

# E-LEARNING LESSONS FOR BUILT ENVIRONMENT EDUCATION FROM THE COVID-19 PANDEMIC EXPERIENCE IN ZIMBABWE

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## **ABSTRACT**

The COVID-19 pandemic and response efforts unprecedentedly disrupted social and economic activities worldwide. In the tertiary education sector, e-learning was embraced as a response during the pandemic. While this transition was important, learners in Zimbabwe experienced unprecedented challenges. This study investigates e-learning challenges and lessons for built environment education during the COVID-19 pandemic. A case study design was adopted wherein an online questionnaire was distributed and received from 471 built environment students of a

selected public university in Zimbabwe. Descriptive and inferential statistics such as mean score (MS) and exploratory factor analysis were adopted for data analysis. Factor analysis revealed five (5) factors affecting a fruitful e-learning experience for built environment students: preparedness for e-learning, social interaction, technological and infrastructure issues, work ethic and e-learning literacy issues, and online class size and student attendance. The study highlights the importance of adopting policy interventions to promote economy to access data, acquire information communication technology (ICT) gadgets, and use interactive online platforms that encourage learner-to-learner and learner-to-instructor engagement. Considering that the study is based on the views of students from one institution of higher learning, caution should be exercised when generalising the results to other universities.

**Keywords:** built environment, challenges, COVID-19, e-learning, Zimbabwe.

## INTRODUCTION

The coronavirus disease 2019 (COVID-19) pandemic disrupted social and economic activities globally. The education sector was not exempt from the effects of COVID-19. On 26 March 2020, the Zimbabwean President proclaimed a national lockdown. This involved the closure of borders, banning mass gatherings, and the introduction of social distancing, wearing of facemasks, and hand hygiene (Chigara and Moyo 2021). In the education sector, the restrictions such as the prohibition of physical on-campus teaching and learning for extended periods (Chigara and Moyo 2021), heightened the need to adopt alternative methods of teaching and learning. Accordingly, higher education institutions (HEIs) swiftly switched from the established face-to-face mode of teaching and learning to an e-learning mode to guarantee the continuity of the teaching and learning process. Thus, the COVID-19 pandemic compelled HEIs that were earlier reluctant to adopt e-learning to migrate exclusively to virtual instruction (Dhawan 2020).

E-learning concerns to the usage of information and communication technologies (ICTs) to augment learning in tertiary education (Organisation for Economic Cooperation and Development, OECD 2005). It shifts learning from a classroom mode to a distance-learning mode. This mode of teaching and learning allows students to attend lectures from anywhere at their convenience (Malik and Javed 2021; Mostafavi 2020) thereby widening access to tertiary education at low cost (Azlan et al. 2020; OECD 2005). Although e-learning was introduced in tertiary education during the past two decades (Wang et al. 2020), it was broadly not adopted in HEIs prior to the COVID-19 pandemic (Zalat, Hamed and Bolbol. 2021). Hermawan (2021) argues that prior to COVID-19; e-learning existed as a complimentary method that seemed to supplement the learning process in a classroom. Hence, the COVID-19 pandemic marks a

substantial turning point relative to the adoption of e-learning in HEIs, specifically in developing countries.

While the transition to e-learning amidst a pandemic was important, students experienced some notable challenges from using this mode of teaching and learning. Notably, HEIs were not prepared for the sudden shift, scale, and intensity of virtuality imposed during the COVID-19 pandemic (Salama and Burton 2021). According to Varma and Jafri (2020), the application context of e-learning throughout the pandemic overlooked the requirement of having recognised and appropriate frameworks for each of the independent educational programmes. Past studies also show e-learning was affected by the lack of digital proficiency among lecturers and students (Wang et al. 2021), unstable internet connectivity, limited digital infrastructure (Hermawan 2021; Salama and Burton 2021), and high cost of data (Allu-Kangkum 2021). Although the challenges had varied effects on higher education students, the impact on the built environment, where courses are predominantly applied, is substantial.

Despite the challenges, e-learning is predicted to remain in place post-pandemic period (Varma and Jafri 2020; Mostafavi 2020). This is confirmed in Zimbabwe where a hybrid/blended teaching and learning approach continued post-pandemic. However, limited research has been done to comprehend the constraints of e-learning for built environment education in developing countries. Therefore, this study pursued to resolve this gap by examining the insights of built environment students from Zimbabwe regarding their experiences of e-learning throughout the COVID-19 pandemic. Considering that e-learning is a relatively unfamiliar phenomenon in the built environment, understanding its challenges is important to develop effective context-specific interventions beneficial to post-pandemic built environment education.

