GLOBAL CLASSROOM: A CASE STUDY IN ONLINE LEARNING ON SUSTAINABLE CITIES

Nadine Ibrahim¹ and Allison Van Beek²

¹University of Waterloo, ²University of Toronto

Corresponding Author nadine.ibrahim@uwaterloo.ca

Abstract – *A new learning opportunity among civil engineering students is learning about urbanization in cities, which combines the sub-disciplines of civil engineering in a seamlessly interdisciplinary manner. One of the greatest benefits of learning about a global phenomenon such as urbanization is introducing the opportunities to offer examples of the technological, cultural and social diversity surrounding the evolution of urban design, technologies and sustainable strategies from global cities. The ability to have a globally diverse classroom to bring in these perspectives and create a learning experience that captures this information sharing and exchange can be created through course design, learning activities, and assessments, hence the “global classroom.”*

The authors present a case study of the global classroom for the online course “Sustainable Cities: Adding an African Perspective” and share their perspective on learner-driven formats that support the global classroom, which hinges upon students’ own interest and commitment to an online learning format.

Keywords: Interdisciplinary Learning, Learner Diversity, Distance Learning, Online Learning, Global Online Learning Community, Global Classroom.

1. INTRODUCTION

Learning about cities is interdisciplinary and context dependent. The topic of cities inevitably includes learning about the contexts within which these cities exist and the technological, cultural and social diversity surrounding the evolution of urban design, technologies and sustainable strategies. One of the greatest benefits of learning about a global phenomenon such as urbanization with examples from global cities is the ability to have a globally diverse classroom to bring in this diversity of perspectives and create learning activities and assessments that capture this information sharing and exchange.

An in-class course on Infrastructure for Sustainable Cities at the University of Toronto was re-designed as an online course offering to include the African student community among others, and renamed as “Sustainable Cities: Adding an African Perspective,” which launched as “global classroom.” In this global online learning format, the learning environment allowed students from geographically diverse locations to participate in one “classroom” to collaborate and learn from one another. This paper presents a case study of the global classroom that was carried out as part of the online learning activities developed for the Engineering Education for Sustainable Cities in Africa (EESC-A) project. Over a period of four weeks, the course engaged four groups of engineering students and their instructors as facilitators in Canada, Nigeria, South Africa and Tanzania. The faculty members from the African-based universities who took part in offering and facilitating the global classroom for their students at their respective institutions were members of the EESC-A team as “roaming scholars”, using a variation of the “visiting scholar” concept but of academics working in situ as ambassadors for the program, while also building ties within the continent that might not otherwise have been created.

As course instructor and educational technologist, the authors share their perspective on learner-driven formats that support the global classroom. By focusing on content that embraces the differences in cultures and includes a diversity of urban perspectives and examples, the online environment affords for different types of learners to benefit from the material. Challenges were identified during design, particularly how to ensure that the material did not rely on high-speed internet for streaming and how the live sessions were convened. The complexity of the course and its particular context sheds light on higher-level pedagogical decisions as well as on the ground practical considerations. The interactions among the learners by way of built-in discussions, peer-to-peer learning opportunities, and end-of-course reflections highlight the opportunities leveraged through a global classroom set-up. The challenges that this type of learning environment can potentially overcome, particularly in

higher education settings, are those that are not ready to fully embrace online learning in their programs, and where the learning environments are still very traditional both in terms of content and method of delivery.

2. BACKGROUND

While engineers have a critical role to play in sustainable urban development, it is recognized that the severe shortage of engineers is a threat to development, particularly as the world moves to more sustainable cities and economies [6]. Despite infrastructure challenges and the ongoing debate around the efficacy of online learning tools with respect to training of engineers, several universities have introduced distance learning, and fewer still have introduced online learning initiatives to supplement and complement traditional learning approaches [6] and [10]. Distance learning and online learning approaches create potential opportunities to educate a larger number of students and expand the reach of qualified academic instructors, however highly dependent on information and communication technologies [5], which still remain underdeveloped in many parts of Africa [7]. Though not unique to Africa, recent studies in Eastern Africa have shown improvements within some universities, though many others lack preparedness to adopt online learning into their curricula [7].

