Theoretical Courses and Architectural Education: Studio-based Approach for Technical Writing Course

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ABSTRACT

Technical writing skills are critical to ensure the success and integration of architecture and urban projects. The practice of architecture requires high communication skills to deliver ideas and plans to the different stakeholders in architecture projects. Clear technical communication provides mutual understanding of the aspects and requirements of projects to all involved parties including contactors, engineers, clients and even authorities, mitigating the high risks of misunderstandings. Technical writing allows for clear project documentation, facilitating coordination between interdisciplinary teams and improving decision making and problem solving. Architectural education relies mainly on hands-on experiences and design-oriented studios. Theoretical courses present a challenge for both architecture students and lecturers, as they are often taught in a lecture setting, which is not so familiar to architecture students, making them overwhelming to students. Theoretical courses challenge students as they often miss the link between concepts and application. Technical writing courses are hardly linked to students' interests. This study presents a pedagogical approach to the course of Technical Writing in the Sustainable Architecture and Urban Design Program at Helwan University in Egypt. It presents an studio-based interactive approach through using in-class discussions, workshops, games, peer discussions and interactions. It also links sustainable architecture and urban design applications into students' work, to ensure their interest in the course and their compound benefit. The paper presents the results of a tailor-made evaluation questionnaire to identify the most effective methods used in teaching the course, in addition to students' key takeaways from the course. Results show that students learned the most of report writing and presentation skills, perceived the course as highly interactive and highlighted that using games enhanced their learning experience.

1. Introduction

Architecture and urban design students are used to visual studies and practices. However, technical writing plays a key role in the practice. Communication with clients, authorities or other team members from different backgrounds requires quality writing. In many fields, communication is a highly sought skill.

The current global challenges such as highly growing population, rising demands on resources and severe impacts of climate change, the role of architects and urban designers is changing. Instead of being a master builder, an architect's is transforming

into a master of information, through collecting, analyzing and disseminating data and information through concise communication (Cosper, 2019).

Cosper in 2019 states that technical writing is often taught to architects based on the notion that architects think differently than the rest of the population. In his book Writing for Design Professionals, Stephen A. Kliment promotes a spontaneous intuitive expression in writing without sticking to the rules or guidelines. In The Architect's Guide to Writing, Bill Schmalz provides a step by step manual for writing that doesn't rely on meta-thinking. Cosper observes that writing in architecture schools is often complementary for the goal of enhancing the design process and not for improve career after graduation. It was recommended that writing be taught in a studio format that includes peer discussions, development of product and one-to-one feedback.

A study was conducted to measure the readiness of architecture graduates to the market competencies in Egypt. It included architecture schools in several universities such as Ain Shams University, Arab Academy for Science, Technology and Maritime Transport, and Cairo University. Questionnaire with graduates of the studied schools showed that students are dissatisfied with their technical report writing skills (Gabr et al., 2021).

Betz in 2005 states that technical writing education in engineering practices doesn't equip students to communicate their ideas in design, policy or social aspects, limiting their professional skills. Gao in 2019 argues that technical communication is generally challenging for STEM students due to less writing opportunities provided in their curriculum. However, technical communication skills highly benefit STEM students in their careers and professional development. He recommends that lecturers should work on engaging students and improve curriculum for technical communication courses, in addition to conducting need assessment for studnets.

Education is the process of helping students to acquire knowledge, skills, and understandings, in addition to developing their personalities for their involvement with society. Methods of education can be student or teacher oriented. Teaching techniques include brainstorming, question and answer, group work, role-playing, and many others. The use of these techniques depends on the course content, characteristics and background of students and the instructor, available tools, and space (Yildirim et al., 2012). Students are more interested and enthusiastic when they engage in the learning process. Active learning encourages students to engage in actions and high-order thinking, practicing analysis to synthesis. They receive feedback that feeds their motivation (Sukkar et al., 2023).

Architecture education includes design-based, science-based, and expression-based courses. Each of them contains different content, teaching methods, durations, and other characteristics. In design studios, students rely on design-based education, where they use collaborations and dialogues with each other and with instructors in a constructive process. In technical and theoretical courses, a science-based approach is used, where a lecture format is dominant, obstructing the nature of studio learning. The common teaching methods for these courses don't align with the common teaching methods in architecture, where a conversational and problem-solving environment takes place, engaging the students and promoting understanding. Additionally, the knowledge used in science-based courses usually is not integrated into design studios. Students perceive these courses negatively (Howeidy, 2017).

Passive learning environments address students as objects that have to learn what knowledge is given by the lecturer. This involves one-way teaching methods such as lectures and literature readings. Students lack problem-solving and cooperation skills. However, in interactive learning environments, students become a subject of the learning process. They get involved in dialogues and participate in activities and problem-solving. These activate the cognitive activities of students, which involves the development of their personality through the process.

Interactive teaching is derived from sociology and social psychology. Its main concept is to allow students to interact and collaborate together and with the teacher. It includes joint activities, autonomy, feedback and cooperation. These methods allow an efficient understanding of materials and promote life skills and behavioral changes (Kutbiddinova et al., 2016).