## **THE REVIEW OF RELATED LITERATURE**

### **E-learning in higher education institutions**

Wang et al. (2021) indicate that e-learning has been in existence for over two decades. Several commercial learning management systems (LMS) such as Blackboard, WebCT, Moodle, and bespoke platforms were developed as a reaction to the necessity for online learning (Mahmud and Gope, 2009). According to Mahmud and Gope (2009), e-learning models in HEIs have roots in conventional distance education. In Zimbabwe, distance learning was promoted as early as 1990 when the Zimbabwe Open University (ZOU), was established. The advancement in ICTs is playing a pivotal function in the shift to an online-based distance model. E-learning in HEIs promotes flexibility, offers students with more options to network with lecturers and their

contemporaries (Mushtaha et al. 2022), and offers real-time access to affordable, quality education and opportunities (Phutela and Dwivedi 2020). According to Aini et al. (2020), an ingenious e-learning system does not only afford learning resources, but also enables other undertakings such as tests, written assessments, and conversation forums. Thus, an e-learning system can assist interactional learning provided the users are linked via the Internet.

There are two main delivery modes for e-learning, namely synchronous and asynchronous. Synchronous e-learning permits for interactive and simultaneous teaching and learning. In this delivery mode, interaction between lecturers and students is instituted instantaneously through digital media (Hermawan 2021). According to Dhawan (2020), the synchronous learning environment is designed in such a way that students listen to live virtual lectures, allow real-time communications between the lecturers and learners, and provide instant feedback. The use of platforms such as Zoom, Google Meet, Microsoft Teams etc. is essential for synchronous learning. However, the effectiveness of teaching delivery in the synchronous mode depends on the internet connection quality (Azlan et al. 2020).

The asynchronous e-learning system is self-paced consisting of taped lectures, supportive videos, links for suggested websites, and supplementary resources such as electronic books (Zalat et al. 2022). In this delivery mode, teaching and learning activities occur at different locations and times, and responses can be transmitted via email (Azlan et al. 2020). The asynchronous delivery mode provides flexibility to lecturers and students to teach and learn, respectively. The main disadvantage of asynchronous teaching is that there is no effective communication between lecturers and students (Azlan et al. 2020).

### **Challenges of e-learning for students in HEIs amidst the COVID-19 pandemic**

Mahyoob (2020) investigated the challenges of e-learning during the COVID-19 pandemic among English Language Learners in Saudi Arabia. The study established that a substantial number of students were either not satisfied or somehow satisfied with online learning. The main challenges encountered by students include poor internet connectivity, online materials and downloading, online exams and no lab sessions. During another study involving postgraduate medical students in Malaysia, Azlan et al. (2020) reported that students found it difficult to concentrate because of disruptions, lack of engagement and mental health issues. The other problems include poor Internet connectivity, prohibitive cost of data, limited data plans, drop in confidence, deficiency of enthusiasm, difficulty focusing on their learning, and lack of support. The study also observed that certain aspects such as clinical research projects, work-based learning sessions and clinical attachments were not suitable to be delivered online.

Thakker, Parab, and Kaisare (2021) used an online questionnaire among engineering students to explore their assessment of the e-learning proposals and the underlying hinderances in India. The main challenges encountered by students relate to security issues (such as cyber criminals hijacking the meetings, dispersing detestable comments, and posting indecent content on the platforms), and disruption of the flow of the lecture by mischievous students.

Kaisara and Bwalya (2021) conducted an online survey using closed and open-ended questions among undergraduate students at the National University of Science and Technology in Namibia. The study categorised the main problems experienced by students on online platforms into five (5) themes: e-learning accessibility, e-learning platform layout, resources to access the internet, isolation and home environment. Students highlighted that they experienced challenges in accessing the online platform, finding information on the platform, lacked resources to purchase data, and felt isolated and unconducive home environment.

In Qatar, Naji et al. (2020) investigated the ease of engineering students to transition to emergency e-learning during the COVID-19 pandemic. The study used a sequential explanatory approach, which required the use of an online structured questionnaire and follow-up interviews. The study reported both benefits and challenges to online learning. The main challenges reported by students relate to misperception and disorder during the initial weeks of online learning, feeling insecure (isolated), balancing homeschooling of children and the ambition to study, encountering IT issues and difficulties, stress encountered during the online learning experience, and home internet issues.

During another study in Oman, Malik and Javed (2021) established that university students reported having moderate stress (82.5%) and high stress (14.4%) through e-learning during COVID-19. The main drivers of social stress are increased academic load, technical difficulties, poor / no access to technology, inadequate learning materials uploaded, inadequate concentration during online lectures, and little support from family, and teachers. In a literature review study, Mseleku (2020) established that lack of teaching and learning resources; connectivity, network, and internet issues; students and academics' difficulty to adjust; unconducive physical space and setting; and psychological health-related matters are the major constraints related with the sudden movement to e-learning.

