COVID-19 online learning experiences for construction students enrolled in the New Zealand Diploma in Construction and the Bachelor of Construction at a selected tertiary education institution during the pandemic.

Primary data were collected through a questionnaire survey and a focus group discussion. Students enrolled in their first, second, and third years of the New Zealand Diploma in Construction and the Bachelor of Construction at a selected tertiary institution were invited to participate in the questionnaire survey. Additionally, a diverse cohort of eight construction students, including four males and four females, with equal representation of four high achievers and four non-high achievers, was invited to partake in the focus group discussion. This deliberate diversity ensured a comprehensive representation of perspectives within the construction student community. Data collection, conducted in English, involved both the questionnaire survey and the focus group interview. Participants had the option to engage in both, with data confidentiality prioritized, and questionnaire data securely stored on campus.

The study, conducted in 2021, received formal ethics approval, and participants were undergraduate students in the construction program at a New Zealand tertiary education provider. The two-stage data collection method involved an online questionnaire and a focus group interview. Participant information was obtained from the student registry team, and the online questionnaire, designed with informed consent, was administered post-COVID-19 pandemic. While student participation was strongly encouraged, it remained voluntary, with personal information protected to ensure confidentiality.

## Questionnaire

The questionnaire was designed to evaluate students' perceptions of the efficacy of online classes conducted during the COVID-19 lockdown. The main questionnaire items featured response options on a 4-point Likert scale (1=strongly disagree to 4=strongly agree), with exceptions for demographic questions, open-ended inquiries, and a few items about future post-COVID-19 learning methods. The questionnaire consisted of 12 questions in total. A total of 103 students participated in the survey, providing valuable insights into their experiences and perspectives.

## Statistical Analysis

The internal consistency reliability of the questionnaire was assessed using Cronbach's alpha. Descriptive statistics were calculated, and bivariate analyses were performed. Logistic regression analyses were used to identify factors associated with

students' preferences for distance learning. The significance level for statistical tests was set at 0.05.

## Results of the Questionnaire Survey

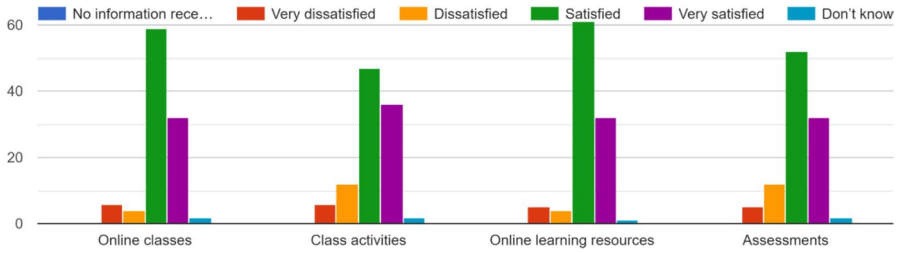
In this study involving 103 undergraduate students from the construction department at a tertiary education institution in New Zealand, representing first, second, and third-year students, the response rate was 84.3%. The majority of participants (58.3%) were enrolled in the Bachelor of Construction program, while 41.7% were in the New Zealand Diploma in Construction (Quantity Surveying) program. The questionnaire demonstrated good internal consistency, with a Cronbach's alpha of 0.880. Each domain's Cronbach's alpha coefficients were above 0.8, indicating satisfactory reliability, and all items had Corrected Item-Total Correlation (CITC) values above 0.30, justifying their inclusion in the instrument.

Participants rated their satisfaction levels on a scale of 1 to 4, with 1 being very dissatisfied and 4 being very satisfied. In terms of online classes, 57.28% of participants were satisfied, with an additional 31.07% rating their satisfaction as very satisfied. The mean satisfaction level was 3.16, with a standard deviation of 2.72. For online class activities such as sketching, group work, and taking measurements from building drawings, 45.63% expressed contentment, and 34.95% were highly satisfied, resulting in a mean satisfaction level of 3.12 and a standard deviation of 2.70. Challenges in replicating hands-on experiences digitally, technological limitations, and communication issues in group work contributed to dissatisfaction, while flexibility in online engagement, adaptation to digital tools, and effective time management were cited as sources of satisfaction.

