International Journal of Evaluation and Research in Education (IJERE)
Vol. 13, No. 4, August 2024, pp. 2603~2612
ISSN: 2252-8822, DOI: 10.11591/ijere.v13i4.28111

The landscape design in online education programs based on interactive technologies

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Article Info

Article history:

Received Jul 20, 2023
Revised Nov 29, 2023
Accepted Mar 19, 2024

Keywords:

Distance learning
Landscape architecture
Landscape design
Online education
Urban environment

ABSTRACT

This study aims to identify the problems that landscape design students face when using Zoom as an educational platform for distance learning purposes and determine their level of satisfaction with distance learning. The main research method was a Likert-scale survey used to assess students' satisfaction with distance learning. The sample included 90 full-time students enrolled in the garden and landscape construction program. According to the students, the main difficulties in distance learning were systemic errors during the use of the platform. The results can help develop a set of measures to solve and alleviate the identified problems in the future. The findings will enhance the optimization of distance education in general. Future research can focus on the advantages and disadvantages of online educational platforms and explore how user-friendly they are for both students and faculty. Studies can also describe faculty barriers to quality online education and provide suggestions to create a comfortable learning experience for landscape students.

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1. INTRODUCTION

The outbreak of COVID-19 in February 2020 affected the health sector, economy, and education. It changed the global learning environment by provoking a massive shift from face-to-face education to online platforms. The teaching methodology also transformed. Learning via a device with an internet connection made the learning process more flexible [1]. Online learning has become the new educational norm and will continue to penetrate pedagogy [2]. When the COVID-19 pandemic separated people physically, online learning became the only solution to maintain communication and help them continue their education [3].

According to the European landscape convention, a landscape is an area characterized by the result of the action and interaction of natural and (or) human factors [4]. Thus, it is both a subject and an object of planning. Society is very concerned about the quality of life, safety, and functionality of rural and urban areas, as well as the landscape diversity of residential areas. Europe has adopted policies based on an overall strategy to improve the living conditions of people and their environment. These policies are implemented through national and regional laws and programs [5]. When implementing the policies, landscape architects consider measures aimed at achieving a high quality of life and the environment. The diversity of landscape-

related disciplines requires integrated yet critical approaches to teaching, learning, and research [6]. The complexity of landscape design as a subject area of landscape architecture broadens approaches to its implementation found throughout Europe. There is still much work to be done to achieve convergence, which is one of the main goals of the Bologna process. European landscape architecture education is rich and diverse. This diversity resides in the nature and culture of the society and the landscapes themselves [7].

The challenges of current landscape design education are to create innovative teaching methods, which will provide an opportunity to highlight and consolidate student skills. The analysis of the current state of landscape practice in Russia revealed gaps in Russian higher education in landscape design and architecture. Scientists believe that the use of individual learning trajectories can improve the effectiveness of the education process [8]. The goal of modern landscape design is to train a new generation of professionals who can transform the urban environment by using natural resources and new technologies [9].

As for education, there is another important problem. Unlike in other countries, Russian laws do not contain norms and regulations for landscape design practice. There are also no clear educational approaches for landscape design training in higher education [10]. Teaching methods vary everywhere, sometimes focusing on urban planning, dendrology, or engineering. Vdovina and Kungurova [11] suggest that the main task of landscape design education is to create, strengthen, and integrate all the skills and knowledge gained by solving specific problems that involve the individual cognitive features of students.

Beyond these typical problems, students have recently faced the challenges of distance education. The problem of online education is especially relevant for design students, including landscape design and landscape architecture majors. The discipline requires social interaction with teachers, for example, during project assessments, which are difficult to complete remotely. Therefore, it is important to examine the problems that students have with online learning. Research into these problems can show how to proceed and find solutions to online education issues to provide students with an appropriate level of training.

The information sources at the core of this research include a wide range of scientific papers from Russian (Chernykh, Gerashchenko, Nefedov, Kizilov, Katkhanova, and Vdovina) and non-Russian (Arslan, Bruns, Ortacesme, Stiles, Chen, Hwang, Cipriani, Stauskis, Auweck, Triboi, Teqja, Du, Lei, Liu, García-Peñalvo, Conde, Alier, Casany, Geng, Jong, Luk, and George) scientists. While some of them were general, others were directly related to the topic of the present article. The methodological framework embraces works by several studies [12]–[14].

The review of scientific publications has shown that the study of the challenges students face in online learning is a pressing problem for many educational institutions. Landscape design education is no exception. The main motivation for this study was to optimize the distance learning process for students majoring in garden and landscape construction and create a favorable learning atmosphere for them. The article aims to identify the problems of landscape students who use the Zoom platform for distance learning. The specific objective of the study was to measure the level of satisfaction of landscape design students with distance learning by using a survey.

2. LITERATURE REVIEW

Landscape architecture is a field of professional activity and an academic discipline dealing with the shaping of landscapes at various scales. It includes landscape planning, design, and management to create, enhance, maintain, and protect places (residences) so that they are functionally, aesthetically, and sustainably suited to a variety of human needs and purposes [15]. The multifaceted nature of landscapes and humanity's interaction with them makes landscape architecture one of the vastest research areas. Consequently, landscape architecture draws on standard concepts and approaches that reach across the traditional division between the arts and natural sciences. In this case, it becomes possible to incorporate many aspects of the humanities and a wide range of technologies [16].

