INTRODUCING PERSONALITY TESTS TO CLARIFY ENGINEERING STUDENT SELF-PERCEPTION AND DEMYSTIFY RECRUITMENT PROCEDURES: QUANTITATIVE AND QUALITATIVE RESULTS

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ABSTRACT

It is often said that Generation Y students have little professional ideal, uncertainty and indecision dominating their professional future appraisal. Engineering program designers are now faced with such new student generations. They certainly must trust students to finally find their own way, but they must also give them a sense of responsibility so as to enable them to take care of their career, as soon as possible and at best, in accordance with their genuine wishes. In 2007, Telecom Bretagne (public French higher engineering institution) reformed its mandatory career preparation program and introduced a professional interest inventory test to help its students have a more objective self-perception, challenge stereotypes, question their own character traits and interests, and ultimately shape their future professional identity. After six years, qualitative and quantitative results permit to respond to three research questions: (1) Is there a specific profile for engineering students? (2) Does this profile significantly evolve between the first and the last year of the engineering program? (3) Do test credibility and acceptance depend on the year when they are taken? In light of this analysis and student feedbacks, it is possible to state that, while sometimes initially reluctant to tests due to misconceptions, some students can develop a true interest and expectancy for their personal and professional project thanks to this formative and reflective tool.

KEYWORDS

Generational issues and trends for engineering students, careers, personal and professional project, professional identity, self-perception and awareness.

INTRODUCTION

Engineering program designers and reformers are now faced with a new student generation. Unlike their parents, incoming students of Generation Y do not put work first [1]. They seek a better quality of life and a balance between work and personal interests. They tend to think short-term and are most often highly mobile. In many countries, however, engineering students belong to a generation of worrying rates of youth unemployment. Nowadays, when entering an engineering school, freshmen have rather little professional ideal, uncertainty and indecision dominating their professional future appraisal [2]. Many studies point out their low conscientiousness and a penchant for delaying passage into adulthood, that radically impact their learning and professional expectations. In practice, some students struggle to identify career directions and therefore need some time before feeling committed and being operational within their curriculum [3].

In 2007, Telecom Bretagne engineering school (French public *Grande Ecole* [4], Master of Engineering level, three-year curriculum) reformed the mandatory career preparation program of its generalist curriculum. It now integrates sessions and tools aligned with the CDIO syllabus and based on a competency continuum over the three years of studies (21 hours per year). As previously defended in a CDIO conference paper [3], "it is –also– essential to provide students with means which will enable them to participate actively in their own learning path, to build their future professional identity, and to plan proactively their future career". The task is challenging since our first-year students often perceive both the engineering profession and themselves under a series of stereotypes.

Among the various tools introduced in our career preparation program, a specific one is used all along the three years: personality tests. Such kind of tests are sometimes used to support the selection of student applicants (e.g. increasing the reliability of the selection process or even using individual personality traits for predicting job performance) or the composition of specific student teams for project based learning (e.g. teamology [5, 6, 7]), but they also have a high potential for demystifying recruitment procedures and facilitating educational and vocational guidance. In this latter respect, in 2007, we introduced within the career preparation program a Professional Interest Inventory (PII) test whose results are delivered to students together with a documented interpretation of each student score (approx. 10 pages), a comparison with nine personality patterns, and an optional 30-minute one-to-one debriefing session.

Each year, the test is proposed (i.e. on a non-compulsory basis) to students, from freshmen (1st year) to seniors (3rd year). Thanks to a large pool of test scores since 2007 (approx. 200 freshmen per year) and regular post-debriefing student/staff feedbacks as evaluation, benefits obtained and lessons learned from introducing this instrument in our program can be discussed in this full paper which is structured as follows: the next section recalls our career preparation program objectives and structure as a context; the following section presents the research questions addressed in this paper; then, the PII test used is detailed before clarifying the associated debriefing session to support student reflection [8]; quantitative results (student profiles) over six years are then reviewed before analysing the test evaluation made by students as qualitative results (i.e. student perception of such tests). Finally, in the conclusion, the authors provide some future work as new research questions to possibly investigate.

