My teaching philosophy focuses primarily on engaging students to *actively* participate in the *process of learning* acquisition rather than remaining as bare receptors, as far as I believe that this strategy (fostering not only *learning* as an *output* but also the *mechanism of learning* as a *process*) will educate *life-long learners*. In the paragraphs to follow, prior to presenting my teaching agenda, I will first elaborate how *Project-Based Learning (PBL)*–as I experienced while serving as a Lecturer of Structural Design at the University of Sharjah (United Arab Emirates) as well as during my recent involvement in the Graduate Microprogram for the Pedagogy of Higher Education at Universite de Sherbrooke (QC, Canada) – can be a powerful tool for nurturing an *active learning* environment capable of transforming engineering education.

## *I. Active-learning for competence-based education: A teaching experience from the University of Sharjah, United Arab Emirates (UAE).*

While working as a full-time Lecturer of Structural Design in the Department of Architectural Engineering at the University of Sharjah, this position allowed me to discover my abilities in teaching. I developed and taught the following courses for four consecutive years (2011–2015): Fundamentals of Structural Analysis (AE0404311), Reinforced Concrete Design (AE0404313), Structural Steel Design (AE0404417), and Modern Structural Systems (AE0404418). Although those courses existed in the Architectural Engineering (AE) curriculum since program inception, they used to be offered as part of the Bachelor's program in Civil Engineering (CE). Thus, AE students had to take those courses along with CE students. The main issue with this scenario is that course material was too focused on pure structural analysis/design (a task rarely performed by architects in the professional ecosystem). Consequently, AE students feel less concerned by the discourse. They feel less motivated as they don't evidently perceive neither the link between those so-called "tough" courses and the so-called "fancy" architectural designs featuring their curriculum, nor the utility of those CE courses in the future professional life of architects.

In my position (affiliated to the AE department) and with the help of some senior faculty members with background in architecture and in curricular reforms, I was able to develop a new version (of those courses) more adapted to the style of courses taught in AE curricula (i.e., *architecture-adapted* course format). The development of this new format was built on the philosophy of *active learning*. I specifically adopted the PBL approach not only to consolidate all pedagogical activities around authentic scenarios (to propel student active engagement), but also to foster a coherent AE curriculum (given the project-based delivery method of all architectural design courses). To accomplish this pedagogical transformation, I worked on four major course components: (*I*) course plan (*ii*) course material, (*iii*) delivery method, and (*iv*) assessment techniques.

*(i)* *Course plan:* I redesigned each course plan following the *constructive alignment*. Starting with the skills the students should be able to demonstrate upon course completion [one example for the course Fundamentals of Structural Analysis (AE0404311): *the ability to stablish a simple structural system, given an architectural plan*], I restructured teaching activities and assessment methods such that those course components are aligned with each other.

*(ii)* *Course material:* Keeping in mind the learning outcomes expected from AE students, I reshuffled course content around holistic structural systems (rather than elemental analysis/design as required from CE students) to which architects are familiarized, while focusing on the synergy between form and function. For example, in Reinforced Concrete Design (AE0404313), I rebuilt course content around a macro-scenario of designing a reinforced concrete (RC) structural system for a simple one-level building. I further subdivided this macro-scenario into sub-scenarios consisting of individual tasks such as: establishment of the structural system, load estimation, load transfer across structural elements, preliminary structural sizing and so on. In line with these tasks, I was able to set the suitable proportion and timing of addressing the theoretical concepts (needed to perform RC structural design) as well as the practical part [laboratory sessions on computer aided structural analysis/design (CAD) of RC]. It is fortunate to notice how student motivation and engagement was boosted as reflected in the course/instructor evaluation by students (see appendix 1: *sample evaluation by students*)

*(iii)* *Delivery method*: Course was delivered in a PBL approach. I gave students the freedom to form working teams based on their inter-personal affinities. I also recommended each team to hold the name of a fictious structural engineering firm and to divide tasks between team members. Class lectures were replaced by: (*i*) theory sessions (to address the fundamentals of structural design), (*ii*) practical sessions (to implement CAD), and (*iii*) follow-up sessions where each team presents to me its project progress. I found this way of mimicking authentic (structural design) scenarios to improve cognitive and metacognitive skills and to drive student motivation, engagement and perseverance.

