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## ► To cite this version:

S. Dumas Reyssier, R. Chaker. The effects of internship abroad on engineering students' self-perceived employability. *European Journal of Engineering Education*, 2024, pp.1-19. 10.1080/03043797.2024.2400184 . hal-04703350

**HAL Id: hal-04703350**

**<https://hal.science/hal-04703350v1>**

Submitted on 20 Sep 2024

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## The effects of internship abroad on engineering students’ self-perceived employability

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### Abstract

Internationalization is seen as one of the means of enabling engineering students to acquire skills, attitudes and also promote their employability. In this study, we investigate the effects of a six-month internship abroad on self-perceived employability, by: 1) observing the global effect of the internship abroad on factors related to self-perceived employability (SPE), 2) analyzing the effects depending on demographic and organization questions, 3) Verifying through clustering if the data can identify homogeneous groups of students based on SPE change, 4) predicting SPE positive change relating to the internship abroad. We conducted a quantitative study on SPE before and after the internship abroad, analyzed sample homogeneity (clustering), and assessed the internship's role in SPE change using logistic regression. Results show that: 1) Some factors have high/low level of influence on SPE; 2) demographic and organizational factors do not affect SPE change; 3) two homogenous groups appeared in terms of SPE change (a positive group and a negative group); 4) only social integration support predicts positive change in SPE for engineering students. The SPE of engineering students seems to be linked to wider range of perceived social support in their host country.

### KEYWORDS

Internship Abroad, Self-Perceived Employability, Engineering, social support

#### 1. ENGINEERING STUDENTS AND INTERNSHIPS ABROAD

Higher education integrates students’ exchanging programs to open up to the world and to develop and internationalize knowledge and experiences. However, over the past decade, this process of openness has accelerated to the point the term “globalization” of higher education is often used today (De Ketele & Hugonnier, 2020). This expanding internationalization phenomenon, supported at the European level by the Bologna Process (1999), was aimed at fostering students’ mobility, the paradigmatic shift of globalization offering to develop transnational and transcultural dimensions. At the European level, the Bologna Process provides a legal framework for the internationalization of higher education. Based on three levels or cycles (Bachelor, Master, Doctorate), it promotes the transferability and the capitalization of ECTS credits based on learning outcomes (knowledge, skills, cross-cultural competences), the transferability of diploma and an innovative and inclusive approach to learn based on the construction of European identity (Wihlborg & Robson, 2018). The Europe 2020 strategy and the Erasmus program complete this legal mechanism and allow access to student loans to finance their studies or exchanges abroad.

The globalization of science, technology, engineering and mathematics (STEM) education, in particular engineering education, offers institutions the opportunity to extend various international experiences to students: distance learning, foreign language courses at home, or in a more traditional way, studies and internships abroad. In this last case, educators see internships abroad as the opportunity for students to improve language fluency, to feel like a citizen of the world, to develop intercultural competences, and increase their self-awareness (Bettez et Lineberry, 2004). As engineering students must be entrepreneurial and market-relevant (Pusser & Marginson, 2013), internationalization is also perceived as a lever for adjustment to the labor market and the attraction of new talents (Hugonnier, 2020). In particular, internship abroad is seen as a path of immersion and adaptation to the industry world (Magtaas

et al., 2020), that provides an experiential learning and a real-world experience where engineering students can develop their knowledge and acquire new skills (Beck & Halim, 2008). These acquisitions must not only enable them to respond to calls for international projects (Amadei, 2004), to develop collective skills necessary to the resolution of complex problems (Charosky et al., 2021; Wulf, 1997), but must also facilitate his or her integration into the professional environment and increase his or her marketability (Pusser & Marginson, 2013).

However, despite widespread agreement among researchers on the positive impact of experience on students' skill acquisition (Bettez et al., 2004; Bori et al., 2007; Hugonnier, 2020; Lohmann, 2004), there has been little assessment of the actual impact of international experiences on students' self-perceived competences and qualifications, particularly for engineering students (Bettez et al., 2004; Bori et al., 2007). For instance, whereas engineering programs are supposed to provide proof that internship abroad of their graduates allows them to respond to global societal problems, the Institute of International Education (IIE) reveals (2004) that on 120 leading US study abroad institutions, 95% of the slightly more than 50% of respondents assessed student satisfaction, but much fewer measure language proficiency (probably the most assessed skill for study abroad students)” and “very few measures career-related outcome” or “intercultural proficiency”. Most of research show contrasted effects of internships abroad. Research conducted at Worcester Polytechnic Institute (Demetry & Vaz, 2017) and another at the University of Michigan College Engineering (Mayhew et al. 2015) do not show any significant gains for students. However, the University System of Georgia notes an enhancing of many affective or attitudinal outcomes such as student’s ethno-relativism, global-mindedness or sense of self-efficacy (Sutton & Rubin, 2004). Another study conducted by the Institute of International Education and the alumni of the Global Engineering Education Exchange (Global  $E^3$ ) noted a significant increase of transversal skills but no effects on the other hand for hard skills (Spodek, Gerhard & Mook, 2003). As this study shows, not all target skills are impacted as the same way. The Erasmus impact study published in 2017 by the European Commission, conducted with 38676 students, reveals a positive effect of internship abroad, on curiosity and sense of self-efficacy (European Commission, 2017). For Jesiek and his colleagues (2012), the variety of these results is due to a difference of methods, samples, but above all a lack of control factors like gender, age, ethnicity and prior international experience.

