POLITECNICO DI TORINO
Repository ISTITUZIONALE

The influence of internship on student's academic performance in industrial and management engineering program in Italy

Original
The influence of internship on student's academic performance in industrial and management engineering program in Italy / Caviggioli, F.. - In: EDUCATION & TRAINING. - ISSN 0040-0912. - (2024). [10.1108/et-11-2022-0437]

Availability:
This version is available at: 11583/2988641 since: 2024-06-12T09:50:01Z

Publisher:
EMERALD GROUP PUBLISHING LTD

Published
DOI:10.1108/et-11-2022-0437

Terms of use:

This article is made available under terms and conditions as specified in the corresponding bibliographic description in the repository

Publisher copyright
Emerald postprint/Author's Accepted Manuscript (articoli e capitoli libri)

© 2024 Emerald Publishing Limited. This AAM is provided for your own personal use only. It may not be used for resale, reprinting, systematic distribution, emailing, or for any other commercial purpose without the permission of the publisher'

(Article begins on next page)

19 November 2026



The influence of internship on student's academic performance in Industrial and Management Engineering program in Italy

Journal:	*Education + Training*
Manuscript ID	ET-11-2022-0437.R3
Manuscript Type:	Research Paper
Keywords:	Internship, Bachelor, Master of Science, Italy, students' academic performance

SCHOLARONE™
Manuscripts

The influence of internship on student's academic performance in Industrial and Management Engineering program in Italy

1 Introduction

Recent studies suggest that internships are increasingly popular among students, universities, and hosting companies (Margaryan *et al.*, 2020; Pereira *et al.*, 2020). Although there is no universal definition of internship (Di Meglio *et al.*, 2022), it is usually referred to as work experience that university students complete in a firm or institution under professional supervision.

Each academic system has its own specificities in incorporating internships in their educational programs. Therefore, assessing and comparing tertiary students' participation in internships across countries is not an easy task. In the US, Hora et al. (2021) recently reported that 22% of students are involved in internships, while NACE (2020) estimates it at 50-60%. Across Europe, the average share is 46%, although there are differences across countries (Allen and van der Velden, 2009; European Commission, 2013).

The increased attention on internships stems from the expected positive impact on all three types of actors involved, in line with the stakeholder theory (Anderson and Sanga, 2019): students, universities, and hosting companies/institutions. From the employers' perspective, internships provide additional workforce for productivity and potential intellectual contribution (Kroon and Franco, 2022), serving as a means for screening a job candidates without commitment to final employment (Binder *et al.*, 2015; Knemeyer and Murphy, 2002). Moreover, recruiters are more likely to select applicants with an internship in their curriculum (Baert *et al.*, 2021; Taylor, 1988).

Education + Training

Universities also have a positive interest in introducing internships for several reasons. They represent a way to increase the educational offer and to outsource the development of skills that are not usually part of the academic framework (Mälkki and Paatero, 2015). Since the post-graduation employment rate has become one of the dimensions along which universities are ranked and recognized, internships serve as a tool to increase their employability: this parameter favours the enrolment of new students (Cappelli, 2015) and, in some countries, the government considers it for funding (Pereira *et al.*, 2020). Furthermore, internship training is a channel to maintain university-industry relations (Pereira *et al.*, 2020).

With respect to the third group of actors, the students, they appreciate the internship experience for the perceived value of improving social abilities and career development (Cannon and Arnold, 1998; Cook *et al.*, 2004; Pérez-Espés *et al.*, 2023), as addressed in the career construction theory (Ocampo *et al.*, 2020) and the theory of planned behaviour (Hsu, 2012). Several studies found evidence of a positive impact of internships on students' employability (Gault *et al.*, 2000; Pereira *et al.*, 2020), thanks to the acquired work experience and professional skills (Mälkki and Paatero, 2015; Pereira *et al.*, 2020; Silva *et al.*, 2016; Yorke and Knight, 2007). However, there is also a dark side to the internship experience, with interns exploited to perform under-skilled tasks, work long hours, and be unethically treated (see Scheuer & Mills, 2016, for a list of newspaper articles and books). These negative experiences result in poor learning outcomes.

In addition, when the focus is on the academic performance of the students, the literature provides mixed evidence. Most of the studies report a positive correlation between grades and internship (Binder *et al.*, 2015; Gomez *et al.*, 2004; Mansfield, 2011; Rawlings *et al.*, 2006; Reddy and Moores, 2006). On the other hand, students report neither perceiving a positive impact of internship on grades (Cook *et al.*, 2004), nor an increased academic value useful in their studies (Cannon and Arnold, 1998).

Education + Training

Additionally, the recent works of Johnson and Stage (2018) and Prescott et al. (2021) found a negative relationship with graduation rates and academic grades, respectively. These latest findings suggest that the time spent on internships complements the time that should be dedicated to studying (Routon and Walker, 2019). There is no consensus on this, which is particularly interesting since university grades are correlated with employability (Binder *et al.*, 2015).

This article contributes to the research on the correlation between university internship and academic performance. The empirical setting focuses on the Bachelor- (BA) and Master of Science (MS) levels of the Industrial and Management Engineering program at Politecnico di Torino, in Italy. The empirical setting also contributes by expanding the disciplines, degree levels, and countries previously investigated. The range of previously examined disciplines includes Economics (Mandilaras, 2004), Bioscience (Gomez *et al.*, 2004), Information Systems (Rawlings *et al.*, 2006), Psychology (Reddy and Moores, 2006), Engineering (Spinks *et al.*, 2006; Tennant *et al.*, 2018), and a multi-area analysis in the work of Binder et al. (2015). Regarding the countries where internships have been examined, the most frequent ones are the US, UK, Portugal, Germany and Spain (see Di Meglio et al., 2022, for a recent review). Previous literature focused only on BA.

The rest of the article includes a review of the literature on the identified correlations between internship and students' performance (Section 2), a description of the method and the empirical setting (Section 3), the results of the analysis (Section 4), and concluding remarks (Section5).

2 Literature review

2.1 Motivations, skills, and professional career

Previous studies agree on the positive relationship between university students' internship and

Education + Training

employability (e.g., Mälkki and Paatero, 2015; Pereira et al., 2020; Silva et al., 2016; Yorke and Knight, 2007)[1]. Such a relationship appears driven by the development of professional competencies (Mälkki and Paatero, 2015; Pereira *et al.*, 2020; Yorke and Knight, 2007), which are not usually provided at university (Becker, 1962; Garavan and Murphy, 2001). At the same time, according to Kinash et al. (2016), interns can practice the academic knowledge they have learnt in a real scenario, in line with the experiential learning theory (Brown *et al.*, 2018). However, the analysis of Ramírez et al. (2017) finds that such a possibility is limited.

Several studies highlight the benefits of internships on the development of soft skills such as: interpersonal communication and teamworking (Kinash *et al.*, 2016; Routon and Walker, 2019; Tovey, 2001), rhetorical skills (Matthews and Zimmerman, 1999), problem solving (Routon and Walker, 2019), critical thinking, (Matthews and Zimmerman, 1999), time management (Reddy and Moores, 2006).