*(iv)* *Course assessment techniques*: In harmony with the PBL approach adopted for course delivery, I also changed course assessment tools. *Formative assessment* (in the form of feedback provided at different stages of project realization) as well as *summative assessment* (a graded final exam) replaced the entirely *summative assessment* in the old course format (3 quizzes, 5 homework, a mid-term exam, and a final exam). This allowed me to get rid of most of those fragmented assessment tools addressing portions of knowledge/skills decontextualized from their practical framework. As a result, the evaluation of course learning outcomes and their alignment against the specific criteria (ABET a-k criteria) required by the accrediting body [Accreditation Board of Engineering and Technology, (ABET)] indicate enhancement in the level of achievement of competencies required from AE graduates. Competencies with a particularly higher achievement pertain to the application of acquired knowledge beyond the learning context as well as to the students' involvement in a life-long learning quest.

In consequence to these changes, the day-to-day pedagogical activities as well as course/instructor evaluation by students reveal an improved level of engagement as students started to perceive the utility of learning activities and the impact of the ensuing learning outcomes beyond course context. One of the most fulfilling comments I received is that my students appreciated to be able to employ the concepts they learn in my structural design courses to propose suitable structural system/material for their own architectural designs. Students also developed a sense of realistic boundaries of their architectural design imagination *vis-à-vis* the optimum capacity of every structural system/material they chose (particularly span-to-depth ratio, material capacity, and

cost-effectiveness issues). I am proud that this sense was reflected on different architectural design courses in the AE curriculum. For instance, in the opening ceremony of the Annual Architectural Exhibition following the year I joined, the department chairperson mentioned my work as follows: "*With the input of our new civil engineering colleague, our designs are becoming more realistic*".

This enriching teaching/curriculum development experience paved for me the path to be appointed as the coordinator of the Departmental Committee for Accreditation. In this role, I was able to lead my team to undergo a successful accreditation cycle for the program of Bachelor of Architectural Engineering by the Accreditations Commission of the UAE ministry of Higher Education for the 2012-2015 cycle as well as to establish all the preparatory works (course folders, program assessment report, etc.) for future accreditation by ABET.

## *II. Active-learning as a driver of curricular innovation from course level to program level (Building an institutional competence-based pedagogical identity): Lessons learned from my involvement in Graduate Microprogram for the Pedagogy in Higher Education (GMPHE) at the University of Sherbrooke (QC, Canada)*

Captivated by the effectiveness of *active learning* through my experience at the University of Sharjah, I toke the opportunity of my enrolment in the Ph.D. program in Civil Engineering at Université de Sherbrooke (QC) to enroll in a graduate training in the Pedagogy of Higher Education. The objective was to hone my skills in higher education teaching, curriculum development and pedagogical innovation and reforms. I particularly deepened my knowledge/skills in the subject of active pedagogies. As part of my involvement in this microprogram, I developed a new project of *Pedagogical Innovation* intended to transform a typical engineering curriculum from the traditional *content-based* format to an innovative *competence-based* format [1]. My tri-phase innovation project (*Conception, Implementation, Evaluation*) consists of adopting PBL approach at an institutional level (delivering the entirety of a curriculum through PBL). This goes via upscaling the implementation of active learning from a course level (as demonstrated in my past experience refined later through my involvement in the GMPHE) to a set of courses of similar theme, then to the whole curriculum (see illustration in Fig. 1). For this, I used the curriculum of the Bachelor's program in AE at the University of Sharjah as a model. Here, the implementation of my Pedagogical Innovation Project starts from a typical structural engineering course (Fundamentals of Structural Analysis, AE0404311). Upon successful implementation (subject to evaluation and adjustment as necessary), the project can be scaled-up to the level of courses of similar theme (structural engineering courses in this case). Upon evaluation and necessary adjustment (if any), project implementation can be carried over to all engineering courses. This transforms almost the entire curriculum into a PBL-based curriculum in this particular example where the AE curriculum mainly consists of architectural courses (already taught in PBL) and engineering courses (transformed into PBL course by the current innovation project). The project is designed to be implemented stepwise over eight years to allow judicious measures for refinement/adjustment as implementation moves up from one level to another. The project also proposes an evaluation plan summarized in Fig. 2. Among original ideas in my project is the dynamic evaluation of an innovation (impact of the project few years after student graduation).