Several studies have recommended the use of active learning in architecture education. Structural and construction courses, in addition to design studios, have been the focus of applying active learning.

The role of the university professor in modern learning lies in helping students learn, rather than solely teaching them. Students need to excel at using their capabilities to face changes instead of just gathering knowledge. Different teaching methods may be used according to the context (Shaqour, 2021).

Theoretical courses such as history are beginning to shift towards an active learning environment too. However, few studies have been made about the use of active learning in theoretical courses (Sukkar et al., 2023).

The aim of this study is to provide an approach for co-creating a course plan, with students, in terms of involving students' expectations and enthusiasm in the teaching process. In addition to providing a template for teaching a theoretical course in an engaging method and integrating it with sustainable architecture and urban design.

2.   Course Overview and Context

2.1   *University, Faculty and Program*

2.1.1   Helwan University

Helwan University is a public university located in Helwan, Egypt. Established in 1975, it is one of the largest universities in Egypt. The university offers undergraduate and postgraduate degrees in a wide range of disciplines including engineering, medicine, science, humanities, and social sciences.

The university has an impressive campus with modern facilities such as libraries, laboratories, lecture halls, and computer centers.

It also has a number of research centers that focus on different areas such as energy research, nanotechnology, and biotechnology. The university also provides a number of student services such as career counseling, financial aid, and student housing.

Helwan University is committed to providing quality education to its students by offering them access to the latest technologies and resources. The faculty members are highly qualified professionals who are dedicated to providing their students with the best possible education. The university also encourages its students to participate in extracurricular activities such as sports teams and clubs. The university is also actively involved in community service projects which aim to improve the lives of people living in poverty-stricken areas of Egypt.

2.1.2   The Faculty of Fine Arts

The Faculty of Fine Arts in Cairo is one of the most prestigious institutions for art education in Egypt. Established in 1908, it is the oldest and largest art school in the country. The faculty offers a wide range of programs in various fields of fine arts, including painting, sculpture, graphic design, photography, and multimedia. The faculty has a rich history and has produced many renowned artists who have contributed significantly to the development of Egyptian art. Some of the notable alumni include Mahmoud Mokhtar, Abdel Hadi Al-Gazzar, and Gazbia Sirry. The faculty has also hosted many exhibitions and cultural events over the years.

The faculty's curriculum is designed to provide students with a comprehensive education in fine arts. Students are exposed to various techniques and mediums and are encouraged to develop their own unique style. The faculty also emphasizes the importance of critical thinking and encourages students to explore different perspectives on art. The faculty has a highly qualified teaching staff who are experts in their respective fields. They provide students with individual attention and guidance throughout their studies. The faculty also offers state-of-the-art facilities that include studios, workshops, galleries, and libraries.
In recent years, the Faculty of Fine Arts in Cairo has undergone significant renovations to modernize its facilities and enhance its academic programs. It continues to attract talented students from across Egypt and beyond who aspire to become successful artists.
The architecture department in the Faculty of Fine Arts in Cairo is one of the most prestigious and well-respected departments in Egypt. The department offers a comprehensive curriculum that covers all aspects of architecture, from design and planning to construction and sustainability. The faculty is home to some of the most talented architects and educators in Egypt, who are dedicated to their students.

The curriculum at the architecture department is designed to prepare students for a career in architecture or related fields. Students learn about architectural history, theory, design principles, building systems, sustainability, urban planning, and project management.

2.1.3   The Sustainable Architecture and Urban Design program

In 2021, a new undergraduate program was launched in the architecture department of the Faculty. This program is the Sustainable Architecture and Urban Design program (SAUD). The aim of this program is driven by the Sustainable development goals (SDGs) and the importance of creating sustainable cities and communities. It aims at preparing architects with the basics of both engineering and art specialized in sustainable architecture and urban design. The program introduces students to architectural and urban sciences and enables them to conceive sustainable architecture and urbanism concepts. Graduates can understand the relationship between societies, buildings, and the environment. Furthermore, graduates of SAUD program deal with complex architectural and urban environment problems on the city, urban and architectural levels.

The duration of studying architecture, as one of the specifications of Fine arts, is five years. It comprises all the architecture requirements as one of the specifications in the engineering and art sectors. The program includes interdisciplinary courses that address water management, and energy resources to equip graduates with the knowledge to face global challenges through their work.

2.2   Course Overview

The course under study is Technical Writing for Research (ARC 191). The course is composed of 3 credit hours. It is part of the university requirements and is taught to the students at the first level, semester 1. The semester's work is scored out of 100. And the course has no final exam requirement.
The course's aim is to study various research types, structures, methodologies, data collection and analysis, citations, and references. Students develop basic scientific writing skills, starting from abstract writing to summary and conclusions. The course also provides an overview of research ethics.
The course was taught for the first time from October 2022 to January 2023. The total number of students was 52, divided into two classes. The two classes were held on two different days, each taught solely by Dr. Zeina ElZein, an assistant professor at the department, and the author of this research.

