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Teaching Sustainability in Architecture through Collaborative Online International Learning

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Abstract: To confront global environmental challenges, architectural design can play an important role to achieve sustainability. This paper addresses the Online collaborative approach to support the integration of environmental sustainability. It will assess the efficacy of integrating collaborative online international learning exchange (COIL) and cross-cultural dialogue pedagogy into a sustainable architecture studio course to develop students' architectural and intercultural competencies. In this study 16 groups, each group consists of 3-4 students, from An Najah university in Palestine and Memphis university in USA were involved in shared learning classroom model. Different methods were used to assess the students' outcomes, such as reflection reports written by the students, the use of new technologies for design and communication, and the outcomes from the architectural design. The results show changes in the students' understanding of different cultures, they improved their communication skills, and their ability to design in different contexts. The findings also underline the importance of integrating COIL into architectural design education to create professionals who are able to design a resilient and sustainable built environment. The paper introduces intercultural dialogue framework and a new pedagogical technique in the field of virtual exchange.

Keywords: Virtual Exchange, International Collaborative Learning, Architecture, Sustainability, Disasters, Resilience.

Introduction

Sustainability has become an important element in architectural design, because of the significant impact of the building on the environment and the natural resources. To address the sustainability integration in architectural education innovative teaching methods including COIL are emerging as promising approaches. Traditional classroom methods have been successful in conveying theory, but incorporating real-world sustainability practices requires more dynamic and interactive approaches.

The project "Design in Times of Crisis: A New Sustainable Community Center for Nablus, Palestinian Territories," demonstrates the efficacy of integrating Collaborative Online International Learning (COIL) exchange and cross-cultural pedagogy into a sustainable architecture studio course to develop students' architectural and intercultural competencies. The collaboration was designed asymmetrically in recognition that the graduate students from the University of Memphis and the undergraduate students from An-Najah National University needed different outcomes and were enrolled in different types of classes. However, international online cooperation for teaching and learning is one of the new teaching methods that connects students all over the world and can facilitate deeper learning in an environment with different desired outcomes.

Coil And Virtual Exchange

COIL, a form of technology-enhanced learning, involves global collaborations that transcend geographical boundaries (1). It combines cross-cultural experiences, digital communication, and shared curricula, offering an opportunity for students to work on projects with peers from different parts of the world.

The intersection of COIL and sustainability in higher education has gotten attention within the wider context of higher education. It emphasized the potential of COIL to enhance sustainability education by fostering global collaboration.

Collaborative Online International Learning has its roots in a Cold War era program called iEARN, to help US and USSR students understand the "other" and envision a more peaceable planet [2). By 1994, the mission had been codified as "The vision and purpose of iEARN is to enable young people to undertake projects designed to make a meaningful contribution to the health and welfare of the planet and its people (3)." Today, iEARN involves 140 countries, 50,000 educators, and 2 million k12 students (4). Building on this success and an increased appreciation of international experience, COIL was initiated at SUNY Purchase College by Jon Rubin in 2006 (5) to take advantage of technology's ability to communicate internationally and has since spread globally. COIL is a pedagogical strategy which uses online technology as a communication tool to mutually enhance student outcomes in two or more culturally diverse parts of the world (6). Faculty members from both universities developed the courses in tandem and students later engaged in synchronous and asynchronous activities.

Much of the early literature on COIL stressed its effectiveness in developing "21st century skills (7)" of "cross-cultural communication and competence and collaboration competence (8)." Recently, instructors have also demonstrated