Ortacesme *et al*. [17] identified several problems in teaching landscape design to students. They include the unsupervised opening of new schools, the large number of students, and the lack of qualified teaching staff. Most of the problems are due to factors beyond the control of landscape schools. In Turkey, the decision to open new schools and programs is primarily made by the university senate and approved by the Turkish Council for Higher Education (TCHE). They have established some criteria regarding the minimum number of teachers and infrastructure for new programs to be approved regardless of the country's demand for landscape specialists [18]. Thus, any university that meets the criteria can open a landscape architecture program. Since the popularity of this discipline and profession in Turkey is high, many universities are eager to open new landscape architecture programs. Therefore, there have been two new programs designed every year since 1990 [19].

Turkey has a high percentage of young people showing interest in higher education. Students are allocated to universities according to their grades in two consecutive examinations administered by a central

agency. Each year, between 2 and 2.5 million students take these exams. The decision on the number of students allocated to the programs is made by the TCHE, which tends to increase the number of student placements each year because of the high demand. The latter means that institutions do not control the number of students they accept each year. The annual quota set by the TCHE ranges from 15 to 65 students. However, due to transfer students from other programs, the actual number could be as high as 100. This situation is difficult indeed for many schools [7]. This study reveals the global challenges of landscape design education.

The landscape architecture discipline is relatively new in Turkey compared to other types of design-related disciplines, such as architecture and urban planning. The student-faculty ratio in undergraduate programs ranges from 20 to 25, which is high for a design-related discipline. More and more graduates are choosing to work in the private sector since businesses related to landscape architecture have grown. This situation can lead to more faculty problems in the future [20].

Online landscape design education is a possible solution to the described issues. In the design field, many traditional lecture courses have been converted to online formats to increase student enrollment. A discussion on this topic at the 2018 Landscape Architecture Faculty Council annual meeting identified four issues expected to affect the success of online landscape design education [21]. These issues are access, interactivity, online preferences, and academic integrity. Using these factors as an analytical framework, the author explored the opportunities for online learning in a university lecture course on the history of landscape architecture. The study covered three years. The students actively attending an online course on the history of landscape architecture were surveyed at the beginning and the end of the course. The results showed that online learning could increase course scheduling flexibility, improve self-motivation, and remove geographic barriers to teaching [22]. However, the study did not highlight emerging difficulties for landscape architecture students during the online learning period.

The field of landscape architecture has yet to see the widespread adoption of online education. This delay is explained by the failure to adequately address the concerns of educators. An American researcher identified critical barriers preventing landscape architecture educators in North America from adopting online education. The study showed that teachers were most concerned about how the social component of traditional studio instruction could be transferred to an online environment (80%). Teachers also indicated that they were not adequately compensated for online learning [23]. Previous research on online education for designers has failed to address many of the major barriers identified by educators [24]. A limitation of the previous study was a lack of information about the difficulties students encountered in digital learning.

The author of West Virginia University investigated the possibility of improving students' creative thinking within the senior courses of landscape design and landscape architecture program. The students were divided into a control group and an experimental group. The researcher replaced some standard learning activities of the experimental group with creative learning activities. The study used Torrance's creative thinking tests before and after the intervention. According to the post-test results, the experimental group achieved a significantly greater increase in overall creativity scores (73%) than the control group [25].

The professor from Krasnoyarsk gave insight into three key problems in landscape design training. First, students often cannot link parts of a multi-component task into one system. Second, they struggle with combining the learned information and skills. Third, they are often unable to apply new knowledge to an unfamiliar complex environment [10].

Other researchers highlighted the following important aspects of Bachelor landscape design education [26], [27], such as: i) motivation for independent work and readiness to search for creative solutions; ii) electronic literacy (knowing how to use digital technologies in design and as elements of the project itself); iii) the public importance of the design objects; and iv) ecology in a broad sense (including the elimination of harmful factors caused by the urban environment and the concepts of psychological comfort and rapprochement of people with nature). Unfortunately, research has not described how realistic it is to implement these features in the education of landscape designers in Russian higher education institutions.

The pandemic revealed many problems in landscape architecture education, such as decreased student attention span, poor self-management, low proactivity, and difficulties with assessment and self-evaluation. Moreover, landscape architecture education requires situational effects. Online education lacks the necessary scenarios for courses during a pandemic. To address these issues, other study proposed a more accessible and interactive approach: spherical video-based immersive virtual reality (SV-IVR) [28]. The positive impact of SV-IVR on learning has been confirmed. It has been adopted in an expanding range of disciplines and educational fields [29]. Unfortunately, although SV-IVR is an actively used tool, the technology was not integrated into landscape architecture disciplines. The research authors attempted to supplement landscape architecture courses with the SV-IVR approach and tested their correlation.