CONTEXT: THE CAREER PREPARATION PROGRAM AT TELECOM BRETAGNE AND RESEARCH QUESTIONS RELATED TO TESTS

The Career Preparation Program Reform: Continuum and Tools

In 2003, our institution reorganized its curriculum by systematically incorporating large semester project-based learning experiences [9]. At that time, in our new integrated curriculum, professional skills were viewed as essential aspects of intended learning outcomes. However, soon after this reform, we were faced with a problem: freshmen struggled to identify career directions and therefore needed some time before feeling committed and being operational in their studies. We thus determined that it was advisable to disclose to students, from the early stages of the curriculum, their career perspectives in order to give some meaning to their studies and learning. As a matter of fact, we believed that our students should be able to enhance their professional potential and to have future expectations as well as a vision and intention in life. Thus, many career-oriented learning activities, now representing 63 hours per students, have been introduced all along the three-year curriculum in order to improve students' ability to actively participate in the construction of a realistic and secured personal and professional project. The notion of "skill provider"

(instead of mere "job seeker") is studied during workshops where real-life situations are experimented. Following an active approach, the program now includes workshops, portfolios, career games, company visits, peer review, etc. [3]. In particular, nomadic careers are emphasized so as to open the possible future engineer to professional flexibility and to lead him/her to become a responsible actor of his/her own employability. Thereafter, these tools may be reused for investigating professional mobility issues: we convey to the students the idea of a "life-long learning & training" while giving them their first "toolkit".

For professionalization purposes, Telecom Bretagne students must also complete an 8-month (minimum and mandatory) internship. As a complement, approximately 45% of students also take a one-year break for practical training (optional for sophomores). In the career preparation program, each year, a specific theme is investigated with a view to increasing student self-efficacy: (year 1, freshmen) identification of one's personality and skills, (year 2, sophomores) career orientation, and (year 3, seniors) itinerary. Thus, this program is conceived as a continuum over the three years of higher education. This progressive approach allows reusing the methods and tools introduced, at any time and any development step. Also, it fits the sense of time characterizing Generation Y students who will thus more easily absorb the concepts studied. We mostly deploy our activities for purposes of achieving the following intended learning outcomes (to be able to):
1. to know oneself and identify one's set of skills in order to better define one's choices;
2. to define, analyze and evaluate career paths, and to combine personal development and desire therewith;
3. to propose a coherent professional project and career orientation;
4. to behave professionally in job research and service offering;
5. to optimize junior career.

Professional Interest Inventory (PII) Test as a Formative Tool

The preparation and orientation of a career cover various notions: the professional project, the development, the mobility, the professional success, the potential, etc. Traditionally, educational institutions design career preparation programs which focus on making their students more attractive to potential employers. While recognizing that students should learn how to enhance their job applications, we believe that it is also essential, at the early stages of their engineering studies, to give them the means which will enable them to build their own future professional identity, to become active players in their own learning path, and to plan proactively their own improvement and future career [3].

Personality tests first allow to "demystify" the recruitment process often implemented by recruiters and head hunters. Personality type tests are also useful tools for helping engineering program designers to understand their students and reform instruction that can benefit students of various types [10]. They may help students to develop an introspection strategy which will facilitate their choices in accordance with their education, culture, values, family, and friend contexts. For this purpose, PII formative and debriefed tests were introduced at Telecom Bretagne, with a view to identifying or discussing the strengths and potentials of its students.

Research Questions

Thanks to the large pool of test scores collected since 2007, as supported by quantitative and qualitative results, three hypotheses are addressed in this paper:
1. H1: there is a specific profile of engineering students;
2. H2: profiles do not evolve between the first and last year of the engineering program;
3. H3: test credibility and acceptance depend on the year when the test is taken.

OVERVIEW OF THE PROFESSIONAL INTEREST INVENTORY TEST (PII)

At Telecom Bretagne, tests are proposed to freshmen and senior students on a non compulsory basis, during the first semester of each year. Freshmen have only access to the PII test. Sophomores and seniors can take several other tests (e.g. Big Five, management, leadership, sales, values and motivation).

Test Details

In the PII test, the personality is analyzed based on twelve fundamental facets of the human character. This psychometric test is frequently requested by psychologists and HR professionals. It is complemented by nine personality patterns (emotionally engaged, conscientious, cooperative, independent, judicious, dynamic, dedicated, combative, and intuitive) which are not addressed in this paper due to a lack of space. Available through the Internet, the questionnaire is composed of 98 questions divided into 2 parts. It takes no more than 15 minutes to complete it. There are several sets of statements. For each set, the student is asked to indicate which statement best describes his/her personality or beliefs by clicking the corresponding box. If neither of the statements describes him/her exactly, he/she must choose the statement that comes closest. Three question examples are given hereafter:

- *I find it stimulating to work in a team vs. I like thinking and analysing;*
- *I pay close attention to details vs. I often make compromises;*
- *To get things done, I am more of a "sprinter" vs. I am more of a "long-distance runner".*

The twelve facets of character traits are reported based also on opposite factors, as defined in Table 1.

Table 1. PII sets of character traits: main and opposite factors.