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COIL's effectiveness in teaching discipline specific information. A study by Asojo et al. (9) used the collaborative online international learning framework to advance interior design learning, solve interior design problems, and respond to the sociocultural context. The study found that the online collaborative approach enhanced students' design solutions and the use of advanced technologies. Addressing sustainability in architectural design is crucial to achieve a sustainable built environment and mitigate the climate change effects (10). Innovative methods through the peer learning approach for sustainable architecture courses were addressed by Núñez-Andrés et. al. (11) and the results indicate that the peer learning and tutoring has increased students' knowledge, motivation, and commitment to sustainable design. Sustainability integration in engineering education in the Palestinian context has been addressed by Monna et. al. (12) Additionally, the United Nations notes that "global competence, however, is the competency that will have the greatest impact on young people's success in the global workforce, and ultimately support the achievement of Sustainable Development Goals (13)." When it comes to addressing global issues, e.g., climate change mitigation, sustainable built environment, international online collaborative approach in sustainable architecture courses becomes an area that needs further research and development. Because of these global challenges and the latest covid-19 pandemic, much attention has been given to online collaborative learning. Architectural online learning was one of the subjects that has been investigated. Several studies have explored the successful integration of COIL in architectural education. A study found that the experienced collaborative approach can improve the awareness on climate change effects and improve the response of architectural design (14). Another study evaluated the joint approach to integrate sustainability in the undergraduate and graduate levels at higher education for urban planning education. The study found that the global discussion between peers around the world would enhance urban planning education towards a more sustainable future (15). Information and Communication Technologies (ICTs) is also addressed by a study to evaluate the integration of sustainability in architectural design through e-learning methodologies (16). To enhance intercultural and interdisciplinary learning, a study found that this approach can be an alternative to students' mobility programs (17). A study used Global Shared Learning Classroom found that this method will give the students the opportunity to promote sustainable development goals and to involve in active and experiential learning and developing soft and hard skills (18). A study found that shifting into educational experience-based models can enhance the knowledge of the practitioners for implications of the climate in architectural design, and co-production at the community level (19). The above-mentioned studies pave the way for integrating sustainability in architecture education through innovative COIL methods, However, the online collaborative learning effects on the architectural decision related to climate change and sustainability in the Palestinian contest have not been sufficiently addressed.

Methodology

The methodology used pedogeological approaches and a collaborative architectural design process to evaluate the COIL model effects on student's design experiences and the enhanced competences. The following sections (establishing shared model objectives, case study for project development, establishing joint architectural program, and finally developing a collaborative design process), illustrate the research flow and the logical framework.

Pedagogical Goals

The world is globalizing and professionals can no longer remain comfortable with only their experiences. In the last thirty years, the number of global architecture firms has risen 500% (20). Architects increasingly work on projects regionally and internationally and need the skills to work in cultures and climates different from their own and with people beyond their comfort zone. COIL and Virtual Exchange (VE) pedagogy are educational approaches that aim to foster the development of soft skills, including cross-cultural intercultural communication, critical thinking, as well as empathy for difference. These methodologies recognize the importance of preparing students for a globalized world by providing them with the opportunities to engage with peers from different cultural backgrounds. In the field of VE, various techniques are employed to develop students' global competencies. This particular project focused on utilizing a cross-cultural dialogue framework that included practices such as active listening, communication summaries, and asking clarifying questions (21). By using these techniques within the COIL framework, the project aimed to provide students with the practical tools for engaging in meaningful cross-cultural dialogue. The ultimate goal was to develop their soft skills, develop critical self-awareness, and understanding of the nuances and experience behind differences, and prepare them for intercultural collaboration in an increasingly interconnected world. This project aimed to develop in students an increased ability to apply sustainable principles to a design project and develop the associated soft skills of communication and empathy.

Additionally, the course at the University of Memphis was required to meet specifical technical outcomes. This project was designated to evidence student achievement to meet the National Architectural Accrediting Board Student Criteria SC.6 Design Integration demonstrating that "students develop the ability to make design decisions within architectural projects while demonstrating integration of building envelope systems and assemblies, structural systems, environmental control systems, life safety systems, and measurable outcomes of building performance (21)."

Project Development

For spring semester, 2023, two professors from, University of Memphis, and An-Najah National University developed a joint project with the help of Alia Gilbrecht, Director of Virtual Exchange and Innovative Partnerships at An-Najah National University. Counter to expectations, the instructors were not teaching equivalent courses. Dr. Snider was teaching a graduate design studio which met for 12 hours per week and Dr. Monna was teaching a 2-credit hour upper-level undergraduate course on sustainability. Because of the asymmetrical nature of the courses, the instructors paid more attention to how the project was constructed so that the workload would be fair and valuable collaboration could occur. The team began planning for this collaboration the semester before the course and evolved throughout the semester when the course ran.

The basic collaborative model for the course was a client-consultant relationship. University of Memphis students conceived of and developed designs for a community center while incorporating programming, space planning, structural systems, heating and cooling, and sustainable strategies in

support of their overall design idea. The ANNU students became the “experts” in the local culture, climate, and construction methods and their assignments were geared towards applying the sustainable strategies to their Memphis partner’s work.

