Assessing the Role of 21st Century Skills on Internship Outcomes in a Steel Multinational Enterprise

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Abstract

Internships prepare students for the workplace by giving them opportunities to develop relevant skills. The Committee on the Assessment of 21st Century Skills of the U. S. National Research Council (NRC), the operating arm of the National Academy of Sciences (NAS), has been developing definitions of workplace skills enabling individuals to face 21st Century challenges. In 2010 the Committee defined three categories of skills underpinning a broad range of jobs: cognitive, interpersonal, and intrapersonal. The goal of this paper is to identify the NRC 21st Century skills that are related to measured internship performance outcomes.

The three outcomes we studied are execution of the internship main tasks, learning task-related new knowledge, and overall internship performance. The subjects for this study include interns, participating in a Mexican National Internship Program from summer 2006 to summer 2010 working at a multinational enterprise in the global steel industry, Ternium Mexico. Intern performance data had been collected using a unique instrument that was developed to evaluate the professional performance of the full time employees of the firm. A general model of internship outcomes was created using the three categories of 21st Century skills. Linear regression was used to predict main task and learning performance internship outcomes, and ordered logistic regression was used to predict overall internship performance. The results confirmed that (1) cognitive intelligence or technical skills are necessary but not sufficient for success in executing professional tasks and (2) certain interpersonal and intrapersonal skills were also significantly associated with better professional performance as an intern.

Introduction

Competition in the global market requires employees to be highly qualified for different types of tasks [1,2] and have transferable skills.[3] In 2007, the European Union called for more research on the skills and competencies required for incremental innovation on products, processes, and organizational and marketing methods.[4]

Clarke and Winch defined skill as "an attribute or property of an individual, associated with the performance of specific tasks, associated with physical or manual dexterity and is not necessarily associated with a particular knowledge base." [5] Clarke and Winch also defined skill in an industrial framework as "the ability to apply theoretical knowledge in a practical context". In 2011, Toner added that the notion of "the theoretical knowledge encompasses not just technical subjects, but mathematics, work planning, autonomous working, problem solving and critical thinking." [6]

The NRC Committee on the Assessment of 21st Century skills has created a list of skills necessary for different types of employment, from high-wage scientists and engineers to low-wage restaurant servers and elder caregivers. The NRC defined three categories of skills that will be the independent variables in this study: (1) Cognitive skills: problem solving (non-routine), critical thinking, systems thinking, information/ ICT literacy, creativity, and learning to learn/meta-cognitive skills; (2) Interpersonal skills: complex communication, social skills, teamwork/collaboration, social-cultural sensitivity, responsibility, tolerance for diversity, emotional/social intelligence, and leadership; and (3) Intrapersonal skills: self-management, time management, self-development, self-regulation, adaptability, flexibility, executive functioning, core self evaluation, work ethic, persistence, study skills, ethics & integrity, and citizenship.[7]

Previous studies have investigated the skills that will be required in the 21st Century. Some have focused on specific skills such as critical thinking, [8,9,10] while others have studied categories of skills independently, including cognitive skills, [11,112,13] social skills, [14,15] self-regulation, [16,17] and intrapersonal skills.[18] A few other studies have investigated more than one skill or category of skills simultaneously such as the effect of cognitive and interpersonal skills on individual performance.[19] A more recent theoretical discussion of professional performance considered multiple aspects such as thinking and working skills, working tools, and living in the world skills.[20]

Empirical studies (based on data on individual employees) have modeled the impact of cognitive and non-cognitive ability on income, [21] and some colleges have been using standardized tests and non-cognitive skill tests to assess correlations between admission scores and professional effectiveness. [22]

Researchers agree that cognitive intelligence or technical skills are needed, but not sufficient to have success in executing complex professional tasks and that interpersonal and intrapersonal skills improve performance. [23,24] Some authors hold that the cognitive skill is the basic determinant of labor market outcomes. [25] In contrast, others researchers have stated that "Non-cognitive ability is as important, if not more important, than cognitive ability." [26] Globalization and world class competitiveness requires teamwork skills, occupational competencies, applying theoretical learning in practical solutions, routine and non-routine problem solving, the ability to deal with uncertainty, verbal and written communication skills, the understanding of needs of external and internal customers, and the ability to engage with external suppliers, among other skills. [27]

The present study empirically relates the NRC 21st Century Skills Categories to internship performance metrics using data from industrial internship performance reports.

