Human interaction skills and employability at information technology internships

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Abstract

To implement internships with undergraduate students is a pedagogical option with some good results perceived by academic staff, employers, and among graduates. The Human Interaction Skills development as well as the attractiveness of such experiences for higher education students are topics assumed as core in the conception and management of the activities implemented in the undergraduate courses offered at the last three decades in computer science degree and in information systems technologies degree at one Portuguese private university. The objectives of this paper are to gather evidence of the Human Interaction Skills explained and valued at Information Technology Internships and to evaluate the importance and the relevance of these experiences in promoting employability after the Information Technology Internships. Data collection was based on the application of questionnaire to trainee supervisors and to students who have completed Information Technology Internships in the last decade at one Portuguese private university. The trainee supervisor, responsible for monitoring the student`s performance at Information Technology Internships, evaluates the following Human Interaction Skills: Motivation and interest in the activities developed, interpersonal relationship, cooperation in company activities, assiduity, ease of knowledge apprehension, compliance with norms, insertion in the work environment, productivity, initiative, ability to take responsibility, creativity in proposing solutions, and self-confidence. The results show that in the concluding phase of these undergraduate courses students have positive levels of development of Human Interaction Skills and that these students, once they finish their degree, initiate remunerated work functions, mainly by invitation of the institutions in which they perform Information Technology Internships. Findings provided strong evidence of Human Interaction Skills advantages contribute to widen the analysis of its effectiveness in terms of future research and actions in regard to the transition from Higher Education pathways to the Labour Market.

Keywords: Human Interaction Skills; Employability; Internships; Information Technology; Higher Education

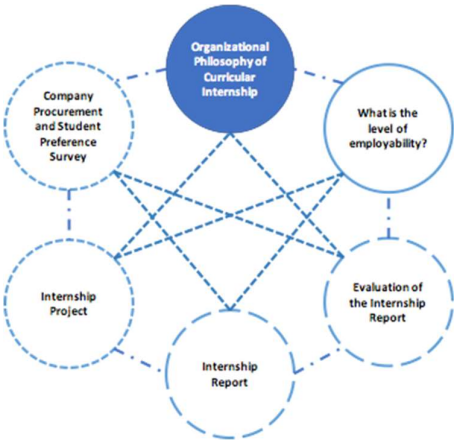
Introduction

To implement internships with undergraduate students is a pedagogical option with some good results perceived by academic staff, employers, and among graduates. In recent years, the authors of social cognitive theory of career have been explaining the influence of academic experiences at Higher Education Institutions in various aspects of vocational development emphasizing that academic experiences are a source of relevant information in the process of constructing meaning the role of modeling, evaluation, performance and merit, contributing to the development of higher education students vocational interests and values (Costa-Lobo, 2011; Costa-Lobo and Ferreira, 2012; Magalhães et al., 2017). The transition to the labour market is seen as an component of vocational development which is categorized by a long process in time, which starts before the conclusion of graduation courses and that endures even subsequently the beginning of the labour activity (Lent, Taveira, &

Costa-Lobo, 2012; Magalhães, 2017). The research carried out over the last eighty years on the issue of "school-labour market transition" has been emphasizing the importance of looking at the preparation of higher education for work in a developmental perspective (Brennan & Little, 2006; Fugate & Kinicki, 2008; Weible, 2009; Yorke & Knight, 2007; Zhao & Liden, 2011). There are few learning experiences in a work context during a course degree, which makes it difficult to understand how the labour market works, what is expected of young people in a professional context, what skills they need to develop, as well as learn what skills are necessary and valued in their area of expertise (Brennan & Little, 2006; Daniels & Brooker, 2014; Fugate & Kinicki, 2008; Jesus-Silva, Medeiros, Caramelo-Gomes, & Costa-Lobo, 2016; Weible, 2009). These aspects are related to the difficulties in the transition to the labour market acknowledged both by employers and by young people - the struggle in adjusting to the hierarchical structure of companies, in understanding what is their role within and demystifying their expectations on tasks they feel able to do and/or hoping to make and those they really are assigned to do (Magalhães et al., 2017; Taveira et al., 2010, Weible, 2009; Yorke & Knight, 2007; Zhao & Liden, 2011). According to Vieira and Marques (2014) the skills chosen by employers as the most important for professional purposes in the first five years are: analysis and problem solving, creativity and innovation, adaptability and flexibility, planning and organization, motivation for excellence. Offer opportunities for the simulation and experimentation of roles designed to prepare students to solve everyday problems in employment, training in career management techniques and role-testing are types of intervention strategies recommended in preparing graduates for the transition to the labour market (Magalhães et al., 2017). Learning approaches should include learning by doing, learning by experimenting, learning by interacting, learning from mistakes in a group context, should promote contribution, problem solving and decision-making, it should also promote teamwork between individuals with divergent backgrounds, because the diversity of paths can lead to a larger collection of competences and joint decision-making among actors with complementary competences (Costa-Lobo, 2011).