The authors developed an approach to a combined system of SV-IVR and landscape architecture education [30]. The conducted quasi-experimental study examined its effectiveness. According to the results, students in the experimental group performed better in terms of grades and attitudes toward learning. The

study also found that students needed more time to improve their self-efficacy. However, the new system did not affect students' cognitive load.

In recent years, researchers and practitioners have developed numerous SV-IVR systems and resources [31] that can meet the needs of the university environment. They are convenient and require only a panoramic camera, such as Insta360 to produce materials [32]. The virtual reality (VR) technology with spherical videos allows viewers to pan and tilt continuously within a circle. Presence videos allow viewers to zoom in 360 degrees and control the content and angle they want to see [33]. In addition, SV-IVR solves the problem of virtual reality, which excessively relies on 3D modeling. Compared to 3D model-based virtual reality technology, SV-IVR saves a lot of time. With the development of SV-IVR technology and mobile apps and the growing popularity of 360-degree cameras, people can quickly, freely, and conveniently create 360-degree spherical images or videos [28]. For landscape architecture teachers, it is an easier and more convenient way to develop materials for virtual reality [34]. Thus, the usability, interactivity, and situational experience of SV-IVR demonstrate its great potential in the field of education. However, the disadvantages of this learning system have not been explored yet.

A Russian teacher analyzed the effectiveness of online learning on the EOS platform for students taking the fundamentals of ornamental dendrology course. The platform allowed the students to get an overview of the available courses and explore the content of topics in detail. Students were able to download files with test assignments for each topic of the course. In turn, the teachers could assess the work and monitor attendance. The author also highlighted some negative aspects of the EOS platform. The lack of live teacher-student interaction does not allow the teachers to assess the work's progress and immediately indicate mistakes [35].

During the COVID-19 pandemic, Malaysian researchers explored the performance of landscape design students in a distance learning program. According to the e-survey results and student performance evaluation, the majority of Malaysian students retained their ability to perform well. Nevertheless, they faced various challenges along the way. The researchers suggest that distance learning plays a crucial role in the continuation of learning under the diploma in landscape architecture program [36].

China faced the need to postpone the scheduled time for the new semester due to the COVID-19 pandemic. Therefore, some universities introduced the reform and amended the mode of teaching landscape design courses. They transformed the original theoretical content of face-to-face teaching into online self-study on the MOSO teach platform. Subsequent classes rested on small private online course (SPOC) blended online and offline flipped classroom. Students had to submit evidence of their pre-class self-study for pre-assessment. The in-class practice mainly included online discussion, questions and answers, and offline learning of theory. According to differences in the students' learning ability and expectations, this reform provided optional learning materials and targeted guidance during practice. It was helpful to boost their learning initiative and enthusiasm. At the same time, the use of online conferences allowed for cross-class reports and reviews. This procedure was rather difficult to complete offline, but it had a better learning effect [37].

3. RESEARCH METHOD

3.1. Participants

The study engaged students from the Institute of Horticulture and Landscape Architecture at the Russian State Agrarian University-Moscow Timiryazev Agricultural Academy (RSAU-MTAA). Specifically, the authors selected 90 full-time students from the gardening and landscape construction program. The sample size was determined using the formula for the standard deviation, and the sample size was deemed adequate [38]. The average age of participants was 20 years. The sampling process was randomized with the help of an online mailing list service. Due to isolation limitations, the questionnaire was delivered through email and social media (e.g., Twitter, Facebook, and WhatsApp). The online survey was distributed between April 20 and May 1, 2020, during the first wave of the COVID-19 pandemic in Russia. No sensitive data by which participants could be identified were collected.

3.2. Research design

The study nature does not imply a conflict of interest and uses an anonymous online survey of students. Therefore, this cross-sectional study was approved by the dean of the faculty, where the study was conducted. After the dean's approval, invitation emails were sent to the students of the bachelor's degree program. Each email contained a description of the study and a link to an online survey on the Qualtrics website. This email also emphasized that the participation of students in the study was voluntary and confidential, and those wishing to participate could follow the link in the email to fill out the questionnaire. The invitation email also clarified that the purpose of the study was to understand the students' experience in

online learning first-hand from their point of view, and their honest feedback was important for the faculty to improve the quality of online education in the future.

3.3. Research tools

The main research instrument was the distance learning satisfaction assessment questionnaire. The survey asked students to rate the quality of distance learning on a 5-point Likert scale. The development of the questionnaire involved five university teachers with Ph.D. degrees. The process consisted of four steps, as presented in Figure 1. The first step was a preliminary review. At this stage, researchers voiced the main idea of the survey. The research questions were: What information to collect? Who are the target respondents? Which data collection method to use? The second step was the questionnaire structure development. When compiling the questionnaire, it is important to reduce the likelihood of data collection difficulties occurring due to the violation of the questionnaire logic. To do this, a preliminary flowchart was constructed to display the logic of the survey.