OPPOSING FACTOR	MAIN FACTOR
Need for objectivity	Persuasiveness
Loyal, Trustworthy, Genuine, Ethical sense	Persuasive, Expressive, Eloquent, Convincing
Firmness	Flexibility
Determined, Firm, Decisive, Resolute, Rigid	Adaptive, Open minded, Considerate, Avoiding conflicts
Sensitivity	Resistance to stress
Sensitive, Sympathetic, Susceptible, Thin skinned, No need for external pressure	Emotionally stable, Placid, Tranquil, Resolute, Need for external pressure
Introversion	Extroversion
Shy, Sober, Inhibited, Impersonal Discreet, Appreciates a calm environment	Cheerful, Sociable, Outgoing, Interactive, Participates in a lively working environment
Method / Organization	Improvisation
Methodical, Structured, Systematic, planned, Comprehensive, Likes to answer definite needs	Enthusiastic, Motivated, Venturesome, Endeavour
Intuition	Rationalism
Spontaneous, Instinctive, Insightful, Subjectivity	Logical, Analytical, Coherent, Factual spirit, Objectivity
Detachment	Involvement at work
Businesslike, Efficient, Balanced, Emotional detachment	Involved, Dedicated, Workaholic

Need for supervision	Desire to lead
Perfectionist, Self disciplined, Structure Seeking, Yearn for a hierarchy	Decisive, Planned, Confident, Likes to be in charge of a team
Long-term view	Need for action
Foresighted, Inefficient in short term goal, Visionary, Likes complexity, long-term projects	Quick in result, Dynamic, Restless, Inefficient in long term goal
Humility	Ambition
Humble / Faithful to commitments	Motivated / Competitive (sometimes opportunistic)
Team spirit	Need for autonomy
Affiliative, Cooperative, Team oriented	Self governed, Independent, Individualistic
Individualism	Altruism
Tight fisted, Wilful, Egocentric, Defends personal interests	Helpful, Selfless, Generous, Service oriented

Radar Sample on Main and Opposite Factors

As results, all factors are rated on a 0-10 scale, with associated comments, analysis of strengths and areas to develop. For instance a 1.2 in *Persuasiveness* as main factor will correspond to an 8.8 in *Need for Objectivity* as opposite factor (cf. Figure 1).
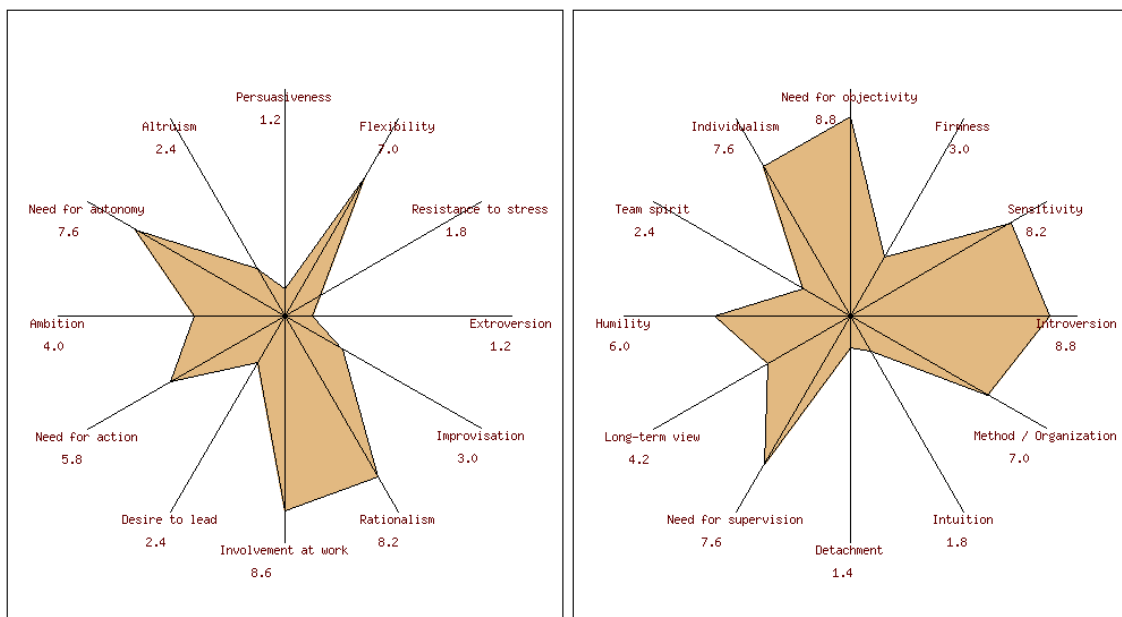

Figure 1. A radar sample result: main and opposite factors.

One-to-One Personalized Debriefing as a Reflective Complement: "Magic Mirror on the Wall, Who is the Fairest of Them All?"