2.1. Online Learning

Although most higher education institutions offer some form of distance education [9] and [12], very few offer online learning that is built into their curricula. Learners often struggle with this mode of learning, especially if experienced for the first time, due to insufficient independence and discipline, particularly when students are tasked with finding their own time to pursue online learning. Success in these online learning contexts requires learner self-regulation, or the ability to control the factors and conditions that affect learning [1] and [3].

Self-regulation prompts self-directed learning, where the goal of self-directed learning is to develop a learning attitude when students acquire knowledge in the particular subject field, and are able to apply it to their own contexts, as in the case of contextualized learning of urban settings. Splitt [14] argues that the essence of self-directed learning is that a teacher should direct the process of a student's self-learning activity formation. It means that students develop abilities for self-learning, and who are willing to direct the learning process themselves. In other words when using online learning technologies the new paradigm of education is to stimulate students to develop their own learning-cognitive activity, rather than the teacher merely transferring knowledge [14]. This is where peer-to-peer learning also makes for an enriched learning experience.

2.2. Interdisciplinary Learning

Within higher education institutions, as key players in preparing young people to cope with the challenges that the 21st Century poses, Salomon [13] argues that although there are theories and pedagogical approaches that have the potential to promote interdisciplinary learning, it seems that current academic organizational structures are typically geared towards instruction that compartmentalizes disciplines, more than providing students with the tools for integrating knowledge. Kidron and Kali suggest that shifting from traditional practices involves rethinking the integration of disciplines, innovating on traditional pedagogies, and restructuring traditional hierarchies based on levels of expertise [8].

2.3. Global Learning Community

Laurillard [11] suggests that “a 21st Century education system needs teachers who work collaboratively to design effective and innovative teaching, and digital technologies are the key to making that work,” and within the background where education is increasingly driven by the economies of scale and research funding, Cochrane et al. advocate for alternative online open and connected frameworks for building global learning communities [2].

One of the key graduate attributes that lecturers aspire to develop in their students is the ability to work collaboratively in teams to design creative solutions to real-world problems [4]. This is essential to learning about cities and learning from one another about global cities, and a prerequisite to understanding diverse urban environments.

3. GLOBAL CLASSROOM CASE STUDY

A case study of the global classroom launched in the Fall 2018 presents the online course structure that enables a contextualization of content, profiles of students who took part in the global online learning community, and the learning activities and assessments that aligned the diversity of students and content.

3.1. Online Course Design

The online course “[Sustainable Cities: Adding an African Perspective](#)” introduces students to the theories and strategies to reimagine cities from an urban sustainability perspective.

The course was redesigned from a 12-week in-class course as a 500-level course offered to both undergraduate and graduate students at the University of Toronto. This online course is a four-module course offered typically over four weeks, and designed to capture the introductory material on sustainable cities, and offered online as a beginner engineering course that caters to the new inter-disciplinary trend around Cities Engineering.

The course was designed for interdisciplinary content, and restructured to include relevant examples to benefit the diversity of the student cohort population. The course modules are shown in Fig. 1, and are organized as follows:

1. [Introduction to Urbanization: Growth of World Cities](#)

Topics include: The Origin of Cities, Population Projects and Demands on Infrastructure

2. [Concepts of Sustainable Cities and Communities](#)

Topics include: Sustainable Development Goals, Sustainable vs. Unsustainable City, Climate Change in Cities, Towards Green Growth

3. [Principles of Sustainable Urban Design](#)

Topics include: Context for Sustainable Urban Design, Good City Form by Kevin Lynch, Social Theory by Jane Jacobs, Ecological Design by John Todd & Nancy Todd, Netzstadt by Franz Oswald & Peter Baccini, New Urbanism in Africa by Vanessa Watson

4. [City Performance Indicators & Methods of Assessment](#)

Topics include: Urban Metabolism, Emergy and Material Flow Analysis, Environmental Life Cycle Assessment, Greenhouse Gas Emissions Accounting

Fig. 1. Online Course Modules.