3.   Teaching Process

3.1   Course Plan

The course plan was established by the author. The targets were to equip students with the following skills:
- Report Writing
- Audience Analysis
- Presentation Skills
- Pitching
- Scientific Poster Presentation
- Teamwork

The author used several references to create the course content. These included:

- Technical Communication 12th Edition by Mike Markel.
- Technical Report Writing Today 10th Edition by Daniel Riordan.
- Professional Report Writing by Simon Mort

- Resources from the University of Texas at Austin, US.

The author included several skills and experiences acquired to the course such as visualization, presentation and pitching skills, that will benefit students in their technical communication throughout their future studies and careers (table 1).

Table 1 Course schedule prepared by the author to achieve the course aim and targets

Week	Topic
Week 1	Introduction to Technical Writing
Week 2	Audience Analysis and Survey
Week 3	References and Resources
Week 4	Report Writing Overview
Week 5	Introduction Writing
Week 6	Visualization and Presentation
Week 7	Mid-term Presentation
Week 8	Report Structuring
Week 9	Presentation Development
Week 10	Poster Preparation
Week 11	Pitching
Week 12	Final Report and Poster Review
Week 13	Final Presentation
Week 14	Final Project Submission

4. Teaching Strategy and Plan

The author has benefited greatly from a Fulbright Junior Faculty Development Program that was held in Summer 2022, at the University of Texas at Austin, US. During the 10-week program, the author learned from experts and professors about the educational system in US universities. The program included several intensive workshops, activities and seminars that focus on education in engineering. The most important one was the Effective Practices in Engineering Education workshop, which was a one-month professional development institute by Dr. Thomas J. Connolly, Cockrell School of Engineering, University of Texas in Austin, US. The workshop focused on the following topics:

- Writing Powerful Learning Outcomes
- Implementing Active Learning Strategies
- Encouraging Higher-Order Thinking
- Promoting Academic Rigor
- Developing Informative Course Syllabi
- Performing Formative Assessments
- Supporting Student Success
- Developing Cultural Intelligence
- Producing a Teaching Portfolio
- Conducting Student Surveys
- Designing Engaging Lesson Plans
- Articulating a Teaching Philosophy

Additionally, during the program, the author attended several classes in the school of engineering to observe the teaching methods, interactions with students, and new technologies used.

The author used all the skills and experiences from the program to create a teaching approach for the course, with the aim to create an interactive course, that involves workshops discussions, games, and roleplaying for the students to get engaged and involved in the learning process. The author also aimed at creating a friendly and supportive environment with students, to motivate their learning.

Figure 1 Course Strategy showing the methods used to achieve the required objectives

Figure 1 shows the course strategy adopted, to achieve the course objectives, which are to co-create the course with students; to establish a model for an engaging theoretical course for architectural students and to integrate the topic of sustainable built environment in the course work, to make sure students learn and apply their acquired knowledge in their major. The tools used to select the strategies were literature review on teaching methods and theories, students' expectations and past experiences for the instructor. The strategies were selected to include interactions in the form of participatory discussions, brainstorming and online tools. Sustainability topics were integrated in all activities of the course and in the course

outcome to make sure the required skills are applied to the main field of study. Gamification was used in the form of online quizzes where winners were awarded, and roleplaying to learn pitching techniques. In class workshops supported the development and follow-up of the outcomes and ensuring an engaging class. Pitching the final outcomes also supported the engagement as it created a collaborative atmosphere, where presenters were asked to engage the audience. It also supported interactions and core topics.

4.1   Interaction

The first lecture was an introduction to technical writing. Before any illustrations, the author introduced the Mentimeter tool to gather students' expectations about the course, and to allow them to participate in the lecture. Students were asked about their two expectations for the course. This helped the author to move to explaining the course plan and the topics that will be covered. In addition, it also helped the author to adapt and develop the course plan according to the students' expectations whenever possible. Figure 1 shows the answers of students. It was clear that students were mostly expecting to learn communication skills, self-improvement, expression, and writing skills and even some students mentioned learning about architecture and design and having a fun course (Figure 2). The answers were inspiring for the author and all answers were considered during the course.

Figure 2 Students' Expectations for the Technical Writing in Research course

To be able to deliver the concept of technical writing, the author introduced the differences between the latter and creative writing in the second lecture. They were asked to write about their day in both types of writing and present their writings to their colleagues (Figure 3). This allowed the students to observe the characteristics of technical writing and its differences from other forms of writing.
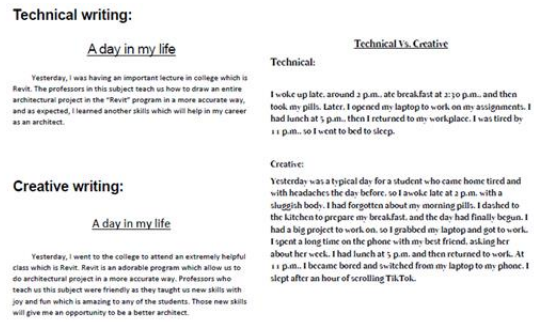