Architectural Program

The architectural program was adapted from the ACSA Collegiate Schools of Architecture (ACSA) Concrete Masonry Unit (CMU) competition to design a community center (22):

Community Centers are public buildings where members of a community tend to gather for group activities, social support, public information and other purposes. They may sometimes be open to the whole community or for a specialized group. Students will explore best practices for meeting sustainability and functional requirements while focusing on social, urban, and environmental conditions at a topographically complex site with diverse social and architectural needs. The site is located adjacent to Ein Beit Al-Ma’, the most crowded refugee camp in the West Bank (23).

Spatial Requirements

40m2	Entrance Hall and lobby
80m2	Reception and waiting
60m2	Small coffee shop/restaurant
30m2	WCs
30m2	Bath + kitchen
500m2	Multipurpose Hall, divisible
50m2	Administrative Offices
15m2	Mechanical room plus other space as needed
500m2	Outdoor space
2 min.	Egress stairs
1 min.	Elevator
1	Emergency Shelter

Technical Requirements

- CMU as primary structural material
- Meets 2021 International Building Code, including accessibility standards
- Solar panels with battery backup
- Water storage

Successful projects will demonstrate the following:

- The development of a clear design idea
- An architectural response which meets the programmatic needs in a culturally appropriate manner
- Building design which demonstrates an understanding of structures
- Building envelope design which responds to measured daylighting and energy analysis
- Integration of building codes, accessibility, and life safety
- Coordination of MEP and environmental controls

The Design Process

Prior to the first meeting, 16 groups consisting of 3-4 students were formed, with one student representing the University of Memphis (UM) and 2-3 students from ANNU for each group. There were a total number of 16 groups who participated in this learning experience. The research team have conducted a focused group research design. The aim was to study the effects of integrating collaborative online learning on the architectural design process and outcome, this can be extended into larger groups in future research. Weekly meetings were held synchronously during the first hour of class for the Memphis students and in the evening for ANNU students who connected from their homes. At the beginning of each synchronous meeting, the educators reminded the students of communication best practices, being inclusive and asking follow up questions to help one another better understand the experiences behind the perspectives that informed team members’ design choices. They shepherded the students online, responded to questions, and visited the break-out rooms. Instructors were also available to help with tech and groups if there were any absences or need to facilitate introductions or have general questions or concerns.

The first meeting was aimed at helping the students get to know one another, their personal work styles, and learning about their values and interests. The goal was to help them get comfortable with the online and intercultural environment. Through the following sessions, students continued to meet within their same groups and build interpersonal relationships with their team members. Cross cultural dialogue guidelines and resources were also shared with them to help ensure meetings maintained equitable team dynamics.

Figure (1): Early attempts to communicate using digital and analog methods. Lorenzo Rodriguez.

For the second meeting, Memphis students were finishing up their first project of the semester, which was the design of a similar community center in Memphis. Each Memphis student introduced their projects to their ANNU counterparts. This allowed students who were still fairly unfamiliar with each other to respond as peers and through their architectural passion.

By the third meeting, the students were much more comfortable with each other and had begun to exchange information. Between meetings, students communicated informally on WhatsApp. The students met in breakout rooms where the ANNU students introduced the Memphis students to Nablus, Palestine, and the site. The sustainable design work started with the site analysis, where students from An Najah National University, shared their analysis of the site with their peers at Memphis University. ANNU students acted like consultants because they were experts in the region and site analysis. Also, there was a sense of pride in showing off their city. Memphis students could tell how proud ANU students were of their city and felt a responsibility to design something good that was worthy of this love. ANNU university students felt more motivated to show their peers all the information about the environmental, cultural and social aspects of the site.