In Mexico, college students must participate in a country-wide mandatory internship program established by Mexican Law. [28] Firms propose projects involving interns in spring, summer and fall. The firm's department of human resources visits universities and technological institutes to identify students who meet the internship criteria. The students select the project they want, and are interviewed and accepted by the firm project owner, also called the internship tutor. Mexican Law of Professions and Law of Education requires an internship tutor to advise, support and assess interns.[29] Students plan and organize their time in order to meet the objectives, main tasks, and learning goals to complete the internship. At the end of the academic period, each intern is assessed as an employee and the firm sends an internship completion letter to the student's university. This study used national level information regarding a Mexican Internship Program of a steel multinational enterprise. The internship tutor uses the same instrument to evaluate regular employees to assess interns, evaluating the internship outcomes: (1) mastering main tasks, (2) learning new knowledge, and (3) overall performance.

Methodology

This study used Structural Equation Modeling, methodology generally used in social sciences to study complex relationship among multiple attributes in determining an effect. 30 In this study, the success of the internship may be thought to be the result of the students having and developing a set of skills. The various skills would then be the variables and the internship success the function of these variables that produces the desired outcome. This approach uses a statistical method to sort out the significant variables and then test and estimate them to arrive at a model that represents the significance

of the possible variables in describing the features of the internship experience that can be considered determinants for its success.

In brief, we define the independent and dependent variables that describe the experience; and use a statistical analysis of qualitative questionnaire-based data to sort out their relevance in answering the research questions, and for testing our research hypotheses described below. A methodology in eight-steps was used, which is explained herewith.

Step 1. Set a research question and its particular hypotheses.
Step 2. Conceptualize a general model and define the dependent and independent variables.
Step 3. Design and pilot a questionnaire; random application or census to build a database.
Step 4. Perform multicollinearity tests to identify which of the variables should be kept and/or dropped from the database to execute the structural model to be able to answer the research question and finally test the hypotheses.
Step 5. Once the multicollinearity test has been met, an internal data consistency test and explanatory descriptive analysis can be executed.
Step 6. Execute the structural equation modeling, using at least one regression method to run the structural model in accordance with the type of the dependent variable. A set of models should be tested to find the best one, ensuring that each new model met the overall significance of the regression and improve the R-squared. Once the best model is found; it was tested for heteroskedasticity, model specification error and for omitted variables problems.
Step 7. Interpret the results.
Step 8. Formulate conclusions and discussion

In the following paragraphs, each of the steps are showed in detail.

Research questions and hypotheses

This study addresses whether the three NRC skill categories are determinants of professional intern performance. Taking into account the context of an industrial internship, the hypotheses are:

H1: Understanding of internal and external clients is a cognitive skill that improves at least one of the following internship outcomes: accomplishing main tasks, learning new knowledge, and overall performance as an intern.

H2: Planning and organizing ability is a cognitive skill that increases at least one of the internship outcomes.

H3: Applying theoretical learning to practical solutions is a cognitive skill that fosters at least one of the internship outcomes.

H4: Teamwork or collaboration ability is an interpersonal skill that impacts at least one of the internship outcomes.

H5: Proactivity and self-updating is an intrapersonal skill that influences at least one of the internship outcomes.

H6: Ability to work in ambiguous situations is an intrapersonal skill that influences at least one of the internship outcomes.

Conceptual model

Figure 1 shows the conceptual model to answer the test the six hypotheses. The independent variables are related to the NRC skill categories. The cognitive category includes skills such as understanding needs of internal and external clients, planning and scheduling internship activities, finding relevant information, practical ability to apply his/her technical competencies, good judgment implementing his/her ideas, and writing reports to share information. The interpersonal category contains skills such as oral communication, network building, working with members from other areas, ability to coordinate tasks in a group. The intrapersonal category contains the following skills: proactivity for his/her professional self-updating, seeking feedback, tolerating frustration due to difficulties and failures, working in ambiguous situations, and recognizing and appraising contributions from others. We control for variables related to gender, academic period, major, type of higher education institution, and firm division where the internship took place. There were four dependent variables to assess the professional intern performance: 1) the performance of main tasks, 2) the

capacity to learn new knowledge, 3) the project execution, and 4) overall performance to execute the internship.