This paper describes activities implemented at one Portuguese private university, Portucalense University (UPT). UPT is a private institution of higher education, certified by ISO 9001, recognized by the Portuguese Government and by the Portuguese Agency for the Evaluation and Accreditation of Higher Education, located in the city of Porto, in the north of Portugal. The organizational philosophy that supports Information technology internships at Portucalense University is presented at figure 1.

Figure 1. Information technology internships at Portucalense University: Organizational Philosophy (adapted from Magalhães et al., 2017)



Information Technology Internships at Portucalense University are understood in a learning environment systematized in table 1.

Table 1 – Information technology internships at Portucalense University: Characterization of the learning environment (adapted from Magalhães et al., 2017)

Steps	Task	Procedure(s)	Participants
1	Company Procurement and Student Preference Survey	Short list of organizations segmented by area, location and type of internship. Identification of the organizations that correspond to the area, place and typology of preference for the curricular internship. Management of the contacts with the welcoming companies (contacts with the partners and reception of the requests) Internship regulations are sent to the organization.	Curricular internship student (AEC) Internship Coordinating Council (CCE) Welcoming trainees Organization (LAO)
2	Organizational Philosophy of Curricular Internship	Student CV is sent to the organizations to plan an interview and select the student. Appointment of the curricular internship advisor and supervisor, after approval of the student CV by the organization. Assignment of the project to the student and definition of the respective planning (gantt chart). At the first internship meeting, the protocol will be presented and the objectives of the internship will be explained.	Curricular internship advisor (OEC) Curricular internship student (AEC) Curricular internship supervisor (SEC) Direction of the Department of Economics, Management and Informatics Internship Coordinating Council, UPT (CCE) Welcoming trainees Organization (LAO)
3	Internship Project	Signing of the internship protocol between the organization and the UPT. Development of the curricular internship project under the OEC orientation (practical implementation of the project) and supervision by the SEC (theoretical framework of the project). Note whether there are deviations in the project from the objectives and tasks carried out in relation to the planned. Realign the project, if necessary, taking into account the organization's initial objectives and expectations.	Core of internship: Curricular internship advisor (OEC) Curricular internship student (AEC) Curricular internship supervisor (SEC)
4	Internship Report	CCE evaluates and approves the report. OEC ensures that the writing of the internship report fulfils the objectives and initial expectations of the OAE organization. SEC guarantees that the writing of the internship report complies with the guidelines pre-defined by the Internship Coordinating Council of UPT (CCE).	Curricular internship advisor (OEC) Curricular internship student (AEC) Curricular internship supervisor (SEC) Internship Coordinating Council (CCE)
5	Evaluation of the Internship Report	ECC critically evaluates the report proposing suggestions for continuous improvement and good practices of the curricular trainee projects to the OEC. OEC assigns a qualitative evaluation on a likert scale of 5 points, according to 12 evaluation and performance criteria. SEC and CCE quantitatively evaluate the student's report and oral test from 0 to 20 values. Student submits the report to the CCE and requests the marking of the oral defense test made up of 3 elements (SEC, OEC and CCE).	Curricular internship advisor (OEC) Curricular internship student (AEC) Curricular internship supervisor (SEC) Internship Coordinating Council (CCE)
6	Conclusion of work contract with the trainee student	Student demonstrated throughout the curricular internship project to have certain skills, abilities and knowledge of the labour market interest that are important and attractive to the company.	Curricular internship advisor (OEC) Curricular internship student (AEC)

This learning environment characterized by the following properties: Participatory and Problem-solving oriented. Information Technology Internships at Portucalense University apply a student centered approach

where they are actively engaged in the learning process, using learning-by-doing and experience-based approaches. The Human Interaction Skills development as well as the attractiveness of such experiences for higher education students are topics assumed as core in the conception and management of the activities implemented in the undergraduate courses offered at the last three decades in computer science degree and in information systems technologies degree at UPT.