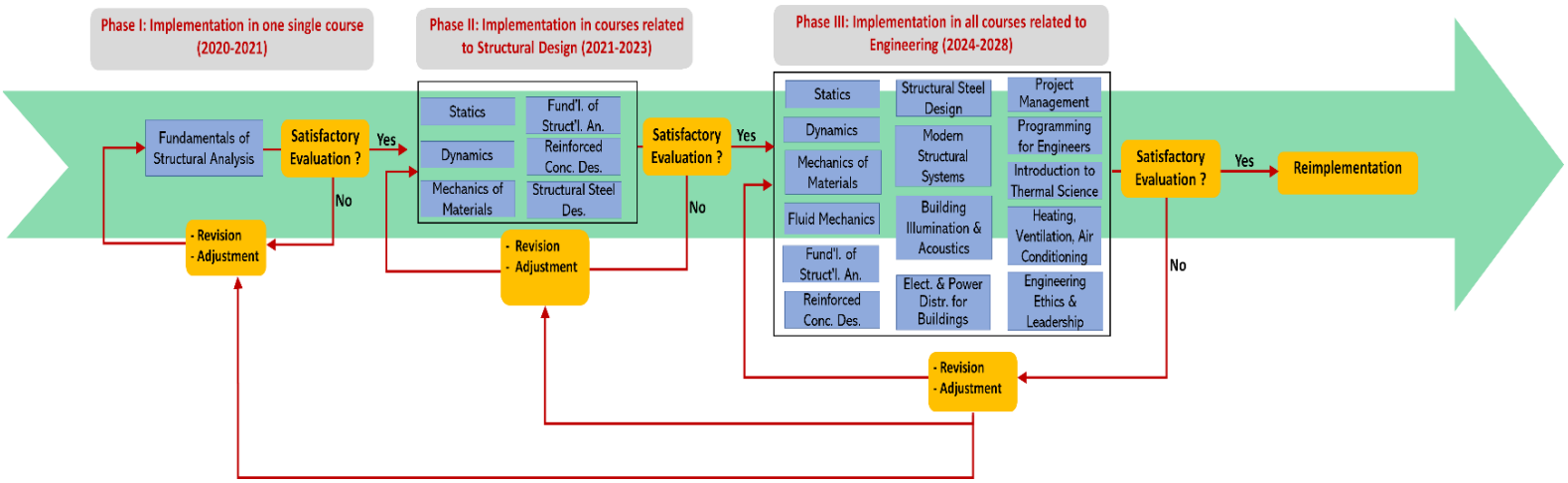



**Fig. 1.** Schematic illustration of the stepwise *Implementation Phase* for the proposed Pedagogical Innovation Project [1]. The time frame between brackets for each phase refers to the initial plan intended for implementation at the University of Sharjah.