These findings suggest that, overall, internships may be related to changes in intrinsic motivation (Binder *et al.*, 2015; Deci *et al.*, 1991) that are associated to changes in social cognitive processes, leading to increased self-confidence and responsibility (Ebner *et al.*, 2021; Reddy and Moores, 2006; Routon and Walker, 2019), improved understanding of career aspirations (Gilbert *et al.*, 2014; Pedro, 1984; Reddy and Moores, 2006; Taylor, 1988), ambition (Nauta *et al.*, 1998; Pedro, 1984; Routon and Walker, 2015) and career adaptability (Ocampo *et al.*, 2020). Scholars have examined these relationships through the lenses of different theories and focusing on different perspectives: e.g., the

[1] In general, in Italy, all things being equal, those who have carried out an internship are 12.2% more likely to be employed one year after obtaining their degree (AlmaLaurea, 2021).

Education + Training

career construction theory provided suggestions to students and universities in terms of counselling (Ocampo *et al.*, 2020); the theory of planned behaviour derived indications to educational institutions to improve the offer of internships (Hsu, 2012); the social representation theory found support for the benefits of internships both for employers and enrolled students (Moscardo and Pearce, 2007); and the professional socialization theory indicated the positive results for all the involved stakeholders from offering internship programs that help bridge theory and practice and foster students' employability (Sonnenschein *et al.*, 2019).

With this skill set, students are better prepared to the professional life and there is wide agreement in the literature on the positive relationship between internship and employability, especially with respect to the first job (Gault *et al.*, 2000; Di Meglio *et al.*, 2022). The positive relationship has been identified through multiple dimensions: internship experience reduces the time to obtain a job (Jung and Lee, 2016; Knouse *et al.*, 1999), increases the probability of a good fit between the graduates' area of study and job competencies, results in average higher wages (Gault *et al.*, 2000; Jung and Lee, 2016), and is more often associated to a first full-time rather than a temporary job (Gault *et al.*, 2010). Concerning the long term effects, the results are weaker in assessing a relationship between internship and integration in terms of job matching or wages (Di Meglio *et al.*, 2022).

2.2 Academic performance

The literature dealing with the relationship between internships and students' academic performance is relatively underdeveloped and includes several articles reporting a positive correlation, while some others a neutral or a negative association. Table 1 summarizes the main findings in the literature, providing information on the examined disciplines and the format of internship in each country. All the articles deal with the BA level. The US and UK are the main target of investigation. Internship in the UK takes the form of "sandwich" placement: students enrol in the placement between the second and

Education + Training

the final year; its length ranges from 36 to 52 weeks, 44 weeks on average (Binder *et al.*, 2015). All the UK-centred studies identify a positive relationship between internship and academic performance, measured either through grades or degree class (i.e., ordinary, third class, lower second, upper second, first) or comparing the groups of students choosing work placement over international study (Jones and Wang, 2023). In terms of grades, the positive relationship between internship and performance ranges between +2.7% and +4%.

The identified studies that examine academic performance and internship in the US do not provide clear indications on the format of internships, with the exception of Prescott et al. (2021)[2]. According to the recent work of Hora et al. (2021) the average length of an internship is 18.3 weeks but there is variety across institutions. In general, the "sandwich" format does not seem typical. The seminal work of (Koehler, 1974) provides descriptive evidence of an increase in the average marks of interns in the exams after the internship, but neither non-interns nor a multivariate approach are considered. More recently, two studies identified a positive relationship with academic performance assessed as a self-reported five-points scale (Knouse *et al.*, 1999) and as a measured increase in the final Grade Point Average (GPA) of +0.076 (on a GPA scale 0-4) (Routon and Walker, 2019). Routon and Walker disentangled the effect of college tenure gap and of internship: the former is negatively related to GPA while the latter is slightly positive related.

The studies finding a positive effect on academic performance argue that it derives from the additional

[2] The empirical setting in Prescott et al. (2021) examines internships with the following characteristics: a minimum of 300 hours up to 2015 and of 240 hours from 2015; two compulsory internships (distributed in different years of the university program); the internship is linked to a course taught by a full-time faculty member who assign a final grade.

Education + Training

skills developed in the internship experience and identified in the literature described in the previous sub-section. This accumulation of human capital is also supplemented by a greater amount of effort in the academic life which support a greater development during college (Astin, 1984; Routon and Walker, 2019). Similarly, in the study of Gilbert et al. (2014), 50 interns in Life-Health sciences report improved essential learning outcomes (self-assessed).

A completely different perception is found by Cook et al. (2004) in their survey on US internship across 12 institutions: 59% are neutral to declaring that their grades improved after the internship and 18% disagree with that statement. No significant difference in terms of grades between interns and non-interns was found also by (Knechel and Snowball, 1987).

Finally, two recent studies have found a slightly negative relationship between grades and internship. The grades of the students in the business school examined in Prescott et al. (2021), where the internship is compulsory, are lower in the semester of the internship. Although the academic performance returns to higher levels after the internships, the increase does not compensate the previous decrease experienced in the internship semester. The analyses in Johnson and Stage (2018) are at the university level in the US and find a slightly negative relationship when focusing on four year graduation rates, while no significant correlation is found with six-year rates: they argue that the internship might add time to conclude the university program. The issue of limited time is also raised by Routon & Walker (2019), although their analyses identify in tenure gap the negative effect.

Hence, the aim of this study is to contribute to the literature by considering a new empirical setting: the Italian university program of Industrial and Management Engineering, both at the BA and MS level, where the internship experience is optional. The analyses are expected to provide further evidence on the academic performance of interns. Following the previous results, the following alternative hypotheses can be formulated:

Education + Training

HPa: the relationship between internship and academic performance is expected to be positive, and it can be argued that it derives from the accumulation of human capital.

HPb: the relationship between internship and academic performance is expected to be negative, and it can be argued that in general the time for studying is reduced in favour of the internship.

The empirical models will thus investigate the correlation between the final grade, i.e., the measure of academic performance at the BA and MS level respectively, and the completion of the internship. Following the settings of the previous studies, the analyses will control for a set of characteristics that might potentially influence the results, such as gender, age, and prior academic scores of the students, course, and year dummies to account for program characteristics and macro events (e.g., the COVID-19 pandemic).

Education + Training

Table 1 Selection of studies dealing with the relationship between internship and academic performance.