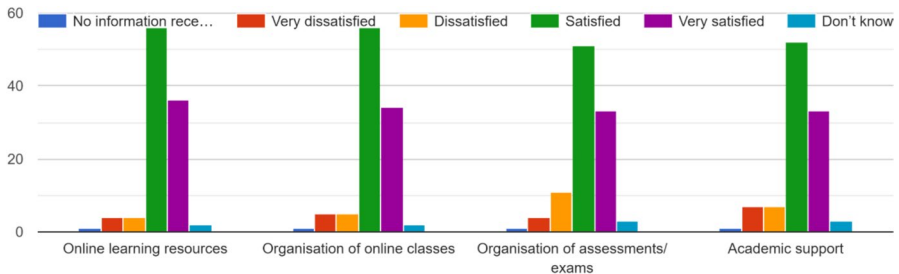
Regarding online learning resources, 59.22% of participants were satisfied, with 31.07% highly satisfied, yielding a mean satisfaction level of 3.18 and a standard deviation of 2.73. Satisfaction in this aspect was attributed to the availability and accessibility of diverse online resources. In assessments, 11.65% reported dissatisfaction, while 50.49% were satisfied, and 31.07% were very satisfied, resulting in a mean satisfaction level of 3.10 and a standard deviation of 2.67. Dissatisfaction with assessments may stem from perceived difficulties or inadequacies. Addressing these issues is crucial for optimising the overall online learning experience, including class activities and assessments.

The study revealed that 82.5% of students believed they had an appropriate level of communication with their lecturers. Regarding satisfaction with the information received, 34.95% were very satisfied, 54.37% were satisfied, 3.88% were very dissatisfied, and 3.88% were dissatisfied, resulting in a mean satisfaction level of 3.24 (SD=2.79) for online learning resources. Possible reasons for satisfaction in this domain include the accessibility and diversity of online resources, while dissatisfaction may stem from issues such as limited availability or perceived inadequacies.

Concerning the organization of online classes, 54.37% were satisfied, 33.01% were very satisfied, 4.85% were very dissatisfied, and 4.85% were dissatisfied, with a mean satisfaction level of 3.19 (SD=2.75). Satisfaction could be attributed to



**Fig. 1** Online learning experience



**Fig. 2** Online information disseminated to students

well-structured online classes, while dissatisfaction might result from challenges such as poor organization or lack of clarity.

Regarding the organization of assessments and exams, 49.51% were satisfied, 32.04% were very satisfied, 3.88% were very dissatisfied, and 10.68% were dissatisfied, resulting in a mean satisfaction level of 3.14 ( $SD=2.70$ ). Satisfaction may be influenced by fair and well-organized assessments, while dissatisfaction could arise from perceived difficulties in the assessment process.

In terms of academic support, 50.49% were satisfied, 32.04% were very satisfied, 6.80% were very dissatisfied, and 6.80% were dissatisfied, resulting in a mean value of 3.12 ( $SD=2.70$ ). Satisfaction with academic support may be linked to accessible resources and responsive assistance, while dissatisfaction might be driven by perceived inadequacies or unmet support needs (See Figs. 1 and 2).

The findings highlight positive sentiments regarding communication and satisfaction with various aspects of online learning, while also emphasizing the importance of addressing areas of dissatisfaction to improve the overall online learning experience.

Upon analysing the responses from the questionnaire survey, a diverse range of preferences emerged regarding the preferred mode of learning in the post-COVID-19 era. Notably, 35.90% of participants expressed a preference for traditional face-to-face classes, while 29.10% showed a keen interest in continuing with online classes even beyond the pandemic. Interestingly, 33% of participants favoured a blended learning approach, indicating a preference for a combination of face-to-face and online learning experiences. The variations in preferences may be

attributed to factors such as individual learning styles, the perceived effectiveness of each mode, or personal circumstances influencing the choice of a particular learning format. Understanding these diverse preferences is crucial for tailoring educational approaches to better meet the varied needs and expectations of learners in the post-COVID-19 landscape.