Figure 3 Example of students' attempt to understand the difference between creative and technical writing through writing about their day

The next topic focused on audience analysis. Here, students were introduced to different types of audiences, analysis processes, and different media for communication-based on the audience characteristics. Students were also introduced to the persona (the public image of a person). A persona was used for each type of audience. Students were divided into groups. Each group was assigned a specific audience. Four types of audiences were used: Decision makers, architectural students, high school students, and environmental engineers. These types covered the people who can implement changes and are more concerned with the impact of the work presented (decision makers); students of architecture who are curious to learn about new concepts and how to implement them in their architectural designs (architectural students); public audience who have no knowledge about architecture and require basic delivery of information (high school students); experts who are well aware of the technical and environmental aspects of the solutions presented (environmental engineers).

Each group was asked to create the persona of the audience assigned to them. They were asked to give a name, age range, interests, and personality for their persona. They were introduced to online tools to create it. Figure 4 shows a sample of their work. In the next lecture, students presented their personas.

Figure 4 Personas of the decision makers (left) and the architecture students (right) carried out by groups of students

4.2　Sustainability

Students were introduced to resource finding, reference styles, and citations. The author presented samples and examined with students the reference styles used. Harvard style was agreed to be the main reference style for the course to make it easier for students to identify any mistakes in their writing.

Each group of students, over the 2 classes, was assigned a specific topic to be their writing process for the course. Students were informed that at the end of the course, they are expected to submit a full report, presentation, and poster for their assigned topic. The topics were all focused on sustainable interventions in university buildings or campuses in Egypt. The selection of university buildings or campuses was meant to allow students to experience their topics in spaces they already use or visit. The sustainability aspect of the topics was based on students' desire to learn more about their interests during the course, which inspired the author to discuss topics that will add to their knowledge and motivate them while learning about technical writing. The topics are:

- Sustainable Landscape in University Buildings in Egypt
- Climate Adaptive Facades in University Buildings in Egypt
- Smart Spaces in University Buildings in Egypt
- Hardscapes in University Campuses in Egypt
- Green Roofs in University Buildings in Egypt
- Xeriscape in University Campuses in Egypt
- Waste Management in University Buildings in Egypt
- Water Conservation in University Buildings in Egypt
- Thermal Comfort in University Buildings in Egypt
- Solar Energy in University Buildings in Egypt

4.3　Gamification

Gamification is the process of incorporating game-like elements into non-game contexts, such as education. It has become increasingly popular in recent years as a way to engage students and enhance their learning experience. Gamification makes learning more fun and enjoyable for students. They are motivated to participate in the learning process and are more likely to retain information. Participation and engagement help students retain information better and also improve their critical thinking and problem-solving skills. Gamification provides instant feedback to students helping them identify areas where they need improvement. Additionally, gamification can help teachers track student progress more effectively.

4.3.1　Online Quizzes

Online quizzes were used frequently throughout the course to strengthen students' understanding and enhance teaching in a different setting. Kahoot platform was used to create online fun quizzes about different topics such as references. This allowed students to compete together, get more engaged and be motivated to get scores. It is important to note that students were informed before the online quiz that it will not be added to

their coursework grades, and it was meant to enhance their learning in a fun way. This transparency built more trust with students, who were surprisingly more engaged than in assignments with grades. Figure 4 shows the summary of the results of a quiz focused on references for one of the 2 classes. Each question was discussed after the students answered. Even though they achieved low scores, illustrating the correct answers throughout the quiz helped them understand and deliver final products that show their clear understanding.

Technical Writing - Referencing	
Played on	30 Oct 2022
Hosted by	zeinabaher
Played with	23 players
Played	8 of 8
Overall Performance	
Total correct answers (%)	36.96%
Total incorrect answers (%)	63.04%
Average score (points)	2369.39 points

Figure 5 Summary of the online quiz on references held for students

Each group of students was asked to collect a set of resources for their assigned topic; to provide the citation and reference for each, based on the Harvard reference style.

Students were introduced to an overview of report writing, guidelines and sections, and samples of reports were presented to them. They were asked to study these samples, especially the introductions. Students then started working on their reports. Their next assignment was to write an introduction based on the resources they collected for the topic assigned to each group. The next lecture was in the form of a workshop, where groups continued developing their introductions, while the author circulated between groups to provide feedback and guidance.

4.3.2　Roleplaying

Then the author held a lecture about presentations to the students, where they learned to communicate their work visually. Each group was asked to deliver a presentation about their topic to other students. In this class, each group presented their work, while each of the remaining groups played their persona. Each group was asked to interact with the presenters in terms of their audience roles, while the presenters were also asked to interact with each group based on their audience category. The exercise was an extreme shift in the education process, as it led to continuous debates between different personas. For example, the decision makers group were asking the presenters how their topic can be implemented. They also criticized its applicability and debated its economic impact. On the other hand, groups representing architecture students acted in a curious way, asking the presenters how they could get more information about the topic. The presenters, in turn, were successfully engaging all groups, as instructed by the author.

