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Exploring a Blended Learning Comprehensive Transformation Process for a Non-Lab Based Graduate Course at UAE University

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Abstract

Blended Learning (BL) as a teaching method has been conceived to be an efficient replacement for the conventional face-to-face teaching method. This is because it merges between student-instructor in-class interaction and the flexibility of learning outside the classroom's place and time. United Arab Emirates University has adopted a recent transformation initiative to BL guided by a clear comprehensive strategy and efficiently supportive tools. This research explored the actors, actions, and outcomes of this BL transformative process in one of the pioneering non-lab based master level courses. The research explored the logistics, infrastructure, technical support, and training provided by the UAE University as essential pillars for the BL courses transformation. The assessment of the degree of success of this BL transformation process was undertaken through the assessment of the attainment of the Course Learning Outcomes (CLOs), Instructor and Students Opinion Surveys and face-to-face interviews. The results of this assessment process indicate that the comprehensive, well planned, and the efficient technical support for the BL transformation process have resulted in a successful model that might be easily replicated in similar higher education institutions. Still, some technical problems have emerged and solutions have been suggested to them to assure the successful implantation of the BL transformation in other courses.

Keywords: Blended Learning, Engineering Education, Architectural Engineering, Graduate Education, Non-Lab Based Courses

1. Introduction

Blended Learning (BL) is normally defined as a process that combines both traditional in-class and face-to-face teaching delivery methods with online and e-Learning instruction. Therefore, while BL gives the students the advantage of in-class interaction, it also gives them a flexible learning opportunity outside the physical boundaries of their classrooms (ELM Learning, 2023). BL is sometimes referred to as the "new normal" in teaching delivery. In BL courses both the face-to-face and online segments are synergically producing a richer learning experience

as they do not just duplicate same course contents in various formats (Dziuban et al., 2018; Tucker et al., 2016). Kolinski (2022) defines three main benefits of BL for students. First, is the safe learning environment through reducing the physical contact hours among students while they still enjoy live communication. Second, is the interactive learning process that avoids the boredom of traditional in-class delivery especially for theoretical topics. Instead, BL equips students with various learning tools that makes the learning process more fun. Third, is the learner autonomy, where BL allows students to individually access the materials of their courses at any time suitable for them. This will not make the learning process an obstacle for practicing other life activities, especially for graduate students. Moreover, it is claimed that the main advantage of BL is evident by its ability to improve the students' learning experience where recent studies revealed that the adoption of BL methods has reduced failure rates and significantly enhanced the students' engagement (Panopto Team, 2019).

Locally in the United Arab Emirates (UAE) the UAE University, the first established public university in the country with its on-going increasing ranking, devised an ambitious plan for creating a smart teaching and learning environment by 2014. In 2017, this smart learning initiative was developed into the Blended Teaching and Learning (BTL) initiative. This initiative aims mainly to achieve better students' engagement in the learning experience through technology-supported pedagogies that utilize both face-to-face and online learning tools. This BL transformation initiative has been managed by the Center of Excellence in Teaching and Learning (CETL) at the UAE University through a well-planned Blended Course Transformation (BCT) process through which the Center called for proposals for courses BL transformations to be submitted by faculty members and instructors. Then, the Center reviews and approve the suitable proposals. The Center also arranged a series of workshops to equip the selected instructors with the tools and skills required to successfully undertake the BL transformation process. Meanwhile, the application of the BL transformation of courses have been monitored by an appointed College Liaison who usually have some prior experience of BL tools (CETL, 2019). The Department of Information Technology (DoIT) at the UAE University provided the needed technical support as required by the involved instructors along the application of the BL transformation process that is usually gradually completed in 2 or 3 academic semesters. Figure 1 summarizes this Blended Course Transformation (BTC) Process showing the main actors with their assigned activities until reaching to the final output of fully BL transformed courses.

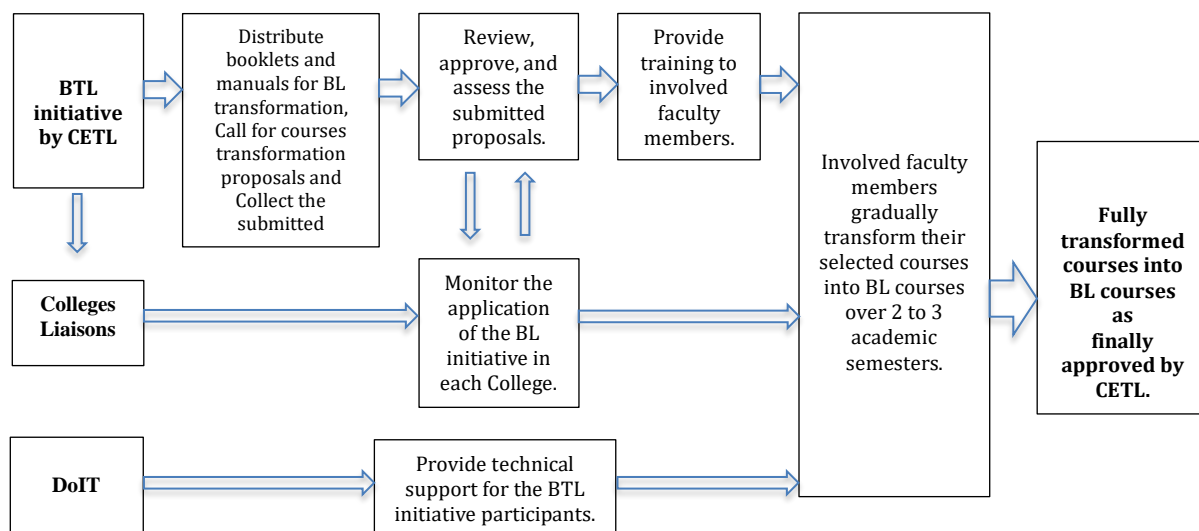


Figure 1: The Blended Course Transformation (BTC) Process at the UAE University.