Zarei and Mohammadi (2021) examined the information to resolve the COVID-19 e-learning challenges for students, educators, policymakers, and administrators. The study noted that learners in emerging countries faced several challenges during COVID-19-induced online learning. Notably, students in rural/remote areas lacked access to an adequate and effective internet connection. The authors observed that while access to the Internet and high-speed computers is a problem for students and instructors in emerging countries, this problem is not

predominant in advanced countries. The other challenges are houses did not provide a desirable environment for learning, students could not manage to purchase a laptop, and the use of outdated digital tools.

Kapasias et al. (2020) studied the COVID-19 online learning challenges among university students in West Bengal, India. The main findings of the study reveal that learners faced various complications such as depression, weak internet connectivity, and an unfavourable study surroundings. The study further observed that e-learning is often inequitable to poor students. The study observed that a sizeable number of students did not attend online lectures due to poor internet connectivity and lack of electricity. Most of the students (77.7%) of the students perceive that low family earnings during COVID-19 would have an adverse effect on their education.

Dhawan (2020) investigated the strengths, weaknesses, opportunities, and challenges of the e-learning mode in a crisis. Students experienced trials such as a lack of e-learning competencies (digital illiteracy), loss of personal attention in online learning, lack of digital devices (digital divide), technology cost and obsolescence, unequal distribution of ICT infrastructure, and lack of internet connectivity.

Allu-Kangkum (2021) investigated the views of architectural students in six public universities in Nigeria relative to the challenges of online learning during the COVID-19 pandemic. The findings of the study indicate that the students experienced inadequate electricity supply, high cost of Internet/data, lack of substitutes to offering 3D analogue models, physically, environmental disruptions at home, high cost of online learning tools, lack of expertise to operate some of the online tools, isolation from classmates, and lack of capability of lecturers to teach competently using online tools and platforms.

Milavancovic et al, (2020) reports on the findings of a study conducted among a cohort of academic leaders (that is, deans and directors of Architecture and Urban Design programmes) in the USA on how COVID-19 will affect architecture education. The cohort highlighted that COVID-19 broke a decades-long resistance to migrating to online learning for the architecture discipline and that digital education will continue post-pandemic. Nonetheless, academic leaders emphasize that physical studio space remains a critical component of architecture education. The notable challenges exposed by the pandemic are the hidden digital divide among students, the inability to access 3D model programmes while working from home, under-preparation, infrastructure challenges, and lecturers' indifference on account of apparent inappropriateness of the online mode for undergraduate architecture education.

Varma and Jafri (2020) investigated the insights of architecture educators to investigate the implications of COVID-19 for undergraduate architecture instruction in India. In this study, 34 per cent of the selected institutions had started online learning prior to the pandemic. A significant proportion of the respondents (61%) recognise that e-learning had difficulties for students to achieve learning objectives, especially in the design studio.

**Table 1:** Overview of the challenges to e-learning among students in HEIs during the COVID-19

| Item | Challenge                                                                   | References                                                                                                                                                                                                                                   |
|------|-----------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CH01 | Poor internet connectivity and accessibility                                | Aboagye, Yawson, and Appiah. 2020, Baticulon et al. 2020, Dhawan 2020, Jahangeer 2020, Kapasia et al. 2020, Mahyoob 2020, Mseleku 2020, Radha et al. 2020, Sharin et al. 2021, Wang et al. 2021, Zalat et al. 2021, Zarei and Mohammadi 2021 |
| CH02 | Low access to digital gadgets / devices (such as laptops, smartphones etc.) | Aboagye et al. 2020, Allu-Kangkum 2021, Dhawan 2020, Jahangeer 2020, Kapasia et al. 2020, Mahyoob 2020, Wang et al. 2021, Zalat et al. 2021, Zarei and Mohammadi 2021                                                                        |
| CH03 | Inadequate (institutional) support to access devices (e.g. computers)       | Azlan et al. 2020, Allu-Kangkum 2021, Baticulon et al. 2020, Dhawan 2020, Mahyoob 2020, Turnbull et al. 2021, Zalat et al. 2021                                                                                                              |
| CH04 | Electricity/power supply constraints                                        | Allu-Kangkum 2021, Baticulon et al. 2020, Jahangeer 2020, Kapasia et al. 2020                                                                                                                                                                |
| CH05 | High cost of data                                                           | Aboagye et al. 2020, Allu-Kangkum 2021, Azlan et al. 2020, Dhawan 2020, Regmi and Jones 2020, Kaisara and Bwalya 2021, Zarei and Mohammadi 2021                                                                                              |
| CH06 | Lecturers lack adequate knowledge/literacy of the e-learning platforms      | Aboagye et al. 2020, Allu-Kangkum 2021, Jahangeer 2020, Regmi and Jones 2020, Turnbull et al. 2021, Zarei and Mohammadi 2021                                                                                                                 |
| CH07 | Learners lack IT / digital skills and literacy                              | Kapasias et al. 2020, Allu-Kangkum 2021, Jahangeer 2020, Regmi and Jones 2020, Sharin 2021                                                                                                                                                   |
| CH08 | Technical issues on e-learning platforms                                    | Turnbull et al. 2021, Thakker et al. 2021, Mushtaha et al. 2022, Kaisara and Bwalya 2021, Zalat et al. 2021, Gagnon et al. 2007, Sharin 2021                                                                                                 |
| CH09 | Limited interaction between learners and facilitators                       | Wang et al. 2021, Dhawan 2020, Regmi and Jones 2020, Phutela and Dwivedi 2020, Sharin 2021, Zarei and Mohammadi 2021                                                                                                                         |
| CH10 | Limited interaction between students and peers                              | Phutela and Dwivedi 2020, Maatuk et al., 2022; Nikou and Maslov 2021, Aboagye et al. 2020, Zarei and Mohammadi 2021                                                                                                                          |
| CH11 | Limited interaction between students and content                            | Sharin 2021                                                                                                                                                                                                                                  |
| CH12 | Large class size                                                            | Dhawan 2020, Sharin 2021                                                                                                                                                                                                                     |
| CH13 | Poor time management                                                        | Naji et al. 2020, Sharin 2021                                                                                                                                                                                                                |