Source	Country	Discipline	Share of students enrolled in internship	Format	Relationship with academic performance
					POSITIVE
(Koehler, 1974)	US	Accounting	n.a. (interns only)	n.a.	From +0.004 to +0.215 points on the average GPA (0-4) after the internship
(Knouse *et al.*, 1999)	US	Business school	33%	n.a.	+2% on a 5-points scale of grade (t-tests only)
(Gomez *et al.*, 2004)	UK	Bioscience	74%	Sandwich placement	+4% on final year grade
(Mandilaras, 2004)	UK	Economics and Business Economics with Computing	60%	Sandwich placement	Positive effect on grades and on class
(Rawlings *et al.*, 2006)	UK	Information systems	66.6%	Sandwich placement	Positive effect on obtaining higher class
(Surridge, 2009)	UK	Accounting and Finance	26-29%	Sandwich placement	+3.6% of average percentage mark (no effect on best students)
(Mansfield, 2011)	UK	property management and development	80.6%	Sandwich placement	+2.77% on final year grades
(Gilbert *et al.*, 2014)	US	Life-Health Sciences	n.a. (interns only)	One year (10 hours per week)	Positive on self-assessment of learning outcomes (t-tests only)
(Binder *et al.*, 2015)	UK	Multidisciplinary	25.6%	Sandwich placement	+2.7 - +3.4% on final year grades
(Routon and Walker, 2019)	US	Multidisciplinary	35% (27% no tenure gap, 8% with gap)	n.a.	+ 0.076 points on final GPA (0-4)
(Jones and Wang, 2023)	UK	Business and Social Sciences	88% work placement, 8% international study, 4% both	Sandwich placement	Work placement better than international study on final year grades
					NEUTRAL
(Cook *et al.*, 2004)	US	12 institutions	Survey to the interns of a single firm	n.a.	59% reported to be neutral on the statement on "improved grades"; 18% disagreed
(Knechel and Snowball, 1987)	US	Accounting	n.a.	n.a.	Negative but not significant difference in GPA between interns and non-interns
					NEGATIVE
(Johnson and Stage, 2018)	US	Multidisciplinary	n.a.	n.a.	(University level analysis) Slightly Negative on 4 years graduation rate (not significant on 6 years graduation rate)
(Prescott *et al.*, 2021)	US	Business school	100%	Two compulsory internships with a min. of 250-300 hours	Negative effect on GPA in the same semester, only partially recovered in the subsequent semester

Education + Training

3 Method and data

This work examines the students that graduated in the "Industrial and Management Engineering" program of Politecnico di Torino in Italy between 2016 and 2021. The examined sample is made of a total of 4,839 graduates: 2,279 BA and 2,560 MS students (Table 2).

The data were provided by the IT office of Politecnico di Torino, which collects personal information when students enrol (gender, date and place of birth, secondary school final grade, matriculation test grade) and keeps track of individuals' careers (grades, internship, final degree) in accordance with the national administrative rules. Data were anonymized.

The internships during the BA or MS programs can be activated by those students with a minimum amount of passed exams and as a replacement of a course which is considered equivalent in terms of educational credits (corresponding to 6 or 8 ECTS - "European Credit Transfer System").

The beginning of the internship can be any time. The hosting organizations can be public institutions (e.g., municipalities, regions), SMEs, large companies, associations, and professional firms. The interns can receive a compensation or not and both a faculty and a company supervisor are identified. The internship can be associated with the thesis. The match-making process is mainly organized through an online portal and interviews. The students can propose an internship location of their own choice. Most of the internships are completed in the same region of Politecnico di Torino but there are some positions in other countries.

Table 2 provides details on the examined samples in the years 2016-2021 (Table 12 in the appendix provides numbers for each examined year). The BA level has two main programs: i) one including more ICT oriented courses (code: BA_L8) and accounting for 665 graduates (share of interns: 15.9%);

Education + Training

ii) one more on manufacturing and logistics (code: BA_L9) for a total of 1,614 graduates (interns: 14.3%). The length of the internship is 300 hours for the BA.

Two main master's degree programs are offered: i) one mostly in Italian (code: MS_ITA) with 1,765 graduates in the sample (share of interns: 61.0%); ii) and one in English (code: MS_ENG) with 795 graduates (interns: 60.4%). At the MS the duration of internship varies between 200 and 800 hours: the average is 363.1.

Table 2 descriptive statistics of the examined sample.

Program code	Level	Graduates in the sample	Share of Interns	% of female students	% of female on tot. interns
BA_L8	BA	665	15.9%	34.4%	33.0%
BA_L9	BA	1,614	14.3%	37.4%	37.0%
Total_BA	**BA**	**2,279**	**14.7%**	**36.5%**	**35.7%**
MS_ITA	MS	1,765	61.0%	37.7%	38.6%
MS_ENG	MS	795	60.4%	34.0%	34.6%
Total_MS	**MS**	**2,560**	**60.8%**	**36.6%**	**37.3%**

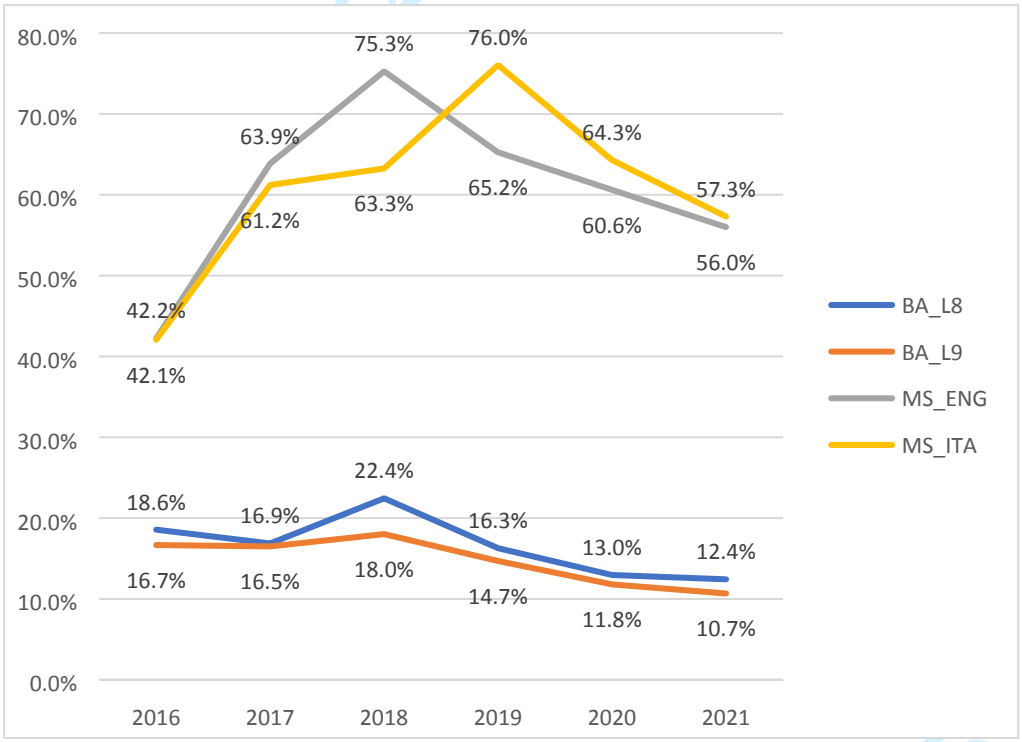
The previous literature analysing the academic performance has mainly dealt with single programmes, controlling for majors when available. Among the studies with multidisciplinary settings, a clear pattern for macro areas, such as STEM, is not evident. For example, Binder et al. (2015) provides summary statistics in terms of internship ratio across fields: e.g., Engineering 16%, Physical sciences 54%, Mathematical and computer sciences 23%. The examined sample is similar only when considering the BA level. Despite the available programmes are very similar inside each level (BA and MS): the model specifications will control for them (L8 and L9 for the BA, Italian and English programmes for the MS).

