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ASSESSING COLLEGE STUDENTS' SOFT SKILLS WITH A MULTIFACTED SOFT SKILL METRIC

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ABSTRACT

Soft skills, such as learning, communication (reading, writing and speaking), adaptability, self-management, teamwork, and leadership skills, while being widely recognized as extremely important qualifications to the workplace, still remain difficult to observe, quantify, and measure. Sandeep Purao, Professor of the College of Information Sciences and Technology (IST) initiated the idea of developing a multifaceted soft skill metric specifically designed to evaluate college students' soft skill performances in his research study with Hoi Suen, Distinguished Professor of Educational Psychology. Professor Purao also developed a complete soft skill metric in a subsequent research study. However, this soft skill assessment tool has not been examined or used by any researcher. This thesis, through a study of 89 subjects from four courses at the Pennsylvania State University, uses the metric to analyze the soft skill differences among four distinct subject groups: entry-level IST students, senior-level IST students, entry-level Business students, and senior-level Business students respectively. This study also examines the relationship between soft skill presences in each student group and several possible influential factors, including their GPAs, internship and project experiences, job offer statuses, and etc..

CONTENTS

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Finally, I offer my deepest blessings to my families, friends, and all of those who have supported me in any aspect during the completion of this thesis.

1. Introduction

As early as in the 1980s, Anthony Carnevale, director of the Gerogetown University Center on Education and the Workforce, had recognized the value and strategic importance of soft skills. Learning, communication (reading, writing and speaking), adaptability, self-management, teamwork, and leadership skills, which Dr. Carnevale identified as extremely important soft skills to achieve workplace competencies, still remain crucial and necessary today. Many researchers have suggested that college students can acquire soft skills through several ways including internships, co-ops, semester long projects with external sponsorship, etc. (Haq, etc., 2001; Lacy, 2003; and Purao and Suen, 2010). However, because soft skills are difficult to evaluate (Wanger and Sternburg, 1985), it is difficult to prove that those external factors do have influences over the soft skills of the students.

In their research study, *Designing a Multi-Faceted Metric to Evaluate Soft Skills*, Sandeep Purao, Professor of College of Information Sciences and Technology and Hoi Suen, Distinguished Professor of Educational Psychology, both at the Pennsylvania State University, suggested a method on how to develop a reliable soft skill assessment tool to resolve this issue (Purao and Suen 2010). In a subsequent research, Dr. Sandeep Purao turned the idea into a practical multifaceted soft skill metric[1].

Powered with the metric, it is no longer a difficult task to evaluate the soft skill presences in college students. The measurement results can be applied to examine whether there exists a relationship between soft skills and external factors such as age, GPA, internship and project experiences, credits currently taking as well as job offer status and what kind of relationship it is.

[1] Dr. Sandeep Purao had further improved the soft skill metric and developed an online soft skill assessment tool named SASSY , which could be accessed at aesop.ist.psu.edu/softskills

1.1. Research Questions

There are two research questions that guide this study:

1. *How soft skills differ among college students?*

   The subjects will be grouped into four distinct groups with each representing a combination of major and grade standing. The groups will be compared with each other to discover differences in soft skills. The hypothesis here is that within the same college, students with higher grade standings tend to perform better overall in their soft skill assessments; and within the same grade standing, students from the different majors will have comparative advantages in different soft skill sets.

2. *Do external factors influence the presence of soft skills and how is each soft skill category affected by the external factors?*

   As mentioned earlier, many researchers have suggested that soft skills can be influenced by external factors such as internship and project experiences. In my study, four more factors, age, GPA, credits currently taking and job offer status are added to the list of external factors to be examined. The hypothesis here is that either a direct or inverse relationship will exist between soft skills and external factors. For example, the presence rate of certain soft skill categories (e.g. abilities to handle conflicts) should increase with the number of internship and project experiences.

1.2.Research Methods

In the experiment, in-class presentations of the soft skill research study were given to four distinct courses at the Pennsylvania State University, University Park – with the first two being entry-level (freshman and sophomore year) courses, and the second two being senior-level courses. Between the two courses within each level, one was derived from the College of Information Sciences and Technology (IST), and the other was from the Smeal College of Business (Smeal). Students were asked to voluntarily participate in the study and answer a two-page paper survey which included one background survey and one scenario-based short-answer survey. A total of 89 responses were successfully collected. After assessing each subject's soft skills using the soft skill metric, four comparisons were conducted to see how differences in soft skills relate to differences in students' majors and grade standings.