They communicated their topics in ways that can reach all types of audiences. They also interacted with the decision makers group to ask them about their expectations and opinions. This, unexpectedly, turned into a stakeholders' engagement workshop, with no intent from the author, only driven by the students' engagement and interactions.

A remarkable debate was held between the group presenting the topic of Green Roofs, and the one presenting that of Solar Energy. The debate was a heated discussion of the feasibility of the application of solar panels on roofs, compared to green roofs. Each group provided their justifications and the impact of their topic in a structured way. The students were so excited about the discussion that the instructor offered them to look for ideas to combine both. This shows how the roleplaying technique successfully engaged the students.

4.4   In-class Workshops

The next class included survey methods. Students learned about questionnaires and interviews. They learned how to design questionnaires and their purposes, types of questions and online tools. They were asked to design a questionnaire for their topic, that will be disseminated online for students, professors, and other stakeholders related to their topic. The process included in-class workshops to provide feedback about the questionnaire design and structure.

When groups were ready with the questionnaires, they were asked to disseminate it using google forms, and add the results to their reports.

Then a class was specifically focused on the visualization of data, where the author provided knowledge about types of charts and graphs that can be used to illustrate the results of the questionnaire. This included also the visual guidelines in terms of dimensions, colors, and size.
Students were asked to create a visual structure of their report in class. They were given feedback and instruction to develop their structures (Figure 6).
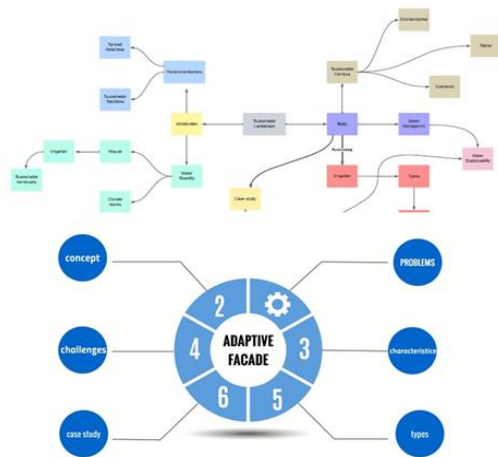
Figure 6 Sample of students' visual structures for their selected topic

The next half of the course included workshops during classes for groups to work on the development of their reports, carrying out presentations of their developed work, and receiving feedback.

4.5   Pitching

Students practiced their presentations all through the semester. No time limit was given to each group at the beginning. Then each group was given 20 minutes to present their work. Afterward, the author noted that students tend to explain all the details of their topic to the audience. Thus, a new improvisation took place. The author decided to hold a class about pitching. Students learned how to present their ideas in three minutes to an audience to deliver the key messages. Groups practiced their presentations using a time watch to ensure they stick to the time. The presentations became more concise, rich, and direct. Also, it was noted that their presentation skills were highly developed. They even used interaction techniques and role-playing during their 3 minutes pitch.
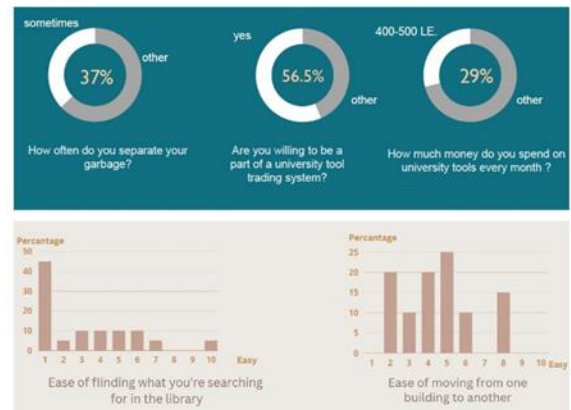
Figure 7 Samples of students' visualization of the questionnaire's results in their pitch presentations showing the advancement of their presentation skills

5.   Course Outcome

The final outcome of the course was a full written report; presentation; pitch presentation and scientific poster, for each group, according to their assigned topic. A jury took place on January 1st 2022, where students presented their 3-minute pitch presentations to the scientific jury. Their posters and reports were printed and handed to the jury for evaluation. Figure 8 shows a sample of the posters submitted for the students' topics.
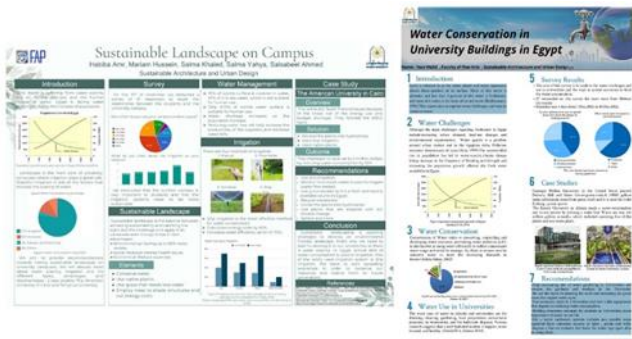
Figure 8 Sample of students' posters in the final submission showing the organization and presentation skills
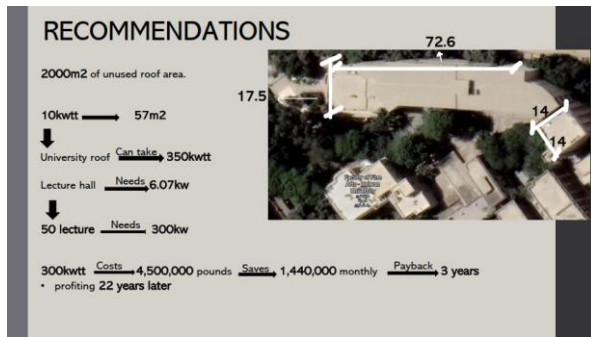