## Results of the Focus Group Interviews

A diverse cohort of eight construction students was invited to participate in a focus group discussion. The group was intentionally balanced, comprising four males and four females, with an equal representation of four high achievers and four non-high achievers. This intentional diversity ensured a comprehensive representation of perspectives within the construction student community. All participants willingly volunteered and were available, demonstrating their commitment to actively contribute to the study and share valuable insights into their experiences with online learning.

The focus group offered several advantages for understanding the effectiveness of online learning for construction students during the COVID-19 pandemic. It provided a platform for gathering diverse perspectives and rich qualitative insights from students. Through interactive discussions, the focus group stimulated dynamic group dynamics, fostering deeper exploration of the challenges and benefits of online learning. Additionally, it allowed for clarification and validation of findings, enhancing the credibility of the study (Greenbaum, 1998). The focus group was also time-efficient and cost-effective compared to individual interviews, making it a valuable complement to the quantitative data obtained through the questionnaire survey.

During the focus group interview, participants were presented with the outcomes of the questionnaire survey and invited to share their perspectives on the findings, with particular emphasis on effective online learning. The initiation of the focus group discussion aimed to assess the relevance and fit of the quantitative findings. Invitations were sent before participant selection for the focus group, using a purposive approach to ensure rigour, relevance, and pragmatic outcomes. The participant recruitment process adhered to the same principles used in the 2020 quantitative research. The guiding principles for selecting focus group participants are summarised in Table 1 below:

**Table 1** The guiding principle for selecting focus group participants

Guiding principles	Description
Aim	Data validation purposes
Selection of participants	Purposive sampling and utilisation of gatekeepers for accessing research participants
Primary target audience	Construction students who have diverse backgrounds (male, female, high and low achieving students)
Research outputs	Emerging findings/themes from the quantitative data (if any) and the relevance of the established findings

The focus group interview transcripts were qualitatively analyzed using thematic analysis, following a systematic approach to coding and identifying patterns within the data. The process began with an in-depth review of the transcripts to familiarize the researchers with the content, allowing for an initial understanding of the participants' perspectives. This was followed by generating codes—representing meaningful units of information—based on recurring concepts and ideas related to online learning experiences. These codes were then grouped into broader categories that shared common elements, ensuring that the relationship between the data and the emerging categories remained consistent and coherent.

Three key themes were identified through this process: Online Learning Perceptions, Online Learning Challenges, and Strategies for Improving Online Learning Effectiveness. These themes were not predetermined but emerged inductively from the data. Each theme represents a distinct set of perspectives or issues raised by participants during the focus group discussions, ensuring they reflect the depth and breadth of their experiences.

The process of generating these themes involved more than simply categorizing quotes. The researchers examined the data for patterns, connections, and underlying meanings across different participants' responses. This iterative process involved constant comparison between the data and the evolving themes, ensuring that each theme was supported by sufficient evidence and grounded in the data. This rigorous approach allowed the research to move beyond surface-level observations and draw out meaningful insights.

Data collection schedule	Interviewee code	Description
June 2021	FG1	Female, High-achieving undergraduate student
	FG2	Female, High-achieving undergraduate student
	FG3	Female, Low-achieving undergraduate student
	FG4	Male, High -achieving undergraduate student
	FG5	Male, High-achieving, undergraduate student
	FG6	Male, High-achieving, undergraduate student
	FG7	Male, Low -achieving undergraduate student
	FG8	Male, Low -achieving undergraduate student

Theme 1: Online Learning Perceptions (Accessibility, Safety, and Educational Quality).