After the test, a personalized one-to-one debriefing is offered to students on a non compulsory basis. In 2007, approximately a dozen of volunteer associate professors from various disciplines were trained for such debriefing during a half-day session. These A/Prof. also take the test. In alignment with the declared outcomes, three steps are to follow during a debriefing which generally lasts 30 minutes:
   1. **Pre-contact**: a moment for welcoming, trust building and contextualization. The student must be asked very general questions about himself/herself and the test: "*When did you take it? Did you complete it while alone or in a group? Did you expect*

this kind of test within your institution?" It is important to let the student express his/her views on the test;

2. **Contact**: the crucial moment of the discussion, when the A/Prof. and the student address the heart of the matter. This is the longest phase when the participants consider the content of the student's self-perception and representation in comparison with the image given by the test results. It is important to work from general to specific, starting with questions such as: *"What do you understand from these test results? Do you recognize yourself in this test? Are you surprised by some results?"* Then, while listening to the speech of the student without adding any comments, the A/Prof. should invite the student to explore some details (those which seem important to the student). If possible, the student should be requested to provide practical examples. Finally, the A/Prof. should open the student to a new way of thinking, for example, in showing strength axis (cf. opposite factors) to those who only see weaknesses and vice versa. If the student did not mention them, the A/Prof. should underline the salient traits of the radar graphs.

3. **Post-contact**: the time to conclude on such self-evaluation experience, to open up to the future, to say good bye. This last phase may be very short. Questions may be asked -- *"We are about to finish. Did you learn something? How did you find this discussion?"* -- before providing some information on the career program.

If, during a debriefing, an A/Prof. experiences difficulties or notices that a student does not feel comfortable, he/she may always provide feedbacks to a Faculty referent. The most frequent issue is test acceptance by students during such debriefings. A/Prof. are requested to try to always use the first person ("*I see, I read, I notice*") when commenting on the results and to let the student provide his/her arguments based on his/her own experiences – to determine whether the mirror reflection is lying or not. In practice, the test is mostly an excuse to initiate a discussion and to question self-perception, self-image, and self-esteem. There is no perfect profile, and the opposing factors greatly favour discussions. Freshmen will have an opportunity to clarify their personality traits and personal skills as well as their adequacy to job profiles through other activities of the career preparation program.

QUANTITATIVE RESULTS AFTER SIX YEARS OF PII TESTS INTRODUCTION

The PII test is non compulsory and its results are the property of students. A vast majority of freshmen take it (96%) while seniors tend to favour other tests because they already took the PII test as freshmen and prefer to discover other types of results. For purposes of quantitative analysis, each year, the authors prompt students to share their results. As of today, 750 scores have been parsed (180 women, 570 men).

Quantitative Statistical Results for Freshmen

As seen in Figure 2, on the 0-10 scale, the average score is approximately 5 for freshmen, the maximum score being 5.7 in *Rationalism*. Male student figures (in blue) are high with respect to *Stress resistance, Rationalism,* and *Ambition* while female student figures (in pink) are higher with respect to *Rationalism*, *Involvement at work*, *Altruism, and Organisation & Sensitivity (opposite factors).*
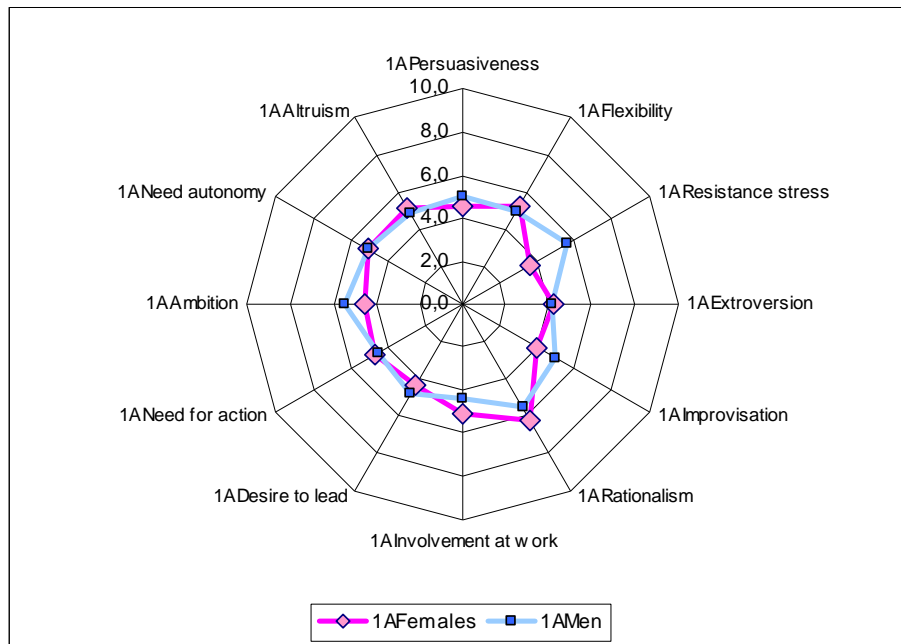
Figure 2. A radar average of main factors for freshmen (female and male).