Figure 1 shows the trends of the share of students doing an internship on the total graduates per year. The last years were affected by COVID-19 restrictions, which resulted in a reduction of companies' offer and potentially in a change among the preferences of the students (see for example Rosario-

Education + Training

Moore et al., 2023, for a recent analysis on the impact of the pandemic on undergraduates). In the examined sample, many internships took place with a remote working approach, but the total share of internships started in 2020 and 2021 is smaller than in the previous years. Concerning the cases started right before the restrictions, BA and MS students were required to reach the same minimum number of hours through remote working or delaying the completion.

Figure 1 share of students doing an internship by graduation year.



3.1 Students' characteristics and ex-ante performance

This paragraph provides descriptive statistics on the main characteristics of the students in the examined samples: gender, age at matriculation, secondary school performance and matriculation test grade for the BA level, and the BA final grade for the MS students.

The presence of female students ranges between 34.0% in the MS_ENG program and 37.7% in

MS_ITA: the presence of female students in "Industrial and Management Engineering" is higher than in the rest of Engineering programs offered by the same university. Previous studies found a gender differential in students' achievement (e.g., Gibb et al., 2008) and in this specific setting it is likely that enrolled female students are a selected group expected to perform on average better than their male counterpart. The proportion of female interns is comparable to the presence of female students (Table 2), suggesting no significant underrepresentation of female interns. This is in line with previous studies (Kapoor and Gardner-McCune, 2020; Knouse *et al.*, 1999).

The ex-ante performance of students is useful to control for the individuals' academic characteristics before the internship and to highlight a potential selection effect: the literature employed measures of pre-university grades: e.g., secondary school grades, matriculation test results or prior marks on disciplines related to the university program (Gomez *et al.*, 2004; Mandilaras, 2004; Prescott *et al.*, 2021; Routon and Walker, 2019; Surridge, 2009) or the university marks in the years before the internship (Binder *et al.*, 2015; Rawlings *et al.*, 2006).

The potential ex-ante differences between students doing internships and those who do not are reported in Table 3. In addition to the age at matriculation both for BA and MS level, several measures of ex-ante performance are considered: at the BA level, the secondary school final grade, ranging from 60 to 100, and the results of the matriculation tests, from 0 to 100; at the MS level, the previous GPA final grade is available for all the Italian student and for 42% of the foreigners[3]. The original BA-level final grade of foreigners is standardized to the Italian degree grading system which ranges between 66 and 110.

[3] The shares of foreign-born students in the BA, MS_ITA and MS_ENG samples are 3.6%, 2.2% and 45.0% respectively.

Education + Training

At the MS level, no significant difference is found when considering the age at matriculation or the previous performance proxied by the BA final grade. This is in line with the previous literature that suggested the absence of a selection effect (Binder *et al.*, 2015; Knouse *et al.*, 1999; Taylor, 1988). However, when focusing on the BA level, the t-tests on the ex-ante characteristics (either the secondary school final grade or the matriculation test grade) report lower values (-3.2% and -3.7% respectively). These findings indicate a potential selection effect for BA programs: hence, the ex-ante performance will be included in the multivariate models.

Table 3 differences in ex-ante average characteristics of students with and without internship.

Characteristic	Level of analysis	Obs.	Avg. value in sample of students with		Differ. (1)-(2)	t-test:
			No internship (1)	Internship (2)		
Age at matriculation	BA	2,279	20.122	20.119	0.003	Not significant
Age at matriculation	MS	2,610	23.827	23.880	-0.052	Not significant
Secondary school final grade	BA	2,278	85.740	81.979	3.761	Significant at 99%
Standardized matriculation test results	BA	2,201	48.261	44.997	3.265	Significant at 99%
BA final grade	MS_ITA	1,085	94.642	94.741	-0.099	Not significant
BA final grade	MS_ENG	640	93.621	92.995	0.626	Not significant

3.2 Ex-post academic performance: dependent variable

The main variable of interest is the measure of the academic performance: this study uses the average of marks, ranging between 18 and 30 according to the Italian University system. An outstanding result scores "30 cum laude" but this is not considered as extra points in this study. The employed average does not include the points for the final thesis project.

Education + Training

4 Results

Table 4 shows the preliminary comparison of the average grades at graduation. Students doing an internship have a statistically lower academic performance: at the BA level the difference is around -2% of the average grades; at the MS level, the difference is smaller but still statistically significant (less than -1%).

Table 4 differences in ex-post academic performance as average of grades.

Level	No internship (1)	Internship (2)	Difference (1)-(2)	t-test
BA_L8	23.623	23.108	0.515	significant at 99%
BA_L9	22.975	22.348	0.627	significant at 99%
MS_ITA	25.527	25.285	0.241	significant at 99%
MS_ENG	24.957	24.678	0.279	significant at 90%

As mentioned, the internship replaces one of the courses which represents 3.4% of the total ECTS available at the BA level and 7.7% at the MS level. The replaceable course can be chosen from a larger portfolio at the BA level than at the MS. The students with no internship experience have an additional exam in their portfolio. If these alternative exams would in general be associated to higher (lower) marks for reasons independent from the students' effort (e.g., easier/harder subject, more/less generous evaluation), then the difference in the academic performance between the average intern and the non-intern would be significantly influenced by such optional exam: if for example the results of the exam alternative to internship are usually higher than the rest of the courses, then we would observe an average higher mark for non-interns mainly due to such exam, regardless of students' characteristics and the potential role of internship. With the aim to consider this potential driver, different scenarios are assessed. The average grades of interns are adjusted by adding one hypothetical exam with mark 25, 26, … 30; such inflated average degrees are then compared with those of the no-internship students. At the BA level (row 1 and 2 in Table 5), the turning point is when the maximum mark to interns is added. At the MS level (rows 3 to 6 in Table 5), the stepwise results indicate that 26 is the minimum mark that makes the difference no longer statistically significant.

Education + Training

Hence, for the MS, if the replaceable exams have an average mark equal to at least 26, then they could be the potential main driver in the lower performance of interns. Direct data are not available but an aggregate assessment of the average marks in year 2020 for the optional exams of 182 students is 25.676, close to the relevant threshold: these preliminary t-tests do not rule out the hypothesis that the replaceable exam is the driver of the lower academic performance at the MS level, confirming that a multivariate approach is required.