Online learning is perceived as more accessible than traditional face-to-face settings. All focus group participants indicated that they had easy access to all the course resources they needed. One student with specific learning difficulties (FG7) shared that they absorbed more information in online courses than they would otherwise, stating: “I absorb more information in online courses because I can review lectures at my own time and revisit challenging topics until I understand them.” Other participants agreed, noting that the flexibility of digital platforms gave them full control and accountability for their learning. The flexibility of online learning was frequently cited as the most appealing factor. As one student (FG2) emphasized, “Online learning lets me adjust my courses to fit how I

learn best. That's why I remember *things better.*" This tailoring of the learning experience helps with better retention.

All focus group participants also agreed that they felt safe from COVID-19 while learning from home during the lockdown and were positive about their well-being during this period. One student (FG1) remarked, "Knowing my lecturers cared and getting regular check-ins made me feel more secure and helped me focus on my studies." However, anxiety about the pandemic was still present among students, which further reinforced the preference for online learning. Thirty percent of participants specifically cited the increased and improved communication with lecturers as a crucial support mechanism in managing their fear of the pandemic. Students reported receiving explicit reassurance from their lecturers, making them feel cared for and supported. They appreciated regular check-ins, which provided structure and a sense of normality.

Students also emphasized the importance of course content, lecturers' expertise, and digital competency in determining educational outcomes. As one student (FG5) noted, "Having courses that are easy to follow online makes a big difference." Students stressed the importance of well-structured, easily navigable online courses, with high-quality, relevant, and compatible materials uploaded to platforms like Moodle. They appreciated the instant results and feedback from online quizzes and assessments, which boosted their self-efficacy. However, they pointed out that the quality of online learning highly depends on the lecturer's pedagogical and subject-matter expertise. It became clear that a lecturer's pedagogical content knowledge plays a significant role in determining overall satisfaction with online learning.

Theme 2: Online Learning Challenges (Limited Access to Technology, Suboptimal Learning Environments, and Digital Literacy Gaps).

The disruption caused by the COVID-19 pandemic forced students to adapt quickly to managing their learning from home. One student (FG8) shared, "Learning from home was a challenge for me, especially with limited access to a computer." While some students adapted well to the sudden shift, a quarter of participants found it more challenging. Concerns arose about unequal access to digital learning resources, particularly due to limited access to appropriate technological devices (such as tablets, laptops, or desktop computers), unsuitable home study environments, and varying levels of digital literacy.

Theme 3: Strategies for Improving the Effectiveness of Online Learning (Structured Planning, Empathetic Design, and Collaborative Engagement).

Several recommendations were made during the focus group to improve the effectiveness of online learning. One student (FG4) shared, "Having a clear plan for the week helps me stay organised." The students suggested that educators should plan ahead by creating weekly learning events with clear learning outcomes and assessments, along with deadlines for each task. It was recommended to incorporate empathy into course design, avoiding overwhelming students with too many activities. Instead, students suggested breaking tasks into manageable weekly objectives with expected learning hours. Planning documents should include checkpoints to guide students towards completing assessments, as well as space for self-reflection on their progress.

Clear instructions should be provided for each task, along with links to relevant resources, and opportunities for collaboration should be included. The students also suggested maintaining consistent communication, regular check-ins, and monitoring engagement to ensure students stay on track. Finally, the focus group recommended balancing synchronous and asynchronous tasks, ensuring that synchronous meetings support and complement asynchronous activities.

## Discussion

This study employs a mixed-methods approach, combining quantitative surveys and qualitative interviews, to explore the experiences of construction students with online learning during the COVID-19 pandemic. Drawing from established research such as Truscott et al. (2010), Papadimitriou et al. (2014), and Ponce and Pagán-Maldonado (2015), this study investigates how students perceived the effectiveness of online learning in terms of both educational outcomes and the quality of their overall learning experience.