The objectives of this paper are to gather evidence of the Human Interaction Skills explained and valued at Information Technology Internships and to evaluate the importance and the relevance of these experiences in promoting employability after the Information Technology Internships.

Method

Data collection was based on the application of questionnaire to trainee supervisors and to students who have completed Information Technology Internships in the last decade at Portucalense University. The data presented and discussed for this study are based on a sample of 60 students from IT courses referring to 9 school years (2006/07 to 2015/16). This sample is predominantly composed of male students (83.3%), a pattern that is constant throughout the school years studied. The trainee supervisor, responsible for monitoring the student`s performance at Information Technology Internships, evaluates the following Human Interaction Skills: Motivation and interest in the activities developed, interpersonal relationship, cooperation in company activities, assiduity, ease of knowledge apprehension, compliance with norms, insertion in the work environment, productivity, initiative, ability to take responsibility, creativity in proposing solutions, and self-confidence.

Statistical analyzes were performed using IBM SPSS software, v.22. Pearson's correlation coefficient was used to study the relationship between the assessment attributed by the curriculum internship advisor and the final grade obtained by the student. Regarding the students' performance in the curricular stage carried out in the company, the evaluations attributed by the company advisor regarding the cognitive skills, business skills and human interaction skills (questions Q1 to Q12) were analyzed, separately by sex. To evaluate the validity of the use of the Exploratory Factorial Analysis (EFA) the KMO criterion (Kaiser-Meyer-Olkin measure of sampling adequacy) was used with the criteria of classification defined by Marôco (2014a,b). Having observed a KMO = 0.803, EFA was used because this value indicates that the use of this factorial model is adequate; more, the Bartlett's test of sphericity has associated a level of significance of 0.000 that led to the rejection of the hypothesis that the correlation matrix is an identity matrix, reinforcing the existence, already verified, of correlation between the variables. If this were not the case, the use of this factorial model would be reconsidered (Pestana and Gageiro, 2008). In order to verify if these variables are strongly associated with each other independently of the student´s sex, and given their nature (ordinal qualitative variables) was used Spearman's correlation coeficient. The relational structure of the 12 variables relating to the evaluation of curricular internship was evaluated by EFA based on correlation matrix, with extraction of the factors by Principal Component Analysis with orthogonal Quartimax rotation. The application of EFA allowed to retain two common factors that explained approximately 66% of the total variance. Finally, with the objective of grouping the variables into homogeneous groups and reinforcing the conclusions obtained by EFA, was used Hierarchical Cluster Analysis (exploratory multivariate data analysis).

Findings

The information was monetized concerning year in which the trainee student completed the 1st cycle of studies at Portucalense University, sex, bachelor's degree course attended (Informatics, Management Informatics, Informatics-software branch and Informatics-Information Systems branch), degree´s final classification, and concerning internship final classification (these last two classifications were measured on a scale between 0 and 20 values). Each student indicated if was employed at the time of graduation and, if so, if was employed at the

place where he / she performed the curricular internship. In addition to these data, information was collected on a set of 12 questions (Q1 to Q12) concerning the quantitative evaluation carried out by the curricular internship advisor based on the classification of a five-point Likert scale (1- poor, to 5-high), being the questions corresponding to components of the following skills: motivation and interest in the activities developed (Q1), interpersonal relationship (Q2), cooperation in company activities (Q3), assiduity (Q4), ease of knowledge apprehension (Q5) , compliance with norms (Q6), insertion in the work environment (Q7), productivity (Q8), initiative (Q9), ability to take responsibilities (Q10), creativity in proposing solutions (Q11) and self-confidence (Q12).

Pearson's correlation coefficient was used to study the relationship between the assessment attributed to the curriculum internship advisor and the final grade, and a moderate positive correlation ($r = 0.47$) was found to be statistically significant at 1% (rejects the null hypothesis of the correlation is 0).