The four specific comparisons are as follows:

1. *IST entry-level versus IST senior-level*
2. *Smeal entry-level versus Smeal senior-level*
3. *IST entry-level versus Smeal entry-level*
4. *IST senior-level versus Smeal senior-level*

The means of each external factor in the subject groups as well as the presence rates of every soft skill category in the same group will be used to perform a correlation analysis to examine whether there exists a statistically significant direct or inverse relationship between them.

1.3.Contributions

The potential contributions of this research study are twofold: first, the IST and Business colleges can utilize my research findings to identify the soft skills that their students typically lack and enhance the program to train them on those skills. Other colleges can also perform similar analysis to plan possible improvements to their programs. Second, students can use the research findings to understand what approaches would have the strongest positive influences on the soft skill categories that they wish to improve in.

2. Literature Review

2.1. Hard Skills versus Soft Skills

Earlier I have introduced the most important concept of this research study: soft skills. In order to help readers form a better conceptualization about this abstract phrase, I would like to compare it with "hard skills". The following section includes the definitions of "hard skills" and "soft skills", some examples of each, as well as their significances with regard to employability – the ability to achieve and maintain employment (Higson, 2008).

Dennis Coates, CEO of Performance Support Systems, Inc., defined hard skills as the "technical or administrative procedures related to an organization's core business" (Coates, 2006). Hard skills are typically easy to observe, quantify, measure and train. Some examples of hard skills include computer protocol, programming, business administration, and financial procedures.

By contrast, soft skills, or people skills, are usually difficult to observe, quantify, or measure (Caudron, 1999). Soft skills influence how people deal with and relate to the surrounding environment (Coates, 2006). Some examples include learning, communication, adaptability, self-management, teamwork and leadership skills.

According to Jane Andrew and Helen Higson, one's employability is an integration of one's hard knowledge and skills, soft skills and competencies, and prior work-experiences. Therefore, both soft skills and hard skills play a crucial part in the career preparation of college students (Andrew and Higson, 2008).

2.2.Prior Research on Soft Skills Assessments

Considering the strategic importance of soft skill performance, many researchers have made substantial efforts on evaluating soft skills.

In 2001, Tanveer Haq and his research team invented an innovative Intelligence System for Dynamic Resource Management (ISDRM) which significantly improved the traditional human resource skill management processes through linking the specific skill sets to the job positions (Haq et al., 2001).

About two years later, David Lacy used a hierarchical tree structure to invent a skill set assessment system that enables assessors to assess the employees by reviewing the skills that are essential for them to perform their current positions in lieu of some comprehensive skills provided by traditional skill assessment tools (Lacy, 2003).

In the same year, Tobias Ley and Dietrich Albert used another method wherein they assessed employee action potentials or competencies (knowledge, skills and abilities) by giving them a particular scenario and evaluating them based on their performance outcomes (Ley and Albert, 2003).

Compared with the above studies which only focused on workplace soft skill assessments, Wagner and Sternberg conducted a study that used a soft skill metric to investigate how practical intelligence (soft skills) differs among psychological professionals and students (Wagner and Sternberg, 1985).

All of the above studies introduced ways to evaluate soft skills, however, they are either for workplace purposes only or too academic to be applied to college students' soft skill assessment. Therefore, a practical soft skill assessment tool specifically designed for college students is urgently needed to fill this gap.

2.3.The Soft Skill Metric

As already introduced in the previous section, Dr. Sandeep Purao and Dr. Hoi Suen's study, *Designing A Multi-faceted Metric to Evaluate Soft Skills,* provides guidance on how to develop a multifaceted and practical soft skill metric that is used to specifically evaluate college students' soft skill performances. Below is the complete soft skill metric developed by Dr. Purao.

Table 1 is the complete metric developed by Dr. Purao in a later research.