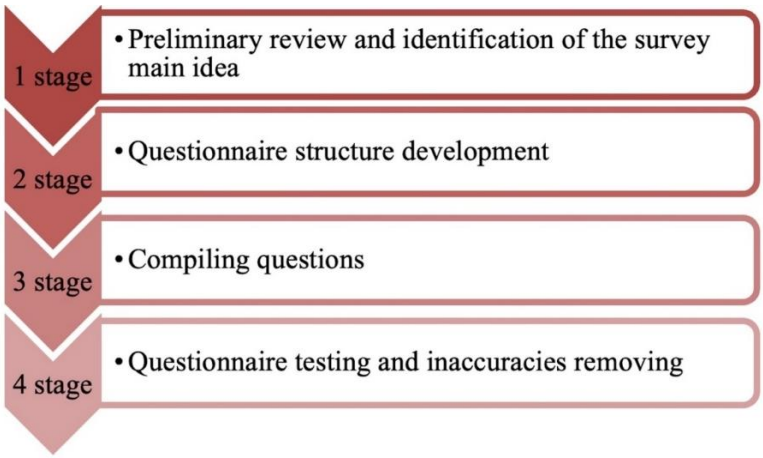

Figure 1. The stages of questionnaire development

The third step was the writing of questions. The fourth step was questionnaire testing, which identified and removed inaccuracies. The last stage allowed the researchers to adjust the method of data collection. The testing involved the same target group under the same conditions. The survey was developed and used online on the Qualtrics platform. The questionnaire consisted of 26 questions divided into four sections: i) demographic background and situation of residence and movement during the period of social distancing; ii) background, state, and infrastructure of online learning; iii) satisfaction with face-to-face and online learning before and during COVID-19; and iv) comments on the advantages, disadvantages, and recommendations for online learning in the future. The procedure of filling out the questionnaire took about 20 minutes.

3.4. Statistical analysis

The reliability of the questionnaire was tested using Cronbach's alpha. The scale for interpreting Cronbach's alpha values, according to Mallery and George [39] is the following: >0.9 excellent; >0.8 good; 0.7 acceptable; 0.6 questionable; and >0.5 poor. The Cronbach's alpha value of the learning attitude questionnaire was 0.83. Thus, the questionnaire was reliable and applicable to the survey. The data analysis employed the statistical package for the social sciences (SPSS) version 25.0. Quantitative data were expressed as frequencies and percentages in the case of categorical and ordinal variables and as the mean and standard deviation in the case of continuous variables. The t-test allowed making comparisons between continuous variables. Finally, Pearson's Chi-square test examined the relationship between categorical variables. Differences were significant at $p < 0.05$.

4. RESULTS

A survey using the distance learning satisfaction scale showed low satisfaction with distance education among students (mean score=1.47). Low satisfaction correlated with the occurrence of system errors (mean score=1.59), the use of Zoom online learning platform (mean score=1.63), and poor internet

connectivity (mean score=2.90). The average score for technical equipment was 3.87, as most design students had computers. The highest average score was for teacher engagement (4.56). However, it was insufficient to increase the overall level of satisfaction. Figure 2 presents the average scores.

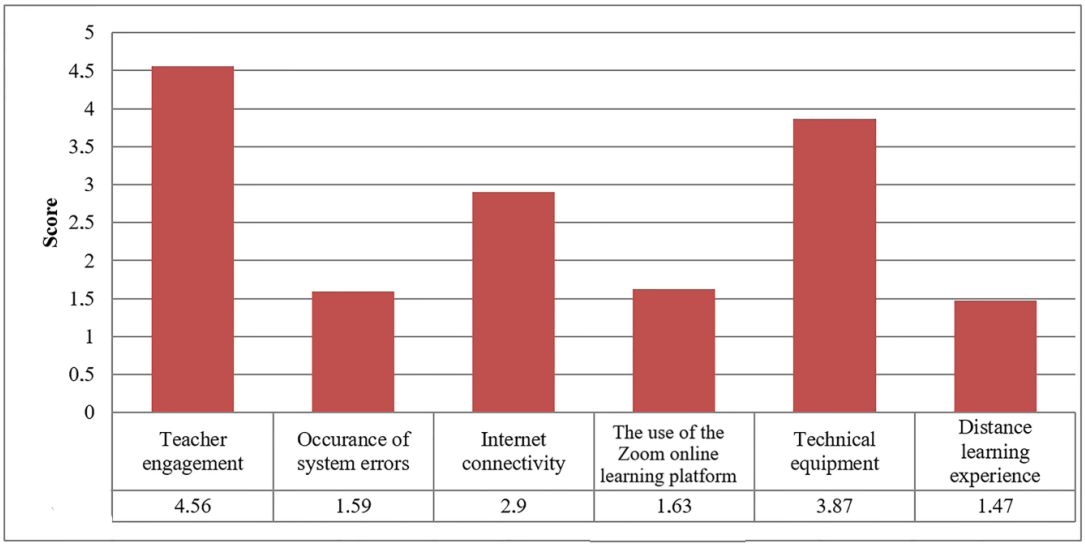

Figure 2. The average scores of satisfaction with distance learning

The study found that students were most satisfied with teacher engagement during the learning process. According to the students, teachers daily monitored and corrected their design drawings and projects through phone apps, email, and constant communication. The $\chi 2$ analysis showed that satisfaction with distance education correlated only with the occurrence of system errors and the use of Zoom ($p<0.05$, Table 1).