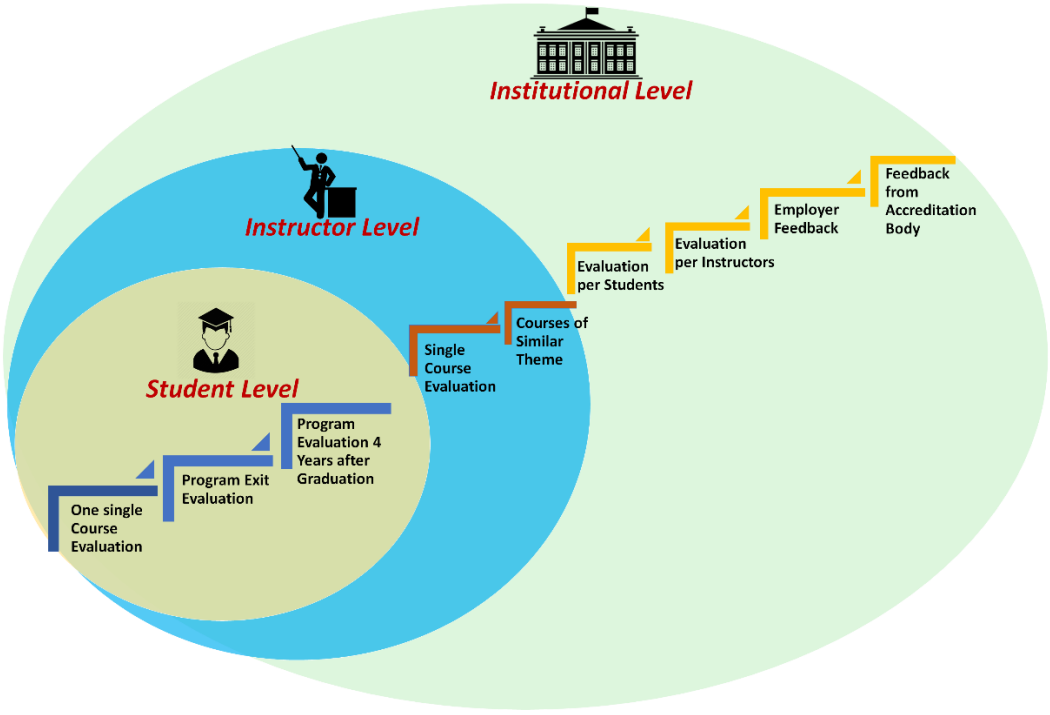



**Fig. 2.** Schematic illustration of the *Evaluation Phase* for the proposed Pedagogical Innovation Project[1]

[1] [1] Hisseine O., and Bédard D. (2020), Active-learning for competence-based education in engineering curricula: Towards a paradigm shift, an article under preparation for potential submission to the *Journal of Advances in Engineering Education*. https://www.researchgate.net/project/Active-learning-for-competence-based-education-in-engineering-curricula-Towards-a-paradigm-shift

## *III. Future Teaching Agenda*

Inspired by some of my professors in concrete technology, structural performance of concrete as well as in the pedagogy of higher education, I am aspiring to see my research in ecological high-performance concrete for sustainable concrete infrastructure (see my research statement) to positively propel my teaching. For this, given my research and teaching experience crossing the boundaries of concrete technology and structural engineering, I am open to teaching the following courses or the similar:

- Civil Engineering Materials
- Statics and Mechanics of Materials
- Structural Analysis
- Introduction to Structural Design
- Advanced Concrete Technology
- Hydraulic Binders
- High-performance Fiber-Reinforced Cement Composites

During my tenure-track, I am also willing to continue my interest in the pedagogy of higher education. I want to leverage my findings in teaching strategies to push the boundaries of engineering education to constantly improve my art of knowledge creation and transfer as well as to contribute to realizing the institutional vision on the scholarship of teaching and learning (SoTL).

# Appendix I

## Sample course evaluation by students

*Pages below shows how my students evaluate my teaching.*

# Student Course Experience Survey

Comparative Report

Directorate of Quality Assurance, Institutional effectiveness and accreditation

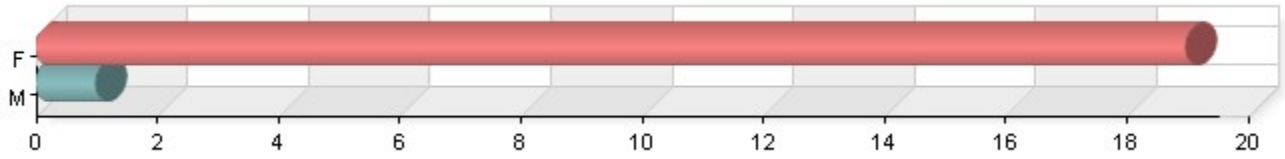
| | | |
|---|---|---|
| College: Engineering | Departmnet: Architectural Engineering | |
| Course Code: 0404417 | Course Title: Structural Steel Design | CRN: 11034 |
| Instructor: Hisseine Ahmat | | Fall 2011 |

**Student Course Experience Survey**

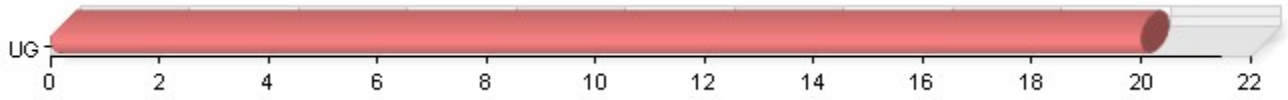
| Raters | Students | Total Raters |
|---|---|---|
| Responded | 20 | 20 |
| Invited | 28 | 28 |