Super-Categories	Inter-personal Relationships	Understanding and Participating in the Socio-technical/organizational Environment
Sub-Categories	1. Demonstrate respect for opinions of others - Shows appreciation of interpersonal sensitivity 2. Handles conflicts maturely - Attempts to clear up miscommunications - Makes appropriate request for meeting to resolve conflicts - Proposes compromise solutions 3. Reaches decisions in cooperation with others - Takes everyone's view into consideration - Works with others to solve problems 4. Participates as an effective member of a team - Understands own role, responsibility and limitation within the team - Arranges individual meeting to clarify issues as appropriate - Does not presume that one can change the plan or project single handedly 5. Influences an individual/group - Knows the role and limitation	1. Demonstrates understanding of the need for organization - Defers decisions of the task to the person or persons - Does not usurp authority - Appreciates organizational constraints 2. Responds to and anticipates clients - Focuses on user needs - Attempts to accommodate complementary objectives - Provides practical pragmatic and or realistic - Does not follow client demands without consideration 3. Understands components of the social organization - Keeps stakeholders informed - Attempts to bring others on board with decisions - Goes beyond intellectual analysis to work with others 4. Identities, anticipates, and

	of each team member - Talks and listens to individual team members following a logical, reasoned process - Does not take inappropriate actions such as public confrontations in team settings 6. Negotiates to arrive at a compromise - Attempts to clarify conflicting objectives to all involved 7. Cooperates with people of different race, sex, etc. - Shows signs of empathy - Appreciates others' skills and abilities - Respects others' privacy and dignity	manages consequences - Keeps the most critical team member engaged - Does not follow purely pedantic solutions 5. Monitors and corrects own and team performance - Uses non-confrontational approaches to deal with team performance issues - Uses appropriate methods for the group culture 6. Asks pertinent questions which yield the information - Comes up with additional research and information 7. Recognizes when help or advice from others is need - Knows who to go to for most appropriate information

Table 1: Soft Skills Metric developed by Dr. Sandeep Purao[2]

The metric mainly evaluates two major soft skill categories: first, student's abilities of managing inter-personal relationships, and second, student's abilities of understanding and participating in the socio-technical or organizational world. Within each major category there are seven sub-categories to describe different types of soft skills. Within each sub-category, the tool introduces a number of observable behaviors as indicators of whether the soft skills are present.

Being different from the other metrics mentioned in the previous section, this soft skill metric clearly lists specific soft skill-sets that employers look for in college graduates and provides a guidance on how to determine whether a particular soft skill is present in the students.

[2] This soft skill metric is directly extracted from the SASSY tool at aesop.ist.psu.edu/softskills

3. Research Methods

3.1.Subjects

Four groups of subjects were studied in this experiment, 89 subjects in total, whose members were collected from four different courses at the Pennsylvania State University: one entry-level IST course, one senior-level IST course, one entry-level business course, and one senior-level business course. [3]

Table 2 illustrates the class composition of the four subject groups.

Subject Group	Freshman	Sophomore	Junior	Senior	Continuing Education	N/A	Total
Entry-level IST	0	15	0	0	0	1	22
Senior-level IST	0	0	5	11	2	0	12
Entry-level Business	26	4	0	0	0	0	33
Senior-level Business	0	0	3	22	0	0	22
Total	26	19	8	33	2	1	89

Table 2: Class Composition of Four Subject Croups

The entry-level IST group consisted of 16 undergraduate students among which 15 were undergraduate sophomores, and one did not want to indicate the grade standing; the senior-level IST group consisted of 18 members among which five were undergraduate juniors, 11 were undergraduate seniors and two were continuing education students; the entry-level business group consisted of 30 undergraduate students among which 26 were undergraduate freshmen, and four were sophomores; and lastly the senior-level business group consisted of 25 undergraduates among which 3 were juniors and 22 were seniors.

[3] Formal IRB approval was obtained to conduct this study

3.2.Materials

As an important standard to evaluate one's employability, soft skill assessment is usually considered crucial during company interviews of potential employees. In recent years, most companies have started to adopt a behavioral-based interview approach, which usually consists of a hypothetical scenario and a series of questions to evaluate students' responses to the situation.

I made four in-class presentations of my soft skill assessment research ideas to the subject classes. As stated earlier, each subject is asked to voluntarily answer a two-page paper survey which includes a scenario-based short answer survey and a background survey. Here I will elaborate more on how I constructed the scenario-based short-answer surveys and what types of information the background survey collects.