Quantitative Statistical Results for Seniors

As seen in Figure 3 (seniors), no trait significantly stands out (i.e. medians -- in yellow -- very close to the means, between 4 and 6), the significant mean scores also being in *Rationalism* (5.7), and in *Extroversion* (4.1). There is a rather tight distribution (huger scatter bars only in the extremes, in a whiskers plot 25% of students are between two quartiles, the median being the 2nd quartile). The 1st and 3rd quartiles are at a minimum of 0.6 points from median (cf. *Flexibility (1st quartile to median)*, *Extroversion* and *Desire to Lead* coming next) and at a maximum of 1.6 points (cf. *Flexibility (median to 2nd quartile)*, and *Resistance to Stress*, *Extroversion*, and *Ambition* coming next). Note that, for seniors, the gender trend is quite similar as for freshmen. By comparing the means with Figure 2, we can notice that no clear evolution appears between the freshmen year and the senior year, even for an overall sample as large as 750 students.

French Preparatory Schools Incoming Students versus Foreign Students

Telecom Bretagne student recruitment sources are mostly found in specialized scientific studies (French preparatory classes [4]) and international university higher education programs -- in particular as regards foreign students (there are 40% of international students at Telecom Bretagne, representing each year approximately 46 nationalities). For these two categories of students, the traits of the average profile are rather similar, except for *Rationalism* (6.1/5.6), *Involvement at work* (5.3/4.5) and *Need Autonomy* (5.7/5.1) which are stronger (approx. 0.6 spread) as regards students coming from the university. Also, according to the test results, students from preparatory schools seem to have a stronger *Need for action* (4.6/3.8) and are more *Stress Resistant* (5.3/4.4).

Quantitative Results for Students who Passed the Test both in 1st Year and Last Year

80 test results taken both at freshman and senior levels (of course by same students: 40), were compared. The gender breakdown is representative of the school population (women represent 21% of Telecom Bretagne students). Even if some student profiles have slightly changed, the average remains quite the same. Quartiles followed approximately the same

mode. Per trait and globally, the results are stable. For the most significant examples among the 40 elements, a student gained 5.2 points in *Desire to Lead,* whereas another decreased of 5.8 points in *Improvisation*.
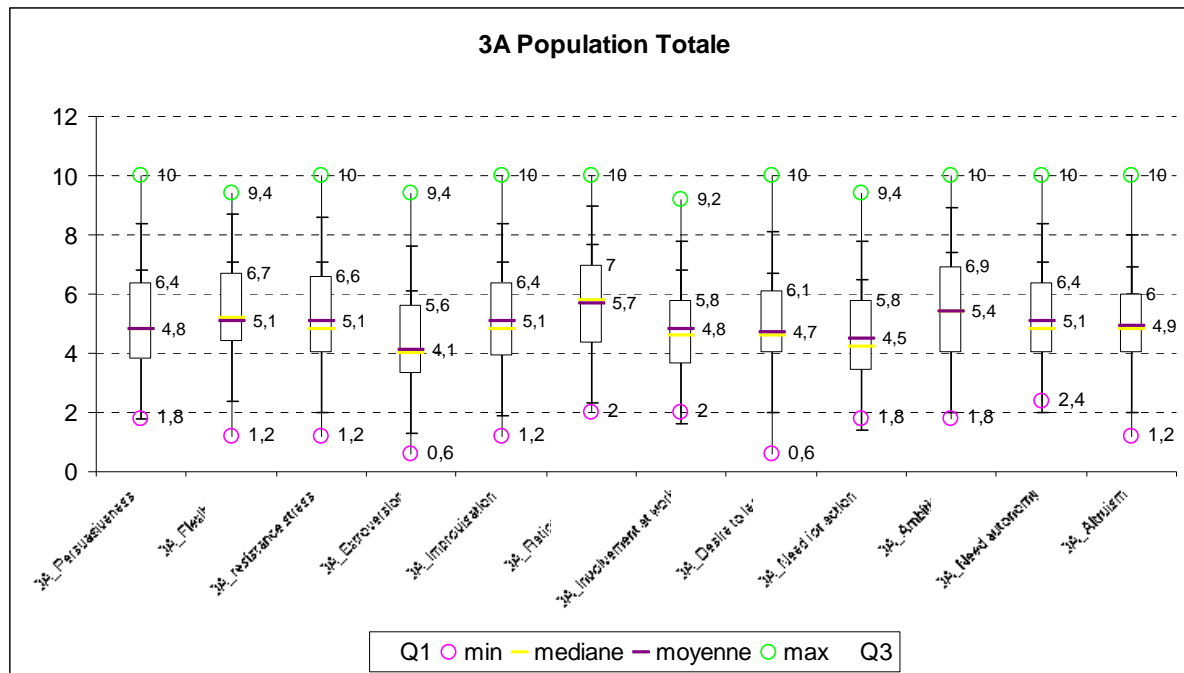

Figure 3. Whiskers plot of main factors for seniors (scale 0-10).