Recently, Netz (2021, p. 4) made a typology of heterogeneous effects of studying abroad, listing “individual or group-specific effects” (e.g. personality traits, previous international experience, experience with foreign culture, academic ability, likelihood in studying abroad, gender, social origin), “context-specific effects” (e.g. curriculum, working context, country of study/work/living), and “effects of different stays abroad” (e.g. duration and purpose of stay abroad, student’s activity during staying abroad, organisation of stay abroad, host institution and country). Considering “individual or group-specific effects”, some authors showed different effects depending on gender (Cordua & Netz, 2021; Thompson & Jesiek, 2010; Van Mol, 2021). For example, Thomson and Jesiek (2010) noted a significant increase of cross-cultural sensitivity for mechanical engineering female students at Purdue University. Differences are also observed regarding on benefit expectations (Zimmerma & Neyer, 2013), socio demographic features (Cordua & Netz, 2021), or previous international experience (Lörz, Netz, & Quast, 2016). Concerning “context-specific effects”, Kisaalita, Muyanja and Mativo (2022) showed that there is no significant difference between short and long internship abroad in the acquisition of global competences. Perna et al. (2015) showed different effects depending on the design of study programs duration of the internship abroad (Lohman et al., 2011; Lörz, Netz, & Quast, 2016) in internship mobility or in study mobility (Messelink, Van Maele, & Spencer-Oatey, 2015), as well as the importance of interpersonal relations (Gagnon, 2017). The

conditions and mobilizing role (Poupart, 2011; Neculau, 2006) of context (abroad institutions and organizations) especially of teachers (Bikie Bi Nguema et al., 2020), can also explain differences in knowledge and skills improvement. For example, Gozik & Oguro (2020) and Le Callonnec (2021) showed that giving students administrative-academic-organizational support and post-sojourn follow-up reflection, can help students become aware of benefits they have acquired following the internship abroad. The “Learner/supervisor/tutor trio” seems to be essential to fix the mission and promote reflexivity (Rouvrais, Renaud & Saveuze, 2017), and requires from supervisors to “position themselves as potential learners in the internship experiences” (Goldsmith & Trede, 2024).

All of these studies highlight the need to consider the internship abroad as a possibility for students to acquire skills, to become market-relevant and to enhance their employability, but also raise the question of the evaluation of the skills to be assessed.

## **2. EMPLOYABILITY OF ENGINEERING STUDENTS**

Employability is a multi-dimensional construct studied from an individual perspective with a focus on individual dispositions, attitudes and behavior (Qenani, MacDougall, & Sexton, 2014). It can be defined as “an individual’s portfolio of previously acquired knowledge, skills, attitudes, competencies, experiences and other qualifications that underpin their ability to be a reliable source of efficiency, innovation, and productivity to an employer” (Smaldone et al., 2022, p. 673). Employability is studied in a macro perspective including the relationships between labor market-employers-employees (Thijssen, van der Heijden, & Rocco, 2008). The current trend is to consider employability as a person-centered construct (Fugate, Kinicki, & Ashforth, 2004; Monteiro et al., 2022) which focuses on both the opportunities afforded by the work environment and the employee’s ability to identify them and their (pro)active adaptability to the market.

There’s a lack of consensus about the dimensions to consider to characterize employability, and which skill must be measured. Blandin (2012) attempt to define and model what an engineering skill is and its construction. Based on a longitudinal research realized with a promotion of French generalist engineering students, between 2007 and 2010, he concludes that “skills are associated with an activity, to the success of which their implementation contributes; they are characterized by the cognitive resources mobilized (knowledge in various registers, skills, rules to take into account), by a particular context in which they are implemented, as well as by indicators of success (effectiveness, efficiency) in this context”. Skill is also a situated-construct that depends on the context of its realisation. For Wulf (1997), in addition to technical skills specific to his field of specialization, the engineer must also be able to adapt to the constraints of costs, safety and ecology (Wulf, 1997), which induces a global knowledge of socio-economic, political and environmental systems, and technological innovations. Some authors agree on the necessity to distinguish several dimensions to characterize employability. Taylor (2005) and Smaldone et al. (2022) distinguish hard skills and soft skills: hard skills can be defined as practical skills that can be acquired with practice and work experience (Forde & MacKenzie, 2004), and soft skills as “emotions in a manner consistent with particular workplaces and organizations” (Hurrell, Scholarios, & Thompson, 2013, p. 162). But this dual vision is reductive and not so evident to implement (Torres, Flores et Torres, 2020). The proposal of Fugate, Kinicki and Ashforth (2004) currently appears to be the most operational model. They define three dependent-context dimensions to characterize employability: career identity; personal adaptability; social and human capital. First, Career identity deals with roles, occupational and organizational identity, that can be defined as “an assimilation of the