|      |                                                                                                  |                                                                                                                                                                                               |
|------|--------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CH14 | Failing to attend scheduled online lectures                                                      | Kapasia et al. 2020, Jahangeer 2020, Regmi and Jones 2020                                                                                                                                     |
| CH15 | Lecturers missed online lectures /<br>Inadequate instructors to assist in lesson delivery        | Aboagye et al. 2020, Kapasia et al. 2020                                                                                                                                                      |
| CH16 | Lecturers take a long time to respond to student issues                                          | Baticulon et al. 2020, Aboagye et al. 2020                                                                                                                                                    |
| CH17 | Psychological issues (inability to focus on studies, frustration and confusion, stress, anxiety) | Azlan et al. 2020, Malik and Javed 2021, Nikou and Maslov 2021                                                                                                                                |
| CH18 | Increased academic load for students                                                             | Malik and Javed 2021                                                                                                                                                                          |
| CH19 | Lack of community (isolation)                                                                    | Aboagye et al. 2020, Allu-Kangkum 2021, Dhawan 2020, Sharin 2021                                                                                                                              |
| CH20 | The unfavourable study environment at home                                                       | Kapasia et al. 2020, Allu-Kangkum 2021, Baticulon et al. 2020, Mseleku 2020, Naji et al. 2020, Regmi and Jones 2020, Kaisara and Bwalya 2021, Nikou and Maslov 2021, Zarei and Mohammadi 2021 |

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Although studies investigated e-learning challenges during the COVID-19 pandemic, scholarly focus on the challenges encountered by students in practical-oriented disciplines such as engineering (Turnbull, Chugh and Luck. 2021) and the built environment (Hamzah, Nordin and Harumain. 2022) remains limited. The peculiarity of built environment programmes calls for an understanding of the perspectives of built environment students relative to e-learning challenges to ensure context-specific interventions (Regmi and Jones 2020; Turnbull et al. 2021; Nikou and Maslov 2021) and prepare HEIs to cope with similar and possible pandemic situations (Zarei and Mohammadi 2021).

## RESEARCH DESIGN AND METHODOLOGY

A case study design was implemented wherein an online questionnaire was deployed to undergraduate and postgraduate built environment students at a selected state university in Zimbabwe. The selected University consists of eight (8) faculties and hosts the largest built environment faculty in the country. The faculty consists of three departments, four (4) undergraduate, and three (3) post-graduate programmes. As the leading faculty of the built environment in the country, it is projected that the findings from this study can inform interventions to enhance teaching and learning in the built environment in a digital era. The case study research design is used in line with past studies (Maatuk et al. 2022, Zalat et al. 2021) and its ability to promote an in-depth exploration of the phenomenon within its real-world context (Yin 2014).

## **Population and data collection**

The data were collected from undergraduate and postgraduate built environment students. A structured questionnaire, designed on Google Forms, was used to collect students' assessments and encounters concerning online learning challenges during the pandemic. The questionnaire consisted of two sections. In Section A, the survey collected the demographic data of the respondents. Section B collected respondents' perceptions of the challenges experienced using e-learning during the COVID-19 pandemic. The challenges included in the questionnaire were generated from literature as presented in Table 1.

A survey link was shared via students' WhatsApp groups because most students have access to this platform. To enhance the response rate, the questions were designed to ensure a short completion time (10-15 minutes) and responses were designed on a five-point Likert-type scale (1 = minor, 2 = near minor, 3 = moderate, 4 = near major, and 5 = major). A five-point Likert scale ensures that response classifications remain expressive to respondents (Losby and Wetmore 2012). In addition, reminders to complete the survey were sent via students' WhatsApp groups and during live lectures.

Five (5) built environment lecturers, from architecture, quantity surveying and urban planning, reviewed the questionnaire prior to distribution. The comments/suggestions of the reviewers were incorporated into the final questionnaire.