## Demographic Analysis

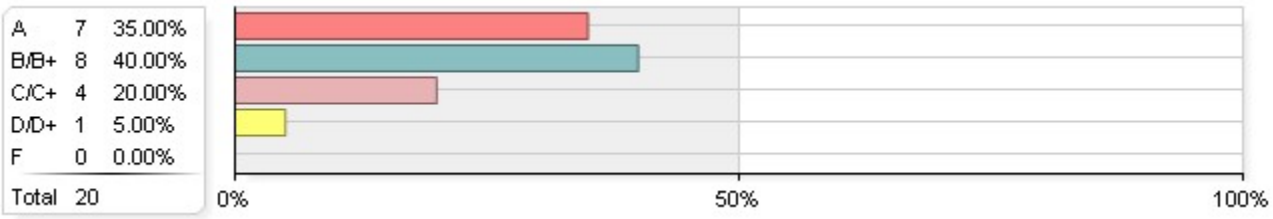
### Gender



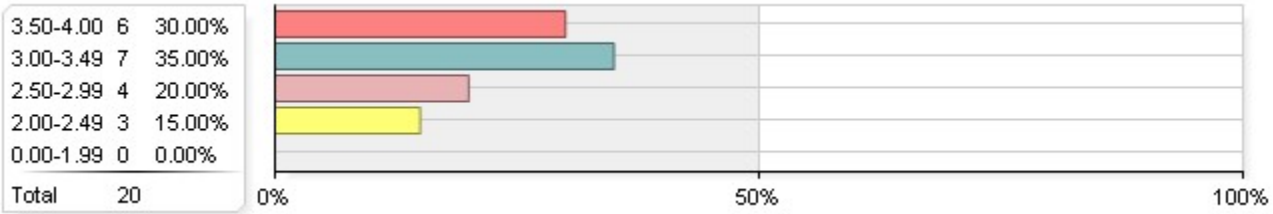

### Level




### Expected Grade:




### Your GPA:



# Evaluation

## Instructor Comparitive Analysis - Hisseine Ahmat

| Question | Course level | College level | Department level | University level |
|---|---|---|---|---|
| Prepared for class | 4.60 | 4.19 | 4.15 | 4.40 |
| Graded exams, assignments, etc... fairly | 4.40 | 4.01 | 4.00 | 4.33 |
| Spoke clearly | 4.45 | 4.03 | 3.93 | 4.31 |
| Used clear and balanced assessment tools | 4.40 | 4.02 | 4.05 | 4.27 |
| Showed interest in the course | 4.75 | 4.19 | 4.16 | 4.39 |
| Gave examples to simplify concepts | 4.55 | 4.14 | 4.06 | 4.40 |
| Accepted ideas and suggestions | 4.65 | 4.11 | 4.14 | 4.32 |
| Increased student appreciation for the subject | 4.70 | 3.98 | 3.98 | 4.23 |
| Organized & presented the subject well | 4.60 | 4.02 | 4.04 | 4.30 |
| Specified course learning outcomes | 4.70 | 4.05 | 4.03 | 4.30 |
| Provided sufficient feedback on graded work | 4.55 | 3.97 | 3.98 | 4.23 |
| Cared about the students | 4.50 | 4.10 | 4.10 | 4.31 |
| Was available during office hours | 4.80 | 4.23 | 4.11 | 4.37 |
| Encouraged student participation | 4.60 | 4.13 | 4.05 | 4.32 |
| Used university IT resources effectively | 4.65 | 4.12 | 4.12 | 4.22 |
| Overall, taught the class effectively | 4.55 | 4.05 | 4.07 | 4.32 |
| **Overall** | 4.59 | 4.08 | 4.06 | 4.31 |

## Course Comparitive Analysis - Structural Steel Design

| Question | Course level | College level | Department level | University level |
|---|---|---|---|---|
| Course content was adequate and reasonable | 4.40 | 3.97 | 3.99 | 4.16 |
| The course was well-organized | 4.45 | 3.97 | 3.99 | 4.18 |
| The course was very interesting | 4.05 | 3.79 | 3.79 | 4.01 |
| Required work was appropriate | 4.45 | 3.91 | 3.94 | 4.15 |
| Tests reflected the course content and outcomes | 4.25 | 3.92 | 3.87 | 4.17 |
| Textbook/course material was useful | 4.20 | 3.76 | 3.80 | 4.06 |
| Grading criteria was clear | 4.35 | 3.94 | 3.90 | 4.22 |
| Effective integration of IT in course delivery & communication | 4.25 | 3.98 | 3.94 | 4.13 |
| The basis for the course grade reflected an appropriate balance of tests, papers, assignments, participation, etc. | 4.35 | 3.99 | 3.93 | 4.23 |
| Teaching & learning methods were effective | 4.45 | 3.94 | 3.93 | 4.19 |
| Feedback on tests and assignments were returned in a reasonable length of time | 4.30 | 3.96 | 3.90 | 4.20 |
| Overall, the course was a good learning experience | 4.35 | 3.93 | 3.93 | 4.20 |
| **Overall** | 4.32 | 3.92 | 3.91 | 4.16 |