In the following sections, the research will present, in an exploratory manner, a pioneering case study for the application of the BL transformation process of a non-lab based graduate course from a conventional face-to-face delivery format to a fully BL one. The main aim of the research is to contribute to the global literature about the BL applications and its best practices as an effective teaching method through exploring the BL transformation process and its detailed actors, actions, and tools as practiced at the UAE University. It also aims at discussing the assessment of the BL transformed course from various perspectives including the involved students' performance

and their opinion about the BL transformed course as a case study. The result of this investigation is believed to inform the future BL transformed courses.

2. A Pioneering Case Study for BL Transformation at UAE University: ARCH614 Master Course

2.1 Background about the Master of Science in Architectural Engineering Program

The Master of Science (MSc) degree in Architectural Engineering attracts students with interests in the architectural design and building construction in high performing built environment. The program focuses on both professional practice and academic research. In doing so, the program encompasses courses dedicated to building science, sustainable building systems, and high-performance design on the built environment level. The 30 credit hours program culminates in 9 credit hours of Thesis work. The MSc in Architectural Engineering Program has the following Program Learning Outcomes (PLOs) (UAEU, 2023a), upon successful completion of this program, students will be able to:

- PLO-1 Apply advanced research techniques and methods to the analysis and solution of engineering problems.
- PLO-2 Demonstrate advanced knowledge sufficient to analyze complex environmental issues related to building and urban systems.
- PLO-3 Develop comprehensive engineering systems, highly specialized components, or appropriate processes for built environment.
- PLO-4 Apply advanced knowledge in a specialized and emerging area in high performance built environment.
- PLO-5 Develop communication skills to present, explain and criticize highly complex issues.
- PLO-6 Evaluate engineering systems in high performance-built environment according to relevant regulations and codes.
- PLO-7 Evaluate knowledge of contemporary professional practice in high performance built environment.

2.2 Background about ARCH 614 Master Course

The presented pioneering BL transformation here is of the non-lab based course ARCH 614: Sustainable Community Development. It is a popular 3 Credit Hours course offered as part of the Master of Architectural Engineering curriculum. The course has the following Catalog Description: Concepts and techniques, spatial aesthetics, social, cultural, technical and marketing issues, integration into existing urban system morphology of today's urban development in the Gulf, common patterns and forms of urban development within the Gulf urban environments, investigation of magnets and forces that induce the interest in the development of urban spaces. Topics include impact on suburb cities, urban master plans, spatial composition and infrastructures, real estate development, urban growth control and management, role of critical analysis, assessment, valuing through community participation feedback in creating appropriate development, case studies.

In addition, the Course Learning Outcomes (CLOs) include first, providing students with a better understanding of, and insight into, the major challenges facing the local communities. Second, helping students develop the skills necessary to address those problems and providing holistic architectural and urban solutions that are sustainable and appropriate to the community being served. Third, helping students develop cultural and social awareness. Fourth, giving students the opportunity to reflect on the importance of their local communities. Sixth, helping students gain a better understanding of the key role of neighborhood planning in sustainable community development (UAEU, 2023b).

The course ARCH 614 used to be conventionally taught through weekly face-to-face classes in Fall and/or Spring semester as needed. The course activities were usually subsumed and distributed among 16 Weeks. Each week included traditionally delivered PowerPoint lecture or class discussion for some textbook chapters assigned to students as reading materials. Communication with students was mainly through face-to-face interaction and the submission of students' work was done through hardcopies and digital copies on a Cloud platform such as Dropbox

or OneDrive. Students were asked to conduct one main research to develop a conceptual framework relying mainly on the assigned reading materials (textbooks) and some supporting materials (videos, etc.). Then, after being trained on utilizing advanced analytical computational methods, students were required to individually undertake an analysis for real case studies using computerized simulation tools. Feedback for the students' both theoretical and analytical work was done through face-to-face class discussions.

2.3 Motivation for the BL Transformation of the Course ARCH 614

The most important motivation to transform the ARCH 614 course was that BL would give the chance for the graduate master students to comprehend the delivered materials in a self-learning manner as the materials, including the recorded online lectures and discussions, would remain available for them and thus, they can visit/revisit the course materials as needed. Second, the BL approach would relieve the graduate students from weekly traveling to the UAE University campus in Al Ain city, especially for those who live or work in Abu Dhabi city, Dubai city, and other remote areas. As this would save the students' time, effort, and money, it is believed that this BL transformation would promote the Architectural Engineering MSc program itself and increase students' enrolment in the course. Finally, for the course instructor, this BL transformation experience would be very essential for his professional self-development and the advancement of his academic career as a university professor because the transformation process would equip the instructor with many new teaching and learning tools that, without the BL transformation process, would not be essential to acquire.

3. Research Method: Exploring the Applied BL Transformation Process of ARCH 614 Master Course

The research followed a qualitative exploratory analysis and assessment method for the applied BL transformation process of ARCH 614 course as a pioneering case study. First, the face-to-face teaching delivery method was briefly explored. This was followed by explaining the adopted BL transformation strategy with a focus on the detailed applied procedures starting with the preparation actions until reaching the full gradual implementation. The research then presents and discusses the involved faculty feedback and the students' assessments of the BL transformation process for the course and its outcomes through the obtained Course Learning Outcomes (CLOs) assessment, the students' evaluation of the transformed course, and the qualitative interviews with the students. The research concludes with highlighting the pillars of the applied BL transformation process and recommending a set of actions to overcome the experienced problems and hence making the BL transformation more successfully generalized.

4. Exploring the Applied BL Transformation Process of the ARCH 614 Master Course

4.1 Conventional Teaching and Learning Strategy of ARCH 614 before the Transformation

Conventionally, the course content was delivered through weekly activities, where each week has its defined covered topics and their related course teaching activities as well as the adopted conventional face-to-face learning methods. The course weekly activities usually included reading, writing, presentation, class discussions and feedback. This conventional face-to-face delivery method is summarized in Table 1.

Table 1: The conventional weekly course activities for ARCH 614 course before BL transformation.