The modules provide an introduction to concepts of sustainability, urbanization, climate change; strategies for best practices in the design of new cities and redesign of existing ones; and tools and methodologies for environmental assessments, material flows, and urban metabolism.

Each module is expected to take 2-3 hours for completion, this includes following the videos, reading through the global cities and African cities examples, and completing assessments, contributing to discussions and reflections, as structured in the representative online course module design shown in Fig. 2. The course activities and interactions enable students to design cities in developed and developing world contexts, in addition to engineering the great African cities of the future. In each of the four modules, the module begins with an introduction to definitions and theories, followed by the latest academic research on the topic, then showcases case studies from global cities in developed and developing world contexts, and from African cities.

Overall, the course includes 21 lecture videos, 13 examples from global cities, and 26 examples from African cities, in addition to 4 module assessments in the form of quizzes and discussions, and a reflection point upon completion.

The course was developed using Articulate 360 Rise, and was built using modular and stackable learning blocks. From the learners' perspective the course is web-based and accessible on desktops, tablets, and mobile devices.

Fig. 2. Representative Online Course Module Design.

The learning outcomes were one of the tools that enabled the diversity of content. Learning outcomes included:

- (i) Recall the context of urbanization in global cities, and specifically in African cities;
- (ii) Describe sustainable design theories and the roles that engineers can have in sustainable growth, particularly in low-resource settings;
- (iii) Recognize and interpret the challenges of rapid urbanization and its implications on the cities' built environment; and
- (iv) Evaluate challenges of and opportunities for African cities as they relate to the Sustainable Development Goals (SDG) in making cities and human settlements inclusive, safe, resilient and sustainable.

3.2. Global Classroom Students

The global classroom learners included a cohort of engineering students drawn from four universities in Canada, Nigeria, South Africa, and Tanzania. The online learners are from the MasterCard Foundation Scholars Program in Civil Engineering at the University of Toronto in Canada, Civil Engineering undergraduate students at Covenant University in Nigeria, graduate students from the Faculty of Engineering and the Built Environment at the University of Johannesburg in South Africa, and undergraduate students in Structural and Construction Engineering at the University of Dar es Salaam in Tanzania. Each institution had a faculty member who championed the global classroom effort, and offered the online course to a group of their students, ranging from 5 to 13 students from each university, and facilitated and supervised the online course activities at their respective university.

4. ONLINE LEARNING

4.1. Course Activities

Synchronous and asynchronous activities were integrated into the course design. Weekly online sessions through the free-to-use Zoom videoconferencing application to bring all the students together in one “Global Classroom” was convened over a period of four weeks, in addition to an introductory session on Zoom to familiarize all students and their instructors with the online platform and tools, learning outcomes, and course deliverables and expectations.

For asynchronous activities, students had one week to go through the course material. Depending on data access, data pricing, and Internet bandwidth, students were self-paced in progressing through the online content. For some, this meant evening hours after their scheduled university classes were done, for others this was carried out on the weekend, and for others they gathered in a classroom on campus to watch the videos. All students also had the opportunity to read through the written course material posted on cities globally, and in Africa.

For synchronous activities, students met online with their instructors and the online course instructor for one hour weekly to contribute to the discussion topic, and discuss the question from the perspective of their own cities. This corresponded to the 12pm lunch hour break for students at the University of Toronto, 5pm in Ota in Nigeria for the students at Covenant University, 6pm in Johannesburg for students at the University of Johannesburg, and 7pm in Dar es Salaam for students at the University of Dar es Salaam. In Week 1 for example, there were 28 students online, 3 instructors from Africa, and the course instructor in Toronto. Some students called in individually, while others were in a classroom with an instructor – the largest being at Covenant University

where there were 13 students present. In the weekly online session, the course instructor guided the students through the modules, answered questions, and encouraged discussion on the cities presented, in addition to draw parallels and thinking about cases from their own cities of choice.

