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"ENGINEER": WHAT DOES IT MEAN TO OUR STUDENTS?

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INTRODUCTION

The École de technologie supérieure (ÉTS), as are all engineering schools and faculties in Canada, is at work adapting its programs to comply with new CEAB Accreditation Criteria and Procedures.

The recently defined twelve CEAB attributes define the knowledge, skills and attitudes that all engineers must possess in order to practice their trade. These attributes thus define, in some ways, the engineer. Therefore, in parallel to measuring how our programs integrate these attributes, we also wish to measure how well our students integrate these twelve attributes in their conception of what an engineer is. The premise of this work is that faculty should focus its efforts on those attributes that students do not seem to readily associate with engineering.

The objectives of this work are to lay the foundation of a method that will enable us to:

- measure how many attributes students readily associate with being an engineer;
- measure which attributes students readily associate with being an engineer; and
- verify if there is an evolution of these measures over time.

METHODS

Students were given the following instruction: "Write a definition of an engineer" in their field of specialty (e.g. Write a definition of a mechanical engineer. Write a definition of an electrical engineer, etc.)

The procedure was conducted in two different groups, each with a different methodology as explained in the next paragraphs.

The first group corresponds to a class of mechanical engineering freshman students taking a mandatory course in design methodology. Within the first hour of instruction of the first lecture, students were asked to form teams of 3 or 4 students. They were given 10 minutes to write down a definition using pencil and paper, after which the definitions were handed in. Ten (10) definitions were produced by this group.

Senior students taking the mandatory course "Environment, Technology and Society" composed the second group. The class was composed of students from all of the seven undergraduate programs. Students were contacted by e-mail at the beginning of the first final examination week. They were asked to write the definition and return it electronically to the instructor before the end of the semester. Nineteen (19) definitions were produced individually.

Neither group was provided with a list of the CEAB attributes (or from any other source, for that matter) prior to the exercise.

RESULTS

Table 1 contains the frequency at which each of the twelve CEAB attributes was included in a definition. The most frequently evoked attribute in both groups is Design. For the freshmen group, Knowledge base, Problem analysis and Economics & Project Management follow closely behind, while for the senior group, Knowledge base and Problem analysis were evoked less frequently. In the category Impact on Society & Environment, the word environment or the expression sustainable development were not mentioned once. All of the definitions that mentioned this attribute referred to safety.

The concept of Life-long Learning, never mentioned by the freshmen group, does appear, albeit timidly, in the senior group.

Engineering tools and Ethics & Equity attributes were never mentioned in the definitions provided by either group.

Table 2 presents the distribution of the number of attributes included in a given definition. On average, the definitions written by freshman students contained a greater number of attributes than those provided by seniors.

DISCUSSION

We would have expected senior students to provide richer definitions, i.e. to include a greater number of attributes in their definitions. This was not the case. We believe that the difference in methodology can explain this discrepancy. In the first group, roughly 8 minutes of the allotted class time was devoted to brainstorming on the type of knowledge, skills and attitudes while the remaining 2 minutes were spent on actually writing the definition. We believe that the group discussion period produced more attributes than individual reflection.

It is quite comforting to see that most students include Design in their definitions as, in our view, this skill represents the quintessence of engineering. It is much more difficult to explain why they did not include Engineering Tools. Perhaps, because of their technical background, students from ETS take this attribute for granted and do not evoke it explicitly. We do not think the same argument can be used to explain why such attributes as Professionalism, Ethics and equity as well as Life-long Learning were not mentioned more frequently. These concepts are very rarely alluded to during their study programs. We also have difficulty explaining why environmental issues were not stated in any definition.

CONCLUSION

This very limited study revealed sufficiently interesting results to recommend a wide-scale implementation. However, close attention will have to be placed on methodological parameters to obtain more significant results. Furthermore, we believe that faculty will be hard pressed to raise awareness and have the majority of student integrate some of the attributes in their conception of what an engineer is.

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Table 1: Attribute frequency

	Knowledge base	Problem analysis	Investigation	Design	Engineering tools	Individual/ team work	Communication skills	Professionalism	Impact on society and environment	Ethics and equity	Economics and project management	Life-long learning
Freshman students (group 1)	7	7	2	8	0	2	1	1	4	0	7	0
Senior students (group 2)	3	5	0	10	0	2	1	3	4	0	9	3

TABLE 2: Distribution of number of attributes

Number of attributes included in a single definition	00	1	2	3	4	5	6	7	8	9	10	11	12	total
Freshman students (group 1)	0	0	1	4	4	0	1	0	0	0	0	0	0	10
Senior students (group 2)	2	6	4	1	2	3	0	0	0	0	0	0	0	19