The scenario-based short answer survey contains one of the following hypothetical scenarios similar to the ones given in behavior-based interviews:

1. You are asked to participate in a team that is building an intranet site for a mid-sized company. The site should be searchable and will need to pull employee benefit information from an internal human resources system. Initially, no information is needed from any other external systems.

   There are a number of stakeholders including other information technology (IT) experts in the team, a project manager, a user interface expert, IT infrastructure administrators, and the manager of the human resource system.
2. You are being asked to participate in a team that is building an IT-based solution that organizers and attendees at a workshop may use. The solution is envisioned as an IT-enhanced tag that attendees can wear. With the tag, the booths that each attendee

visits can be tracked. The tag can also contain other information such as the attendee's dietary preferences.

You must work with a number of stakeholders including other IT experts in the team, a project manager, a finance person who is in charge of budgets, the IT infrastructure administrators, and the conference venue manager.

3. You are being asked to recommend a solution for a small, fast growing company that needs an automated system to track inventory throughout the manufacturing process. The application will need to also exchange information with the company's accounting system.

   There are a number of stakeholders including another IT expert in the team, a project manager, an accounting system expert, the manufacturing manager, IT infrastructure administrators.

4. You are being asked to create an IT-based solution for a small company that will allow the real-time exchange of information between the company's accounting system and the company's customer relationship management (CRM) system. This information exchange is needed eliminate duplication of information that is increasingly causing data consistency problems.

   There are a number of stakeholders including other IT experts in the team, a project manager, an accounting systems expert, a CRM systems expert, and IT infrastructure administrators.

Three questions were then randomly selected from the following question list and presented along with the scenarios:

1. Who would you talk to first for understanding your task? Why?

2. Who would you talk to for understanding requirements of the solution to be built? Why?
3. What would you do if in your quest for gathering requirements you get conflicting answers from the project manager and the IT administrators? Explain the rationale behind your answer.
4. What would you do if in your quest for understanding the task and the resources available to you and you get conflicting answers from the budget manager and the project manager? Explain the rationale behind your answer.

Although there are some differences among the four hypothetical scenarios, every scenario provides the subjects with three pieces of key information: the size and type of the company they work for; the project or task they are assigned with; and the stakeholders of the project. The questions that they were asked generally fall under the following two categories: first, who and where to look for appropriate information; and second, how to handle conflicts. The rationale behind this scenario and short-answer construction is to provide the subjects with some background information that they should think of before working on the short-answer questions and examine their business agility (i.e. the ability to respond appropriately to different business scenarios).

The background survey gathers the demographic data of the subjects. Sample survey could be found in Appendix 1. Criterion reference measures for the subjects included (a) age, (b) GPA, (c) number of internship experiences, (d) number of project experiences with external sponsorship, (e) number of credits taking for the current semester, and (f) job offer status

3.3.The Assessment

In order to practically use the soft skill metric, a category code table needs to be first developed using a three digit (X-Y-Z) format. X stands for the main category that the soft skill fits in, Y stands for the subcategory, while Z stands for the specific behaviors listed below each sub-category. For example, "Shows appreciation of interpersonal sensitivity", which is a behavior of sub category "Demonstrate respect for opinions of others" (1-1) under the main category "Interpersonal Relationships" (1) is presented as 1-1-1. Also, during the soft skill assessment process, 1 is used to indicate the presence of a specific soft skill while 0 indicates the absence of it. The full category code table is shown in Table 3.

CATEGORY 1: Inter-personal Relationships	
	Code
1. Demonstrate respect for opinions of others	
- Shows appreciation of interpersonal sensitivity	1-1-1
2. Handles conflicts maturely	
- Attempts to clear up miscommunications	1-2-1
- Makes appropriate request for meeting to resolve conflicts	1-2-2
- Proposes compromise solutions	1-2-3
3. Reaches decisions in cooperation with others	
- Takes everyone's view into consideration	1-3-1
- Works with others to solve problems	1-3-2
4. Participates as an effective member of a team	
- Understands own role, responsibility and limitation within the team	1-4-1
- Arranges individual meeting to clarify issues as appropriate	1-4-2
- Does not presume that one can change the plan or project single handedly	1-4-3
5. Influences an individual/group	
- Knows the role and limitation of each team member	1-5-1
- Talks and listens to individual team members following a logical, reasoned process	1-5-2
- Does not take inappropriate actions such as public confrontations in team settings	1-5-3
6. Negotiates to arrive at a compromise	
- Attempts to clarify conflicting objectives to all involved	1-6-1
7. Cooperates with people of different race, sex, etc.	
- Shows signs of empathy	1-7-1
- Appreciates others' skills and abilities	1-7-2
- Respects others' privacy and dignity	1-7-3