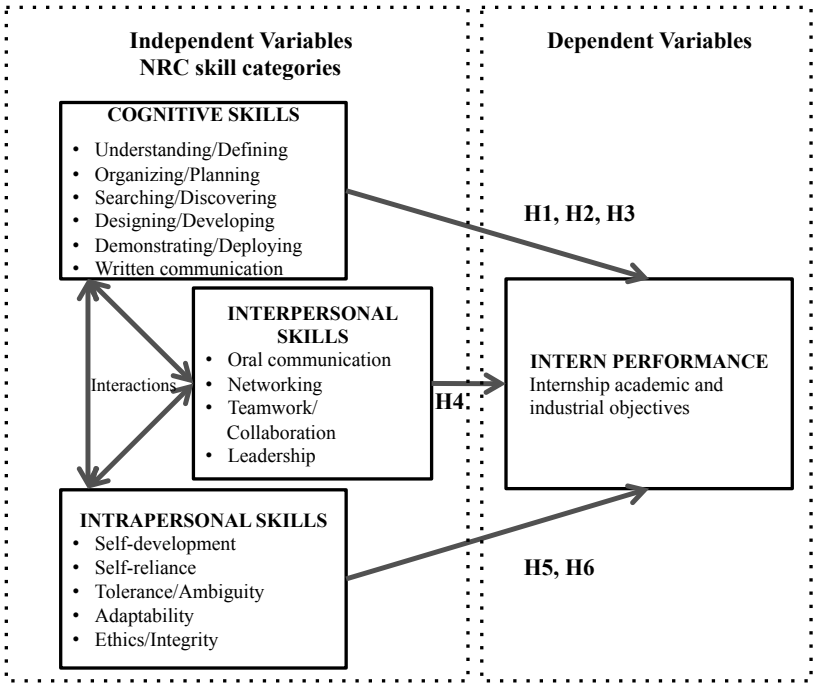

Figure 1. A conceptual model of the relationship between internship skills and dimensions of professional performance of an intern

Method of collecting data

The dependent and independent variables were collected using a unique instrument designed, piloted, and applied for evaluating each year the professional performance of the full time employees in the firm, and each academic period (spring, summer and fall) intern performance. This instrument has been used for the steel multinational enterprise for more than 10 year in all its plants around the world. The database was built with the assessment of all students interning from summer 2006 to summer 2010, covered 500 students who complete a first internship. The instrument is organized into two parts. Section A. intern objectives, and Section B. professional skills needed in this firm. Section A assesses the performance of main tasks assigned to the interns, how well they learned new knowledge required

for the internship tasks, the project execution, and overall performance as an intern. Section B assesses 43 skills divided in six subsections: 1. Professional expertise (includes 6 skills); 2. Business management (includes 6 skills); 3. Drive for results (includes 7 skills); 4. Client focus (includes 2 skills); 5. Interpersonal skills are divided in: 5.1. teamwork (includes 6 skills), 5.2. Communication (includes 4 skills), and 5.3. Leadership (includes 3 skills); and 6. Sharing knowledge is divided in: 6.1. Searching for information (includes 2 skills), 6.2. Using and applying knowledge (includes 2 skills), 6.3. Sharing knowledge (includes 2 skills), and 6.4. explicit knowledge (includes 3 skills). A five point Likert scale was used in each question in the evaluation instrument, where: 5 = very good performance, 4 = good performance, 3= satisfactory performance, 2 = poor performance, and 1 = very poor performance. At the end of the academic period, the internship tutor assessed each intern, using the same instrument of evaluation that the firm uses for the regular employees.

Multicollinearity Testing

The multicollinearity testing of all dependent and independent variables in the unique instrument included the bivariate correlation test, the tolerance test (T), and the variation inflation factor test (VIF). Tests showed that all values of T were >0.29 and VIF were <3.5, showing no multicollinearity problems in the data. Furthermore, we dropped independent variables having bivariate correlations greater than 70% with any of the other variables. Table 1 shows in the first column the independent variables kept in the study, and in the second column are the independent variables dropped in the study to avoid multicollinearity problems arranged according with the firm's skill categories. The first digit in the number shown in each item refers to the subsection of section B; in items with three digits the second digit is the area in the subsection. For all items the last digit is the question or skill that the internship tutor assessed at the end of the academic period for each intern. In addition, one of the

dependent variables was dropped, project execution, due to high correlation with the performance of main tasks.