Table 1 shows that the interest of teachers in learning, problems with internet connection, and the lack of technical equipment did not affect student satisfaction with distance learning. It seems plausible that distance education technology will improve and maximize the quality of learning while bringing it to the level of traditional learning. However, in landscape design, which includes a variety of knowledge areas, topics, and details, it seems difficult to develop complete and skillful courses. Thus, despite technological advances, distance education will continue to be insufficient for design training courses. A possible solution to this problem could be virtual design communities that allow geographically distant students to create designs in a digital environment through cooperation and communication.

Table 1. $\chi 2$ analysis to determine the correlation between scale items and student satisfaction

Items	Value	df	Asymp. Sig.
Teacher engagement	4.183[a]	2	0.123
Occurrence of system errors	16.111[1]	4	0.003
Internet connectivity	5.699[a]	6	0.458
The use of the Zoom online learning platform	19.936[1]	6	0.003
Technical equipment	3.105[a]	6	0.796

4.1. The assessment of face-to-face and online learning

The study used a paired selective independent t-test to assess the level of student satisfaction with online and face-to-face learning. Before comparing the group averages by all criteria as presented in Table 2, the authors evaluated the assumptions of the paired sample t-test. There were no violations found.

The results showed a statistically significant difference in student assessment of all learning criteria ($p<0.05$). At the same time, student satisfaction was higher with face-to-face learning than with online learning, especially in such criteria as classroom activities ($t=6.90$, $p=0.000$) and student-student interaction ($t=8.03$, $p=0.000$). In both types of teaching, students were the least satisfied with the practice criterion. In turn, pedagogy contributed to the highest satisfaction. These results indicate that students still prefer face-to-face education to online one.

Table 2. The student assessment of the quality of face-to-face and online teaching

Criteria	Face-to-face	Online	t-test (95% CIs)		
	M±SD	M±SD	df	t	p-value
Knowledge content	3.81±0.63	3.60±0.69	173	3.66	0.002
Classroom activities (role-playing and group discussion)	3.69±0.84	3.13±0.88	169	6.90	0.002
Pedagogy	3.90±0.63	3.70±0.77	183	3.23	0.001
Lecturer-student interaction	3.90±0.77	3.48±0.83	171	5.01	0.002
Student-student interaction	3.73±0.90	3.11±0.98	179	8.03	0.001
Assessment methods	3.79±0.68	3.69±0.88	170	3.33	0.002
Practice (if necessary)	3.31±1.09	2.08±1.11	53	2.29	0.0021
General assessment	3.89±0.68	3.57±0.77	129	4.54	0.001

5. DISCUSSION

This study had some limitations, such as the relatively small sample size from one institution and the fact that the data were collected only after the transition to online education. Nevertheless, the paper provides important information to address gaps in knowledge about online education in the field of landscape design. Among the main results of the study, students reported minor difficulties in online learning, such as unstable communication and poor-quality sound. These difficulties, which prevented them from participating in the course, are the common problems of online education [40]. The study participants were relatively satisfied with most of the learning components. This result corresponds to the data obtained from students of other countries [41]. Thus, students were able to adapt quickly to sudden changes in teaching and learning methods.

The global research community investigated the potential of online learning in landscape design. One study found that online learning, including landscape design education, could increase flexibility in course planning, improve student self-motivation (69%), and remove geographic barriers to teaching (83%) [22]. Greek students, when describing some of the negative aspects of online education, noted the technical difficulties encountered on the part of the teacher that prevented satisfactory communication regarding practices [42]. In the study presented here, however, the main difficulties of students were system errors and dissatisfaction with the Zoom online learning platform.

Another study identified critical barriers preventing landscape architecture educators in North America from adopting online education [23]. It found that teachers were most concerned about the transfer of the social component of instruction into an online environment (80%). Teachers also indicated that they were not adequately compensated for online learning [23]. Researchers at the Italian National Institute of Statistics found that 45% of learners had difficulty with distance learning due to a lack of necessary devices such as a computer or smartphone in their homes [43]. This survey, however, showed different results. Respondents demonstrated a high level of satisfaction with the availability of technical equipment (3.87) compared to other analyzed factors, such as the occurrence of system errors and the use of the Zoom platform.

A scientist from Turkey also suggested creating virtual project communities to support distance education in landscape design. The researcher found that design students could communicate with each other in interactive and non-interactive classes via the virtual studio application. Students were able to share their knowledge and opinions about design in a computer-based environment. The researcher believes that incorporating communication systems and experimenting with virtual studios, and design universities around the world can improve the distance education process. Adapted to Turkey's context, this application will improve student performance and achievements [44]. Other authors found a discrepancy in the instructional approaches that different teachers use. While some teachers had the camera on, most turned off the camera and provided access to their screen, displaying only the relevant Microsoft Word, Excel, or PowerPoint [45].

Chinese scientists found that for landscape architecture students, the SV-IVR learning system is feasible and effective. They confirmed that this system improves student performance. Russian researchers also investigated the opportunities and disadvantages of virtual reality in landscape design teaching [46]. They established that all types of equipment are indispensable for the professional application of 3D technology in landscape design. However, stereo displays, stereo projectors, high-precision data processing gloves, and helmets are also expensive, which is a limitation to mass use. To complete the display of a complex three-dimensional model, high-performance graphics software is needed [47]. If universities provide a full set of hardware support for virtual reality technology, the first investment should be greater than the result. The implementation of modern technology in education always requires large investments. Therefore, virtual reality technology is still an advanced technology in educational institutions [48].