Figure 9 Sample of application of students' research on the faculty: application of solar panels on the roofs of the faculty.

Figure 9 and 10 show the resulting recommendations by the students after their work on the report and questionnaires regarding challenges in the faculty of fine arts and application of sustainable elements in campus.

Figure 10 Sample of application of students' research on the faculty: application of green roofs on the roofs of the faculty

6.   Students' Feedback

An online questionnaire was designed to receive student feedback about the course. In this questionnaire, the aim was to assess their understanding of technical writing and

communication, in addition to sustainability. The questionnaire was also designed to collect their assessment of how the interactive approach and the use of games benefited their learning experience. The questionnaire was meant to assess the experience and help the development of the course approach and content for the coming semesters. The questionnaire addressed 30 students (50% of the total enrolled students) and was open from May to September 2023. The questionnaire evaluated 5 key sections: technical writing and communication skills, sustainability knowledge, interactive approach teaching approach, gamification, in addition to other general questions.

6.1   *Technical Writing and Communication Skills*

The first section of the questionnaire included questions about the key topics of technical writing and communication skills. Respondents were asked to rate their gained knowledge on a scale from 1-10 about references and citation; audience analysis; report writing; presentation skills; visualization of data; survey design and dissemination. Their responses were highest to the references and citations (30% rated their learning as 10), Figure 11. For the audience analysis, 40% rated their learning as 8 (Figure 12), for the report writing, 36% rated their learning as 8 (Figure 13).
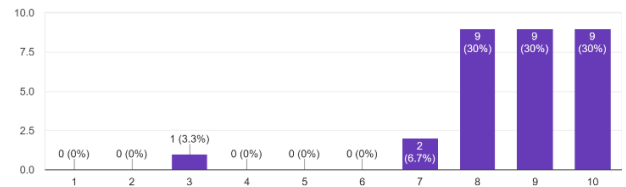

Figure 11 Respondents' answer to the question: On a scale from 1-10, rate your gained knowledge about References and Citations after the course
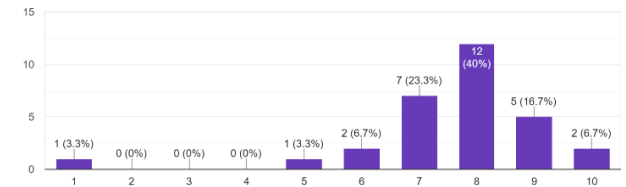

Figure 12 Respondents' answer to the question: On a scale from 1-10, rate your gained knowledge about audience analysis after the course

On a scale from 1-10, rate your gained knowledge about Report Writing after the course.
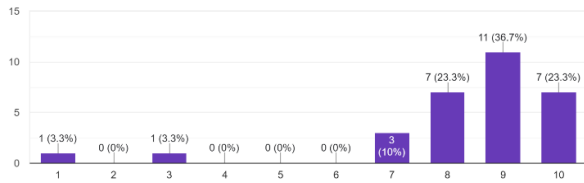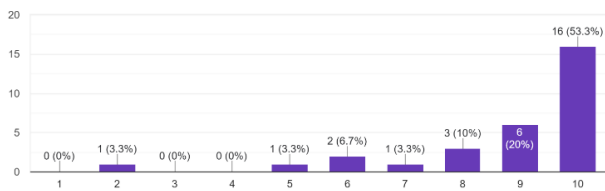30 responses

Figure 13 Respondents' answer to the question: On a scale from 1-10, rate your gained knowledge about report writing after the course

When asked about their learning of presentation skills, 53% rated it as 10 (Figure 14). While for the data visualization skills, almost 47% rated their learning as 10 (Figure 15), and 33% rated their gained knowledge about survey design and dissemination as 10.