## **Data analysis**

The data were examined using Statistical Package for Social Sciences (SPSS) software (24.0) to compute descriptive statistics such as frequencies, mean scores (MSs), and inferential statistics. As recommended by Doloi et al. (2012), the standard deviation was used to facilitate rank differentiation where two or more variables had the same MS. Cronbach's alpha was used to assess the internal consistency reliability of the Likert-type scale of the questionnaire. Factor analysis exposed better understanding amongst numerous connected characteristics, into less principal factors (Doloi et al. 2012).

## **RESEARCH FINDINGS**

### **Sample stratum and response rate**

The online survey yielded 498 responses. However, 28 questionnaires were discarded for incomplete information leaving 470 responses.

**Table 2:** Respondents' profile (n = 470)

| Characteristic        | Frequency  | Percent (%) |
|-----------------------|------------|-------------|
| <i>Gender</i>         |            |             |
| Male                  | 314        | 66.8        |
| Female                | 156        | 33.2        |
| <i>Level of study</i> |            |             |
| 1 <sup>st</sup> year  | 108        | 23.0        |
| 2 <sup>nd</sup> year  | 98         | 20.9        |
| 3 <sup>rd</sup> year  | 43         | 9.1         |
| 4 <sup>th</sup> year  | 179        | 38.1        |
| Post graduate         | 42         | 8.9         |
| <i>Discipline</i>     |            |             |
| Quantity Surveying    | 229        | 48.7        |
| Real Estate           | 131        | 27.9        |
| Architecture          | 110        | 23.4        |
| <b>Total</b>          | <b>470</b> | <b>100</b>  |

Most respondents (66.9%) are male and female respondents constituted 33.4 per cent. This confirms the long-held notion that the built environment is a male-dominated sector. In terms of the level of study, the majority were undergraduate students distributed as follows: 38.0 per cent (Fourth year of study), 23.1 per cent (first year), 20.8 per cent (second year), 9.1 per cent (third year). Post-graduate students accounted for 8.9 per cent of the respondents. The disciplines, which participated, include quantity surveying (48.8%), real estate (27.8%), and architecture (23.4%).

### Level of satisfaction with online learning

The students were requested to rate the extent to which they are satisfied with e-learning and the results are presented in Table 3.

**Table 3:** Level of satisfaction with e-learning

| Level of satisfaction | Frequency  | Percent (%)  |
|-----------------------|------------|--------------|
| Not at all satisfied  | 138        | 29.4         |
| Slightly satisfied    | 122        | 26.0         |
| Moderately satisfied  | 126        | 26.8         |
| Satisfied             | 61         | 13.0         |
| Very satisfied        | 23         | 4.9          |
| <b>Total</b>          | <b>470</b> | <b>100.0</b> |

The results show that 29.4 per cent of the students were not at all satisfied with e-learning while 26.0 per cent were moderately satisfied. Only 4.9 per cent were very satisfied with e-learning.

Although the results confirm past studies (Nikou and Maslov 2021; Turnaball et al. 2021; Varma and Jafri 2020), they reflect the existence of underlying challenges to e-learning.

### ***Challenges of e-learning during the COVID-19 pandemic in Zimbabwe***

Table 4 presents the challenges, which affected the built environment students from having an effective e-learning experience during the COVID-19 pandemic.

**Table 4:** Challenges of e-learning during the COVID-19 pandemic

| Item | Challenge                                                          | MS   | SD    | Rank |
|------|--------------------------------------------------------------------|------|-------|------|
| CH03 | Inadequate institutional support                                   | 4.58 | .853  | 1    |
| CH05 | High cost of data                                                  | 4.27 | 1.007 | 2    |
| CH20 | The unfavourable study environment at home                         | 3.83 | 1.218 | 3    |
| CH09 | Limited interaction between learners and facilitators              | 3.82 | 1.085 | 4    |
| CH01 | Poor internet connectivity and accessibility                       | 3.80 | 1.023 | 5    |
| CH10 | Limited interaction between students and peers                     | 3.76 | 1.164 | 6    |
| CH04 | Electricity/power supply constraints                               | 3.56 | 1.278 | 7    |
| CH14 | Failing to attend scheduled online lectures                        | 3.51 | 1.160 | 8    |
| CH12 | Large class size                                                   | 3.37 | 1.297 | 9    |
| CH08 | Technical issues on e-learning platforms                           | 3.36 | 1.149 | 10   |
| CH13 | Poor time management                                               | 3.31 | 1.186 | 11   |
| CH17 | Psychological (inability to focus, frustration, confusion, stress) | 3.28 | 1.250 | 12   |
| CH11 | Limited interaction between students and content                   | 3.27 | 1.107 | 13   |
| CH16 | Lecturers take long to respond to student issues/concerns          | 3.26 | 1.206 | 14   |
| CH06 | Lecturers lack of adequate knowledge/literacy of the e-learning    | 3.22 | 1.204 | 15   |
| CH15 | Lecturers not showing up during scheduled e-lectures               | 3.21 | 1.303 | 16   |
| CH19 | Lack of community (isolation)                                      | 3.20 | 1.246 | 17   |
| CH07 | Learners lack IT/digital skills and literacy                       | 3.17 | 1.231 | 18   |
| CH02 | Low access to digital devices (such as laptops, smartphones etc.)  | 3.11 | 1.302 | 19   |
| CH18 | Increased academic load for students                               | 2.99 | 1.118 | 20   |