Table 5 t-test results on the significance of the difference between average of grades, with inflated marks for internship students and deflated marks for non-internship students

Row #	Avg of grades No-internship (1)	Exam mark added to avg. of internship stud.	New avg. of grades Internship (2)	Difference (1)-(2)	t-test
BA level					
1	23.142	29	22.763	0.378	significant at 99%
2	23.142	30	25.509	-2.367	significant at 99%
MS level					
3	25.277	25	25.077	0.200	significant at 95%
4	25.277	26	25.154	0.124	Not significant
5	25.277	27	25.231	0.046	Not significant
6	25.277	28	25.307	-0.030	Not significant

4.1 Multivariate models

Since the average grades can be influenced by other confounding factors, a multivariate approach is required: the model specification is Ordinary Least Square (OLS). Gender and age at graduation of the students are included as control, following the previous literature (Mansfield, 2011; Routon and Walker, 2019; Surridge, 2009). Their geographical origin as dummies on the region of birth (i.e., the twenty Italian regions, Europe, or the rest of the world) is also considered. The models control for the graduation year and the examined programs in each level (BA_L8, BA_L9, MS_ITA, MS_ENG).

Similar to the previous approach for the t-tests, some of the models employ a different dependent

Education + Training

variable which corrects the average of grades for the internship students by adding an extra mark (e.g., "29-inflated avg of grades"): the aim is to investigate the role of the optional replacement exam in determining the difference of performance.

The main variables are summarized in Table 6 and distinguished between the BA and MS level. Correlations are in Table 7 and Table 8. In addition, the analysis will also consider dummies for students' region of birth (20 dummies for the Italian regions, a dummy for any other European country and a residual group for the rest of the world) and for the graduation year.

Table 6 summary statistics of the examined variables and their labels.

Variable (label)	Description	Obs.	Mean	Std.dev.	Min	Max
BA level						
Avg. of grades	Final average of exam grades	2,279	23.078	1.883	19.100	29.550
Internship	Dummy equal to 1 if the student experienced an internship	2,279	0.147	0.355	0	1
Gender (F)	Dummy equal to 1 for female students	2,279	0.365	0.482	0	1
Age at matr.	Age at matriculation in years	2,279	20.121	1.152	19	44
Sec.Sch.Grade	Secondary school final grade	2,279	85.185	10.990	60	100
Matr.test res.	Matriculation test grade	2,279	47.781	14.320	6.548	97.024
MS level						
Avg. of grades	Final average of exam grades	2,560	25.196	2.132	19.08	29.77
Internship	Dummy equal to 1 if the student experienced an internship	2,560	0.608	0.488	0	1
Gender (F)	Dummy equal to 1 for female students	2,560	0.366	0.482	0	1
Age at matr.	Age at matriculation in years	2,560	23.859	1.627	21	54
Prev. BA grade	Previous final BA grade	2,395	94.309	8.508	63.8	110

Education + Training

Table 7 Correlation matrix for the BA level sample.

	Variable	1	2	3	4
1	Internship	1.000			
2	Gender (F)	-0.007	1.000		
3	Age at grad.	-0.001	-0.028	1.000	
4	Sec.Sch.Grade	-0.121	0.163	-0.133	1.000
5	Matr.test res.	-0.081	-0.110	-0.138	0.328

Table 8 Correlation matrix for the MS level sample.

	Variable	1	2	3
1	Internship	1.000		
2	Gender (F)	0.020	1.000	
3	Age at grad.	0.016	-0.062	1.000
4	Prev.BA grade	-0.007	0.107	-0.277

The results of the OLS models for the BA sample are reported in Table 9. In models from 1 to 3 the dependent variable is the average of grades at the graduation. The internship is negatively related to grades: the average of grades is smaller by 0.39, a marginal decrease of -1.7%. Although the magnitude is small, the negative correlation is robust when controlling for the ex-ante performance proxied by the matriculation test results, the age at matriculation, gender, students' region of birth, graduation year and BA program. Similar results can be found when using the secondary school final grade instead of the matriculation test results as control for the ex-ante performance. The hypothesis HPb is thus supported and HPa is rejected. Models 4 and 5 are introduced to test for the role of the marks of the replaceable exams. In this case, only if the replaced exams would be associated to the top mark to every student, then they would compensate for the negative relationship found for the internship. Hence, the argument that at the BA level the negative correlation is driven by higher marks in the replaced exams can be ruled.

Education + Training

Table 9 Results of OLS models for the BA sample. The dependent variable for models from 1 to 3 is the average of grades; in model 4 and 5 the average of grades for interns is inflated by a mark equal to 29 and 30 respectively. Stars from one to three indicate statistical significance at 10%, 5%, and 1% levels, respectively.

Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
Dep.var.	Avg. of grades	Avg. of grades	Avg. of grades	+29 to interns	+30 to interns
Internship	-0.568***	-0.396***	-0.386***	-0.170*	2.575***
	(0.109)	(0.096)	(0.096)	(0.095)	(0.095)
Matr.test res.		0.067***	0.066***	0.066***	0.066***
		(0.002)	(0.002)	(0.002)	(0.002)
Age at matr.			-0.174***	-0.173***	-0.173***
			(0.064)	(0.063)	(0.063)
Gender (F)	0.134*	0.381***	0.373***	0.371***	0.371***
	(0.080)	(0.070)	(0.070)	(0.070)	(0.070)
Dummy BA_L8	0.699***	0.472***	0.481***	0.479***	0.479***
	(0.085)	(0.075)	(0.075)	(0.075)	(0.075)
Dummies for regions of birth	Yes	Yes	Yes	Yes	Yes
Dummies for graduation year	Yes	Yes	Yes	Yes	Yes
Constant	21.715***	19.234***	22.932***	22.940***	22.940***
	(0.263)	(0.261)	(1.377)	(1.369)	(1.369)
Observations	2,279	2,201	2,201	2,201	2,201
R2	0.076	0.312	0.314	0.308	0.422

The results for the MS sample are reported in Table 10. In models from 1 to 3 the dependent variable is the average of grades at the graduation. The internship is negatively related to grades: the average of grades is smaller by 0.23, a marginal decrease of -0.9%. The magnitude is smaller than what found for the BA level, but again it is robust to controls including the ex-ante performance proxied by the final grade received for the previous BA. Models 4 and 5 are introduced to test for the role of the marks of the replaceable exams. In this case, the threshold mark for the optional exams is 27. This is close to the value that can be calculated for the cohort of students attending those courses in 2020: 25.676 is the average mark of 182 students in those replaceable exams. Hence, the statistical significance in the lower academic performance of internship students might be determined by the replaced exams.

Table 10 Results of OLS models for the MS sample. The dependent variable for models from 1 to 3 is the average of grades; in model 4and 5 the average of grades for interns is inflated by a mark equal to

Education + Training

26 and 27 respectively. Stars from one to three indicate statistical significance at 10%, 5%, and 1% levels, respectively.

Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
Dep.var.	Avg. of grades	Avg. of grades	Avg. of grades	+26 to interns	+27 to interns
Internship	-0.365***	-0.252***	-0.226***	-0.169***	-0.092
	(0.079)	(0.070)	(0.068)	(0.065)	(0.065)
Prev.BA grade		0.122***	0.111***	0.106***	0.106***
		(0.004)	(0.004)	(0.004)	(0.004)
Age at matr.			-0.286***	-0.271***	-0.271***
			(0.023)	(0.022)	(0.022)
Gender (F)	0.075	-0.079	-0.102	-0.098	-0.098
	(0.078)	(0.070)	(0.068)	(0.065)	(0.065)
Dummy MS_ENG	0.605***	0.456***	0.447***	0.432***	0.432***
	(0.100)	(0.087)	(0.084)	(0.081)	(0.081)
Dummies for regions of birth	Yes	Yes	Yes	Yes	Yes
Dummies for graduation year	Yes	Yes	Yes	Yes	Yes
Constant	22.762***	12.093***	20.378***	20.548***	20.548***
	(0.157)	(0.410)	(0.764)	(0.732)	(0.732)
Observations	2,560	2,395	2,395	2,395	2,395
R2	0.216	0.382	0.421	0.419	0.419

Education + Training

Table 11 Results of OLS models. The dependent variable for models 1 and 2 is the final grade at the BA graduation; in model 3 it is the final grade at the MS graduation. Stars from one to three indicate statistical significance at 10%, 5%, and 1% levels, respectively.

Variables	**(1)**	**(2)**	**(3)**
Dep.var.	Final grade at BA grad.	Final grade at BA grad.	Final grade at MS grad.
Internship	-1.723***	-1.168***	-0.766***
	(0.374)	(0.364)	(0.260)
Matr.test res.	0.255***		
	(0.010)		
Sec.Sch.Grade		0.362***	
		(0.013)	
Prev.BA grade			0.405***
			(0.017)
Age at matr.	-0.762***	0.044	-1.098***
	(0.248)	(0.126)	(0.086)
Gender (F)	1.554***	-0.815***	-0.220
	(0.275)	(0.271)	(0.259)
Dummy BA_L8	1.591***	1.805***	
	(0.294)	(0.283)	
Dummy MS_ENG			1.498***
			(0.322)
Dummies for regions of birth	Yes	Yes	Yes
Dummies for graduation year	Yes	Yes	Yes
Constant	92.531***	58.479***	81.671***
	(5.381)	(3.040)	(2.917)
Observations	2,201	2,278	2,395
R2	0.306	0.326	0.421

As robustness tests, Table 11 reports the results of the models where the dependent variable is the final grade achieved at the BA level (models 1 and 2) and at the MS level (model 3). This grade ranges between 66 and 110 and includes the mark for the final thesis project. The results confirm the negative relationship between internship and academic performance and support the hypothesis HPb.

5 Discussion and conclusion

This study explored the correlation of an internship with the academic performance, as no consensus seems to be found in previous literature. Studies in the UK framework, where the sandwich placement is adopted, find a small and positive relationship between an internship and academic performance at

Education + Training

the BA level (e.g., Binder et al., 2015; Mansfield, 2011). The works focusing on the US at the BA level found mixed results: a positive (Routon and Walker, 2019), mostly neutral (Cook *et al.*, 2004), or negative correlation (Johnson and Stage, 2018; Prescott *et al.*, 2021). To investigate further, this study analyses the case of an Italian technical university, Politecnico di Torino, and focuses on the BA and MS programs in Industrial and Management Engineering.

The negative correlation between an internship and the average of grades at the BA level is very small (-1.3%) but robust to several controls, including the ex-ante performance. The difference does not seem driven by the replaced exam. Since the internship time can overlap lectures, the finding suggests that students might prefer to invest in the internship rather than prepare for the exams. Another possible explanation would be that students are self-selected into an internship, as indicated by the preliminary t-tests on ex-ante performance (an average lower prior score of circa 3.2-3.7%) and prefer to replace one of the exams with it: students might perceive an internship as an easier task, more in line with their abilities and expectations. If that is the case, the self-selected students are likely to be characterized by a stronger attitude towards the professional career, as in the theory of planned behaviour (Hsu, 2012). And the academic performance reduction is less than what was measured before entering the university. Future research could investigate this aspect with direct questionnaires on the reasons for the choice of doing an internship and linking the results to the academic performance.

The analysis of the MS level reveals less-negative results (-0.9%) than at the BA. Although part of the higher performance of non-internship students could be driven by the substitute course in this case, since there is no evidence of self-selection and the negative correlation holds when controlling for ex-ante performance, it is not possible to rule out the argument that students' involvement in the internship slightly reduces their effort in academic courses.

In terms of managerial implications, these results suggest caution to universities that intend to organize

Education + Training

an internship as overlapping with lectures and exams, especially when considering the BA level, when students' maturity and skills are less developed than at the MS level. The UK sandwich placement approach in this sense seems to provide a better framework than the examined Italian case, where the absence of a dedicated period for an internship might lead students to allocate their time inefficiently. For example, the organization of the academic calendar could consider limiting an internship to the weekdays or the months with less lessons/exams, minimizing the potential overlap.

This work is not exempt from limitations. The role of the exams alternative to an internship has been only partially assessed due to lack of related data on students' perceptions and marks. Student level characteristics that have been found correlated to academic performance (Routon and Walker, 2019) were not available, such as family income, being a part-time student, and willingness to continue studying after the BA. Future research should address these issues and control whether students doing an internship at the BA level are likely to participate in another internship during the MS level: this would be particularly interesting in the Italian context where most of the BA students continues studying at the MS level after graduation. In addition, students' intentions should be surveyed and investigated for example through the lenses of the theory of planned behaviour (Hsu, 2012). Finally, exogenous shock such as the COVID-19 pandemic could be explored further as empirical setting to study the relationship between internship and performance.

6 References

Allen, J.P. and van der Velden, R.K.W. (2009), *Competencies and Early Labour Market Careers of Higher Education Graduates*, European Union. ROA External Reports.

AlmaLaurea. (2021), *XXIII Indagine Condizione Occupazionale Dei Laurea - Rapporto 2021*.

Education + Training

Anderson, W. and Sanga, J.J. (2019), "Academia–Industry Partnerships for Hospitality and Tourism Education in Tanzania", *Journal of Hospitality & Tourism Education*, Vol. 31 No. 1, pp. 34–48, doi: 10.1080/10963758.2018.1480959.

Astin, A.W. (1984), "Student involvement: A developmental theory for higher education", *Journal of College Student Development*, Vol. 25 No. 4, pp. 297–308.

Baert, B.S., Neyt, B., Siedler, T., Tobback, I. and Verhaest, D. (2021), "Student internships and employment opportunities after graduation: A field experiment", *Economics of Education Review*, Vol. 83, p. 102141, doi: 10.1016/j.econedurev.2021.102141.

Becker, G.S. (1962), "Investment in Human Capital: A Theoretical Analysis", *Journal of Political Economy*, Vol. 70 No. 5, Part 2, pp. 9–49, doi: 10.1086/258724.

Binder, J.F., Baguley, T., Crook, C. and Miller, F. (2015), "The academic value of internships: Benefits across disciplines and student backgrounds", *Contemporary Educational Psychology*, Vol. 41, pp. 73–82, doi: 10.1016/j.cedpsych.2014.12.001.