4.2. Formative and Summative Assessments

Assessments included quizzes, discussions and a reflection point. For quizzes, there was a total of four quizzes, placed at the end of each module as a summative assessment of the module’s topics. Quizzes are presented in a set of 5 multiple choice questions with unlimited attempts. For discussions, one discussion question was placed at the end of each module, to offer an online space to share thoughts and ideas from students’ own cities of choice. For the reflection, upon completion of all four modules, there is an opportunity to reflect on the material overall, where students have an opportunity to define a sustainable city by reflecting on the material covered based on the exploration of cities throughout the course modules.

At the conclusion of the online course, students were asked to submit a response to the Reflection Point at the end of Module 4, with instructions as follows: “This reflection point is a way to encourage you to pause and reflect on the overall material covered so far in the course. In doing so, you can formulate your opinion about sustainable cities, and share it in writing. Reflecting on the material covered so far in the course, while observing the pros and cons of the city that you live in, in addition to your own ideologies, in your own words, define a “sustainable city” and indicate the elements that are required to build a sustainable city. Your thoughts on sustainable cities formulate an urban design theory. What would you name your theory and what are the principles of this sustainable design?” A total of 17 submissions were received by all those participating in the global classroom, which were then graded, and a winner selected from each of the participating institutions.

In late October/early November 2018, the instructor along with members of the EESC-A project team visited each of the institutions participating in the Global Classroom to meet with the student cohorts at all three participating African institutions, and to receive feedback as well as to congratulate and thank them for their effort and time commitment. This was accompanied by delivering a public lecture at the University of Johannesburg, the University of Dar es Salaam, and Covenant University. These public lectures introduced the larger student body to the interdisciplinary topic of cities, and presented on the global classroom pilot to encourage future online learning participation, as an option that for the majority of students would be a first time experience. The global classroom pilot served to demonstrate the possibility of online learning, and highlight some of the

variations in the format, in which different universities can introduce it to their student body.

5. DISCUSSION

Stemming from a belief that African urbanization will be a hallmark of human development in this century and will transform the planet, the pedagogical approaches to educating the next generation of engineers point to an anticipated proliferation of various types of learning in higher education in Africa. Traditional universities will thrive but will be transformed in their pedagogical approaches, and there will be many other productive forms of education in Africa, so leapfrogging in education is certainly possible.

Global approaches to collaboration will transform the traditional model of engineering education in Africa, and this is one area where a Canadian university can be of great assistance given the relative strength in these types of interdisciplinary learning that can be exported. The potential for the use of online engineering models in engineering education is considerable. Modern engineers mostly work on virtual models, software simulations and not always in traditional labs, so providing part of engineering education in that way is an opportunity. From a discipline specific perspective, and from the perspective of engineering education, there are more similarities than differences among African countries, and much to be learned by the African cities in comparing approaches and collaborating on solutions, with each other and with global partners.

6. CONCLUSION

Though considered to be a first-of-its-kind pilot for engineering education that brings together students from the Global North and South, more precisely, it included students in an engineering school in Canada interacting with engineering students in African universities. Solutions for sustainable cities may look different in Africa, and these solutions will not necessarily borrow best practices from the west, but rather, will be created through interdisciplinary knowledge, and knowledge created through the learning synergies from a global learning community. The learners meet online to enable this global thinking, where the online environment may be the only space where global students can learn and interact together.

Acknowledgements

The authors would like to thank the team behind the Engineering Education for Sustainable Cities Project (EESC-A), and members of the Education Technology Office at the University of Toronto who led the design and building of the modules, and the students and instructors at the African universities who participated in

the global classroom, and the students at the MasterCard Foundation Scholars Program at the University of Toronto. The course production was funded as part of the Engineering Education for Sustainable Cities in Africa (EESC-A), which was funded by the Dean's Strategic Fund, Connaught Global Challenges Award, and the Learning and Education Advancement Fund (LEAF). The resources mentioned in this paper are all licensed under a Creative Commons Attribution-Non-Commercial-Share Alike 4.0 International License.