It can be concluded that the better is the student's academic performance (measured by their final grade), the better is their performance in the stage (as measured by the curricular stage grade) and the average final grade of these students is approximately 12,5 values (*SD*= 0.96), with a mean score of 15.4 (*SD* = 1.25), which indicates that students are well prepared while their curricular training is in progress. Hence, the high employability rate at the end of the curricular traineeship (77.8%) and the high percentage (57.1%) of these undergraduate degrees *alumni* who work at the company where they completed the internship are not surprising. These classifications were also analyzed separately by sex and it was found that there were no significant differences.

Regarding the performance of students in the curricular stage carried out in the company, the assessments attributed by the company advisor regarding cognitive skills, business skills and human interaction skills (Q1 to Q12) are presented in Table 1. This study was conducted separately by sex (see Table 2). It was found that for both sexes all the evaluations present an average score of over 4 (between good and very good), except for Q8 (productivity) and for Q9 (Initiative) for the female sex (being *Mean* = 4.8 in females, and being *Mean* = 4.4 in males). It should be noted that the average score obtained for male students is higher in all questions than the scores obtained for female students, except for "assiduity" (Q4) where the trend reverses (m = 4.8 in the Females vs m = 4.4 in males). These high ratings reinforce and explain the high classifications obtained in the curricular stage in detriment of the markedly lower scores in the final grade of the degree.

Table 2 – Descriptive statistics for questions Q1 to Q12

	Gender			
	Male		Female	
	Mean	Std. Deviation	Mean	Std. Deviation
Q1. Motivation and interest in the activities developed (Mean=4,48)	4,52	,646	4,30	,675
Q2. Interpersonal relationship (Mean=4,37)	4,40	,782	4,20	,632
Q3. Cooperation in the activities of the company (Mean=4,20)	4,24	1,001	4,00	,667
Q4. Assiduity (Mean=4,48)	4,42	,928	4,80	,422
Q5. Ease of knowledge apprehension (Mean=4,25)	4,28	,948	4,10	,568
Q6. Compliance with norms (Mean=4,63)	4,68	,551	4,40	,699
Q7. Insertion into the work environment (Mean=4,35)	4,36	1,005	4,30	,823
Q8. Productivity (Mean=4,25)	4,33	,718	3,90	,316
Q9. Initiative (Mean=4,20)	4,28	,834	3,80	,789
Q10. Ability to take on responsibilities (Mean=4,28)	4,28	,784	4,30	,949
Q11. Creativity in proposing solutions (Mean=4,10)	4,12	,824	4,00	,471
Q12. Self-confidence (Mean=4,12)	4,13	,789	4,10	,738

To verify if these variables are strongly associated with each other, regardless of the gender of the student, and given their nature (ordinal qualitative variables) Spearman's correlation coeficient was used. It should be noted that the correlations found are positive and globally high, namely between interpersonal relationship (Q2) and cooperation in company activities (Q3) (rs = 0.642), between productivity (Q8) and creativity in proposing solutions (Q11) rs = 0.705) and between creativity in proposing solutions (Q11) and self-confidence (Q12) (rs = 0.648).

To evaluate the validity of the use of the Exploratory Factorial Analysis (EFA) was applied the KMO criterion (Kaiser-Meyer-Olkin measure of sampling adequacy) with the criteria of classification defined in Maroco, 2014. Having observed a KMO = 0,803 the EFA was useful, because this value indicates that the use of this factorial model is adequate. More, the Bartlett's test of sphericity has associated a level of significance of 0.000 that led to the rejection of the hypothesis that the correlation matrix is an identity matrix, reinforcing the existence, already verified, of correlation between the variables.

Based on these results, the option was based on a multivariate analysis with the aim of identifying which skills contribute most to the curricular evaluation of internship advisor, and how these variables are associated with each other. A relational structure of the 12 variables relating to questions regarding the evaluation carried out by curricular internship advisor was assessed by EFA, based on correlation matrix, with extraction of the factors by Principal Component Analysis with orthogonal Quartimax rotation Revealed as the most appropriate), which allowed for an easier and more evident interpretation of the factorial structure. The finding of the factors potentiated to identify structural relations among the variables, structural relations that would otherwise go unnoticed in the set of the original variables. The application of EFA allowed to retain two common factors that explained approximately 66% of the total variance. So, on Table 3 are summarized the factorial weights of each variable in their factors and their eigenvalues.