experiences into meaningful or useful structures” (Meijers, 1998, p. 200). With a cognitive-affective nature, it reflects an individual’s identity style (Berzonsky & Adams, 1999), oriented *versus* normative style (Ashford, 2001). It can explain the link between individual dispositions, knowledge, skills or abilities and the capacity to identify career opportunities. For Fugate, Kinicki, and Ashforth (2004, p.20) “by addressing “who I am or want to be” in the work domain, career identities delineate possibilities for the self at work”. Next, Personal adaptability concerns organizational performances (Crant, 2000) and career success (Pulakos et al., 2000). It can be defined by measuring the degree of optimism in the domain work (Stokes & Levin, 1990), the propensity to learn that can be define as “a lasting set of dispositions favorable to the action of learning in all formal or informal situations, in an experiential or didactic way, self-directed or not, intentional or fortuitous” (Carré, 2022, p. 57). It is a notion that refers the concepts of readiness to learn of Bruner (1957) or openness, self-directed learning readiness of Guglielmino & Guglielmino (2006) and the question of the internal locus of control (De Charms, 1968), and self-efficacy of Bandura (1986). Then, Social capital refers to social networks and the manner how information is distributed between people. The potential of the information is determined by the size, the diversity of the network (Seibert, Kraimer & Crant, 2001), the influence of people in this network and it implies reciprocity (Higgins & Kram, 2001). The benefit of social capital is particularly highlighted in workplace research. Human capital relates to all different variables related to career development, like age, education, etc. It is a qualitative dimension of work dimension related to both conceptual and pragmatic knowledge and acquired abilities enabling the productivity to be improved (Schultzs, cited by Levrak, 2016).

Fugate, Kinicki, and Ashforth (2004) propose that this multidimensional construct is causal and not reflective as suggested by Law, Wong and Mobley (1998). That means that career identity, personal adaptability, social and human capital explain employability and that “one’s perceived ability to identify and realize career opportunities is derived from their career identity, personal adaptability, and social and human capital” (Fugate, Kinicki, and Ashforth, 2004, p. 26). Moreover, personal adaptability, career identity and social and human capital exert mutual influence on each other. Lee & Lee (2018) notes this multidimensional and person-centered construct, highlights the importance of self-efficacy, self-awareness and self-confidence to enhance employability, all self-concepts that should question schools and teachers on the necessity to promote the perceived self-perceived employability of students (Qenani, MacDouglas, & Sexton, 2014).

### **3. INTERNSHIP ABROAD AS A DETERMINANT OF SELF-PERCEIVED EMPLOYABILITY**

The concepts of self-efficacy and self-perception were addressed by Bandura (1994). Perceived self-efficacy determines the individual’s belief in his/her ability to perform while setting goals to achieve it. Bandura postulates that it can be influenced by four sources of information: active experience of mastery, vicarious experience based on observation of the success of peers, verbal persuasion of third parties on our capacity to succeed, and our physical and emotional states. For Rothwell and Arnold (2007), self-perceived employability refers student’s perception and beliefs in their capacities to get a job and to become market-relevant after its studies. For Berntson, Sverke & Marklund (2008), self-perceived employability precedes self-efficacy.

Coetzee & Engelbrecht (2020) developed a model of self-perceived employability based on the association between career adaptation concerns, employability attributes, and self-perceived employability. They postulate that career adaptation influences both employability attributes (career self-management, career resilience, sociability and proactivity) and self-perceived employability, itself influenced by employability attributes. Several relevant results,



obtained from a sample (N=404) of knowledge workers employed in various industries in the South African context, show the importance of “developing knowledge workers’ employability attributes” to strengthen their self-perceived employability (2019, p. 1010), the manner in which managers and human resources can influence self-perceived employability. They also showed the changing nature of this construct depending on self-concept, personal career-life needs, and continuous changes in jobs and occupational requirements. Monteiro, Ferreira, & Almeida (2020) conducted a research with 373 students attending the last year of master’s degree programs and observed a mediating role between self-perceived competency and self-perceived employability and question the necessity for students to be supported in the transition from university to the work domain. Another study (Pitan & Muller, 2019) conducted at a south African university (from a 402-student sample), demonstrates a positive strong influence of university reputation on experiential learning activities, which in turn positively influences the self-perceived employability of students. A study (Vetter & Wingenbach, 2019) conducted at the College of Agriculture and Life Sciences (COALS) at Texas A&M University observed perceived employability skill gains (global awareness, flexibility, adaptability, and intercultural skills, such as increased acceptance of diversity) from selected study abroad programs. Ebner, Soucek, & Selenko (2021) observed a positive effect between the positive evaluation of an internship abroad by students and their self-perceived employability.

#### 4. RESEARCH QUESTIONS

All these studies highlight a positive effect of the context on self-perceived employability and invite us to focus on the way in which students are supported before and during their internship abroad. In this paper, we analyze the effect of an internship abroad, that can be defined as a student’s learning experience in a real-life working environment (Tan & Umamoto, 2021), on the self-perceived employability (SPE) among French engineering school student. During their last year of engineering study cycle, students must resume a six-months internship abroad under the supervision of a business tutor and an academic tutor. We measured SPE before and after the internship. We seek to verify if some factors defining personal identity, career identity and human and social capital are affected to the same extent by the internship and if there are emerging groups among the studied sample in terms of homogeneous behavior. Finally, we seek to verify the specific effects of the perceived experience as predictor of SPE positive change. These results contribute to documenting research on the self-perceived employability, particularly in the field of engineering education and inform educators about how to design the international internship and the social support of engineering students during their experience abroad.

We propose to answer the following questions: *How does the international internship affect students’ self-perceived employability (SPE)? (RQ1)*. We study the variation in SPE before and after the internship abroad among a sample of engineering students. We also seek to verify for students’ differences in terms of SPE changes. In other words: *are there any differences between students in terms of variation of SPE? (RQ2)*. To answer this question, we study how SPE variables are distributed across the sample. Finally, we seek to investigate to what extent these potential changes depend on how this experience was perceived by the students. In other words, *to what extent perceived cultural integration, perceived social support and satisfaction during the internship abroad predict change in terms of SPE? (RQ3)*. We considered the effect of personal and interpersonal relations to evaluate how the engineering students perceived cultural and social abroad context affects SPE.