Brown, C., Willett, J., Goldfine, R. and Goldfine, B. (2018), "Sport management internships: Recommendations for improving upon experiential learning", *Journal of Hospitality, Leisure, Sport & Tourism Education*, Vol. 22, pp. 75–81, doi: 10.1016/j.jhlste.2018.02.001.

Cannon, J.A. and Arnold, M.J. (1998), "Student Expectations of Collegiate Internship Programs in Business: A 10-Year Update", *Journal of Education for Business*, Vol. 73 No. 4, pp. 202–205, doi: 10.1080/08832329809601630.

Cappelli, P.H. (2015), "Skill gaps, skill shortages, and skill mismatches: Evidence and arguments for the United States", *Industrial and Labor Relations Review*, Vol. 68 No. 2, pp. 251–290, doi:

Education + Training

10.1177/0019793914564961.

Cook, S., Parker, S. and Pettijohn, C. (2004), "The perceptions of Interns: a longitudinal case study", *Journal of Education for Business*, Vol. January/Fe, pp. 179–185.

Deci, E.L., Ryan, R.M., Vallerand, R.J. and Pelletier, L.G. (1991), "Motivation and Education: The Self-Determination Perspective", *Educational Psychologist*, Vol. 26 No. 3–4, pp. 325–346, doi: 10.1080/00461520.1991.9653137.

Ebner, K., Soucek, R. and Selenko, E. (2021), "Perceived quality of internships and employability perceptions: the mediating role of career-entry worries", *Education + Training*, Vol. 63 No. 4, pp. 579–596, doi: 10.1108/ET-02-2020-0037.

European Commission. (2013), "The experience of traineeships in the EU", No. November.

Garavan, T.N. and Murphy, C. (2001), "The co-operative education process and organisational socialisation: A qualitative study of student perceptions of its effectiveness", *Education + Training*, Vol. 43 No. 6, pp. 281–302, doi: 10.1108/EUM0000000005750.

Gault, J., Leach, E. and Duey, M. (2010), "Effects of business internships on job marketability: The employers' perspective", *Education and Training*, Vol. 52 No. 1, pp. 76–88, doi: 10.1108/00400911011017690.

Gault, J., Redington, J. and Schlager, T. (2000), "Undergraduate Business Internships and Career Success: Are They Related?", *Journal of Marketing Education*, Vol. 22 No. 1, pp. 45–53, doi: 10.1177/0273475300221006.

Gibb, S.J., Fergusson, D.M. and Horwood, L.J. (2008), "Gender Differences in Educational

Education + Training

Achievement to Age 25", *Australian Journal of Education*, Vol. 52 No. 1, pp. 63–80, doi: 10.1177/000494410805200105.

Gilbert, B.L., Banks, J., Houser, J.H.W., Rhodes, S.J. and Douglas Lees, N. (2014), "Student development in an experiential learning program", *Journal of College Student Development*, Vol. 55 No. 7, pp. 707–713, doi: 10.1353/csd.2014.0072.

Gomez, S., Lush, D. and Clements, M. (2004), "Work placements enhance the academic performance of bioscience undergraduates", *Journal of Vocational Education and Training*, Vol. 56 No. 3, pp. 373–385, doi: 10.1080/13636820400200260.

Hora, M.T., Colston, J., Chen, Z. and Pasqualone, A. (2021), *National Survey of College Internships (NSCI) 2021 Report*.

Hsu, M.-S. (2012), "A study of internship attitude, subjective norm, perceived behavioral control, and career planning of hospitality vocational college students", *Journal of Hospitality, Leisure, Sport & Tourism Education*, Vol. 11 No. 1, pp. 5–11, doi: 10.1016/j.jhlste.2012.02.003.

Johnson, S.R. and Stage, F.K. (2018), "Academic Engagement and Student Success: Do High-Impact Practices Mean Higher Graduation Rates?", *The Journal of Higher Education*, Vol. 89 No. 5, pp. 753–781, doi: 10.1080/00221546.2018.1441107.

Jones, C. and Wang, Y. (2023), "The performance effects of international study placements versus work placements", *Higher Education*, Vol. 85 No. 3, pp. 689–710, doi: 10.1007/s10734-022-00861-5.

Jung, J. and Lee, S.J. (2016), "Impact of Internship on Job Performance among University Graduates in South Korea", *International Journal of Chinese Education*, Vol. 5 No. 2, pp. 250–284, doi:

Education + Training

10.1163/22125868-12340070.

Kapoor, A. and Gardner-McCune, C. (2020), "Exploring the Participation of CS Undergraduate Students in Industry Internships", *Proceedings of the 51st ACM Technical Symposium on Computer Science Education*, ACM, New York, NY, USA, pp. 1103–1109, doi: 10.1145/3328778.3366844.

Kinash, S., Crane, L., Judd, M.M. and Knight, C. (2016), "Discrepant stakeholder perspectives on graduate employability strategies", *Higher Education Research and Development*, Vol. 35 No. 5, pp. 951–967, doi: 10.1080/07294360.2016.1139555.

Knechel, W. and Snowball, D. (1987), "Accounting internships and subsequent academic performance: An empirical study", *The Accounting Review*, Vol. 62 No. 4, pp. 799–807.

Knemeyer, A.M. and Murphy, P.R. (2002), "Logistics internships: Employer and student perspectives", *International Journal of Physical Distribution and Logistics Management*, Vol. 32 No. 2, pp. 135–152, doi: 10.1108/09600030210421732.

Knouse, S.B., Tanner, J.R. and HARRIS, E.W. (1999), "The Relation of College Internships, College Performance, and Subsequent Job Opportunity", *Journal of Employment Counseling*, Vol. 36 No. 1, pp. 35–43, doi: 10.1002/j.2161-1920.1999.tb01007.x.

Koehler, R.W. (1974), "The Effect of Internship Programs on Subsequent College Performance", *Accounting Review*, Vol. 49 No. 2, pp. 382–384.

Kroon, N. and Franco, M. (2022), "Antecedents, processes and outcomes of an internship program: an employer's perspective", *Journal of Applied Research in Higher Education*, Vol. 14 No. 2, pp. 556–574, doi: 10.1108/JARHE-09-2020-0315.

Education + Training

Mälkki, H. and Paatero, J. V. (2015), "Curriculum planning in energy engineering education", *Journal of Cleaner Production*, Vol. 106, pp. 292–299, doi: 10.1016/j.jclepro.2014.08.109.

Mandilaras, A. (2004), "Industrial Placement and Degree Performance: Evidence from a British Higher Institution", *International Review of Economics Education*, Vol. 3 No. 1, pp. 39–51, doi: 10.1016/S1477-3880(15)30146-8.

Mansfield, R. (2011), "The effect of placement experience upon final-year results for surveying degree programmes", *Studies in Higher Education*, Vol. 36 No. 8, pp. 939–952, doi: 10.1080/03075079.2010.486073.

Margaryan, S., Saniter, N., Schumann, M. and Siedler, T. (2020), "Do Internships Pay Off?", *Journal of Human Resources*, pp. 0418-9460R2, doi: 10.3368/jhr.57.4.0418-9460R2.