A higher level of professionalism and computer skills is required of teachers in this case. A theoretical analysis of teachers' abilities at various universities showed that they could master computers well but were not sufficiently aware of virtual reality technologies [49]. The authors of the study believe that

enriching the curriculum in landscape design teaching with virtual reality technology facilitates the learning process. This technology also makes students more motivated and enthusiastic about the process. Virtual reality technology significantly increases learning efficiency by visualizing the learning process [46].

6. CONCLUSION

Due to the impact of COVID-19, education systems around the world faced enormous challenges. The pandemic has forced many educational institutions to cancel face-to-face classes and switch to online learning. More and more universities are adopting distance education and using various platforms for learning. Thus, educational institutions widely apply videoconferencing, e-mail, and massive open online courses. Higher education professors and administrators face the challenge of creating the most favorable conditions for students during the distance learning period. The study identified and analyzed the main inconveniences of distance learning encountered by the students and evaluated student satisfaction with distance learning. According to students, the main difficulties in distance learning were system errors (satisfaction score=1.59) and the use of the Zoom online learning platform (satisfaction score=1.63).

Due to the specifics of landscape design education, this discipline requires social interaction with teachers. For instance, project assessments are problematic to complete remotely. Therefore, it is useful to study the problems associated with distance learning methods. Studies on these problems can reveal the possible directions and solutions to provide students with an appropriate level of education. This study has several limitations. First, there is a need to conduct a longer-term experiment in the future. For example, researchers could examine a year-long course and test the stability of its results. The stability and robustness of the study results are questions that need further research. Second, it is worth trying to consider other design courses. Third, researchers may increase the sample size of the experiment to attract more students and further improve the accuracy of the experiment results. Finally, future studies should address other factors, such as different learning styles, different characteristics, academic performance, and gender, to expand the scope and depth of the study further.

This study contributes new findings regarding the impact of distance learning methods on student satisfaction. This information can be useful to develop measures aimed at improving student satisfaction in distance learning programs. Future research can focus on the advantages and disadvantages of online educational platforms and explore how user-friendly they are for both students and faculty. Studies can also describe faculty barriers to quality online education and provide suggestions to create a comfortable learning experience for landscape students.

REFERENCES

[1] J. Paul and F. Jefferson, "A comparative analysis of student performance in an online vs. face-to-face environmental science course from 2009 to 2016," *Frontiers in Computer Science*, vol. 1, p. 472525, Nov. 2019, doi: 10.3389/fcomp.2019.00007.

[2] S. L. Schneider and M. L. Council, "Distance learning in the era of COVID-19," *Archives of Dermatological Research*, vol. 313, no. 5, pp. 389–390, Jul. 2021, doi: 10.1007/s00403-020-02088-9.

[3] V. Gewin, "Five tips for moving teaching online as COVID-19 takes hold," *Nature*, vol. 580, no. 7802, pp. 295–296, Apr. 2020, doi: 10.1038/d41586-020-00896-7.

[4] K. Kristiánová, E. Putrová, and K. Gécová, "Landscape architecture for architects-teaching landscape architecture in the architecture and urbanism study programmes," *Global Journal of Engineering Education*, vol. 19, no. 1, pp. 60–65, 2017.

[5] K. Jørgensen, R. Stiles, E. Mertens, and N. Karadeniz, "Teaching landscape architecture: a discipline comes of age," *Landscape Research*, vol. 47, no. 2, pp. 167–178, Feb. 2022, doi: 10.1080/01426397.2020.1849588.

[6] D. Akyol, "Basic design course in the education of landscape architecture," *Online Journal of Art and Design*, vol. 9, no. 3, pp. 46–52, 2021.

[7] D. Bruns, V. Ortacesme, R. Stiles, J. de Vries, R. Holden, and K. Jorgensen, "ECLAS guidance on landscape architecture education," ECLAS, 2010. [Online]. Available: https://www.eclas.org/eclas-guidance-on-landscape-architecture-education/

[8] S. M. Gerashchenko and N. G. Shilina, "Features of the educational process in the system of FGOS," (in Russian), *Prospects for Architectural and Art Education: Proceedings of the International Scientific Conference*, Krasnoyarsk: Siberian Federal University, 2012, pp. 30–32.

[9] L. Cipriani *et al.*, "An EU common training framework for landscape architecture addressing the current needs of society," in *ECLAS Conference: Stop and Think*, 2021, pp. 1–20.

[10] S. M. Gerashchenko and K. V. Chernykh, "Problems of using individual trajectories for teaching students landscape design," (in Russian), *International Scientific and Practical Conference "Modern Problems of Architecture, Urban Planning, Design*, 2014, pp. 96–100.

[11] S. A. Vdovina and I. M. Kungurova, "The essence and directions of implementation of an individual educational trajectory," (in Russian), *Bulletin of Eurasian Science*, vol. 6, no. 19, p. 175, 2013.