Table 1 List of independent variables kept and dropped in the study

Variables kept in the Model	Variables dropped in the Model due multicollinearity problems
1. Professional Expertise	
1.2. Practical ability to apply his/her Professional Competences	1.1. Possesses specific knowledge and skills of his/her profession
1.3. Good judgment to implement his/her ideas	1.6. Shows maturity about his/her professional growth expectations
1.4. Utilizes various ways to network building	
1.5. Proactive for his/her professional self-update	
2. Business management	
2.3 Planning and scheduling his/her activities	2.1. Connects project objectives with the company's objectives
	2.2. Aligns projects activities with sector targets
	2.4. Establishes priorities and reports achieved results on time
	2.6. Recognizes mistakes and reacts with a continuously improving attitude
	2.7. Makes his/her job methodological achieving all quality standards
3. Drive for results	
3.5. Tolerates frustration due to difficulties and failures	3.1. Responsible for his/her specific role
3.6. Can work in ambiguous situations	3.2. Completes tasks and achieves the objectives
	3.3. Exceeds requirements and goes beyond
	3.4. Self-motivation without external stimuli
	3.7. Intern maintains his/her effectiveness under pressure
4. Client focus	
4.1 Needs understanding of internal and external clients	4.2. Considers the impact of his/her tasks on other projects
5. Interpersonal skills: 5.1 Teamwork	
5.1.3. Works with members of other sectors	5.1.1. Achieves an appropriate link with his/her leader
5.1.5. Recognizes and appraises contribution from others	5.1.2. Integrates his/her work with his/her sector/department
	5.1.4. Contributes to a good working environment
	5.1.6. Ability to work in multidisciplinary/multicultural teams
	5.1.7 Listens and understands ideas of speaker
5. Interpersonal skills: 5.2. Communication	
5.2.2. Seeks feedback	5.2.1 Listens and understands ideas of speaker
5.2.3. Expresses his/her ideas clearly and with confidence	5.2.4 Presents reports in a professional way
5. Interpersonal skills: 5.3. Leadership	
5.3.2. Has ability to coordinate group tasks	5.3.1. Influences his/her group by persuasion and consensus
	5.3.3 Achieves respect and authority
6. Sharing knowledge: 6.1 Searching information	
6.1.2. Proactive to locate contacts who have relevant information	6.1.1. Finds relevant information for his/her project
6. Sharing knowledge: 6.2 Using and applying knowledge	
	6.1.2. Takes advantage of the existing knowledge of the firm
	6.2.2. Avoids designing processes or tasks from scratch
6. Sharing knowledge: 6.3 Sharing knowledge	
6.3.2. Writes report for information sharing	6.3.1. Shows a positive attitude towards sharing knowledge
6. Sharing knowledge: 6.4 Explicit knowledge	
	6.4.1. Makes documents to share knowledge
	6.4.2. Develops industrial and administrative procedures for the tasks performed
	6.4.3. Inventories best practices for his/her project

Data Internal consistency test and Explanatory Descriptive Analysis

In addition to the multicollinearity tests, the Cronbach's alpha test was used to evaluate the internal consistency of respondents. Alphas of 0.70 or higher are acceptable. The alpha for cognitive skills was 0.91; for interpersonal skills, 0.88; for intrapersonal skills, 0.90; and the global alpha was 0.96.

Table 2 Firm skills categories and the NRC skill categories and its items in the questionnaire

Firm Skill Categories	
1. Professional Expertise	
Designing/Developing	1.2. Practical ability to apply his/her Professional Competences
Demonstrating/Deploying	1.3. Good judgment to implement his/her ideas
Networking	1.4. Utilizes various ways to network building
Self-development	1.5. Proactive for his/her professional self-update
2. Business management	
Planning	2.3 Planning and scheduling his/her activities
3. Drive for results	
Tolerance for stress	3.5. Tolerates frustration due to difficulties and failures
Adaptability / Ambiguity	3.6. Can work in ambiguous situations
4 Client focus	
Understanding/Defining	4.1 Needs understanding of internal and external clients
5. Interpersonal skills	
5.1 Teamwork	
Teamwork / Collaboration	5.1.3. Works with members of other sectors
Ethic / Integrity	5.1.5. Recognizes and appraises contribution from others
5.2. Communication	
Self-reliance	5.2.2. Seeks feedback
Oral Communication	5.2.3. Expresses his/her ideas clearly and with confidence
5.3. Leadership	
Leadership	5.3.2. Has ability to coordinate group tasks
6. Sharing Knowledge	
6.1 Searching information	
Searching/Discovering	6.1.2. Proactive to locate contacts who have relevant information
6.3. Sharing knowledge	
Written communication	6.3.2. Writes report for information sharing