## 5. RESEARCH DESIGN

### 5.1. Context and participants

Students of the CESI Engineering School of Lyon, in the last year of their engineering cycle, are involved in this research. The school prepares them in four specialties: generalist, building and public works, computer science and embedded electrical and electronic systems. The international internship program is compulsory for the final year engineering students. The mission abroad is either proposed to the student by the CESI Engineering School or directly found by the student themselves and can be carried out as part of the research and development activities of the chosen organization. Hence, it is not a specific instructional program or course organized by the School, but experiences conducted independently by students depending on the institution and the host country.

More precisely, the internship abroad is organized as follows: each student is followed up with by a tutor and a pilot from the School. The pilot, who is a member of the department's personnel, oversees the yearly promotion. They monitor administrative compliance: verify the signings of the internship agreement by the School and the host institution, risk-insurances, and that all requirements are met before the departure (even though they are the students' duties, the pilot supervises and validates). The tutor, who is a teacher, monitors each student individually by validating the contents of their internship (engineering level, coherent framework, mission quality). The student must implement and apply their engineering competences in a different cultural context. Once abroad, the student must inform the tutor and the pilot that the mission meets all these requirements. After the mission, there is a debriefing phase during which the student defends a dissertation about their experience.

### 5.2. Procedure and data analysis

One hundred and ten students (8 women and 102 men of the 2019 promotion, out of 240 possible respondents). Participation was done on a voluntary basis and without financial remuneration, which explains the low rates of participation (answer rate of 49.16% at first survey T1 and 60% at second survey T2). The first survey (T1) was administered to the students (N = 118) before the international mobility which lasted six months, and the second survey (T2) was administered after their return (N = 144). The aligned and merged data that will be used involve the students who answered both surveys: N = 110. At T1, we measured self-perceived employability (SPE), which was again measured at T2. Using IBM SPSS 23<sup>®</sup>, we conducted *t*-tests to verify the potential effects of international mobility on SPE and proceeded to a cluster analysis to verify for population homogeneity across target variables, in terms of SPE changes between pre- and post-international internship. Finally, we verified to what extent international experience (characterized using different variables) predicted cluster membership, using logistic regression.

### 5.3. Demographic and organization questions

At T1, we asked questions informing about the characteristics of our sample. *Gender* is the only demographic item. In line with our literature review, the other items seek to inform about the context of internship: *size of the hosting organization* (little, medium or large)<sup>1</sup>; whether the internship will occur in the *research and development (R&D)* department of the organization; the *occupational sector* (based on the CESI Engineering School specializations offer); *how* the student found the internship (thanks to the Engineering School, by their own or their employer).

### 5.4. Self-perceived employability measures

All the measures presented below use a scale of level of agreement from 1- *definitively not agree* to 6- *definitively agree*. The choice of factors retained to measure the three constructs of

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<sup>1</sup> The size of the company is established from French decree n°2008-1354 of December 18, 2008.

personal adaptability, social and human capital and career identity, is based on the theoretical framework presented about self-perceived employability.

### Personal adaptability

- **Cognitive flexibility.** For many authors, personal adaptability is an important dimension of employability (Fugate, Kinicki & Ashforth, 2004; Coetzee, Ferreira & Potgieter, 2015, among others). Griffin & Hesketh (2003) demonstrated that cognitive flexibility, as a personal adaptability trait, could predict career performance. We used three items from Dennis and Vander Wal (2009) Cognitive Flexibility Inventory (CFI), which originally comprises nine items, is described by the authors as related to adaptive thinking. The CFI was chosen as it yields convergent construct validity via its correlations with other measures of cognitive flexibility (Cognitive Flexibility Scale) and coping (Ways of Coping Checklist-Revised). Example of item: *When I find myself in difficult situations, I consider different options before deciding how to behave.*
- **Stress Coping.** From the employability point of view, Fugate, Kinicki and Ashforth (2004) point out the importance of coping when individuals face important changes in their career, including when dealing with stress. We thus adapted the Lazarus and Folkman (1984) *Stress-Coping* questionnaire, including *playful problem-solving* (six items) and *seeking social support* (eight items). Both subscales measure individual adaptiveness in a real-life situation. This instrument was selected as it is one of the most popular models describing stress pathways, emphasizing the person–environment relationship and suggesting that a stress response is highly influenced by individual appraisal processes (Obbarius et al., 2021).

### Social and human capital

- **Professional social capital.** To measure social capital, as a dimension of SPE, we used the *recognition and interactions* dimension from the *Professional social capital* scale constructed and validated in a previous study (Chaker, 2020), which measures professional relationships and recognition of one’s skills from pairs and superiors within their workplace. These items were selected as a valid and reliable instrument measuring social capital in the professional context. The scale comprises five items, such as: *My colleagues ask for my advice on important topics.*