A key finding from the study is that students valued the flexibility and convenience that online learning provided, as evidenced by a 57.28% satisfaction rate. However, they also faced significant challenges, particularly in replicating hands-on experiences and dealing with technological limitations. The availability of online resources, such as course materials, assessment guidelines, and academic support, emerged as essential for the success of online learning. This aligns with Gillett-Swan (2017), who emphasized that well-organized online resources significantly enhance the learning experience, particularly during disruptive events like the pandemic.

Although students appreciated the time-saving benefits of online learning, their preferences for the mode of delivery were divided. Approximately one-third preferred traditional face-to-face classes, mainly due to difficulties in conveying technical aspects of construction courses online (Samarasinghe et al., 2020a). Another third preferred the continuation of online learning, citing COVID-19 concerns and the reduction of travel time, while the remaining third favored a blended learning approach, which would combine the advantages of both methods. These findings highlight the complexity of student preferences and emphasize the need for flexibility in course delivery, as supported by studies like Snodin (2013) and Jeffrey et al. (2014).

The study also assessed the effectiveness of online learning in achieving specific educational outcomes. No significant difference was found between face-to-face and online learning regarding knowledge acquisition ( $P=0.46$ ). However, students rated online learning as less effective for developing practical skills ( $P<0.001$ ) and social competencies ( $P<0.001$ ). This suggests that while online learning is effective for delivering theoretical knowledge, practical and interactive components, particularly in technical courses like construction and quantity surveying, may require in-person instruction (Samarasinghe, 2019; Woodward et al., 2020).

Another critical factor identified in this study was lecturer-student communication. A significant 82.5% of students reported having appropriate levels of communication with their lecturers, with platforms like MS Teams playing a pivotal role

in maintaining effective interaction. One student remarked, “MS Teams was a very user-friendly and helpful way to communicate with teachers,” underscoring the platform’s role in fostering connectivity. The importance of effective communication in online education has been well-documented (Sun & Chen, 2016), and this study reaffirms that it is key to sustaining student engagement. Students also suggested that web cameras be used more consistently during online classes and recommended more opportunities to discuss assessments and performance, a sentiment shared by Bhuana and Apriliyanti (2021).

Dissatisfaction arose, however, in replicating hands-on learning experiences, especially in technical courses. Students emphasized that certain practical skills could not be adequately taught through online platforms, reinforcing the necessity of face-to-face learning in these areas. This finding aligns with previous research, which argues that construction and similar technical fields are best suited to in-person instruction when it comes to skill development and student interaction (Woodward et al., 2020).

The study also uncovered distinct challenges faced by international students, such as feelings of isolation and being overwhelmed by the online learning environment. These issues resonate with Gillett-Swan (2017), who suggested that educators need to provide additional support to international students to help them navigate the complexities of online education. A scaffolded approach to content delivery, frequent communication, and support mechanisms could help alleviate these difficulties, as indicated by Bhuana and Apriliyanti (2021) and Law et al. (2023).

Overall, while online learning presents clear advantages in terms of flexibility and convenience, it also introduces challenges, particularly for courses requiring hands-on interaction. Educators are advised to adopt a balanced approach that combines both online and face-to-face elements, adapting the learning experience to meet the content’s needs and students’ diverse learning styles. Future research should explore ways to optimize online and blended learning models to address these challenges and further improve the learning experience and outcomes for different student groups.

## Recommendations

Building upon the study’s findings, which highlighted both the enjoyment and challenges of online teaching methods, it is clear that these methods can foster increased autonomy in learning experiences (Herrador-Alcaide et al., 2020). To further enhance student autonomy and motivation, tertiary educators should consider implementing blended delivery modes that combine both online and face-to-face methods (Jeffrey et al., 2014; Oliver & Trigwell, 2005; Snodin, 2013). This approach offers the flexibility students appreciate while addressing the need for direct interaction, particularly in contexts where hands-on experiences or face-to-face communication are crucial.