NRC Skill Categories	
1. Cognitive Skills	
Understanding/Defining	4.1 Needs understanding of internal and external clients
Planning	2.3 Planning and scheduling his/her activities
Searching/Discovering	6.1.2. Proactive to locate contacts who have relevant information
Designing/Developing	1.2. Practical ability to apply his/her Professional Competences
Demonstrating/Deploying	1.3. Good judgment to implement his/her ideas
Written communication	6.3.2. Writes reports to share information
2. Interpersonal skills	
Oral Communication	5.2.3. Expresses his/her ideas clearly and with confidence
Networking	1.4. Utilizes various ways to network building
Teamwork/Collaboration	5.1.3. Works with members of other sectors
Leadership	5.3.2. Has ability to coordinate group tasks
3. Intrapersonal Skills	
Self-development	1.5. Proactive for his/her professional self-update
Self-reliance	5.2.2. Seeks feedback
Tolerance for stress	3.5. Tolerates frustration due to difficulties and failures
Adaptability/Ambiguity	3.6. Can work in ambiguous situations
Ethic/Integrity	5.1.5. Recognizes and appraises contribution from others

Table 2 shows the firm skills categories and the NRC skill categories, and the skills-questions that were kept in the study to avoid multicollinearity problems. These skills were used to execute the conceptual model.

Table 3 shows a summary of the 20 independent variables included in the study taking account the NRC skills categories: six cognitive skills, four interpersonal skills, and five intrapersonal skills, and five control variables. This table also includes the three dependent variables, which are the main tasks performance assigned to the interns, how well they learned new knowledge required for the internship

tasks, and overall performance as an intern. The first two columns represent the independent variables and the next eight columns show the mean and standard deviation for independent variables related with the three NRC skills categories and frequency for each control variables.

Table 3. Explanatory Descriptive Analysis for Overall Intern Performance

Independent Variables			Dependent Variables							
NRC Skill category	Variables	Skills/attrubutes/Attitudes assessed by the firm	**Main tasks Learnings**		**Overall performance**					
					Below n=14		Satisfactory n=216		Above n=270	
			Mean	*sd*	*Mean*	*sd*	*Mean*	*sd*	*Mean*	*sd*
Cognitive Skills	Understanding / Defining	Needs understanding of internal and external clients	3.62	0.80	2.43	1.02	3.12	0.52	4.09	0.66
	Planning	Planning and scheduling his/her activities	3.61	0.83	2.43	0.85	3.15	0.65	4.04	0.70
	Searching / Discovering	Proactive to locate contacts who have relevant information	3.61	0.83	2.29	0.99	3.15	0.64	4.04	0.69
	Designing / Developing	Practical ability to apply his/her Professional Competences	3.72	0.75	2.64	1.01	3.27	0.50	4.14	0.62
	Demonstrate / Deploying	Good judgment to implement his/her ideas	3.65	0.79	2.36	0.84	3.20	0.54	4.08	0.68
	Written communication	Writes reports to share information	3.72	0.84	2.29	0.99	3.20	0.55	4.21	0.67
Interpersonal Skils	Oral Communication	Expresses his/her ideas clearly and with confidence	3.54	0.80	2.21	0.80	3.08	0.53	3.98	0.69
	Networking	Utilizes various ways to network building	3.58	0.79	2.36	1.01	3.14	0.52	4.00	0.70
	Teamwork / Collaboration	Works with members of other sectors	3.68	0.84	2.43	1.09	3.19	0.58	4.14	0.71
	Leadership	Has ability to coordinate group tasks	3.51	0.83	2.43	1.09	3.07	0.60	3.92	0.75
Intrapersonal skills	Self-development	Proactive for his/her professional self-update	3.69	0.81	2.29	0.83	3.25	0.56	4.11	0.70
	Self-reliance	Seeks feedback	3.60	0.86	2.21	0.97	3.23	0.67	3.97	0.79
	Tolerance for stress	Tolerates frustration due to difficulties and failures	3.59	0.81	2.21	1.05	3.14	0.57	4.01	0.69
	Adaptability / Ambiguity	Can work in ambiguous situations	3.55	0.83	2.21	1.05	3.08	0.55	4.00	0.71
	Ethic / Integrity	Recognizes and appraises contribution from others	3.74	0.82	2.50	1.02	3.28	0.52	4.18	0.74
Control variables			***Freq***	***%***	***Freq***	***%***	***Freq***	***%***	***Freq***	***%***
Gender		Male, ***baseline***	310	62%	26	5%	122	24%	162	32%
		Female	190	38%	22	4%	95	19%	73	15%
Period		Summer, ***baseline***	154	31%	12	2%	63	13%	79	16%
		Fall	126	25%	15	3%	62	12%	49	10%
		Spring	220	44%	21	4%	92	18%	107	21%
Major		Industrial, ***baseline***	169	34%	16	3%	74	15%	79	16%
		Chemical	62	12%	6	1%	30	6%	26	5%
		Materials and Mechanical	127	25%	15	3%	53	11%	59	12%
		Business	50	10%	7	1%	25	5%	18	4%
		Electronics	77	15%	4	1%	26	5%	47	9%
		Others	15	3%	0	0%	9	2%	6	1%
Type of University		Private Technological Institutions, ***baseline***	157	31%	15	3%	59	12%	83	17%
		Public Technological Institutions	26	5%	0	0%	13	3%	13	3%
		Public Universities	205	41%	24	5%	89	18%	92	18%
		Private Univesrities	112	22%	9	2%	56	11%	47	9%
Firm Division		Human resources, ***baseline***	185	37%	8	2%	82	16%	95	19%
		Engineering and Technology	82	16%	3	1%	45	9%	34	7%
		Management and Finance	28	6%	2	0%	7	1%	19	4%
		Operations	205	41%	1	0%	82	16%	122	24%