### Career identity

- **Self-efficacy in engineering project management.** For Haasler (2013), employability relates to “internalized control mechanisms through self-discipline and other attributes and attitudes that emphasize the notion of ‘self’”. Hence, we used the French adaptation in the project management context made by Heutte (2011) of the General Self-Efficacy scale (Jerusalem & Schwarzer, 1995) in the context of engineering project management. The scale we used comprises four items, such as: *I feel able to explain to someone what characterizes an engineering project.*
- **Occupational expertise.** Professional and occupational competences constitute a key component of career identity (Boudreau, Boswell, and Judge, 2001; Onstenk & Kessels, 1999). We adapted the six items from the *occupational expertise* dimension from Heijde and Van der Heijden (2006) employability questionnaire based on self-perceived competence, since it has a good reliability index and was validated using a robust methodology. Example of item: *I consider myself competent to engage in in-depth discussions in my field as a specialist.*
- **Marketability.** Marketability is a key component of career identity (Berntson, Sverke & Marklund, 2006). We adapted items from the questionnaires of Rothwell and Arnold



(2007) and Rothwell, Jewell & Hardie (2009) in relation to the perceived external marketability (six items in total), such as: *Anyone with my level of skills and knowledge, and similar job and organizational experience, will be highly sought after by employers.*

### 5.5. International experience measures

**Francophone context.** Opportunities to express oneself in the language of the host country are opportunities to integrate the cultural codes, verbal and non-verbal, of the host country (Hilton, 2007). Hence, we wanted to verify if, by opposition, the students integrated French-speaking communities during their internship abroad, which could have led them to potentially fewer interactions with more local or international groups. We created three items to measure the degree of communication in French during the internship such as: *During my internship, I had the opportunity to speak French.*

**Social integration support.** Social support is how the individual perceives the help of others (Gentry & Kobasa, 1984). It has a beneficial effect on well-being (Kessler, 1992). We used the Wesleyan Intercultural Competence Scale (WICS) developed by Stemler, Imada and Sorkin (2014) based on situational judgement testing, that evaluates the effect of the support context on the international experience of students. Example of item: *I could count on some people to help me in everyday life.*

**Perceived satisfaction.** As there is a positive effect between the positive evaluation of an internship abroad by students and the enhancing of self-perceived employability (Ebner, Soucek, & Selenko 2021), five items were created to measure perceived satisfaction related to the internship abroad. Example of item: *I am very satisfied with my stay abroad.*

**Expectations-reality gap.** As we saw experiential learning activities can positively impact self-perceived employability (Pitan & Muller, 2019), we aimed to measure the self-perceived gap between the expected and the lived international experience. Six items were created. Example of item: *I got the important things I wanted from this corporate assignment abroad.*

We summarize the conceptual framework and our research variables according to the following model (Figure 1):



**FIGURE 1. Synoptic diagram representing the competences framework**

## 6. FINDINGS

### 6.1. Descriptive statistics

#### 6.1.1. Organization variables

Results show that the students were rather sent to large organizations (53%), and to a lesser extent to medium organizations (28.9%) and small organizations (18.1%) (see table 1). Only one third (25%) of internships are in the R&D department of the host organization. The most cited occupation sector is generalist (64.4%), followed by electrical and electronic systems (26.4%), construction industry (8%) and computer science (1.1%).

**TABLE 1. Organizational variables descriptive results at pre-test (T1)**

Organization variables	Frequency	Percentages
Size of host organization		
Small	22	18.1
Medium	34	28.9
Large	62	53
Research & Development		
Yes	29	25
No	89	75
Occupational sector		
Generalist	76	64.4
Construction industry	9	8
Computer science	2	1.1
On-board electrical and electronic systems	31	26.4
Finding of international internship		
On my own	33	28
School help	19	15.9
Employer help	66	56.1

#### 6.1.2. Competences change between T1 and T2

Descriptive results at T1 indicate acceptable to excellent reliability indices for the target competences scales ( $.67 < \alpha < .90$ ). At T2, descriptive results indicate acceptable to very good reliability indices for the target competences scales ( $.70 < \alpha < .85$ ), as well as for the international experience indicators ( $.68 < \alpha < .89$ ) (see Table 2).

**TABLE 2. Descriptive results and reliability analyses at T1 and T2**

	T1 (N = 118)			T2 (N = 144)		
<b>Gender</b>						
M	108			133		
F	10			11		
	M	SD	$\alpha$	M	SD	$\alpha$
<b>Target competences</b>						
Cognitive flexibility	4.82	.76	.77	5.04	.72	.76
Occupational expertise	4.44	.74	.70	4.72	.75	.80
SE in Project Management	4.48	.81	.72	4.87	.73	.78
Marketability	4.60	.86	.83	4.70	.89	.83
Professional social capital	4.05	1.09	.90	4.33	.90	.85
Stress coping – social support	4.10	1.17	.77	4.00	1.06	.74
Stress coping – problem solving	4.42	.94	.81	4.39	.96	.70
<b>International experience</b>						
Francophone context				3.14	1.43	.78
Social integration support				5.07	1.03	.70
Perceived satisfaction				4.96	1.00	.85
Expectations-reality gap				4.82	1.04	.89

Abbreviations used in the table: M = Mean, SD = Standard Deviation,  $\alpha$  = reliability indices, T1 = first survey, and T2 = second survey

## 6.2. Changes in target SPE

To answer our first research question (*RQ1*), we verified the changes for each target skills between pre- and posttest by conducting paired *t*-tests between T1 and T2 (see table 3). Results yield significant increases in: occupational expertise ( $t = 2.87, p < .01$ ), self-efficacy in project management ( $t = 3.50, p < .01$ ), cognitive flexibility ( $t = 2.16, p < .05$ ) and professional social capital ( $t = 2.14, p < .05$ ). However, no effect of the internship abroad on marketability and on the two forms of stress coping were found ( $p > .05$ ). The effect sizes reveal moderate effects for cognitive flexibility ( $d = .34$ ), occupational expertise ( $d = .36$ ) and SE in project management ( $d = .45$ ), and a small effect for professional social capital ( $d = .29$ ) (table 3).