Results and Discussion

One of the most important outcomes of this collaboration was for students to apply technical solutions to real world problems and to think about real people using them. Yet, teaching sustainability can often lead to "student overload" or becoming encumbered by unsolvable global problems (8). While the project was originally conceived to teach students how to design in a different climate, the collaboration helped students see that choices about materials, heating, ventilation, and daylighting affect real people and sometimes in unexpected ways. They learned about different types of materials and construction methods as well as different expectations for thermal comfort. In many ways the Memphis students found it freeing to design with a wider range of temperature expectations. Because they were working in a different part of the world, they also questioned their default materials choices and, in many cases, selected materials that were more available in Nablus but might require more labor and would have been unaffordable in the US. After seeing the prevalence of solar hot water systems, the Memphis students questioned why this wasn't more common in the US. Because mitigating solar heat gain is such an important aspect of design in Nablus, the Memphis students learned how to harness traditional designs for shading and how to incorporate shading into the core of the design. The Memphis students also learned that resilience has different meanings in different parts of the world and have increased their knowledge about designing for earthquakes and political violence.

Throughout the semester, the meetings generally began with the whole group to talk about major issues and then students separating into their break out rooms. Students primarily worked together on materials and detailing, heating and cooling, and sun control. However, the most interesting and unexpected outcome was that students started to work on design and cultural issues together. For example, one student's design responded to the massing and details of the old city. Their partners helped them create the same feeling as the vaulted streets and staired alleys of the historic city in a new building that responded to the steeply sloping suburban site. They also helped them develop modern mashrabiya (traditional Islamic screened window boxes) that worked with prevailing winds to take advantage of natural cooling while retaining privacy for events. Another student was intrigued by the topography of the area and wanted their building to reflect the valley between Mount Ebal and Mount Gerizim but was unsure how their very bold design would be received. Thus, they asked their partners if it was offensive or celebratory. The US students were enchanted by their ideas which emboldened them more and they worked with the ANNU students to further develop the ideas. For this student, the feedback helped them not second guess themselves and they were able to go into more depth than his previous projects and even started experimenting with technology as a way to improve design communication. Not only were students more willing to try more innovative architectural, structural, and material solutions but they also spent more effort to assure that the solutions were viable and reached a greater level of depth of design than previous iterations of this course.

One ANNU student noted that they expected that the Memphis students would start by showing them the American way of doing projects but they were surprised that instead, the Memphis students began by listening to the ANNU students, taking notes, and incorporating what they said into the designs. It was empowering to be heard (especially by graduate students) and have their ideas manifest in the Memphis students' projects. One of the things ANNU students noted was the difficulty in designing a building remotely because the Memphis students did not have physical access to the site and had to rely on ANNU students for information. This challenged how they thought about communication and the methods they will use going forward.

This was the first time speaking to native English speakers for many of the ANNU students. At first communication was challenging for some of the students but the graphical nature of architecture and the fact that all students had a common professional language helped students persevere until they felt comfortable. Interestingly, Memphis students also increased their communication ability. When the Memphis students presented their final projects (to live jurors and with ANNU students Zooming in), their presentations were significantly more articulate and better organized than previous presentations based on feedback from the jurors. Without being specifically instructed, students provided better descriptions of their design process including how they incorporated building performance data, sustainable strategies, and feedback from ANNU students. This could be due to the fact that ANNU students specifically highlighted their sustainable design methods when sharing their designs with Memphis students and giving feedback throughout the virtual exchange.

Technology and Learning Results

For this project there were three main realms of technology: communication, analysis, and visualization. In the past, the communication tools would have been the most stressful and technologically difficult but everyone had been in school during COVID, so faculty and students were conversant with Zoom and its features such as break out rooms and annotations. WhatsApp was a very comfortable means of communication for the students and they corresponded naturally between meetings. They shared questions, conversation, photos, and drawings. Part of their autonomous group work requirements were to ask group members questions to get to know each other's work styles and hobbies between meetings within their WhatsApp groups. This helped encourage the students to continue learning about one another on a personal level to build trust.

Figure (2): Josh Yarbrough showing Lia Eftekhari how to enter his model using Virtual Reality goggles.

The final presentation for the Memphis students was hybrid with jurors attending in person from Memphis and virtually from the region and from Nablus. The ANNU students were able to see how their work dovetailed into the Memphis students' work.

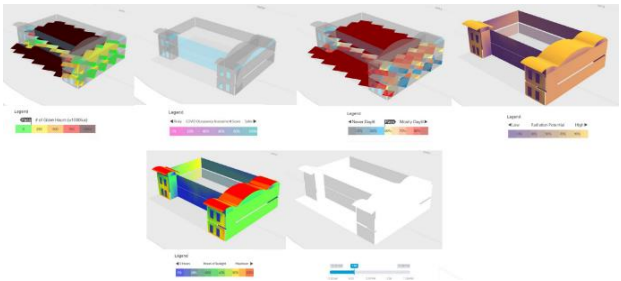

Figure (3): Initial Cove Tool analysis by Phil Haynes.