Week	Topics	Course Activities/Teaching & Learning Methods	Assessment Tools
1	Introduction to the Course	<i>Group:</i> Introductory in-class web research on main themes.	n/a
2	Defining Main Themes and Principles	<i>Group:</i> Home research + in-class presentation & discussion.	Assignment 1 Presentation
3	PART I: Theoretical concepts and principles: Textbook - Chapter 3	<i>Individual:</i> Home critical reading and in-class discussion.	Assignment 2
4	PART I: Theoretical concepts and principles: Textbook - Chapter 6	<i>Individual:</i> Home critical reading and in-class discussion.	Assignment 3
5	PART I: Theoretical concepts and principles: Textbook - Chapter 8	<i>Individual:</i> Home critical reading and in-class discussion.	Assignment 4

6	PART I: Theoretical concepts and principles: Textbook - Chapter 2	<i>Individual:</i> Home critical reading and in-class discussion.	Assignment 5
7	PART I: Theoretical concepts and principles: Textbook - Chapter 4	<i>Individual:</i> Home critical reading and in-class discussion.	Assignment 6
8, 9	Mid-term Research (<i>applying standard research format</i>)	<i>Mid-term Exam</i> Written Research	Mid-term Exam
10	PART II: Space Syntax as a planning tool: Introduction	<i>Lecture/ in-class discussion.</i>	n/a
11	PART II: Space Syntax as a planning tool: Using DepthmapX - Tutorials	<i>Lecture/ in-class discussion.</i>	n/a
12	PART II: Space Syntax as a planning tool: DepthmapX Analysis.	<i>Individual:</i> presentation and in-class discussion	Assignment 7a
13	PART II: Space Syntax as a planning tool: DepthmapX results.	<i>Individual:</i> presentation and in-class discussion	Assignment 7b
14,15	Final Term Research	<i>Final term Exam</i> Presentation for oral final exam + Written Research	Final-term Exam

4.2 Pre-transformation Logistics, Training and Support

Before starting the transformation process the needed logistics and infrastructure were well-prepared where the broadband high-speed Internet connection overall the whole UAE University campus was very reliable to deliver online teaching. The Blackboard Collaborate Ultra within the Blackboard platform was utilized to deliver the online teaching part of the BL course (Blackboard, 2023). Furthermore, all needed software packages for video recording of the online classes and class discussions, mainly Panopto (Panopto, 2023) and Camtasia Studio (TechSmith, 2023), were provided by the UAE University to all instructors involved in BL transformation. The University also provided a digital tablet to each faculty who is teaching a BL transformed course in Architectural Engineering undergraduate and graduate curriculum. On the other hand, technical support was provided as needed by the UAE University Helpdesk hotline and email.

On another front, the CETL developed and distributed a booklet entitled ‘Blended Course Transformation Process’ to introduce the involved faculty members to the procedures of the BL transformation process. The booklet contained four sections. First is the eligibility criteria of the BL transformation developers, second is the format and guidelines for developing the BL transformation proposal, third is the explained approval process, and fourth is the adopted policies and procedures for the BL transformation process. Despite these procedures, the booklet leaves a reasonable margin for innovation and creativity of BL course transformers (CETL, 2019). Furthermore, the CETL provided the involved faculty with two manuals, the Digital Teaching and Learning Manual: Definitions (CETL, 2021a) and the Digital Teaching and Learning Manual: Online/Blended Course Evaluation Rubric (CETL, 2021b). Both manuals contained important procedural and technical information and guidelines for the courses transformation developers to help them undertake the BL transformation for their courses successfully.

The CETL also organized a series of training workshops dedicated to the selected faculty members who submitted successful BL transformation proposals. These series started first with 4 workshops about BL process itself as follows: Introduction about BL, What does a Blended Course look like, Tools and Resources for Implementing Instructional Design within a Blended Course, and Managing the Blended Course with Blackboard. Then, the CETL organized a one-week workshop focused on Blackboard platform tools and applications within the BL process. This included the course structure, assessment and tests, students attendance and grading, online class and video recording.

4.3 The Applied BL Transformation Process

The following 6-point BL course transformation strategy was decided by the developed of the ARCH 614 course in the submitted proposal and was followed after getting the CETL approval on the BL transformation proposal, as detailed later. First, is utilizing *Synchronous* rather than *Asynchronous* class delivery in the online segment of the BL course to keep the advantage of both ‘live interaction’, albeit online, between the instructor and the students on the one hand, and to allow for distant online attendance on the other hand. This is specifically important for this course because it has an essential hands-on component involving critical analysis of exiting urban community

developments. So, keeping live interaction is exceptionally important even in the online classes. Second is recording the lectures and class discussions of the Synchronous online classes to give the students the chance to return to them, fully or partially, as needed while studying for the course. Third is giving more efficient and instant feedback to the students' urban designs during the hands-on application module of the course by the instructor's sketching using iPad and iPad Pencil instead of marking on the Smartboard in the conventional face-to-face delivery. As this is recorded, each student/group can check the feedback they received from the instructor again at any time convenient to them. Fourth is using distant live interaction tools such as Discussion Board to Interact with students, either individually or as groups, outside class time, as requested. Fifth is allowing the students to exchange thoughts and ideas through tools such as Wikis and Journals embedded in the used Blackboard platform. Finally, is availing the students and the instructor the chance to keep adding extra relevant materials (articles, videos, figures, websites, etc.), which they found relevant and could help the students understand more critically the tackled topics.

As for the BL course structure, the course has profoundly transformed from the conventional 100% face-to-face delivery mode to a 75% online content and only 25% face-to-face content. The experienced gradual transformation that started with 50% online delivery in its 1st phase of transformation in Fall 2019 semester to 75% in the 2nd phase of transformation in Fall 2020 semester, reaching to the 3rd and final phase of transformation with the 'compulsory' 100% online delivery (due to Covid-19 Pandemic) in Spring 2021 semester. The whole BL transformation process was applied and monitored through the CETL. In Fall 2022, the CETL fully approved the BL transformation of the course based on the 75% online content and only 25% face-to-face content formula. The application process started with the involved instructor first applied a pre-proposal for the transformation strategy of the ARCH 614 course. Once approved the instructor submitted the full proposal of the BL course transformation. After getting feedback and final approval on the BL transformation proposal from the CETL, the instructor started applying the BL delivery strategy in the first semester by the end of which the instructor submitted a mid-report and got feedback from the CETL. The final report was submitted after the last semester of the BL gradual transformation of the course. Then the approval with some required amendments were communicated to the instructor by the CETL. As a successfully transformed course, the BL transformation process ended with the CETL archives the course and started the official procedures to obtain the University Curriculum Department approvals to continue offering it as a fully BL transformed course.