Table 4 shows that nineteen (19) challenges have mean scores (MSs)  $> 3.00$ , which indicates that respondents view them to have a major effect on built environment students' experience with e-learning.

The factors ranked 1<sup>st</sup> and 2<sup>nd</sup> have MSs  $> 4.20 \leq 5.00$ , which suggest that respondents deem "limited institutional support relative to equipment and data provision" and "the high cost of data" to affect effective delivery of e-learning among built environment students between a near major to a major extent. The shift to e-learning required the use of ICT tools such as laptops, mobile phones, etc., and the need for Internet data. However, most students and lecturers had limited resources to purchase data. The situation was amplified by the limited support from the University to purchase ICT tools, equipment, and data. The outcomes reinforce the findings of past studies which showed that Internet costs limited students' online access

(Azlan et al. 2020; Baticulon et al. 2020) and that lack of institutional support affected e-learning during the pandemic (Turnbull et al. 2021). The huge costs associated with the purchase of digital devices and Internet data require institutions to support students so that students from underprivileged backgrounds are not left out.

The challenges ranked 3<sup>rd</sup> to 16<sup>th</sup> have MSs  $> 3.20 \leq 4.20$ , which suggests that respondents regard the challenges to have moderate to a near major effect relative to e-learning experiences for built environment students. The top-five factors are the unfavourable study environment at home, limited interaction between learners and facilitators, poor internet connectivity and accessibility, limited interaction between students and peers, and electricity/power supply constraints. The results reinforce the need for the government and other stakeholders to intervene and enhance the e-learning pedagogical skills of lecturers to ensure effective use of the platforms while maintaining interaction among students and enhancing access to the internet through new infrastructure and /or reducing the cost of data. The findings also verify the discoveries of past studies. During a study involving medical physics students in the Philippines, Baticulon et al. (2020) reported that the home environment presented several problems with online learning. The situation was amplified by power interruptions (Baticulon et al. 2020) and the difficulties of balancing work, family, social life and studying in an online learning environment (Dhawan 2020).

The challenges ranked 16<sup>th</sup> to 20<sup>th</sup> have MSs  $> 2.60 \leq 3.40$ , which submits that students consider “lack of community (isolation)”, “lack of IT / digital skills and literacy among learners”, “low access to digital devices” and “increased academic load for students’ to have a minor to a moderate effect on students’ experience of e-learning amidst a pandemic. The results confirm the growing ownership of digital devices such as smartphones and laptops and digital skills. However, there are some students from low-income families and underprivileged backgrounds struggling to own digital devices. The findings align with past studies; one out of five students did not have a computer (Azlan et al. 2020) and that low family income could adversely affect students’ education amidst COVID-19 (Kapasias et al. 2020).

## Factor analysis

The study used factor analysis to reveal interrelated variables and present interpretable clusters (Yong and Pearce, 2013). Bartlett’s test of Sphericity results ( $\chi^2 = 3112.396$ ,  $p = .000$ ) and the Kaiser-Meyer-Olkin (KMO) (.896) confirm that the data is appropriate for factor analysis. According to Hair et al. (2020), data with a KMO coefficient greater than 0.50 and Bartlett’s test of Sphericity is significant ( $p < 0.05$ ) is appropriate for factor analysis. The Principal Component Analysis with varimax rotation was used to mine the challenges affecting e-learning

during the pandemic. Using the Eigenvalues greater than the 1.00 criterion, five (5) factors, which explained 58.03 per cent of the total variance, were extracted. Two variables, namely, “CH20 - the unfavourable study environment at home” and “CH03 - Inadequate institutional support” were excluded due to their factor loadings being  $< 0.50$  (Hair et al. 2020).

The extracted factors, presented in Table 5, were named in accordance with the challenges that relate highly with the factor.