On a scale from 1-10, rate your gained knowledge about presentation skills after the course.
30 responses

Figure 14 Respondents' answer to the question: On a scale from 1-10, rate your gained knowledge about presentation skills after the course

On a scale from 1-10, rate your gained knowledge about visualization of data after the course.
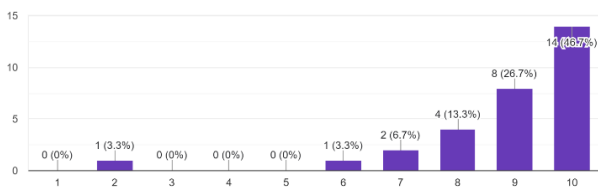30 responses

Figure 15 Respondents' answer to the question: On a scale from 1 - 10, rate your gained knowledge about visualization of data after the course

On a scale from 1-10, rate your gained knowledge about survey design and dissemination after the course.
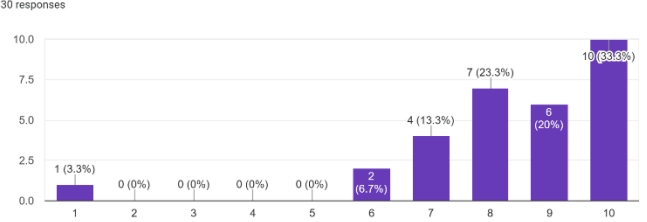30 responses

Figure 16 Respondents' answer to the question: On a scale from 1-10, rate your gained knowledge about survey design and dissemination after the course

6.2   *Sustainability*

In this section, students were about their report topics and how the sustainability theme benefited them. When asked how the integration of sustainability topics benefited their work in other courses, the majority rated the benefit from 7 to 9 (Figure 17). 40% rated the effect of the integration of sustainability topic on their career as 10 (Figure 18). When asked how the integration of sustainability topics motivated their learning through the course, the majority rated their learning from 7-10.

On a scale from 1-10, rate how the integration of sustainability topic benefited your work in other courses.
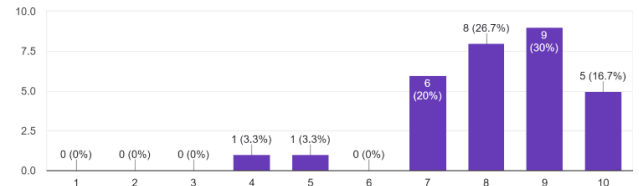30 responses

Figure 17 Respondents' answer to the question: On a scale from 1-10, rate how the integration of sustainability topic benefited your work in other courses

On a scale from 1-10, rate how you believe the integration of sustainability topic will affect your career.
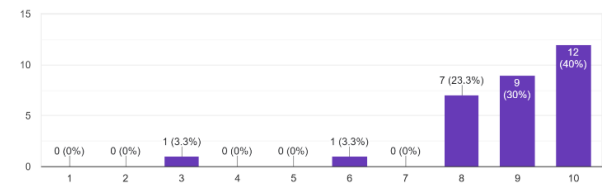30 responses

Figure 18 Respondents' answer to the question: On a scale from 1-10, rate how you believe the integration of sustainability topic will affect your career

6.3   Interactive Approach

Students were asked to rate how interactive they perceived the course, their answers mostly were between 8-10 (Figure 19). They were asked to select the interaction technique that they believe highly benefited their learning experience. The top answers were discussions through lectures (37%) and brainstorming in groups (17%) (Figure 20)

On a scale from 1-10, rate how interactive you perceive the course.
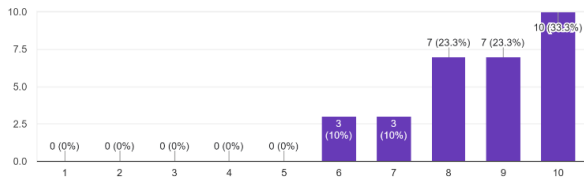30 responses

Figure 19 Respondents' answer to the question: on a scale from 1-10, rate how interactive you perceive the course

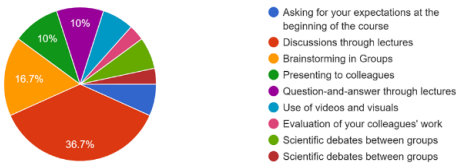Select the interaction technique that you believe highly benefited your learning experience.
30 responses

Figure 20 Respondents' answer to the question: Select the interaction technique that you believe highly benefited your learning experience

6.4   Gamification

Students were asked how the use of online quizzes enhanced their learning experience, where 50% voted for 10 (Figure 21), while for roleplaying, 30% voted for 10 (Figure 22)

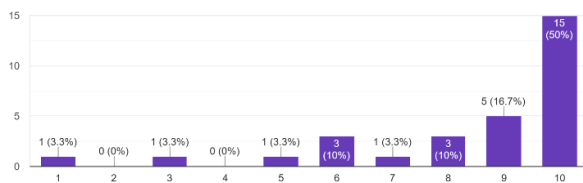On a scale from 1-10, how did the use of online quizzes enhance your learning experience.
30 responses

Figure 21 Respondents' answer to the question: On a scale from 1-10, how did the use of online quizzes enhance your learning experience

On a scale from 1-10, how did the use of roleplaying (using personas) enhanced your learning experience.
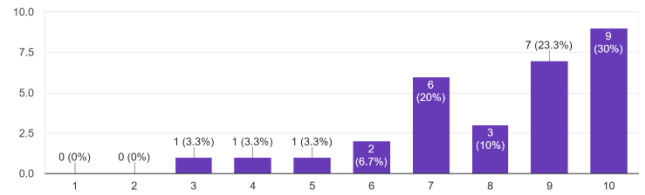30 responses