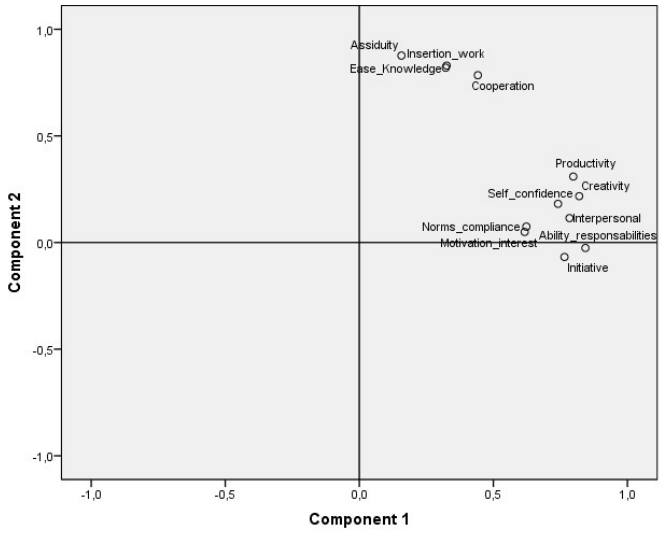
Table 3- Exploratory factorial analysis results

	Components	
	1	2
Q1- Motivation and interest in the activities developed	,617	,050
Q2- Interpersonal relationship	**,784**	,115
Q3- Cooperation in the activities of the company	,442	**,784**
Q4- Assiduity	,157	**,877**
Q5- Ease of knowledge apprehension	,322	**,820**
Q6- Compliance with norms	,623	,075
Q7- Insertion into the work environment	,326	**,830**
Q8- Productivity	**,798**	,309
Q9- Initiative	**,765**	-,068
Q10- Ability to take on responsibilities	**,843**	-,026
Q11- Creativity in proposing solutions	**,820**	,217
Q12- Self-confidence	**,741**	,181
Eigenvalues	5,912	2,004

The first factor (component 1) shows high factorial weights on the variables "Interpersonal relationship" (Q2), "Productivity" (Q8), "Initiative" (Q9), "Ability to take on responsibilities" Proposing solutions "(Q11) and" Self-confidence "(Q12). The second factor (component 2) shows high factorial weights on the variables "Cooperation in the activities of the company" (Q3), "Assiduity" (Q4), "Ease of knowledge apprehension" "(Q7). Figure 1 shows Component plot in rotated space, with map of factorial weights obtained display.

It is emphasized that, in relation to the 1st factor, factor defined by the variables Q2 and Q8 to Q12, all of them have positive weights which justifies their positioning on the same side of the axis, allowing to conclude that, the greater the student's creativity in the proposal of Solutions, the greater the productivity, the initiative, the self-confidence, the ability to take on higher responsibilities is the quality of the interpersonal relationship. As for the 2nd factor, a factor defined by variables Q3 to Q5 and Q7, the high weights allow us to conclude that the more easily the student is able to apprehend knowledge, the better the student is inserted in the work environment, being more cooperative in company activities and being more assiduous.

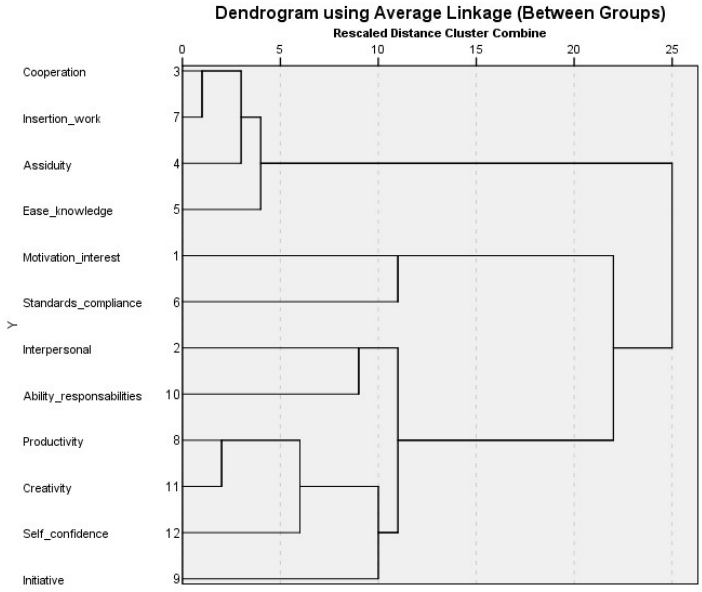
Figure 2. Component plot in rotated space