[12] M. L. Patten, *Understanding research methods: an overview of the essentials*, 9th ed. New York: Routledge, 2016, doi: 10.4324/9781315266312.

[13] P. Stokes and T. Wall, *Research methods*. London: Macmillan Education UK, 2017.

[14] R. Coe, M. Waring, L. V. Hedges, and L. D. Ashley, *Research methods and methodologies in education*. Thousand Oaks, CA: SAGE Publications, Inc., 2021.

[15] H. Sasaki, "Thoughts on education in landscape architecture: some comments on today's methodologies and purpose," *Landscape Architecture Magazine*, vol. 40, no. 4, pp. 158–160, 1950.
[16] D. Chun-lan, L. Xiao-liang, and L. Jun, "The challenge and prospect of the development of contemporary landscape architecture education," *Chinese Landscape Architecture*, vol. 33, no. 1, pp. 25–29, 2017.
[17] V. Ortacesme, M. Atik, and E. Yildirim, "Development of landscape architecture education in Turkey: key issues and challenges," in *Presentation at the meeting of the 5th International Federation of Landscape Architecture Africa Symposium, Rabat, Morocco*, 2017, pp. 1–10.
[18] V. Ortacesme, P. Kinikli, and E. Yildirim, "Türkiye'deki peyzaj mimarlığı bölümleri ve eğitim-öğretime ilişkin mevcut durum," in *Peyzaj Mimarlığı Eğitim-Öğretim Çalıştayı, Bildiriler Kitabı*, Antalya, Turkey (in Turkish), 2014, pp. 31–45.
[19] M. Arslan, "Ankara üniversitesinde peyzaj mimarlığı eğitim-öğretiminin tarihçesi," in *Peyzaj Mimarlığı Eğitim-Öğretim Çalıştayı, Bildiriler Kitabı*, Antalya, Turkey (in Turkish), 2015, pp. 17–30.
[20] A. van den Brink, D. Bruns, H. Tobi, and S. Bell, *Research in landscape architecture: methods and methodology*. New York: Routledge, 2016.
[21] D. R. Godschalk and L. Lacey, "Learning at a distance: technology impacts on planning education," *Journal of Planning Education and Research*, vol. 20, no. 4, pp. 476–489, Jun. 2001, doi: 10.1177/0739456X0102000411.
[22] G. Newman, D. Li, Z. Tao, and R. Zhu, "Recent trends in LA-based research: a topic analysis of CELA abstract content," *Landscape Journal*, vol. 39, no. 2, pp. 51–73, May 2021, doi: 10.3368/wplj.39.2.51.
[23] B. H. George, "Barriers to the adoption of online design education within collegiate landscape architecture programmes in North America," *Landscape Review*, vol. 17, no. 1, pp. 15–29, 2017, doi: 10.34900/lr.v17i1.1006.
[24] F. J. García-Peñalvo, M. Á. Conde, M. Alier, and M. J. Casany, "Opening learning management systems to personal learning environments," *Journal of Universal Computer Science*, vol. 17, no. 9, pp. 1222–1240, 2011.
[25] A. Kvashny, "Enhancing creativity in landscape architectural education," *Landscape Journal*, vol. 1, no. 2, pp. 104–112, 1982, doi: 10.3368/lj.1.2.104.
[26] A. S. Kizilov, "Individualization of teaching landscape design to university students, taking into account their dominant types of thinking," (in Russian), Ph.D. dissertation, Siberian Federal University, Krasnoyarsk, Russia, 2004.
[27] V. Nefedov, *Urban landscape design*. Saint-Petersburg: Lubavitch (in Russian), 2012.
[28] W. L. Wu, Y. Hsu, Q. F. Yang, and J. J. Chen, "A spherical video-based immersive virtual reality learning system to support landscape architecture students' learning performance during the COVID-19 era," *Land*, vol. 10, no. 6, p. 561, May 2021, doi: 10.3390/land10060561.
[29] G. Yang, Y. Chen, X. Zheng, and G. Hwang, "From experiencing to expressing: a virtual reality approach to facilitating pupils' descriptive paper writing performance and learning behavior engagement," *British Journal of Educational Technology*, vol. 52, no. 2, pp. 807–823, Mar. 2021, doi: 10.1111/bjet.13056.
[30] W.-L. Wu, Y. Hsu, Q.-F. Yang, J.-J. Chen, and M. S.-Y. Jong, "Effects of the self-regulated strategy within the context of spherical video-based virtual reality on students' learning performances in an art history class," *Interactive Learning Environments*, vol. 31, no. 4, pp. 2244–2267, May 2023, doi: 10.1080/10494820.2021.1878231.
[31] J. Geng, M. S. Jong, E. Luk, and Y. Jiang, "Comparative study on the pedagogical use of interactive spherical video-based virtual reality: the EduVenture-VR experience," in *2018 International Symposium on Educational Technology (ISET)*, Jul. 2018, pp. 261–263, doi: 10.1109/ISET.2018.00064.
[32] X. Ye, P.-F. Liu, X.-Z. Lee, Y.-Q. Zhang, and C.-K. Chiu, "Classroom misbehaviour management: an SVVR-based training system for preservice teachers," *Interactive Learning Environments*, vol. 29, no. 1, pp. 112–129, Jan. 2021, doi: 10.1080/10494820.2019.1579235.