In Table 3 the 5-point Likert scale is collapsed into three-points. We found it necessary to compact the five-point scale to a three-point scale the ordered logistic regression model because of the small number of answers in the first and fifth level of the Likert scale. This allowed the study to meet the parallel lines assumption for the overall intern performance. The linear regression models for execution of main tasks and learning of new knowledge used the five-point Likert scale.

From the explanatory descriptive analysis, in Table 1, one can see that 270 interns were assessed above a satisfactory performance, 216 completed their internship with a satisfactory performance, and only 14 of the 500 were evaluated with a performance below the satisfactory level. The practical ability to apply his/her technical competencies (mean =3.72) and writing reports to share information with others (mean =3.72) were better evaluated as cognitive skills; when interns work with members of other areas (mean =3.68) was better evaluated as a interpersonal skill; and recognizing and appraising contribution from others (mean =3.74) was better evaluated as intrapersonal skills.

Three hundred ten males (baseline) and 190 women were in cohort. One hundred fifty-four154 internships were completed in summertime (baseline), 126 on fall time, and 220 on springtime. One hundred sixty-nine industrial engineers (baseline), 62 chemical engineers, 127 material and mechanical engineers, 77 electronic engineers, 50 business bachelors; and 15 other academic programs form the 500 internships. Private technological institutions (baseline) form 157 internships; private universities, 112 internships; public technological institutions, 26 internships; and public universities, 205 internships.

Analysis methods and selection of best model

The six hypotheses were tested using linear regression and ordered logistic models. Equation 1 represents the linear model form. Linear models predicted two internship outcomes (y_i): accomplishing main tasks and learning task-related new knowledge. Equation 2 represents the ordered logistic model for overall intern performance. This model form was necessary for linear models with heteroskedastic

residuals. The independent variables were categorized as cognitive ($\boldsymbol{X}_1$), interpersonal ($\boldsymbol{X}_2$), intrapersonal skills ($\boldsymbol{X}_3$) and control variables ($\boldsymbol{X}_4$).

$$y_i = \beta_o + \boldsymbol{X}_{1i}\,\beta_1 + \boldsymbol{X}_{2i}\,\beta_2 + \boldsymbol{X}_{3i}\,\beta_3 + \boldsymbol{X}_{4i}\,\beta_4 + u_i \quad [1]$$

$$y_i^* = \propto_o + \boldsymbol{X}_{1i}\,\gamma_1 + \boldsymbol{X}_{2i}\,\gamma_2 + \boldsymbol{X}_{3i}\,\gamma_3 + \boldsymbol{X}_{4i}\,\gamma_4 + \varepsilon_i \quad [2]$$

Table 4 shows the three additive models for each internship outcome. Each subsequent model is nested in the previous model. Model 1 includes only the control variables; Model 2 adds the interpersonal skills. Model 3 includes the control variables, interpersonal skills, intrapersonal skills and control variables. Model 4 includes the control variables and the three 21st century skills categories: interpersonal, intrapersonal and cognitive skills. The best additive model for the dependent variable, main tasks performance, was the Model 4 ($F=3.99$, $p \leq 0.002$, and $R^2=0.72$). Model 4 also was best for learning new knowledge ($F=5.02$, $p \leq 0.000$, and $R^2=0.41$). The best additive model for overall performance as an intern was Model 4 (LR=63.41, df=6, $p \leq 0.000$, and AIC=390).