As for the overall ARCH 614 course specification, both the Course Description and the Course Learning Outcomes (CLOs) have been kept the same in the BL transformed version as they are in the conventional face-to-face delivery, as they are still appropriate in both course delivery methods. These BL Course Learning Outcomes (CLOs) were aligned with the Learning Outcomes (PLOs) of the Architectural Engineering MSc Program as shown in Table 2. For each of the four CLOs, the Proficiency level was defined as either D for Developed or M for Mastery, while Introductory level was excluded for this master level course.

Table 2: Mapping the CLOs with PLOs of the ARCH 614 BL transformed course*.

	PLO-1	PLO-2	PLO-3	PLO-4	PLO-5	PLO-6	PLO-7
CLO-1		D					
CLO-2	D	D					
CLO-3			M				
CLO-4						M	M

*Proficiency level: "I = Introductory, D = Developed, or M = Mastery"

The ARCH 614 course content was changed and expanded to suit the BL pedagogy where students have more online reading, video, figures and other relevant multi-media and conventional study materials to help them in their study and research assignments. The online discussions took place in a Synchronous mode using Blackboard Collaborative Ultra (Blackboard, 2022), which normally availed more feedback from students as they had been already engaged in critical reviewing and writing about the discussed topics of the course. In addition, more examples and case studies about topics related to local context were presented to students, so they can have better decision-making ability when it comes to undertaking their group and/or individual research tasks. Besides the usual reading materials, students were provided with online recorded lectures as well as simulation software tutorials and instructions. As mentioned above, the door was opened for students to enrich the course with extra

materials through using collaborative Wikis, Discussion Boards and Journals, instead of only relying on the provided materials and feedback by the course instructor as it used to be in the conventional delivery of the course. For the online delivery, the instructor used a stylus of a sketching pad connected to the laptop, as a double screen, to be able to digitally comment on the students submitted work or to explain some issue related to the offered topics in some Units and Modules as detailed later (Figure 2).

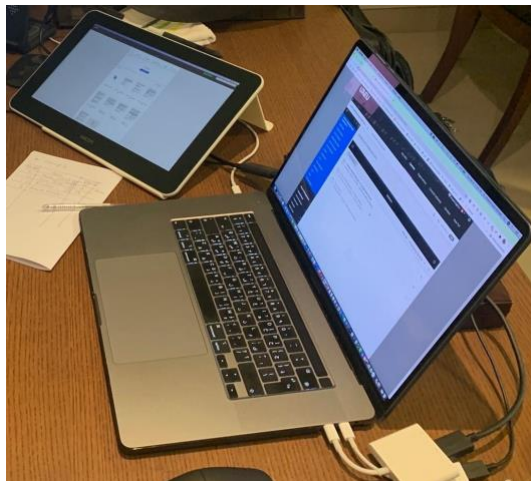


Figure 2. Digital feedback from the instructor via a sketching pad connected to the laptop as a double screen.

The adoption of the BL pedagogy has significantly affected the delivery of the course materials which were delivered in 4 Units instead of the 15 Weeks class activities in the conventional structure of the course (Table 3). Each of the 4 Units encompassed related Modules as follows:

Unit 1- Conceptual Framework, encompasses all the online and face-to-face classes in three Modules. Instead of only giving students lectures about the topics about the course subject (sustainable community development), a ‘flipped classroom’ method was applied for this Unit. The students were given the weekly assignments, in advance, where they were asked to critically review the assigned online materials uploaded on Blackboard platform including reading materials, videos, and references from official resources, to extract the relevant data from them. The students were given 1 Week to submit each of their weekly research assignments, followed by a Synchronous class where a collective discussion took place with students. Unlike the conventional classes in which students cannot usually recall part or all of in-class discussions, this Synchronous class was recorded and uploaded on Panopto. Based on these online recorded discussions, students were allowed to re-upload their written research assignments after amending them where they were given two attempts to submit these assignments on Blackboard. Ultimately, each student was able to better develop a comprehensive theoretical framework for the tackled principles. This Unit ended up with final research individually presented in a face-to-face class and to be graded as their mid-term exam (Table 3).

Table 3: The detailed class structure of the ARCH 614 BL transformed course showing Unites, Modules, delivery method, used BL tools, and assessment methods, as finally delivered and approved by the CETL.

Course Units	Teaching & Learning Activities (Modules)	Delivery method	Used BL Tools/Technology	Assessment Strategies and Methods
Unit 1- Conceptual Framework	Module 1 (W1): Introduction to the Main Themes - Introductory in-class web research on main themes. - In-class group discussion.	face-to-face	- List of websites.	NA
	Module 2 (W2): Defining Main Themes and Principles	online	- Synchronous class Lect. & Discussions with BB. Collaborate Ultra. - Record lect. & discussions on Panopto.	<i>Flipped Class</i> Assignment 1: - Submitted group work will be discussed in the Synchronous class.