Figure 22 Respondents' answer to the question on a scale from 1-10, how did the use of roleplaying (using personas) enhanced your learning experience

6.5   General

In this section, students were asked to select the most valuable skill they learned from the course relevant to their future career, 40% voted for presentation skills, while 30% voted for report writing (Figure 23)

Select the most valuable skill you learned from the course relevant to your future career.
30 responses

Figure 23 Respondents' answer: select the most valuable skill you learned from the course relevant to your future career

7.   Conclusion

The studio-based approach to teaching technical writing course adopted several strategies to achieve its targets. The approach included audience analysis and establishing personas; pitch presentation of outcomes; scientific poster design and presentation; resource selection, referencing and literature review; and finally report structure, writing and recommendations (Figure 24).

The outcome of the course is in the form of group work projects. These projects include a report on the use of specific sustainable architecture and urban design aspects to be applied on our faculty campus. The different topics were mentioned in the manuscript including water management, renewable energy, green roofs and others. Students had to carry out a survey for faculty students, faculty and staff to understand their needs, in addition to their analysis of the campus. Then they had to carry out research on the topic and provide recommendations of how to apply it on the campus to fulfill the needs and tackle the

challenges. Students had to present their results in the form of a technical report, pitch presentation and poster presentation. Each presentation method targeted specific audiences: researchers and academics, investors and decision makers and public audience respectively. That way, students applied their learned knowledge and skills on the place they use most, while learning technical communication for different audiences. The solutions were also beneficial to their design projects. Solutions included (but were not limited to) using adaptive facades, environmental materials and passive design techniques to increase thermal comfort and also included reuse of grey water in buildings, using local landscape to conserve water and using solar energy on campus.

The results of the questionnaire show that the key learnings from the course were using references and citations; presentation skills; visualization of data skills and survey design and dissemination. Results also show that the majority of students benefited from the sustainability theme in their reports, in other courses which include design studios, in addition to their future careers as architects and urban designers. Most students perceive the course as highly interactive while stating that the most effective interaction methods used were the discussions and brainstorming throughout the classes. Also, most students believe that the use of games in the form of online quizzes and roleplaying enhanced their learning experience. Finally, presentation skills and report writing were the most rated skills gained from the course, which addresses the main topic and objectives of gaining technical communication skills.
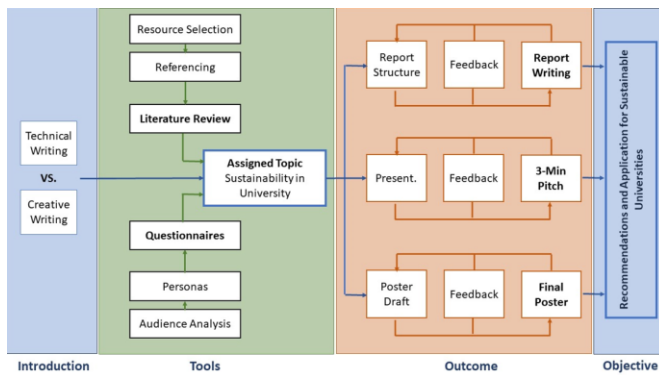

Figure 24 Mapping of the studio-based approach and the process including using the learnt tools and achieving outcomes and targets

8.   Recommendations

The work of students, along with the questionnaire results show that students benefited the most in the core technical communication skills. Based on the experiment of the studio-based teaching approach and students' feedback it is recommended that:

- Online quizzes should be used more frequently in the course as gamification using online platforms to enhance students' retention of the lessons and also promote a sense of safe competition and fun.

- Starting the course with assessing the students' needs and expectations provides valuable input that supports the structuring of the curriculum to fit the studnets.

- Audience analysis and establishing personas for different audiences is key in teaching technical communication and allows students to understand different audiences, identify their needs, backgrounds and adjust their technical communication accordingly.

- Roleplaying should be integrated in learning audience analysis as it helps include students as part of the learning process and allow them to take part in delivering information to their peers in a fun engaging way.

- Adopting an interactive approach in theoretical courses within architecture programs is highly recommended and of high benefit to the students' learning experience.

- Integrating the topic of sustainability in the built environment and setting a goal to apply sustainability aspects into the campus is recommended to support the studio-based approach and to help orient and structure students through the report writing process.

- For further implementation, it is recommended that students address topics in coordination with the design studio to allow an integrated approach to teaching.

- Working on transforming reports into scientific posters is recommended to help students understand how to deliver the same information and findings to different audiences and using different media, in addition to learning which parts to highlight and prioritize, which supports the goal of technical communication in being clear and concise.

- It is recommended that in similar courses, students can work on their reports and develop them later so they can be published. It is also recommended to establish an online platform for the program, where students can publish their reports for their colleagues and the public to read. This will enhance the students' sense of ownership and pride in their work, leading to more commitment.

Acknowledgements

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