The Breusch-Pagan and Cook-Weisberg test for heteroskedasticity shows that the errors from the main tasks and learning performance models passed the homoscedastic assumption, but the overall performance as an intern residuals did not meet the homoscedastic assumption, showing a residual variation associated with gender. Therefore, a heteroscedastic order logistic model was needed. This model had a $\chi^2 = 6.18$, $p \leq 0.013$, and AIC = 385.

Once the best linear regression models were found, tests were run to detect model specification error and to detect omitted variables, the Ramsey reset test. The best model for main task execution and

learning performance passed both the specification error and the omitted variables tests. Similarly, the best ordered logistic model for the overall intern performance passed the parallel lines assumption test, indicating a well specified model.

Results interpretation

Table 4 shows the best model for each internship outcome: main tasks, learning new knowledge, and overall intern performance predicted by the 21st Century skill categories. The cognitive skills with positive effects on the execution of main tasks were understanding needs for both internal and external clients (ß = 0.19, $p \leq 0.000$), planning and scheduling internship activities (ß=0.09, $p \leq 0.002$), practical ability to apply his/her technical competencies (ß=0.08, $p \leq 0.031$), good judgment to implement his/her ideas (ß=0.07, $p \leq 0.048$), and writing reports to share information with others (ß=0.12, $p \leq 0.001$). Proactivity to locate contacts that had relevant information had a negative effect on task execution (ß=-0.07, $p \leq 0.020$). Teamwork/collaboration measured by the ability to work with members in other areas had a significant and positive effect on the execution of the main tasks (ß=0.08, $p \leq 0.021$). An intrapersonal skill with significant and positive effects was the ability to work in ambiguous situations (ß=0.09, $p \leq 0.009$).

The best linear model for learning new knowledge shows the following results: only two of six cognitive skills had significant and positive effects on learning new knowledge, these were understanding needs of both internal and external clients (ß=0.29, $p \leq 0.000$), and having good judgment to implement his/her ideas (ß=0.15, $p \leq 0.064$). No interpersonal skills were significant for the best linear model of learning new knowledge. The intrapersonal skill, proactivity for his/her professional self-update had a significant and positive effect (ß=0.16, $p \leq 0.033$). Completing an

internship during fall and spring academic periods instead of the summer period had a negative effect on internship learning ($ß_{fall}$=-0.63, $ß_{summer}$=-0.97, $p \leq 0.000$ for both fall and spring).

Table 4. Additive models for internship outcomes: main tasks, learnings, and overall performance