STUDENT EVALUATIONS

For quality assurance purposes, Telecom Bretagne regularly collects qualitative feedbacks from students. In order to analyze test perception, the first year of their introduction was particularly scrutinized (2007). At the end of the semester a satisfaction questionnaire was submitted to the students on the Moodle Learning Management System. A transcription of its results is provided in Table 2.

Table 2. Freshmen and seniors feedback comparison (2007).

Freshmen (56 respondents)	*Seniors (51 respondents)*
• 73% of the respondents have fully read the results of their test, 25% partially, one student did not; • 80% discussed the results of the test with a friend, another student or a family member. 20% did not; • 69% judge the results as partially relevant, 27% as fully relevant, and 2 students totally disagree with the results; • 66% of replying students feel that this test is to be taken early in the freshmen semester; 30% sit on the fence; • 61% wishes to attend a debriefing with an A/Prof. 24% did not want to.	• 53% of the respondents have fully read the results of their test, 42% partially, one student did not; • 60% discussed the results of the test with a friend, another student or a family member. 40% did not; • 73% judge the results as partially relevant, 21% as fully relevant, and 2 students totally disagree with the results; • 60% of replying students feel that this test is to be taken early in the senior semester; 53% of respondent said that this test should have been introduced earlier in their program (e.g. first year), 13% no, 34% sit on the fence.

Freshmen Testimonials

About the Debriefings (Freshmen)

57% answered that this debriefing was useful, 40% not. Some students had rather positive comments about it (translated from French):

- It gives "*a better awareness of one's future*" or "*a better understanding of the adjectives characterizing us and how to use this character traits*"; "*it is always interesting to have an external point of view on a personality test because the interpretation may differ from ours*"; "*It permitted me to discuss the usefulness of this test, to criticize or identify with the results, and to discuss our professional project*"; "[it] *allowed to better understand the interest of this test and to try to determine whether some aspects of the test were consistent with my project*"; "*this debriefing reassured me as regards the results and their interpretation(s). The teacher gave me some advice, explained what I should work on; he gave me examples of students who were in a situation similar as mine*"; "*partial answers to my questions were found during the discussion which was very pleasant and shows that it is not always easy to speak of oneself*"; "[…] *I am convinced that the look of an external person is necessary to see oneself objectively. Alone, one may not judge oneself totally*"; a student appreciated it "*because it confirmed the test results and enabled me to conceive other approaches for my professional project*"; another one liked it "*in a certain way, but not as regards personal results which I had understood, rather as regards the professional future in general*";
- Others were more lukewarm: "*The test was interesting as such, because it was representative of what I should expect in the future, but I found it transparent and, in this respect, totally unuseful...*", "*it allowed to mitigate the results because some oppositions are not appropriate*", "*it did not add anything to what was already written*", "*the teacher did not know what the debriefing was about and asked me to conduct the debriefing alone; hence, it lasted five short minutes*".

About the Utility of the Tests (Freshmen)

- "*This test is interesting because it prompts to ask questions about oneself, something one does not always do spontaneously*";
- "*Almost all the test results reflected what I thought to be and confirmed some concerns I had. A few new things also appeared and led me to ask questions to myself. There were very few errors*";
- "*To me, it seems to be an excellent initiative. Three years before a job, the most indecisive ones (as I used to be) must make some efforts and engage into a genuine reflection about their professional project*";
- "*Interesting but is it really useful?*";
- "*Very interesting, however, there are some contradictions as regards the personality*";
- "*For freshmen, it was difficult to answer the questions relating to the business (our dedication, overtime…) due to a lack of experience in a company*".

Seniors Testimonials (Utility of Tests)

- "*Sometimes, slightly contradictory and a debriefing on them would have been more constructive*";
- "*I think that, sometimes, the allegations of this summary are exaggerated and even inaccurate*";
- "*Not very accurate, but it gives me ideas for my future job*";
- "*Interesting, although sometimes weird in its comments*". [Q] Your ability to balance your personal and professional lives. You accept some routine, a relative stability at work?