**Table 5:** Challenges constraining effective e-learning experience during the pandemic

| Item                                                          | Factor/Component                                                          | Factor load | Eigen value | Var.  |
|---------------------------------------------------------------|---------------------------------------------------------------------------|-------------|-------------|-------|
| <i>Component 1: Preparedness for e-learning</i>               |                                                                           |             | 6.50        | 32.52 |
| CH19                                                          | Lack of community (isolation and loneliness)                              | .655        |             |       |
| CH07                                                          | Lack of IT/digital skills and literacy among students                     | .638        |             |       |
| CH13                                                          | Poor time management                                                      | .625        |             |       |
| CH17                                                          | Psychological effect (inability to focus, frustration, confusion, stress) | .616        |             |       |
| CH18                                                          | Increased academic work load for students                                 | .600        |             |       |
| <i>Component 2: Social interaction issues</i>                 |                                                                           |             | 1.66        | 8.31  |
| CH10                                                          | Limited interaction between students and their peers                      | .821        |             |       |
| CH09                                                          | Limited interaction between learners and facilitators                     | .748        |             |       |
| CH11                                                          | Limited interaction between students and content                          | .614        |             |       |
| <i>Component 3: Technology and infrastructure challenges</i>  |                                                                           |             | 1.24        | 6.20  |
| CH01                                                          | Poor internet connectivity and accessibility                              | .781        |             |       |
| CH05                                                          | High cost of data                                                         | .676        |             |       |
| CH02                                                          | Low access to digital devices (such as laptops, smartphones etc.)         | .642        |             |       |
| CH04                                                          | Electricity/power supply constraints                                      | .595        |             |       |
| CH08                                                          | Technical issues on e-learning platforms                                  | .533        |             |       |
| <i>Component 4: Work ethic and e-learning literacy issues</i> |                                                                           |             | 1.15        | 5.76  |
| CH15                                                          | Lecturers not showing up during scheduled online lectures                 | .751        |             |       |
| CH16                                                          | Lecturers taking long to respond to student issues/concerns               | .739        |             |       |
| CH06                                                          | Lecturers lack adequate e-learning knowledge/literacy                     | .661        |             |       |
| <i>Component 5: Online class size and student attendance</i>  |                                                                           |             | 1.05        | 5.26  |
| CH14                                                          | Low students attendance at online lectures                                | .721        |             |       |
| CH12                                                          | Large class size                                                          | .657        |             |       |
| <i>Notes: Var. = % of the variance</i>                        |                                                                           |             |             |       |

### ***Preparedness for e-learning***

The first factor was named “preparedness for e-learning”. The factor accounted for 32.52 per cent of the entire variance. Five challenges contributed to this factor, namely, “lack of community (isolation)” (0.655), “lack of IT/digital skills and literacy among students’ (0.638), “poor time management” (0.625), psychological effect (inability to focus, frustration, confusion, stress etc.)” (0.616), and increased academic workload for students (0.600). The factor highlights the importance of student readiness for them to benefit from e-learning. According to Qin et al. (2022), student readiness is a necessity for valuable e-learning educational practice and success. The variables loading to this factor suggest that students lacked the key competencies required to effectively participate in e-learning. Lack of digital proficiency, time management skills and self-directed learning skills affect the student’s ability to navigate the platforms and balance their study and lives. The findings confirm past studies that students had a low rate of readiness to use e-learning systems (Sharin 2021) and struggled to balance their work, family, and social lives with their study life (Dhawan 2020). The sudden shift from a classroom mode to a remote learning environment imposed a feeling of isolation and psychological distress on students. E-learning stressors such as academic burden, emotional detachment from fellow students, lack of relaxation time and the failure to navigate the e-learning platforms can aggravate stress levels among students and can negatively affect students’ academic performance. The results highlight the importance of preparing students for online learning.

### ***Social interaction issues***

The second factor was named “social interaction issues”. The factor accounted for 8.31 per cent of the entire variance. Out of the three constituent challenges, “limited interaction between the students and their peers’ had the highest factor loading score of 0.821, followed by “limited interaction between learners and facilitators” (0.748), and “limited interaction between the learner and content’ had the lowest loading of 0.614. This factor reflects on the replacement of interactive teaching spaces such as studios with non-interactive platforms e-learning platforms such as WhatsApp, google classroom and emails for teaching and learning in Zimbabwe. While the platforms facilitated the sharing of learning material, the lack of in-person collaboration and peer learning affected students’ understanding of the relevant subject (Tze 2018). In a related study, Salama and Burton (2021) reported that online learning affected most aspects of studio culture such as students’ sense of community, interaction with peers, and motivation support from peers. Slow learners, who need personalised attention from lecturers to understand complicated content, are likely to bear the biggest brunt of this transition. As put forward by

Zarei and Mohammadi (2020), a lack of in-person collaboration and peer learning has a significant effect on knowledge transfer. This factor highlights the need for a blended approach to learning, wherein students have the opportunity for both learning in a face-to-face and online setting.