[33] S.-Y. Chien, G.-J. Hwang, and M. S.-Y. Jong, "Effects of peer assessment within the context of spherical video-based virtual reality on EFL students' English-Speaking performance and learning perceptions," *Computers & Education*, vol. 146, p. 103751, Mar. 2020, doi: 10.1016/j.compedu.2019.103751.
[34] M.-R. A. Chen and G.-J. Hwang, "Effects of experiencing authentic contexts on English speaking performances, anxiety and motivation of EFL students with different cognitive styles," *Interactive Learning Environments*, vol. 30, no. 9, pp. 1619–1639, Oct. 2022, doi: 10.1080/10494820.2020.1734626.
[35] N. L. Larionova, "Analysis of the results of teaching the discipline 'fundamentals of decorative dendrology' in a distance format," *Art Pedagogy*, vol. 2, pp. 78–84, 2021.
[36] S. Ahmad, N. H. M. Hussain, S. R. M. Sakip, A. Mansor, A. Bahaluddin, and N. H. Ilias, "The shift in teaching pedagogy for independent landscape design during the pandemic: an analysis of student performance in ODL," *Planning Malaysia*, vol. 19, no. 16, pp. 131–140, Jul. 2021, doi: 10.21837/PM.V19I16.958.
[37] X. Hui, "Tentative practice on profound reform of principles of landscape design course during the COVID-19 pandemic period," in *Proceedings of the International Conference on Education Studies: Experience and Innovation (ICESEI 2020)*, 2020, pp. 286–293, doi: 10.2991/assehr.k.201128.053.
[38] A. Singh and M. Masuku, "Sampling techniques & determination of sample size in applied statistics research: an overview," *International Journal of Economics, Commerce and Management*, vol. 2, no. 11, pp. 1–22, 2014.
[39] D. George and P. Mallery, *SPSS for Windows step by step*. Boston, MA: Allyn and Bacon, 2003.
[40] C. Lee, "Challenges for education sector while coping with COVID-19," *Vietnam Times*, 2020. [Online]. Available: https://vietnamtimes.org.vn/challenges-for-education-sector-while-coping-with-covid-19-19748.html (accessed Jul. 12, 2023).
[41] M. Webber, L. Currin, N. Groves, D. Hay, and N. Fernando, "Socialworkers can e-learn: evaluation of a pilot post-qualifying e-learning course in research methods and critical appraisal skills for social workers," *Social Work Education*, vol. 29, no. 1, pp. 48–66, Feb. 2010, doi: 10.1080/02615470902838745.
[42] A. Giannoulas, A. Stampoltzis, K. Kounenou, and A. Kalamatianos, "How Greek students experienced online education during covid-19 pandemic in order to adjust to a post-lockdown period," *Electronic Journal of e-Learning*, vol. 19, no. 4, pp. 222–232, Aug. 2021, doi: 10.34190/ejel.19.4.2347.
[43] M. Iavarone *et al.*, "High rates of 30-day mortality in patients with cirrhosis and COVID-19," *Journal of Hepatology*, vol. 73, no. 5, pp. 1063–1071, Nov. 2020, doi: 10.1016/j.jhep.2020.06.001.
[44] K. Sakarya, "İç mimarlik eğitimine yönelik uzaktan eğitim modeli önerileri," (in Turkish), *Çukurova Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, vol. 28, no. 2, pp. 388–401, Oct. 2019, doi: 10.35379/cusosbil.578516.
[45] A. Q. Ahmad, M. A. Jawad, and K. M. Jaber, "E-learning issues and solutions for students with disabilities during COVID-19 pandemic: Al-Zaytoonah University of Jordan case study," *International Journal of Evaluation and Research in Education (IJERE)*, vol. 11, no. 4, pp. 2087–2094, Dec. 2022, doi: 10.11591/ijere.v11i4.22842.
[46] L. Mengxin, D. D. Avetisian, and Y. F. Katkhanova, "Virtual reality technology in teaching landscape design (in Russian)," in *II International Scientific and Practical Conferences "Digitalization as a Driver for the Development of Science and Education*, 2021, pp. 15–22.

[47] Y. F. Katkhanova, K. I. Katkhanova, and K. I. Bestibaeva, "Augmented reality technology in education," (in Russian), *Pedagogical Excellence and Pedagogical Technologies: Materials of VIII International Scientific-Practical Conference*, 2016, pp. 289–291.
[48] Y. Zhang, "Research on the application of computer 'virtual reality' technology in physical education of colleges and universities," in *7th International Conference on Social Network, Communication and Education (SNCE 2017), Advances in Computer Science Research*, 2018, pp. 420–423, doi: 10.2991/meici-18.2018.261.
[49] Y. Jun, "Exploring the application of virtual reality technologies in teaching landscape design courses," (in Chinese), *Drama House*, no. 19, pp. 238–238, 2016.

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