> "*For me, routine is a crucial feature in selecting my job. I refuse it, I need change to live and thrive. Routine kills me! This test is interesting for trying to better define one's strengths and weaknesses*";

- "*I am very sceptical about the interest of this kind of test. It may be useful to HR, but, as far as I am concerned, it appeared to me as simplistic as a speech delivered by Miss…* ";
- "*To me, it is a good initiative, although some people find it unuseful… and it's a pity. Since I already had interviews for internships, I would have found useful to know about these details on my personality event though, as a matter of fact, it describes myself well*":
  - "*It is interesting for people who never asked themselves questions about themselves. When one knows oneself already, it simply permits to check that everything is accurate*";
  - "*It is good for knowing, more or less, our skills, but it does not help to discover what we want to do in the future*";
  - "*It is good to take such a test, it allows to better define the points which could be a problem during an interview/review upon recruitment*".

HYPOTHESIS VERIFICATION REGARDING RESEARCH QUESTIONS

H1: it exists a specific profile of engineering students

Overall, the average test results are very close to the medium score (i.e. 5 on a 0-10 scale), as seen in Figures 2 (freshmen) and 3 (seniors). Few students reach extreme figures as regards their personality traits (cf. quartiles and medians in Figure 3, from 0.6 to 1.6 of distance). In fact, the distribution do not shows linearity (e.g. quartiles of 2.5 length), or two extreme profiles (e.g. large quartiles near the medians). Thus, globally, it seems that there is actually a general profile of the engineer student at Telecom Bretagne, with no really noticeable difference as to genders or educational backgrounds (preparatory schools or universities). The profile does not bring out significantly a specific personality trait or extreme patterns, but *Rationalism*, *Ambition, Flexibility* and *Introversion* are noticeable regarding the distribution. Finally the profile is not far from the average, although one might expect an emphasis on some traits such as those discussed about digital natives [11], e.g. *Flexibility*, *Improvisation*, *Need for action*, or *Need of autonomy*.

H2: profiles do not evolve between first year and last year of the engineering program

Some personality traits have significantly evolved for some students. But, as seen previously, the absence of clear global evolution on average between the first year (freshmen) and third year (seniors) is quite surprising (cf. sample of 40 students). This is all the more curious as this population (between 21 and 24 years old) is constructing its identity and is supposed to assert itself over that period. As the PII test is based on Carl Jung's typological approach to personality, it reflects psychological types derived from spontaneous trends which seem to last over time. It is to be noted that a majority of seniors take the test before leaving for the internship, which is a testing ground allowing to increase ambition, confidence and autonomy.

H3: test credibility and acceptance depend on the year when the test is passed

Qualitative results show us that the credibility of the tests depends on the semester during which they are taken. But overall, approximately 70% of the students concerned judge the results as partially relevant and 25% as fully relevant. The activity was often lowly rated by freshmen, even if they recognized that it was a precious seed to initiate self-awareness and self-perception as regard careers. But such an experience was too isolated in the first semester to provide students genuine tools to analyze and evaluate, from a personal standpoint, the various careers available for them. French students coming from scientific preparatory classes tend to merely question the validity of the tests, neglecting to consider

them as a reflective tool [8], while our foreign students seem to be more open-minded and curious. As tests are a tool to prepare recruitments, senior students are more receptive to them because they are more assertive and even wish to be exposed to other types of tests (e.g. management, leadership, or sales profiles).

Syllabus, Graduate Attributes, and Character Traits

Several graduate attributes lists are proposed for accreditation purposes or program reform worldwide. Among them, the CDIO syllabus is divided into four categories [12 (Appendix A)], the latest being recently associated with two subcategories, respectively "Leading engineering endeavours" and "Engineering entrepreneurship". The following items propose a first attempt to categorize opposite and main factors extracted from the personality test and the CDIO subcategories of its syllabus:

- *Need for objectivity*: 2.5 Ethics, equity and other responsibilities;
- *Persuasiveness*: 3.2. Communications;
- *Flexibility*: 3.2. Communications;
- *Extroversion*: 3.1 Teamwork;
- *Method/Organization*: 2.3. System thinking; 2.4. Attitudes, thought and learning; 4.3 Conceiving, systems engineering and management;
- *Improvisation*: 4.7 Leading engineering endeavors;
- *Rationalism*: 2.1 Analytical reasoning and problem solving;
- *Desire to lead*: 3.1 Teamwork;
- *Long-term view*: 4.7 Leading engineering endeavors;
- *Team-spirit*: 3.1 Teamwork;
- *Need for autonomy*: 2.4. Attitudes, thought and learning;
- *Altruism*: 4.1. External, societal, and environmental context; 4.2. Enterprise and business context.

As knowledge and skills oriented, the CDIO syllabus does not directly address some personality traits in a formal manner such as: *Firmness, Sensitivity/Resistance to stress, Introversion/Extraversion, Intuition, Detachment/Involvement at work, Need for supervision, Need for action, Humility/Ambition, or Individualism*. The correlation of the character traits could be investigated as well, based on the Engineers Australia 'A to J' Graduate Attributes ("substantially equivalent" outcomes as those of the other signatory jurisdictions of the Washington Accord and Sydney Accord [13]) or on the EUR-ACE European framework.