Optimising online teaching spaces requires establishing a structured framework from the course’s outset. This framework should clearly outline weekly learning events, aligned deadlines, and assessments (Teo et al., 2021). It is essential to

cultivate empathy in task planning by defining expected learning hours and avoiding overwhelming students with excessive demands. Including weekly objectives, assessment checkpoints, and explicit instructions in planning documents can significantly reduce challenges in assessing student understanding without face-to-face interaction.

In addition, incorporating multimedia-rich tasks and guiding questions can foster collaboration among students, encouraging them to engage with both their peers and the course material. Consistent communication is critical for creating an interactive learning environment. Therefore, establishing contact hours and utilizing collaborative tools like Microsoft Teams can enhance connectivity and support among students.

It is also recommended to continuously monitor student engagement and proactively address common difficulties that may arise during online learning. Balancing synchronous and asynchronous tasks is crucial to prevent overwhelming students. A focus on supporting asynchronous activities ensures that students maintain flexibility while remaining engaged and supported (Samarasinghe et al., 2020a).

By implementing these recommendations, educators can create a more effective and supportive online learning environment that not only acknowledges the challenges identified in this study but also maximizes the benefits of online learning to enhance student experiences.

## Conclusions

The COVID-19 pandemic necessitated a rapid shift to online teaching, and construction students exhibited notable adaptability in this transition. While students embraced the flexibility and convenience of online learning, they also developed a higher degree of autonomy in managing their studies. This experience underscores both the strengths and challenges of online learning—students appreciated the flexibility, but their perceptions of its effectiveness in developing practical skills and social competencies were less favorable compared to face-to-face learning.

The findings suggest that a blended learning model, which combines online and traditional methods, could offer a more balanced approach. This model would retain the flexibility of e-learning while enhancing skill development and social interaction. Tertiary educators have the opportunity to reassess and innovate their teaching practices by integrating effective online strategies with in-person learning. By doing so, they could foster greater student autonomy, motivation, and active participation, leading to an enriched and more holistic educational experience in the post-COVID-19 landscape.

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**Data Availability** The data collected for the above study, including the responses from the online questionnaire survey and the transcripts of the focus group interview, are available upon request. However, it is important to note that the data contains personal and confidential information of the participants, and

strict ethical guidelines and privacy regulations must be followed when handling and accessing the data. Researchers interested in accessing the data can make a formal request to the institution or research team responsible for conducting the study. The request should outline the purpose of data usage, the intended analyses, and the measures that will be taken to ensure participant confidentiality and data security. The availability of the data is subject to the approval of the institution and compliance with applicable legal and ethical requirements. Additionally, any data sharing or usage must adhere to the informed consent obtained from the participants during the study, ensuring their privacy and anonymity.

## Declarations

**Conflict of interest** No financial or non-financial interests linked to this project that could potentially affect the research outcomes.

**Ethical Approval** We confirm that the research project received ethical approval from the Otago Polytechnic Research Ethics Committee (Reference Number: AIC54), ensuring compliance with ethical guidelines and standards.

**Informed Consent** App participants provided informed consent prior to their involvement in the study, ensuring their participation was both voluntary and informed.

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## Authors and Affiliations

**Don Amila Sajeevan Samarasinghe<sup>1</sup>**  · **Imelda Saran Piri<sup>2</sup>** · **Oisik Das<sup>3</sup>**

✉ Don Amila Sajeevan Samarasinghe  
D.Samarasinghe@massey.ac.nz

Imelda Saran Piri  
imelda.piri@aut.ac.nz

Oisik Das  
oisik.das@ltu.se

- <sup>1</sup> School of Built Environment, College of Sciences, Massey University, Auckland 0632, New Zealand
- <sup>2</sup> Faculty of Design and Creative Technologies, School of Future Environments, Auckland University of Technology (AUT), Auckland 1010, New Zealand
- <sup>3</sup> Department of Fibre and Polymer Technology- Polymeric Materials, School of Chemical Sciences and Engineering, KTH Royal Institute of Technology, 100 44 Stockholm, Sweden