Furthermore, we notice for all measures that standard deviations (SD) are rather large compared to the means (M). This shows a great discrepancy among the results, which leads us to look for potential homogeneous sub-samples, providing evidence of specific behaviors among the students.

**TABLE 3. Deltas between T2 and T1 of target skills with *t* tests**

$\Delta T2 - T1$ (N = 110)	M	SD	<i>t</i>	Cohen's <i>d</i>
Cognitive flexibility	.21	1.05	2.16*	.34
Occupational expertise	.27	1.00	2.87**	.36
SE in Project Management	.38	1.15	3.50**	.45
Marketability	.10	1.24	.84	
Professional social capital	.28	1.36	2.14*	.29
Stress coping – social support	-.02	1.35	-.21	
Stress coping – problem solving	-.09	1.53	-.66	

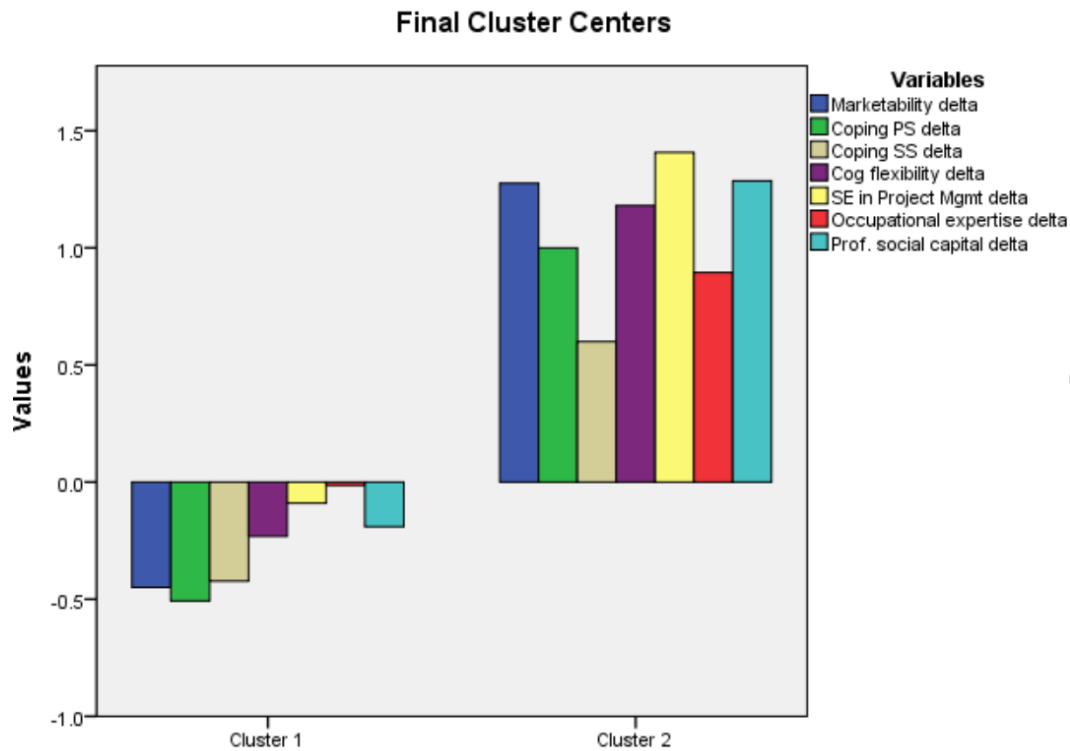
Abbreviations used in the table: M = Mean, SD = Standard Deviation, *t* = test de Student, Cohen's *d*= effect size. (\*  $p < .05$ ; \*\*  $p < .01$ )

### 6.3. Cluster analysis

The obtained results involve the whole sample. As not all target skills were observed to have significantly and positively changed between pre- and posttest, we look to verify for potential groups of students expressing homogeneous changes in target skills, across all variables, to answer *RQ2*.

#### 6.3.1. *K*-means clustering

To verify for potential emerging homogeneous groups among our sample across target competences and the number of these potential groups, we ran a *K*-means clustering fixing two target groups. The *K*-mean method distributes the observations across a fixed *K* number of groups (which can be seen as a supervised method), respecting variances homogeneity. The results revealed the same number of groups as the two-steps clustering method, with a slightly different distribution of students across groups. Cluster 1 ( $n = 75$ ) indicates negative change in target competences, and Cluster 2 ( $n = 35$ ) indicates positive changes for all constructs (see Figure 2).



**FIGURE 2. Results of the *K*-means clustering analysis**

The *F* test for each variable makes it possible to measure the ratio between the intergroup variance and the total variance (see Table 4). We found that the distribution of students within the two clusters for all target skills are significant ( $.014 < p < .001$ ).