The Memphis students used (Cove. Tools) (24), a Revit add-on, to quantify and apply the analysis supplied by the ANNU students. Students examined the wind and sun patterns, common building materials and methods, and building performance through (Cove. Tool's) analytics. As expected, the first iteration of the (Cove. Tool) analytics showed low performing buildings. So, the Memphis students worked with the ANNU students to find ways to mitigate solar heat gain, increase daylighting, embrace natural ventilation, employ effective HVAC systems, and optimize thermal resistance in the building envelope. Because building techniques are different in Nablus and different systems are affordable, the ANNU feedback was essential. Memphis students also learned about different thermal expectations and how people commonly use heating and cooling. With this information, Memphis students iterated their designs and then retested with (Cove. Tools) to confirm that their strategies were effective. ANNU students learned how to improve the environmental performance of the buildings using computer simulation tools.

The third and most experimental technological method was visualization. At first, students began by sharing PowerPoint slides and in some cases sketching on paper which they held up to the camera. As their designs and their digital models developed, they began experimenting with new ways to communicate spatial ideas remotely. The goal was for both Memphis and ANNU students to inhabit the same digital model synchronously through tools like spatial.io (25) so that they could meet virtually in a "building" that they were both working on. Although students were not able to achieve this goal, the pursuit dramatically increased their visualization ability. Students began developing their digital models in virtual reality using Twin Motion, Lumion, and other software. They introduced each other to their spaces with Virtual Reality goggles and even used QR codes so that jurors could inhabit the models with their phones. The future goal is to be able to virtually inhabit a third space for increased collaboration but thinking about how to effectively share their designs increased students' technical abilities.

Assessment

To assess the effectiveness of the collaboration, students wrote periodic reflection papers about specific aspects of the project and how they had grown. The data for this paper comes primarily from the reflection papers, post-project discussions, and the results of the final projects. A quantifiable assessment will be available later but it was undertaken by an outside entity who is still processing the data.

Challenges and Lessons Learned

The first challenge, time differential, was further complicated by the advent of Daylight Savings Time and Ramadan. The instructors set the times for synchronous meetings within the Memphis students' studio (1pm) and when the ANNU students would be at home (9pm). As time changed for Daylight Savings in the US, and then did not change in Nablus until after Ramadan, there was some confusion about the actual hour of meeting. This was solved through emails and WhatsApp messages to confirm the actual time each day.

Holding the synchronous meeting during class time was effective because it ensured that all students would remember and there was someone to help with technical issues. It proved problematic when students were in Break Out Rooms with their teammates because they could overhear other students' voices and sometimes proved difficult to hear because the Memphis side was noisy.

Language is typically an issue in COIL. In general, students were able to communicate effectively with each other fairly quickly but a few of the students did not have enough English competency to be understood. The instructors rearranged the groups and those students partnered with a bi-lingual American student. In the future the instructors will work to better prepare students for the English environment.

The initial goal was that students from both universities would work on projects in the others' city and thus both groups would experience acting as designer and consultant. In this way, learning would have been more symmetrical and hopefully increased cross pollination among students. Unfortunately, the asymmetrical nature of the courses and the time constraints only allowed students to work on one project. The instructors hope to ameliorate this in the future.

The students wish that they had more time to get to know their partners and many of them have continued their friendships after the conclusion of the course. Figures 4 to 11 represent the outcomes of the collaborative experiences.

Conclusion

Collaborative Online International Learning (COIL) offers an innovative approach to teaching sustainability in architecture as it supports the integration of sustainability into architectural education. This research highlights the benefits of COIL in promoting cross-cultural collaboration, enhancing global perspective, and addressing sustainability challenges from a wider perspective. The potential of COIL in architectural education is clear, and it represents a promising way for preparing future professional architects to participate in sustainable and resilient built environments.

The paper introduces a new intercultural dialogue framework and a new pedagogical technique in the field of virtual exchange.