### ***Technological and infrastructure issues***

The 3<sup>rd</sup> factor was named “technological and infrastructure issues”. This factor accounted for 6.20 per cent of the entire variance achieved with four (5) variables loading to it: poor internet connectivity and accessibility (0.781), high cost of data (0.676), low access to digital devices (such as laptops, smartphones etc.) (.642), electricity/power supply constraints (0.595), and technical issues on e-learning platforms (0.533). While e-learning continued amidst a pandemic, students lacked access to high-end graphics computers and experienced poor internet connectivity to present their work. The prohibitive cost of data, lack of a reliable power supply, and poor internet connectivity in most parts of the country in Zimbabwe amplified the problem. Against this background, there is a need to manage the digital divide gap between students to reduce the problem of educational inequality. The results resonate with past studies, wherein a lack of technological and infrastructure-related aspects had an adverse effect on built environment e-learning (Tze 2018; Moustakas and Robrade 2022; Salama and Burton 2021). According to Salama and Crosbie (2020), architecture students had challenges accessing adequate off-campus software, high-speed broadband and computers for modelling and visualisation.

### ***Work ethic and e-learning literacy issues***

The 4<sup>th</sup> factor was named “work ethic and e-learning literacy issues”. This factor accounted for 5.76 per cent of the entire variance and three (3) challenges loaded to this factor, namely lecturers not showing up during online lectures (0.751), lecturers taking a long time to respond to students’ concerns (0.739), and lecturers lacking adequate knowledge/literacy of e-learning (0.661). The factor reflects on two main issues: work ethic and the aptitude of lecturers to transition to e-learning. Notably, lecturers failed to show up during scheduled lectures and to timeously provide feedback to students. Moustakas and Robrade (2022) report that communication and response were limited. This may be attributed to the abrupt change from physical teaching to online teaching with limited or lack of training for instructors and the increased administrative and teaching workloads. The results are consistent with Tze (2018) that the lack of technological skills among senior lecturers is one of the factors constraining the transition to online learning for quantity surveying training. Moustakas and Robrade (2022)

highlight that the inadequate training in delivering e-learning makes the implementation of the course difficult for lecturers. Given that e-learning is becoming an integral part of teaching and learning post the lockdown phases; this factor highlights the importance of instructor training and upskilling in e-pedagogy as a key to sustaining e-learning HEIs.

### ***Online class size and student attendance***

The 5<sup>th</sup> factor was named “online class size and student attendance”. The factor accounted for 5.26 per cent of the entire variance and two challenges loaded to this factor, namely, “low student attendance of scheduled online lectures” (0.721) and “large class size” (0.657). Student attendance of lectures is a crucial factor influencing student performance. Yet, low attendance in classes is common for online classes as alluded to by Kapasia et al. (2020). Lack of / poor internet connectivity, lack of gadgets, screen fatigue and self-discipline can hinder students from attending online lectures. Nonetheless, a low attendance rate results in less engaging meetings and discussions (Wang et al. 2021). The increasing enrolment and large class sizes also affected the e-learning experience for built environment students. The large classes affected student interaction and lecturers’ ability to provide individualised instruction and attention to weaker students. This finding resonates with past studies that that some e-learning platforms could not support a large number of students (Moustakas and Robrade 2022).

## **CONCLUSIONS**

The study sought to examine the challenges affecting built environment students from having a fruitful e-learning experience during the COVID-19 pandemic. Research findings suggest that the leading challenges encountered by students are inadequate institutional support to access devices, the high cost of data, an unfavourable study environment at home, limited interaction between learners and facilitators, and poor internet connectivity and accessibility. Factor analysis revealed five (5) factors affecting the e-learning experience for built environment students. The factors were named as preparedness for e-learning, social interaction issues, technological and infrastructure-related issues, work ethic and e-learning literacy issues, and online class size and student attendance. The factors suggest that e-learning challenges emanated from various sources: students, lecturers, university administration, and the government and internet service providers.

The results have notable post-pandemic implications for policy and practice. Notably, e-learning continued post-pandemic albeit, alongside physical lectures. This highlights the need to respond to the constraints faced by learners through the pandemic. At the national level, there

is a need to promote the development of ICT infrastructure across the country to ensure that students can learn from anywhere in the country. The prohibitive cost of data and deficit of funds to purchase ICTs gadgets (high-speed computers/laptops and software, which cater for the peculiarity of built environment programmes) may widen the education gap between the “have and have not”. This calls for the government and internet service providers to produce special packages designed to ensure economical access to the internet (data) and ICT gadgets for students. Second, the results point to the need for training of both lecturers and students on e-learning to enhance the effective use of the education model. Lecturers have an added responsibility to keep students motivated during online teaching and learning. Third, the results highlight the importance of having a blended teaching and learning strategy, which recognises the standing of traditional face-to-face teaching for practical-oriented modules and the need to respond to the digital age through infusing e-learning in other modules. Theoretically, an important contribution to the developing body of knowledge relative to e-learning challenges in HEIs in Zimbabwe is made.

The major limitation of the study is that it is based on the perceptions of students from one Faculty at one public university in Zimbabwe. This limits the generalisation of the findings to other universities in Zimbabwe and elsewhere.

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