			Linear Models						Ordered Logistic Models		
Internship Outcomes Models: Multinational Steel Company			**Interval dependent variable**						**Ordinal variables**		
Skill category (NRC)	**Independent variables**	**Skill assessed by the firm Firm intern evaluation**	**Main tasks**			**Learnings**			**Overall Performance**		
			Coef		***p***	**Coef**		***p***	**Odds Ratio**		***p***
Cognitive Skills	Understanding / Defining	Needs understanding of internal and external clients	0.19	***	0.000	0.29	***	0.000	5.14	***	0.000
	Planning	Planning and scheduling his/her activities	0.09	**	0.002	0.08		0.243	1.80	+	0.055
	Searching / Discovering	Proactive to locate contacts who have relevant information	-0.07	*	0.020	-0.06		0.416	1.18		0.613
	Designing / Developing	Practical ability to apply his/her Professional Competences	0.08	*	0.031	0.09		0.257	2.54	*	0.017
	Demonstrate / Deploying	Good judgment to implement his/her ideas	0.07	*	0.048	0.15	+	0.064	1.55		0.256
	Written communication	Writes reports to share information	0.12	**	0.001	0.09		0.252	4.01	***	0.000
Interpersonal Skils	Oral Communication	Expresses his/her ideas clearly and with confidence	0.05		0.178	-0.06		0.426	1.81		0.111
	Networking	Utilizes various ways to network building	0.06	+	0.102	0.04		0.604	0.99		0.977
	Teamwork / Collaboration	Works with members of other sectors	0.08	*	0.021	0.01		0.846	2.24	*	0.028
	Leadership	Has ability to coordinate group tasks	0.03		0.453	-0.04		0.551	0.69		0.307
Intrapersonal skills	Self-development	Proactive for his/her professional self-update	0.04		0.242	0.16	*	0.033	2.22	*	0.026
	Self-reliance	Seeks feedback	-0.06	+	0.054	-0.08		0.190	0.64		0.145
	Tolerance for stress	Tolerates frustration due to difficulties and failures	0.06		0.104	0.08		0.302	1.10		0.812
	Adaptability / Ambiguity	Can work in ambiguous situations	0.09	**	0.009	0.02		0.793	1.88	+	0.079
	Ethic / Integrity	Recognizes and appraises contribution from others	0.04		0.296	-0.02		0.833	1.00		1.000
Control Variables	Gender, baseline = Male	Female	0.02		0.617	0.11		0.200	1.02		0.965
	Period	Fall	0.02		0.743	-0.63	***	0.000	0.68		0.470
	baseline = Summer	Spring	0.01		0.890	-0.97	***	0.000	0.44	+	0.090
	Major	Chemical	0.09		0.145	-0.03		0.840	1.05		0.945
	baseline = Industrial	Materials and Mechanical	0.03		0.510	0.10		0.315	2.20		0.104
		Business	0.09		0.222	0.15		0.354	1.00		1.000
		Electronics	-0.07		0.227	-0.11		0.368	0.48		0.230
		Others	0.17		0.102	-0.17		0.453	4.97		0.605
	Type of University	Public Technological Institutions	0.22	*	0.012	0.09		0.650	3.41		0.207
	baseline = Private Tech	Public Universities	0.11	*	0.026	0.06		0.546	0.74		0.569
		Private Univesrities	0.05		0.299	0.10		0.362	1.84		0.250
	Firm Division	Engineering and Technology	0.09		0.123	0.17		0.162	0.40		0.100
	baseline=Human Resources	Management and Finance	0.02		0.818	-0.09		0.685	2.53		0.441
		Operations	0.11	*	0.023	0.11		0.306	1.38		0.517
	Addressing Heteroskedasticity	Gender: Female							0.42	**	0.013
		Period: Fall									
	lnsigma	Period : Spring									
		6.1.2. Proactive to locate contacts that has relevant info.									

The best-ordered logistic model for overall performance as an intern included four of six cognitive skills: understanding needs for both internal and external clients (Odds ratio=5.14, $p \leq 0.000$), planning and scheduling internship activities (Odds ratio=1.80, $p \leq 0.055$), practical ability to apply his/her technical competencies (Odds ratio=2.54, $p \leq 0.017$), and writing reports to share information with others (Odds ratio=4.01, $p \leq 0.000$). The model also included the interpersonal skill of teamwork/collaboration measured by the ability to work with members of other areas (Odds ratio=2.24,

$p \leq 0.028$) and the intrapersonal skills measured by proactivity for his/her professional self-update (Odds ratio=2.22, $p \leq 0.028$), and the ability to work in ambiguous situations (Odds ratio=1.88, $p \leq 0.079$). Completing the internship in fall and spring academic periods compared with summer had a negative effect on the overall performance as an intern, but only spring was significant (Odds ratio-spring=-0.44, $p \leq 0.090$).

Conclusions and discussions

This study confirmed the theoretical notion stated by Goleman, [21] Whetten & Cameron, [22] and the Committee on the Assessment of 21st Century Skills of the NRC [5], that cognitive skills are necessary but not sufficient for success in executing complex professional tasks. Interpersonal and intrapersonal skills are needed as well.

All six hypotheses were found to be true for the internships represented in the database. Understanding needs of internal and external clients (H1) increased the effect on the three internship outcomes: main tasks, learning task-related new knowledge, and overall performance. Planning and organizing abilities (H2), practical ability to apply his/her technical competencies (H3), teamwork/collaboration (H4), the ability to work in ambiguous situations (H6) also increased the effect of main tasks execution and the overall performance as an intern. Proactivity for her/his professional self-updating (H5) contributed to learning and overall performance as an intern.

In addition to confirming the theoretical relationships between skills and intern performance, this study revealed a practical and actionable option to improve internship performance. Performing an internship during the regular fall and spring academic semesters had a negative effect on learning and

overall performance as an intern compared to internships completed in the summer. It is plausible that when interns are distracted by coursework, their internship performance suffers. Firms and universities could set policies to schedule the most complex and interesting internships in summer or to discourage students from taking internships during the regular school year.

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