The significance of the results of this project are more than the social and technical it includes the synthesis of the two and encourages more profound solutions for improved human habitat. Through learning about people from a different place and how the (social, cultural, political, and natural) environment affects their daily lives, students deepened their knowledge about the importance of societal aspects. Through communicating with peers from a different place, they learned how to ask better questions, improve their language skills, and listen better. Through learning about how people apply technical issues of design in different parts of the world, students

increased their understanding of how components go together and to think about a building as a whole. The end result was that students were better able to try new things, make decisions based on evidence, and articulate their process.

Despite the promising aspects of COIL methods, challenges, such as differing time zones, technology disparities, and language barriers must be resolved. Addressing these challenges is crucial to ensure the effectiveness of COIL in teaching sustainability in architecture. Future research should focus on best practices, assessment methods, and strategies for mitigating these obstacles.

Figure (4): Earth-sheltered structure to provide natural cooling and privacy. By Duewa Alfuqaha, 2023.Figure 5. Demonstrating natural cooling using heat sinks and ventilated enclosures. By. Julien Yray, 2023.

Figure (5): Demonstrating natural cooling using heat sinks and ventilated enclosures. By. Julien Yray, 2023.

Figure (6): Using local architectural elements on a contemporary building. By Lorenzo Rodriguez, 2023.

Figure (7): Space between retaining wall and building used as an accessible ramp. By Josh Yarbrough.

Figure (8): Using CMU to create organic forms. By Danielle Turner, 2023.

Figure (9): Roofs like the ripple of a cloth in the wind. By Phil Haynes, 2023.

Figure (10): Decorative screens to reduce heat gain and allow for natural ventilation. By Aditya Chidananda, 2023.

Figure (11): Roof Garden negotiating between urban and private gathering. Lia Eftekhari, 2023.

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Availability of data and materials

The raw data required to reproduce these findings are available in the body and illustrations of this manuscript.

Author's contribution

The authors confirm contribution to the paper as follows: study conception and design: S Monna, M Snider and A Gilbrecht, theoretical calculations and modeling: S Monna, M Snider and A Gilbrecht; data analysis and validation, S Monna, M Snider and A Gilbrecht. draft manuscript preparation: S Monna, M Snider and A Gilbrecht. All authors reviewed the results and approved the final version of the manuscript.

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Conflicts of interest

The authors declare that there is no conflict of interest regarding the publication of this article.

References

1) Asojo, A. O.; Kartoshkina, Y.; Jaiyeoba, B.; Amole, D. Multicultural Learning and Experiences in Design through Collaborative Online International Learning (COIL) Framework. JoTLT 2019, 8, 5-16.https://doi.org/10.14434/jotlt.v8i1.26748

1) A. Bush, S. Chung, W. Holton, and M. Kokozos, "The New York State - Mosco Schools Telecommunications Project: The Founding Project of iEARN." MPA Capstone, New York University, 2007, p. 4.

2) iEARN. (nd) Constitution, Available: https://iearn.org/pages/iearn-constitutiont

3) iEARN. (nd) "Learn with the world, not just about it." Available: https://www.iearn.org/

4) Coil Consulting, "The Guide to COIL Virtual Exchange." http://www.coilconsult.com/coil-book.html

5) Ward, Heather. Internationalization in Action Internationalizing the Co-curriculum Part One: Integrating International Students. 2017. 10.13140/RG.2.2.33339.11049.

6) Erdem, Cahit & Bağcı, Hakkı & Koçyiğit, Mehmet & Altıner, Cennet & Saykili, Abdullah & Polat, Mustafa & Eğmir, Eray. 21st Century Skills and Education. 2019..

7) Junfeng Yang and R. Huang "Strategies for Smooth and Effective Cross-Cultural Online Collaborative Learning." Journal of Educational Technology & Society, vol. 17, no. 3, 2014, pp. 208–21. JSTOR, http://www.jstor.org/stable/jeductechsoci.17.3.208..

8) A. Asojo, Y. Kartoshkina, D. Amole, B. Jaiyeoba,. "Multicultural Learning and Experiences in Design Through the Collaborative Online International Learning (COIL) Framework," Journal of Teaching and Learning with Technology, 2019. Vol. 8, Special Issue, pp. 5-16.

9) Sijakovic, M. and Peric, A., "Sustainable architectural design: towards climate change mitigation", Archnet-IJAR, 2021. Vol. 15 No. 2, pp. 385-400.