LESSONS TO BE LEARNED

We initially had to face a significant reluctance to the test introduction both from the students and the teaching staff. For the three stakeholders (students, teachers, and program designers), it is advisable to analyze the perception gaps and test relevance at key moments of student personal development. But, there is a danger to lock up students in boxes as some of them could place too much faith into the PII test. The mirror is not magic: intercultural factors or a misunderstanding of some test questions (only available in English and French) could lead to biased answers. Besides, the test is proposed as a tool enabling to better know oneself and we recommend taking it in a quiet environment. Some freshmen, in particular, declared to have taken it quickly, considering it more as a distraction than a self-development tool. For this reason, the debriefing phase is critical: the discussion permitted by this phase must be organized soon after the taking of the test, -- rather than the end of the semester; solicitations for participating in the debriefing must be as precise and proactive as possible and debriefers must be prior trained. Moreover, the reliability of the test scores is regularly questioned, both by students and Faculty. This is not a problem as regards the intended learning outcomes of the career preparation program: the test is above all a

medium to initiate and discuss self-awareness and self-perception for further activities during this program (e.g. choices in front of a career kaleidoscope [3]).

CONCLUSION

In the coming years, an executive engineer will, on average, change jobs four to six times over his/her career. Many of them will go through periods of inactivity (unemployment, reorganization, sabbatical) or will go back to formal learning. The traditional notion of career which favours a linear passage from one job to another within a single organization will have to give way to that of a nomadic career (e.g. Protean career [14], Boundaryless career [15) which is managed and controlled by the individual, instead of his/her organization. Students construct their professional identity at various stages of their studies, as well as after graduation [16]. "Before their first job or internship contact with industry, many students do not clearly envision their professional future and are not really able to foresee the economic, technological and, most of all, managerial changes affecting their future profession. We certainly must rely upon our students to finally find their own way, but we must also give them a sense of responsibility so as to enable them to take care of their career, as soon as possible and at best, in accordance with their genuine wishes… Many freshmen inherited a quest for perfection and fear the little-known employment market. It is therefore advisable to help students evolve from exemplary learners to fulfilled professionals in promoting their active participation in their own choices" [3].

In this full paper, we explored the challenges and opportunities in generational issues and the diversity of our students. After six years of practising professional interest inventory tests in a career preparation program, implemented by a public French higher engineering institution (welcoming 40% foreign students), qualitative and quantitative results permitted to answer three research questions: (1) it exists a specific profile of freshmen and senior engineering students (i.e. *Rationalism*, *Ambition, Flexibility* and *Introversion, cf. Figure 3*) which is finally not so far from the average, (2) globally, student profiles do not significantly evolve between the first and last year of the engineering program, (3) test credibility and acceptance depend on the year when the test is taken. As for future work, other research questions could be investigated:

- RQ: As of today, we only propose the PII test to freshmen. Seniors have access to many others. Are some tests better aligned with engineering student expectations? What is the right time to take them in a curriculum?
- RQ: Internships are part of Telecom Bretagne curriculum. Their duration must be from 8 to 18 months, spread over the three years of studies. Is it possible that students obtaining high test scores as regards *Ambition*, *Improvisation*, *Desire to lead,* or *Resistance to stress* come up with more varied internship choices? Is there a link between character traits and types of internships? (e.g. production, technique, engineering, or management);
- RQ: Traits of people who are doing well in engineering have been analyzed since several years [17, 18, 19]. It would be interesting to compare these scores and ours with those of students coming from business schools as interpersonal skills seem to be more significant in marketing, sales and management (e.g. [20]);

Professional interest inventory tests permit to demystify recruitment procedures and be better prepared for job interviews. But, overall, tests are a good instrument for career counselling if they are taken in a quiet and personal environment and if a well conducted debriefing is offered. But tests are tools to use with caution. At Telecom Bretagne, a test result belongs to the student who has taken it and may not be used as a selection tool during the curriculum. The tests used in our program since 2007 help many of our students have a more objective self-perception and self-image. They also induce them to challenge stereotypes, question their own character traits and interests, and shape their future professional identity [21]. For

freshmen, we informally identified four categories of students thanks to the reflective debriefings (i.e. weak interest, weak interest but curiosity, interested, lost-looking for references). Moreover, several of our freshmen students do not seem to clearly identify the original intended learning outcomes of the tests and debriefings [22], in light of the evaluations and testimonials [23]. However, in relation with the personal and professional project to be defined in the career preparation program, student categories and related behaviours evolve as time passes and maturity grows, depending on each individual's type [3]. Based on our experience, it is now possible to state that, although sometimes initially reluctant to tests due to misconceptions, some students can develop through this tool an interest and expectancy for their personal and professional project.

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