	- Sustainable development, community, sustainable community development.		- BB Assignment.	
	Module 3a,b,c,d,e (W3-W9): Theoretical Concepts and Principles -Discourse about the principles and indicators of sustainable community development.			
	3a. <i>Unsustainable settlements (W3)</i> - Home critical review of assigned materials. - Online class discussion.	online	- Synchronous class with BB Collaborative Ultra. - PDF - Chapter 3. - Video Materials (YouTube, Daily Motion, etc.). - Record lect. & discussions on Panopto. - BB Assignment.	<i>Flipped Class Assignment 2:</i> - Critically read/watch the assigned material, prepare 2p. summarizing Principles and Indicators. - Submitted work will be discussed in the Synchronous class.
	3b. <i>The Neighborhood as Ecosystem (W4)</i> - Home critical review of assigned materials. - Online class discussion.	online	- Synchronous class with BB Collaborative Ultra. - PDF - Chapter 6. - Video Materials (YouTube, Daily Motion, etc.). - Record lect. & discussions on Panopto. - BB Assignment.	<i>Flipped Class Assignment 3:</i> - Critically read/watch the assigned material, prepare 2p. summarizing Principles and Indicators. - Submitted work will be discussed in the Synchronous class.
	3c. <i>The Design of Neighbourhoods (W5)</i> - Home critical review of assigned materials. - Online class discussion.	online	- Synchronous class with BB Collaborative Ultra. - PDF - Chapter 8. - Video Materials (YouTube, Daily Motion, etc.). - Record lect. & discussions on Panopto. - BB Assignment.	<i>Flipped Class Assignment 4:</i> - Critically read/watch the assigned material, prepare 2p. summarizing Principles and Indicators. - Submitted work will be discussed in the Synchronous class.
	3d. <i>Eco-villages: Dream and Reality (W6)</i> - Home critical review of assigned materials. - Online class discussion.	online	- Synchronous class with BB Collaborative Ultra. - PDF - Chapter 2. - Video Materials (YouTube, Daily Motion, etc.). - Record lect. & discussions on Panopto. - BB Assignment.	<i>Flipped Class Assignment 5:</i> - Critically read/watch the assigned material, prepare 2p. summarizing Principles and Indicators. - Submitted work will be discussed in the Synchronous class.
	3e. <i>Do Neighborhoods Matter (W7)</i> - Home critical review of assigned materials. - Online class discussion.	online	- Synchronous class with BB Collaborative Ultra. - PDF - Chapter 4. - Video Materials (YouTube, Daily Motion, etc.). - Record lect. & discussions on Panopto. - BB Assignment.	<i>Flipped Class Assignment 6:</i> - Critically read/watch the assigned material, prepare 2p. summarizing Principles and Indicators. - Submitted work will be discussed in the Synchronous class.
	Mid-Term Exam (W8-W9): - Draft Presentation in W8 and Final in W9. - In-class group discussion.	face-to-face	- BB Assignment (2 attempts).	Mid-Term Exam Presentation: - Presentation summarizing all the principles and indicators of sustainable community development.
Unit 2- Selected Case Study	Module 1 (W10): Criteria of selecting neighborhood Case Studies	online	- Collaborative Tools (Discussion Board, Wiki, Journal).	Assignment 7: - Submit the selected case study in DWG/DXF formats.

	- Discussing the criteria of selection including: location, accessibility, complete information.		- BB Assignment.	
Unit 3- Software Simulation (Space Syntax Application)	Module 1 (W11): Space Syntax Theory - Introductory lecture about Space Syntax theory.	face-to-face	- PDF Lecture Notes.	NA
	Module 2 (W12): DepthmapX Tutorial - Tutorial for using DepthmapX in Space Syntax analysis using tutorial (.dxf) files.	online	- Video/Audio-enabled screen recording using MacPro, then Convert Files using Camtasia Studio or similar. - Tutorial .dxf files. - Reading Materials	NA
	Module 3 (W13): DepthmapX Analysis of Case Studies - Discussion of Space Syntax spatial analysis of the case study.	online	- Synchronous class with BB Collaborative Ultra. - BB Assignment.	Assignment 8: - Submit (.graph) DepthmapX files for the Space Syntax spatial analysis of the case study.
Unit 4- Final Case Study Assessment	Module 1 (W14): Selected Principles and Indicators for Analysis - Discussion about selected principles and indicators.	online	- Synchronous class with BB Collaborative Ultra. - Collaborative Tools (Discussion Board, Wiki, Journal). - Record lect. & discussions on Panopto.	NA
	Module 2 (W15): Final Case Study Analysis - Final term Presentation and in-class group discussion.	face-to-face	- BB Assignment (2 attempts).	Final term presentation: - Presentation for the assessment of the selected principles and indicators of sustainable community development.

Unit 2- Selected Case Study, this 1 Week Unit was delivered online to help students better adhere to the selection criteria for their case studies through direct online contact with the course instructor.

Unit 3- Software Simulation (Space Syntax Application), is dedicated to the training on Space Syntax DepthmapX software, which is developed and provided free for academic use by University College London (UCL) (UCL, 2023), to assess the selected case studies for local urban communities. This Unit has three Modules. While the first Module was planned as a face-to-face introduction to the software application, Module 2 was an online tutorial through voice-enabled screen recording using the instructor's own laptop. But because the output video would be too large, the instructor converted the produced video files from the produced default (.mov) format to the compressed (.mp4) format using Camtasia Studio (TechSmith, 2023). Previously, this tutorial was a face-to-face tutorial only and many students used to come back with several questions because they missed some parts of the in-class tutorial or just simply forgot it! With the recorded tutorials, they can repeat the instructor's explanation of the usage of the software as much as they wish. The third Module was delivered online as a Synchronous class to assure that the students have applied the simulation software successfully on their assigned case studies.

Unit 4- Final Case Study Assessment, each student conducted an assessment for his/her selected case study of a local urban community utilizing the theoretically developed conceptual framework and DepthmapX as a quantitative assessment tool. The online Module 1 replaced the traditional in-class discussion about the principles and indicators that were used in analyzing the selected case studies. Again, students could revisit the Panopto video recording about these selected principles for final analysis. The final research was digitally submitted and checked against plagiarism (using Blackboard SafeAssign tool), while the final presentation took place in a face-to-face class, followed by a manual grading for both of the Final Report and Presentation on the Blackboard Grade Center as the Final Exam. Figures 3, 4 and 5 below illustrate some screen shoots of the Units components, software application, and students grading with feedback on Blackboard.