10) Núñez-Andrés, M.A., Martinez-Molina, A., Casquero-Modrego, N. and Suk, J.Y., "The impact of peer learning on student performance in an architectural sustainability course", International Journal of Sustainability in Higher Education, 2022. Vol. 23 No. 1, pp. 159-176.

11) S. Monna, A. Barlet, M. Haj Hussein, D. Bruneau, A. Juaidi, and M. Baba, , "Sustainability integration in Palestinian universities: a focus on teaching and research at engineering faculties", International Journal of Sustainability in Higher Education, 2022. Vol. 23 No. 7, pp. 1709-1729.

12) W. Hunter (n.d.), "Global Competence Amongst Youth is Critical to Achieve Sustainable Development Goals, 2015. on UN.org. Available: https://www.un.org/youthenvoy/2015/07/global-competence-amongst-youth-critical-achieve-sustainable-development-goals/ (accessed on Jan 1, 2024)

13) Antonini, E.; Gaspari, J.; Visconti, C. Collaborative Learning Experiences in a Changing Environment: Innovative Educational Approaches in Architecture. Sustainability 2021, 13, 8895. https://doi.org/10.3390/su13168895

14) Fokdal, J., Čolić, R. and Milovanović Rodić, D., "Integrating sustainability in higher planning education through international cooperation: Assessment of a pedagogical model and learning outcomes from the students' perspective", International Journal of Sustainability in Higher Education, 2020. Vol. 21 No. 1, pp. 1-17. https://doi.org/10.1108/IJSHE-01-2019-0045

15) S. Altomonte, "Enhancing teaching and learning of sustainable design through ICTs," 2010 2nd International Conference on Education Technology and Computer, Shanghai, China, 2010, pp. V2-27-V2-31, doi: 10.1109/ICETC.2010.5529441.

16) Amaral, CarlaEdral, Adriana, Polson, Deb, Collaborative online international learning for design education: A framework for studio-based learning, Journal of Design, Business & Society,V 9 Design and Interdisciplinarity. 2023, Vol 145-158, 2055-2114. https://doi.org/10.1386/dbs_00050_1

17) L. Sundaram (n.d.). "Globalization: Its impact on Architectural Profession," Rethinking The Future. Available : https://www.re-thinkingthefuture.com/2022/12/05/a8695-globalization-its-impact-on-architectural-profession/ (accessed on Jan 2, 2024)

18) Membrillo-Hernández, Jorge & Cuervo-Bejarano, William & Vazquez-Villegas, Patricia. Digital Global Classroom, a Collaborative Online International Learning (COIL) Approach: An Innovative Pedagogical Strategy for Sustainable Competency Development and Dissemination of SDGs in Engineering Higher Education. 2023. 10.1007/978-3-031-26876-2_3.

19) Antonini, E.; Gaspari, J.; Visconti, C. Collaborative Learning Experiences in a Changing Environment: Innovative Educational Approaches in Architecture. Sustainability. 2021, 13, 8895. https://doi.org/10.3390/su13168895

20) J. Yates. Active listening and reflective responses. 2004. Retrieved from MIT DSpace website: https://dspace.mit.edu/bitstream/handle/1721.1/55898/15-281Spring2004/NR/rdonlyres/Sloan-School-of-Management/15-281Spring2004/369F673A-374C-42F8-8C42-F917567010C1/0/yates_listen.pdf (accessed on Jan 2, 2024)

21) National Architectural Accrediting Board, Conditions for Accreditation, 2020 Edition, SC.6. Washington, DC: NAAB, February, 10, 2020.

22) Association of Collegiate Schools of Architecture (2023) "2023 Concrete Masonry Competition" Available at: https://www.acsa-arch.org/competitions/2023-concrete-masonry-competition/program/ (accessed on Jan 2, 2024)

23) United Nations Relief and Works Agency (nd). "Camp No. 1 Camp." Available at : https://www.unrwa.org/where-we-work/west-bank/camp-no-1-camp (accessed on Jan 2, 2024)

24) Cove.Tool, 2023, Atlanta, Georgia 30303 available at: https://cove.tools/

25) Spatial Systems, Inc, 2023, available at: https://www.spatial.io/ (accessed on Jan 2, 2024)