**TABLE 4. Ratio between the intergroup variance and the total variance for each target skills**

	<i>F</i>
Cognitive flexibility $\Delta$	68.76**
Occupational expertise $\Delta$	23.51**
SE in Project Management $\Delta$	62.73**
Marketability $\Delta$	78.08**
Professional social capital $\Delta$	36.92**
Stress coping – social support $\Delta$	11.69*
Stress coping – problem solving $\Delta$	39.74**

\*  $p < .05$ ; \*\*  $p < .01$

### 6.3.2. Cluster membership and demographic and previous internship abroad variables

Using the clusters obtained from the *K*-means method, we found no significant interactions between cluster membership and all demographic variables (gender, organization size, R&D, occupational sector, how the student found the internship), using  $\chi^2$  tests ( $p > .05$ ).

## 6.4. Predicting SPE positive change

To answer our third research question (RQ3), we conducted a logistic regression to measure the weight of each variable of the international experience, towards SPE changes. The result of the binomial logistic regression (since there are two clusters) with the *Wald* forward stepwise



method indicates that there is only one factor significantly predicting cluster membership, among the international experience evaluation factors. The Nagelkerke  $R^2$  of the model is 13.90%. The only variable kept in the equation model is *social integration support*:  $\beta = -.752$ ; Standard Error = .286; Wald = 6.911;  $p = .009$ ; Odds Ratio = .472. In other words, each time the *social integration support* variable increases by 1, the probability of belonging to Cluster 2 ( $\Delta+$ ) rather than Cluster 1 ( $\Delta-$ ) is increased by 47.20%.

## 7. DISCUSSION

### 7.1. General effects on self-perceived employability

The first finding of our study is that the international internship of the cohort of engineering students we studied does not affect all SPE variables to the same extent. Indeed, cognitive flexibility, professional expertise, self-efficacy in engineering project management and professional social capital display positive change between pre- and post-abroad professional experience. Whereas marketability and stress coping (both social support and problem solving) do not display significant change. In other words, employability dimensions (i.e., personal adaptability – cognitive flexibility, stress coping; and career identity – occupational expertise, SE in project management and marketability) display heterogeneous variation. It is interesting to note that marketability, as a construct reflecting external employability (Rothwell & Arnold, 2007; Rothwell, Jewell & Hardie, 2009), behaves differently from the other constructs, that rather reflect internal employability (self-concepts). As for stress coping, it is rather a more general psycho-social construct that is linked to internal resources, when the other constructs (cognitive flexibility, professional expertise, self-efficacy in engineering project management and professional social capital) are linked to internal self-perceived employability factors, or a competence-based approach of employability (Heijde & Van Der Heijden, 2006). For instance, we measure self-efficacy in project management, rather than general self-efficacy. Globally, these results show that the internships abroad were more efficient for a minority of students (as seen in 5.5), who were able to develop psycho-social constructs related to internal self-perceived employability. These results confirm a meta-analysis carried out by Spodek, Gerhard and Mook (2003), based on data from the Institute of International Education for the National Science Foundation with alumni of the Global Engineering Education Exchange (Global E3) program, and who found that only 70% of students declared having acquired transversal skills, 60% technical skills and few students felt they were more marketable after the exchange program.

Our positive change results in SPE confirm those of a previous study that observed an increase in professional expertise and self-efficacy in project management, which are all “instrumental cross-curricular competences” (Rico-Garcia & Fielden Burns, 2019) acquired most of time beyond three- or four-months internship abroad (Lohmann, Rollins, & Hoey, 2006; Rodrigues, 2013). Nguyen, Jafferries & Rojas (2018) showed that general self-efficacy and cultural intelligence were higher for 79 U.S. American undergraduate students who studied in a 5-week program in Puerto Rico and the U.S. Virgin Islands, after studying abroad than before studying abroad. The observed consequences of six-months internship abroad are in line with those studies. This international experience also seems to impact positively, but to a lesser extent, cognitive flexibility and professional social capital, which are also “interpersonal cross-curricular competences” (Rico-Garcia & Fielden Burns, 2019). These two skills are most of the time associated with employability (Ferreira & Potgieter, 2015), even though we did not find for the whole sample an increase of marketability, which is a component of external self-perceived employability (Rothwell and Arnold, 2007).

Another possible explanation could focus on the situated experience of the students. To better understand what caused a positive change among the variables mentioned above, it would

be interesting to delve deeper into the investigation to better characterize their experiences during the international professional experience. For example, it involves better understanding the professional support from peers and superiors, which can explain students' commitment (Wan et al., 2013). More generally, it involves investigating their level of satisfaction during this experience, which could have benefited their motivation and professional engagement, potentially contributing to the development of skills (Bhattacharya & Neelam, 2018). Indeed, the entire internship process can be described: from the choice of the company and host country to the quality of the reception within the company.

The second finding of our study is that, whereas most of SPE variables display significant positive change between pre- and post-international internship, the clustering method showed that this positive change only concerns a minority of students ( $n = 35$ ). Indeed, most of the students ( $n = 75$ ) displayed significant negative change in terms of SPE variables. For Netz (2021, p.1054), “the value of study abroad experience may largely depend on the working tasks that graduates complete on a daily basis”: hence, contextual factors can explain our results. It is possible that students did not feel that they have acquired skills that are valuable to future employers, in the case that they were entrusted to resume tasks not sufficiently transformative. Unfortunately, the researchers currently do not have individual details regarding the title of the tasks for each student, making it impossible to verify this link. We can also wonder about the monitoring of the engineering student by his mentor during and after the internship. As many authors have noted (Rouvrais, Renaud, & Saveuze, 2017; Popescu, 2023), the mentor's reflexive feedback allows us to become aware of the skills acquired and those in process of being acquired.