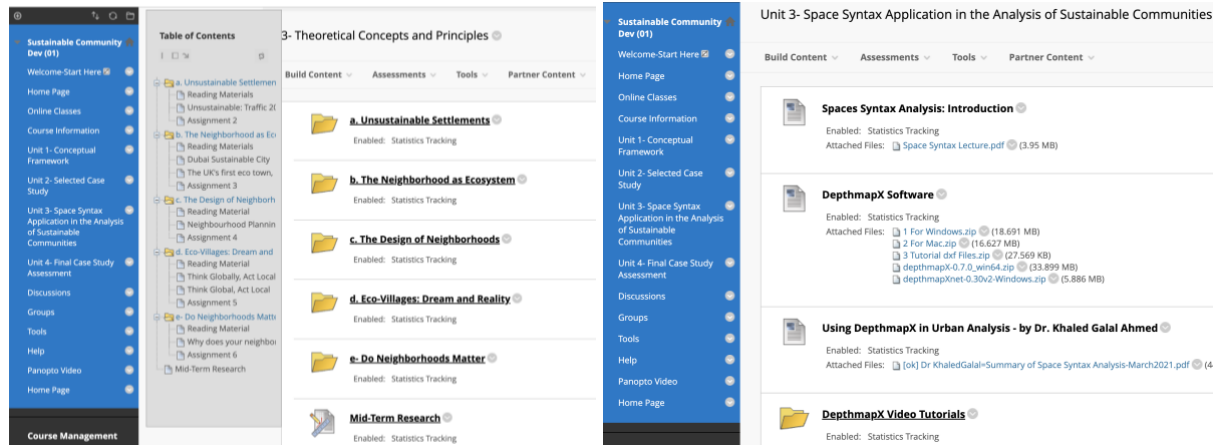


Figure 3a,b: a) Main structure of the theoretical Unit 1: Conceptual Framework, b) Unit 3 Structure.

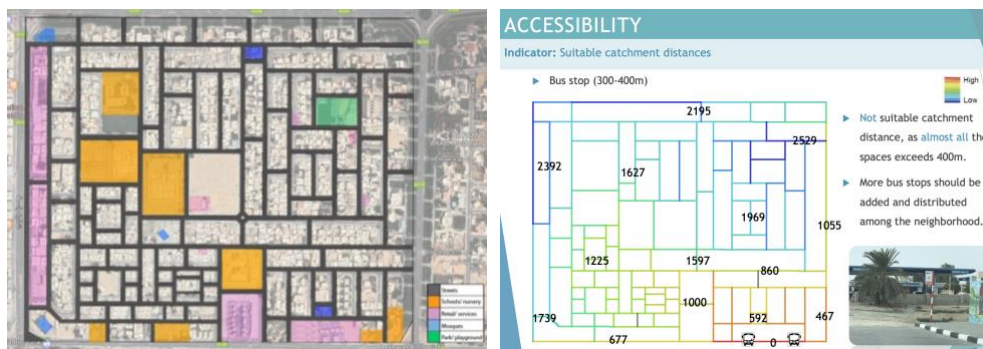


Figure 4: Example of the application of the Space Syntax Analysis Tool in Students Research.

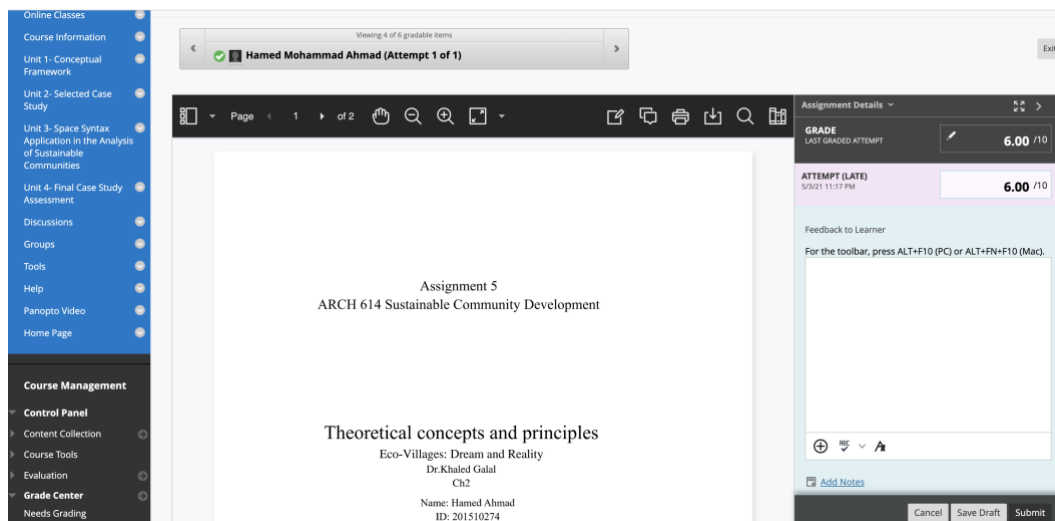


Figure 5: Grading and giving feedback to students through Blackboard platform.

5. Research Results: Assessment of the Outcomes of the ARCH 614 Course Transformation Process

5.1 Feedback from the Instructor

The students benefited from the transformed course in multiple ways. First, they had much more online resources such as videos, reading materials, and documents that encouraged them to critically think about the addressed topics and come up with their own written thoughts. They also had the chance to revisit the video recorded online

Synchronous sessions on Blackboard Collaborative Ultra and Panopto where they did not miss any important discussions that let them improve their written research. Furthermore, students worked according to their own pace in the Screen Recorded videos especially for the utilized software tutorial. This made them overcome several problems while applying the software on their own selected case studies. On another front, the students were given the chance to exchange ideas and thoughts among each other using the Blackboard's Discussion Boards and Wikis. They had the chance to create their own Journals that allowed them to share extra materials with each other and with the Instructor. Finally, as the majority of the registered students in this ARCH 614 MSc course were distantly residing/working from the UAEU campus in Al Ain, they significantly saved their travel effort, time, and the expensive petrol cost.