Looking at Figure 2, the 1st factor (component 1) defines human relations skills, and explains 49.3% of total variance, and the 2nd factor (component 2) defines organizational skills and competences, and explains 16.7% of total variance. Finally, with the objective of grouping the variables into homogeneous groups and reinforcing the conclusions obtained by EFA, was used Hierarchical Cluster Analysis (exploratory multivariate data analysis).

The dendogram obtained (see Fig. 3) suggests that there are two distinct clusters of variables: the clusters formed by the variables Q3, Q4, Q5, Q7 and the other formed by the remaining variables Q1, Q2, Q6, Q8, Q9, Q10, Q11, Q12.

Figure 3- Dendogram for questions Q1 to Q12



It is interesting to note that this clustering in two clusters justifies the retention of two factors in EFA.
As for the first cluster, the most similar variables are Q3 (cooperation in company activities) and Q7 (insertion in the work environment), which reveals that the better the student enters the work environment, the more he participates in the company's activities. However, for the last cluster, the division between the variables (Q1, Q6) and the remaining ones (Q2, Q8, Q9, Q10, Q11, Q12) seems clear. In this last cluster, the closest variables are Q8 (productivity) and Q11 (creativity in proposing solutions), which reveals that the more creative the students are in proposing solutions, the more productive they are. It should be noted that these conclusions are similar to those obtained in the EFA, with respect to the two retained factors.

Results, Conclusions and Recommendations

These students, once they finish their degree, initiate remunerated work functions, mainly by invitation of the institutions in which they perform Information Technology Internships. The greater these students are in proposing solutions, the greater will be their productivity, initiative, self-confidence, as well as ability to take responsibility and good interpersonal relationship, and the more easily the student is able to apprehend knowledge, the better is inserted in the work environment, thus being more cooperative in the company's activities, and consequently more assiduous.

The results show that these undergraduate courses promote the development of Human Interaction Skills, and in this study human relations skills explains 49.3% of total variance, and organizational skills and competences explains 16.7% of total variance. Through these results, in the curricular units attended prior to the beginning of the internship, and during the supervision of the internship practices, training strategies in the fields of human relations skills and organizational skills and competences are of interest.

These are undergraduate courses predominantly attended by boys, while performances (in both sexes) are equivalent. It is noteworthy that girls, compared to boys, are more assiduous, less productive and have less initiative. In particular, it is mainly significant to involve boys in the training and valuation of attendance, signaling with the girls, at formative contexts, both learner and non-learner contexts, behavioral options that increase the levels of productivity and initiative. The average grade in the internship is, higher than the average final grade of all the activities of the degree, which shows the good performance in the companies by the students as well as the recognition and appreciation of the trainees' competences by them. In the classifications issued by trainee supervisors, there are high scores (level 4 and level 5, in the scale of 1 to 5) for all 12 questions that assess students' competences in companies.

Findings provided strong evidence of Human Interaction Skills advantages contribute to widen the analysis of its effectiveness in terms of future research and actions in regard to the transition from Higher Education pathways to the Labor Market.

This article, following the work of Magalhães et al. (2017) presents information that reinforces that it is important to consider the following suggestions and intervention strategies to be implemented with higher education students: to improve communication between teachers and students in order to build more and better supports and academic resources; create psychoeducational interventions to boost academic self-efficacy and outcome expectations; psychological counseling centered in the training of relations skills and in the training of organizational skills and competences; increase the level of practical experiences provided to young people during their academic career (e.g. job shadowing programs); help to identify the strengths and weaknesses of each individual in order to implement skill development techniques directed towards the real and personal needs of young people; Tthe creation of programs with the purpose of mentoring, coaching and talent development, and personal and social skills supports within and outside the education system.

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