Matthews, C. and Zimmerman, B.B. (1999), "Integrating service learning and technical communication: Benefits and challenges", *Technical Communication Quarterly*, Vol. 8 No. 4, pp. 383–404, doi: 10.1080/10572259909364676.

Di Meglio, G., Barge-Gil, A., Camiña, E. and Moreno, L. (2022), "Knocking on employment's door: internships and job attainment", *Higher Education*, Vol. 83 No. 1, pp. 137–161, doi: 10.1007/s10734-020-00643-x.

Moscardo, G. and Pearce, P.L. (2007), "The Rhetoric and Reality of Structured Tourism Work Experiences: A Social Representational Analysis", *Tourism Recreation Research*, Vol. 32 No. 2, pp. 21–28, doi: 10.1080/02508281.2007.11081273.

NACE. (2020), *Student Survey Report: Results from NACE's Annual Survey of College Students. NACE.*

Education + Training

Nauta, M.M., Epperson, D.L. and Kahn, J.H. (1998), "A multiple-groups analysis of predictors of higher level career aspirations among women in mathematics, science, and engineering majors.", *Journal of Counseling Psychology*, Vol. 45 No. 4, pp. 483–496, doi: 10.1037//0022-0167.45.4.483.

Ocampo, A.C.G., Reyes, M.L., Chen, Y., Restubog, S.L.D., Chih, Y.-Y., Chua-Garcia, L. and Guan, P. (2020), "The role of internship participation and conscientiousness in developing career adaptability: A five-wave growth mixture model analysis", *Journal of Vocational Behavior*, Vol. 120, p. 103426, doi: 10.1016/j.jvb.2020.103426.

Pedro, J.D. (1984), "Induction into the workplace: The impact of internships", *Journal of Vocational Behavior*, Vol. 25 No. 1, pp. 80–95, doi: 10.1016/0001-8791(84)90038-1.

Pereira, E.T., Vilas-Boas, M. and Rebelo, C.F.C. (2020), "University curricula and employability: The stakeholders' views for a future agenda", *Industry and Higher Education*, Vol. 34 No. 5, pp. 321–329, doi: 10.1177/0950422220901676.

Pérez-Espés, C., Cervera Oliver, M. and Cea D'Ancona, F. (2023), "Impact of curricular internships in accounting on university students: an empirical study in Spain", *Revista de Contabilidad*, Vol. 26 No. 2, pp. 213–228, doi: 10.6018/rcsar.464441.

Prescott, P., Gjerde, K.P. and Rice, J.L. (2021), "Analyzing mandatory college internships: academic effects and implications for curricular design", *Studies in Higher Education*, Vol. 46 No. 11, pp. 2444–2459, doi: 10.1080/03075079.2020.1723531.

Ramírez, M.-A.A., Ciriza, E.A., Gil, C.R. and Cabestre, F.J.R. (2017), "Satisfaction with External Internships: Do Students Acquire the Professional Skills Necessary to Improve their

Education + Training

Employability?", *International Journal of Human Capital and Information Technology Professionals*, Vol. 8 No. 1, pp. 42–50, doi: 10.4018/IJHCITP.2017010103.

Rawlings, P., White, P. and Stephens, R. (2006), "Practice-based learning in information systems: The advantages for students", *Journal of Information Systems Education*, Vol. 16 No. 4, pp. 455–464.

Reddy, P. and Moores, E. (2006), "Measuring the benefits of a psychology placement year", *Assessment and Evaluation in Higher Education*, Vol. 31 No. 5, pp. 551–567, doi: 10.1080/02602930600679555.

Rosario-Moore, A., Graham, K.E., Mitric, S. and Avila, G. (2023), "Shocks to the System: COVID-19's Perceived Interference With the Academic Performance and Plans of University Undergraduates", *Journal of College Student Retention: Research, Theory & Practice*, p. 152102512311564, doi: 10.1177/15210251231156420.

Routon, P.W. and Walker, J.K. (2015), "A Smart Break? College Tenure Interruption and Graduating Student Outcomes", *Education Finance and Policy*, Vol. 10 No. 2, pp. 244–276, doi: 10.1162/EDFP_a_00160.

Routon, P.W. and Walker, J.K. (2019), "College internships, tenure gaps, and student outcomes: a multiple-treatment matching approach", *Education Economics*, Vol. 27 No. 4, pp. 383–400, doi: 10.1080/09645292.2019.1598336.

Scheuer, C.-L. and Mills, A.J. (2016), "Discursivity and Media Constructions of the Intern: Implications for Pedagogy and Practice", *Academy of Management Learning & Education*, Vol. 15 No. 3, pp. 456–470, doi: 10.5465/amle.2014.0358.

Silva, P., Lopes, B., Costa, M., Seabra, D., Melo, A.I., Brito, E. and Dias, G.P. (2016), "Stairway to

Education + Training

employment? Internships in higher education", *Higher Education*, Vol. 72 No. 6, pp. 703–721, doi: 10.1007/s10734-015-9903-9.

Sonnenschein, K., Barker, M. and Hibbins, R. (2019), "Benefits of Work-Integrated Learning: Perceptions Held by Chinese International Students Enrolled in an Australian University and Managers in the Chinese Hotel Industry", *Journal of Hospitality & Tourism Education*, Vol. 31 No. 3, pp. 139–148, doi: 10.1080/10963758.2018.1487784.

Spinks, N., Silburn, N. and Birchall, D. (2006), *Educating Engineers for the 21st Century: The Industry View*.

Surridge, I. (2009), "Accounting and finance degrees: Is the academic performance of placement students better?", *Accounting Education*, Vol. 18 No. 4–5, pp. 471–485, doi: 10.1080/09639280802008498.

Taylor, M.S. (1988), "Effects of college internships on individual participants.", *Journal of Applied Psychology*, Vol. 73 No. 3, pp. 393–401, doi: 10.1037//0021-9010.73.3.393.

Tennant, S., Murray, M., Gilmour, B. and Brown, L. (2018), "Industrial work placement in higher education: A study of civil engineering student engagement", *Industry and Higher Education*, Vol. 32 No. 2, pp. 108–118, doi: 10.1177/0950422218756384.

Tovey, J. (2001), "Building Connections between Industry and University: Implementing an Internship Program at a Regional University", *International Journal of Phytoremediation*, Vol. 21 No. 1, pp. 225–239, doi: 10.1207/s15427625tcq1002_7.

Yorke, M. and Knight, P. (2007), "Evidence-informed pedagogy and the enhancement of student employability", *Teaching in Higher Education*, Vol. 12 No. 2, pp. 157–170, doi:

Education + Training

10.1080/13562510701191877.

7 Appendix

Table 12 Graduates in the sample broken down by year and BA/MS programmes.

Program code	Level	2016	2017	2018	2019	2020	2021
BA_L8	BA	70	83	98	129	108	177
BA_L9	BA	174	200	283	279	322	356
Total BA		244	283	381	408	430	533
MS_ITA	MS	214	250	264	263	322	452
MS_ENG	MS	90	83	93	164	165	200
Total MS		304	333	357	427	487	652

Education + Training