On the other hand, the mid-term and final research work (exams) were held face-to-face to be more convenient and transparent. The reported difficulty was a technical one about the limited storage space on the Blackboard platform that necessitated the instructor to move all the recorded videos from where they were originally stored on the Blackboard Collaborate Ultra to Panopto which consumed time and effort. Also, the instructor was asked to archive the fully transformed course on a local digital storage device as it cannot be stored on Blackboard for more than one year.

5.2 Assessment of the Attainment of the CLOs of the ARCH 614 Course

Table 4 illustrates the various assessment tools used to assess the attainment of each of the 4 CLOs of the course. These tools included various research-related weekly assignments (Cs) besides the Mid-term research presentation (M) and the Final term research presentation and written paper (F). The table also shows the allocated weights assigned to each assessment tool and the due submission dates. Meanwhile, Table 5 shows also the Indirect assessment tools for the 4 CLOs that include both the student and instructor surveys.

Table 4: CLOs Attainment Measuring Tools.

Assessment Methods	Description	CLOs	Grade Weight %	Due Date
C1	Research Field Assignment	1	5	Week 2
C2	Literature Review Assignment	2	5	Week 3
C3	Literature Review Assignment	1,3	5	Week 4
C4	Literature Review Assignment	1,3	5	Week 5
C5	Literature Review Assignment	2,3	5	Week 6
C6	Literature Review Assignment	1,3	5	Week 7
C7a,b	Research Method Assignment	3,4	10	Weeks 12,13
C8	Individual Class Participation	1,2,3,4	10	All Weeks
M	Presentation Research	1,2	20	Week 8,9
F	Presentation + Written Research	2,3,4	30	Week 14,15,16

Table 5: Direct and Indirect Assessment Tools.

	Direct Assessment Tools			Indirect Assessment Tools	
	Assignments	Midterm Research	Final term Research	Student Survey (SO)	Instructor Survey (IO)
CLO-1	✓	✓		✓	✓
CLO-2	✓	✓	✓	✓	✓
CLO-3	✓		✓	✓	✓
CLO-4	✓		✓	✓	✓

After applying these direct and indirect assessment tools, the final course assessment results were obtained. Figure 6 shows the summary of this results report which obviously prove that the students have evidently attained the ARCH 614 CLOs as they far exceed the benchmark of "70% of enrolled students score 80% or higher in summative assessment tools (Direct and Indirect)".

College:	College of Engineering		
Department:	Architectural Engineering		
Course Code:	ARCH614		
Course Title:	Sustainable Community Develop		
Section Number:	1	CRN	28120
Enrollment	6		

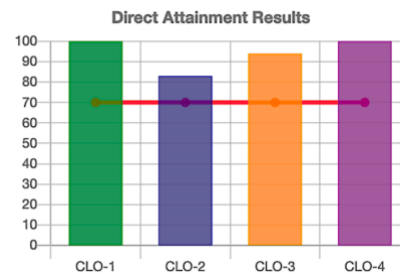


Figure 6: Assessment Summary Report for the CLOs of ARCH 614 Course, as per the attained grades.

5.3 Measuring Students Satisfaction

5.3.1 Course Surveys

On another front, the student’s evaluation related to the delivered course in its third and final delivery semester indicated the success of the delivery of the applied BL method and tools as shown on Table 6 below.

Table 6: Students official evaluation of the ARCH 614 overall course delivery.

[Course Comparative Analysis]				
Question	Course	Department (Architectural Engineering)	College (Engineering)	University
	Mean	Mean	Mean	Mean
The course material was effectively organized.	5.00	4.55	4.38	4.47
The course activities and assignments were helpful in learning.	5.00	4.40	4.26	4.35
The course workload was acceptable.	5.00	4.25	4.09	4.18
The course content addressed real-life experiences.	5.00	4.53	4.33	4.37
The course helped me to improve my thinking skills.	5.00	4.52	4.28	4.34
The course added to my knowledge.	5.00	4.56	4.43	4.47
Overall, the course was of high quality.	5.00	4.59	4.27	4.38
Overall	5.00	4.48	4.29	4.37

5.3.2 Students Qualitative Feedback about the BL Transformation Process of ARCH 614 Course

Table 7 illustrates the open-ended questions of the brief questionnaire administered with the 8 registered students in the ARCH 614 course by the end of the semester and their feedback on each question.

Table 7: The qualitative response of the registered students to the open-ended questions of the brief face-to-face administered questionnaire.

	Q1: What are the difficulties that faced you while experiencing the BL delivery?	Q2: Do you prefer online class (BB Collaborative Ultra) at the same weekly class time or recorded lectures with later interaction?	Q3: All in all, to what extent do you think that the BL utilization helped you in your course	Q4: What do you recommend for benefiting from using the BL in the future ARCH 614 Classes?
Student 1	The need to have a strong WIFI connection at our homes to enable it to work easily and clearly. It would be helpful to have the ability of sharing the screen with others.	Online Class (Synchronous)	Very Much.	Invite people from the industry or from outside the university to be engaged in the online class discussions.
Student 2	Sometimes due to weak Wi-Fi signal at my house the connection was slow at first but then it gets better.	Online Class (Synchronous)	Very Much.	Just continue using BL, Yes.
Student 3	None.	Online Class (Synchronous)	Very Much.	Nothing. Everything is fine with online classes this semester.

Student 4	None.	Both Online Class (Synchronous) and Video Recorded Lecture (Asynchronous).	Very Much.	Activating the course project and applications both on CityCAD +2.8 and Space Syntax. Thanks.
Student 5	No issues or difficulties, it was very useful specially for working students.	Video Recorded Lecture (Asynchronous).	Very Much.	Having the same class structure is very useful.
Student 6	Everything was fine.	Online Class (Synchronous)	Very Much.	It is easier for students that are not from Al Ain city.
Student 7	None.	Video Recorded Lecture (Asynchronous).	Very Much.	Nothing more!
Student 8	Sometimes the quality of sound is not good.	Online Class (Synchronous)	Very Much.	Enhancing the quality of sound.