References

- [1] Maureen Snow Andrade, "Self-Regulated Learning Activities: Supporting Success in Online Courses," in *International Perspectives of Distance Learning in Higher Education* (J. L. Moore and A. D. Benson, Eds). InTechOpen, March 2012, 332 pp. {ISBN 978-953-51-0330-1}
Available as of May 6, 2019, from <https://www.intechopen.com/books/international-perspectives-of-distance-learning-in-higher-education>
- [2] Thomas Cochrane, Ilona Buchem, Mar Camacho, Catherine Cronin, Averill Gordon, and Helen Keegan, "Building global learning communities," in *Research in Learning Technology*, 21. September 2013, in *Conference Proceedings for ALT-C 2013 - Building new cultures of learning*. Available as of May 6, 2019, from <https://doi.org/10.3402/rlt.v21i0.21955>
- [3] M. H. Dembo and H. Seli, *Motivation and Learning Strategies for College Success: A Self-Management Approach (3rd ed.)*. Lawrence Erlbaum, New York, 2008.
- [4] P. Hager and S. Holland, (eds.), *Graduate Attributes, Learning and Employability*, Springer, Dordrecht, The Netherlands, 2006.
- [5] N. E. Ibezim, "Technologies Needed for Sustainable E-Learning in University Education," *Modern Economy*, vol. 4, pp. 633-638, 2013.
- [6] N. Ibrahim, M. Metcalfe, R. Rezaie, D. Hoornweg, G. Evans, J. Drake, A. Després-Bedward, M. Klassen, C. Luo, K. Moozeh and K. Newfield, "Engineering Education for Sustainable Cities in Africa." In *8th Conference on Engineering Education for Sustainable Development*, Bruges, Belgium, September 4-7, 2016. Available as of May 6, 2019, from http://instituutvoorduurzameontwikkeling.be/fileadmin/user_upload/eesd2016_proceedings.pdf
- [7] M. Kashord and T. Waema, E-Readiness Survey of Kenyan Universities. Kenya Education Network, 2014.
- [8] Adi Kidron and Yael Kali, "Boundary breaking for interdisciplinary learning," *Research in Learning Technology*, vol. 23, no. 1, January 2015. Available as of May 6, 2019, from [doi: 10.3402/rlt.v23.26496](https://doi.org/10.3402/rlt.v23.26496)

- [9] Jiwon Kim, Chiu-Yin Wong, and Yongjin Lee, "Transformative Learning Through an Online Global Class Project in Teacher Education." *The Teacher Educator*, vol. 53, no. 2, pp. 190-207, April 2018.
- [10] Boris Kruk and Olga Zhuravleva, "Distance Learning: Modern Approaches to Engineering Education," *International Perspectives of Distance Learning in Higher Education*, (J. L. Moore and A. D. Benson, Eds), IntechOpen, March 2012, 332 pp. {ISBN 978-953-51-0330-1}
Available as of May 6 2019, from:
<https://www.intechopen.com/books/international-perspectives-of-distance-learning-in-higher-education/-distance-learning-modern-approaches-to-engineering-education>
- [11] D. Laurillard, *Teaching as a Design Science: Building Pedagogical Patterns for Learning and Technology*, Routledge, New York, 2012.
- [12] B. Parsad and L. Lewis, 2008. *Distance Education at Degree-Granting Postsecondary Institutions: 2006-07*. National Center for Education Statistics, U.S. Department of Education.
- [13] G. Salomon, "From theory to practice: the international science classroom – a technology-intensive, exploratory, team-based and interdisciplinary high school project," *Educational Technology*, vol. 31, no. 3, pp. 41-44, 1991.
- [14] F. G. Splitt, "The challenge to change: on realizing the new paradigm for engineering education," *Journal of Engineering Education*, vol. 92, no. 2, pp.181-187, April 2003.