## **7.2. Effects of demographic and contextual factors**

The performed clustering analyses revealed that only 30 to 40% of students report positive effects of the internship abroad. We did not observe any significant differences in skill changes depending on the gender variable, contrary to previous research (Jesiek, Shen, & Haller, 2012; Cordua & Netz, 2021). The fact that there are only ten women for a hundred men declared in our research certainly explain this result. We also verified for size of organization effect, being part of a research and development center effect, as well as occupational sector effect on the acquisition of the target skills. No significative differences were found.

## **7.3. The role of social integration support**

We conducted an analysis to measure the weight of each variable of the international experience in target skills acquisition. Only *social integration support* significantly predicts the probability of belonging to Cluster 2 ( $\Delta+$ ) rather than Cluster 1 ( $\Delta-$ ). In other words, when students perceive social integration support during their international experience, it helps them thrive towards SPE enhancement. This result can be interpreted by the mobilizing role (Neculau, 2006) of both the business tutor and the academic tutor supervising the engineering student during the six-months internship abroad. It can also be due to student support including the administrative and academic international internship preparation phase, organizational support in the host country or post-internship follow-up reflection (Gozik & Oguro, 2020; Le Callonnec 2021). It highlights the importance of interpersonal relations (Gagnon, 2017) and especially the role of tutors who can facilitate the integration of learners in the host country (Bikie Bi Nguema et al., 2020). This result can help understand the discrepancy between the number of students in Clusters 1 and 2: it appears that Cluster 2 students ( $N = 35$ ) benefited more from social support than students of Cluster 1 ( $N = 75$ ).

## **8. CONCLUSION**

### **8.1. The main results of the study**

This article presents the results of a study on the impact of the international experience on the evolution of self-perceived employability among French engineering students. We analyzed pretest and posttest results of a survey including the responses 110 CESI students after data alignment. These findings provide some insights into how the internship abroad affects the self-assessment of SPE and how sending institutions can address identified issues.

First, we observed that the internship abroad does not affect all SPE variables and dimensions in the same way. We recommend that future studies about internationalizing in higher education explore the notion of time and context to investigate its role in the changes of self-perceived psychological constructs such as employability. It would also be relevant to study in more detail the effect of the tasks assigned to students during their internship.

Second, we noted that students were not impacted in the same way and that two homogenous unbalanced groups appeared in terms of self-perceived employability change (a positive minority group and a negative majority group).

Third, we did not observe any effect on SPE change from organizational variables, *i.e.*, size of the organization, mission in an R&D center. It seems relevant for future research, to further investigate contextual factors as well as the duration of the internship.

Fourth, as we intended to measure social support within the frame of social integration, we measured social integration support. Social support can be defined in terms of “actions of others that are either helpful or intended to be helpful” (Deelstra et al., 2003, p. 324). As such, social support can be a significant and decisive factor during students’ internships, as it can positively or negatively affect hospitality internship satisfaction (D’Abate et al., 2009; McHugh, 2017). We observed that, among different contextual factors, only social integration support predicts positive change in SPE for engineering students. It would be interesting to study the different forms of social support to evaluate the effect of each of them. Furthermore, our results shed light on the importance of social support, stemming from both the host organization and the educational team at home. It appears that this social support was only effective for a minority of students: educational institutions, in particular engineering schools, must then address that dimension as a fundamental factor that can affect the efficacy of the internship abroad.

### **8.2. Limitations of the study**

Nevertheless, our results lead us to formulate several limitations. First, the size of our sample does not allow the generalization of our results and may explain the lack of significance of certain variables (e.g. gender). Second, the absence of qualitative data (e.g. interviews with students) prevent a finer interpretation of the differences observed between the two clusters.

However, it would be interesting to supplement the results of this research with a study aimed at better understanding the students’ experiences during their internship abroad. This could be achieved through qualitative methods designed to describe their satisfaction, the challenges they faced, the quality and frequency of in-situ supervision, as well as academic supervision. A more situated perspective would allow for a more nuanced interpretation of the data. For example, including qualitative questions in the survey related to the students’ lived experiences during their internship abroad would allow for a better understanding of the

relatively low rate of positive improvement in the target skills in terms of perceived employability. Specifying the characteristics of the context, i.e., the industrial context, the type of project conducted (applicative *versus* research), the diversity of colleagues, the students they collaborated with, etc., would establish a reference base that could then be used to compare results obtained in other contexts. More specifically, in light of our results, it also involves qualitatively understanding the specifics of the social support that the students were able to benefit from in the host country.

More sustained support with the implementation of on-site activities (Netz, 2021) as well as reflexive feedback after the internship (Le Callonnec, 2021; Goldsmith & Trede, 2024; Popescu, 2023; Rouvrais, Renaud & Saveuze, 2017), could raise awareness that a certain number of skills were acquired during the internship and thus promote SPE. Choosing the type and scope of the project during the internship could also present advantages to raise self-efficacy, performance (Pandey & Azeem, 2023) and then SPE. Future research will have to take into consideration and focus on the effects of the different forms of social support during the internship abroad. As research perspective, we propose to compare the expectations before the international mobility, with their attainment post-mobility, to assess the efficiency of international experience on cross-cultural and cross-curricular competences among higher education students, and to verify to what extent they are related to the development of self-perceived employability.

#### **ACKNOWLEDGEMENT**

This work is part of "The Contribution of Internship Abroad for CESI Students" project financed by the CESI Engineering School. We would like to thank CESI school staff and the students who participated in this study.

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