The responses of the interviewed students revealed that the majority of them supports the Synchronous delivery method over the Asynchronous one. All of them appreciated the benefits they gained through the BL delivery of the course. As noticed, some students faced some little technical problems mainly due to weak internet connections at their homes and some malfunctioning devices especially mics. Most of these problems have been immediately solved by the students themselves.

6. Discussion and Conclusions

The research analytically explored the applied comprehensive BL transformation process of a non-lab based Master of Architectural Engineering course. The first important outcome of this exploratory analysis is that there should be a strong motivation for undertaking the BL transformation process for both students and instructor, as well as the whole program. In the presented case the motivation for the BL transformation of the graduate course ARCH 614 was fourfold, first for students it would give them the chance to comprehend the delivered materials in a self-learning manner. Second, is that the BL course would release the students from the need to travel every week to the UAE University campus in Al Ain city. Third, it would promote the Master program itself and increase the students' enrolment in the course. Fourth, for the instructor who developed the course, the BL transformation experience would help him acquire many teaching and learning tools that would benefit him in his academic career as a university professor.

The second outcome is that the BL transformation process of any course needs to be inclusive and comprehensive where the higher education institution, the instructor, and the students are all contributing to the success of it. The meaningful guidance either through the provided manuals and guidelines or the dedicated training sessions as well as the technical support, all helped the instructor tremendously in gradually accomplishing the full transformation of the course in a satisfactory manner.

The third important outcome is that the BL transformation strategy should appropriately fit the transformed course CLOs and its nature. In the explored ARCH 614 non-lab based graduate course the synchronous delivery method was an efficient strategy as defined from the beginning. This is attributed to the fact that it kept a vivid interaction with students while recording the lectures and the class discussions during the synchronous sessions added to this success by enabling the students to go back to these recordings at their own preferred time. Furthermore, replacing the Weekly Class Activities with Units and Modules, and adding more self-learning materials were contributors to the success of the BL transformed course. Also, the various applied assessment tools allowed for collecting meaningful feedback about the applied BL transformation process and hence readjust the process accordingly. So, in summary, the main strategy points of the BL transformation process of the non-lab based courses should be as follows:

- The delivery mode to be around 25% face-to-face and 75% online.
- The online Modules to be delivered as a Synchronous class mode.
- The online Modules to be recorded and uploaded on Panopto.
- Live feedback and interaction with students through digital sketching tools is essential in the success of the BL of this specific and other similar Architectural Engineering courses.
- Allowing the students to add extra learning materials (case studies, videos, photos, etc.) to the course is

- fundamental in engaging them appropriately and in creating more critical thinking discussions in the class.
- Distant interaction among students themselves on the one hand, and the students and their instructor on the other hand, is encouraged through related various tools on Blackboard platform such as Wikis, Journals and Discussion Board.

The success of the BL transformation of this non-lab based course indicates the possibility of the wider successful applicability for all non-lab based graduate courses especially in Architecture Engineering MSc curriculum especially with the efficient infrastructure and continuous technical support provided by the UAE University. The main technical problem was the limited cloud storage space for the recordings of the synchronous online classes on the Blackboard platform and the limited cloud storage capacity for Blackboard itself, where the whole course would be removed after one year to an archived local storage at the UAE University.

Such success of the applied BL transformation process is expected to encourage more graduate students to apply for the Architectural Engineering MSc Program, especially when more courses of the program will be flexibly offered as BL courses, because this would be more convenient for them given that most of the applicants are working in industry and hence time flexibility is very essential for them. Finally, one should bear in mind that the presented experience of BL transformation here was undertaken in a higher education institution with strong financial capabilities, so replicating it in other higher education institutions should be carefully studied in terms of the costly logistics of technical infrastructure, etc.

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References

- Blackboard (2023) Teaching & Learning: Online Learning & Teaching Platforms, Available online: <https://www.blackboard.com/en-eu/teaching-learning>.
- Blackboard (2022) Blackboard Collaborate with the Ultra Experience, Available online: https://help.blackboard.com/Learn/Instructor/Original/Interact/Blackboard_Collaborate/Collaborate_Ultra
- TechSmith (2023) Camtazia, Available online: <https://www.techsmith.com/video-editor.html>
- CETL (2019) BCT – Blended Course Transformation Process 2019. CETL-UAEU: AI Ain.
- CETL (2021a) Digital Teaching and Learning Manual: Definitions. CETL-UAEU: AI Ain.
- CETL (2021b) Digital Teaching and Learning Manual: Online/Blended Course Evaluation Rubric. CETL-UAEU: AI Ain.
- Dziuban, C., Graham, C.R., Moskal, P.D. *et al.* (2018) Blended learning: the new normal and emerging technologies. *Int J Educ Technol High Educ* 15, 3. <https://doi.org/10.1186/s41239-017-0087-5>
- ELM Learning (2023) What is Blended Learning? A Guide to Everything You Need to Know. Available online: <https://elmlearning.com/hub/elearning/blended-learning/>
- Kolinski, Helga (2022) What Is Blended Learning? Available online: <https://www.ispringsolutions.com/blog/blended-learning-a-primer>
- Panopto (2023) Stop Typing.Start Recording, Available online: <https://www.panopto.com/>
- Panopto Team (2019) Blended Learning Defined. Available online: <https://www.panopto.com/blog/what-is-blended-learning/>
- Tucker, Catlin R.; Wycoff, Tiffany; Green, Jason T. (2016) *Blended Learning in Action: A Practical Guide Toward Sustainable Change*. Corwin Teaching Essentials; First Edition.
- UAEU (2023a) Master of Science in Architectural Engineering, Available online: <https://www.uaeu.ac.ae/en/catalog/graduate/programs/master-of-science-in-architectural-engineering.shtml>
- UAEU (2023b) Sustainable Community Development (ARCH614), Available online: https://www.uaeu.ac.ae/en/catalog/courses/course_2898.shtml?id=ARCH614.
- UCL (2023) DepthmapX: visual and spatial network analysis software, Available online: <https://www.ucl.ac.uk/bartlett/architecture/research/space-syntax/depthmapx#:~:text=depthmapX%20is%20an%20open%2Dsource,source%20and%20available%20as%20depthmapX>.