CATEGORY 2: Understanding and Participating in the Socio-technical/organizational Environment	
	Code
1. Demonstrates understanding of the need for organization	
- Defers decisions of the task to the person or persons	2-1-1
- Does not usurp authority	2-1-2
- Appreciates organizational constraints	2-1-3
2. Responds to and anticipates clients	
- Focuses on user needs	2-2-1
- Attempts to accommodate complementary objectives	2-2-2
- Provides practical pragmatic and or realistic	2-2-3
- Does not follow client demands without consideration	2-2-4
3. Understands components of the social organization	
- Keeps stakeholders informed	2-3-1
- Attempts to bring others on board with decisions	2-3-2
- Goes beyond intellectual analysis to work with others	2-3-3
4. Identities, anticipates, and manages consequences	
- Keeps the most critical team member engaged	2-4-1
- Does not follow purely pedantic solutions	2-4-2
5. Monitors and corrects own and team performance	
- Uses non-confrontational approaches to deal with team performance issues	2-5-1
- Uses appropriate methods for the group culture	2-5-2
6. Asks pertinent questions which yield the information	
- Comes up with additional research and information	2-6-1
7. Recognizes when help or advice from others is need	
- Knows who to go to for most appropriate information	2-7-1

Table 3: Category Code Table

4. Research Findings

4.1.Background Analysis

The return rates for the four groups, entry-level IST, senior-level IST, entry-level business and senior-level business, were 100%, 86%, 94% and 100% respectively. Descriptive statistics for the criterion measures for the four groups are shown in Table 4.

	Mean	**Median**	**Range**
IST entry-level			
Age	20.82	20	19-32
GPA	3.39	3.47	2.5-3.98
Number of internship experiences	0.59	0	0-4
Experiences with external projects	0.36	0	0-1
Credits (current semester)	15.86	16	12-19
Job offer status	1.68	1	1-4
IST senior-level			
Age	24.08	22	21-39
GPA	3.32	3.23	2.23-3.8
Number of internship experiences	1	1	0-2
Experiences with external projects	2.09	2	2-3
Credits (current semester)	16.14	17	15-22
Job offer status	1.83	2	1-4
Business entry-level			
Age	18.76	19	16-21
GPA	3.86	3.9	3.37-4
Number of internship experiences	0.36	0	0-3
Experiences with external projects	0.3	0	0-5
Credits (current semester)	16.39	16	12-20
Job offer status	1.33	1	1-4
Business senior-level			
Age	21.64	21	21-22
GPA	3.52	3.49	3-3.91
Number of internship experiences	1.32	1	0-3
Experiences with external projects	1.54	0	0-5
Credits (current semester)	11.6	12	4-18
Job offer status	3.23	3	1-4

Table 4 Descriptive Statistics for Soft Skill Assessments for the entry-level IST student, senior-level IST student, entry-level business student, and senior-level business student

As observed from Table 2, with the level of grade standing increases, internship, project experiences and job offer scores increase while GPA scores decrease within the same college. When comparing students from the two colleges, business students generally have better GPA scores than IST students. IST entry-level students achieved higher scores in the categories of internship and external project experiences as well as job offer status than business entry-level students, however, the situation reversed in the senior-level comparison where business seniors earned higher scores in those categories. In addition, IST entry-level students took fewer credits compared with business entry-level students, whilst IST senior-level students took many more credits than the business seniors.

One possible explanation of the difference in scores between entry-level IST and business students with regard to internship and project experiences is that the college of IST introduces more team projects to the students earlier than the business college does. Another possible explanation is that in the samples collected, the majority of IST entry-level students are sophomores while the majority of the business entry-level students are freshmen. The IST sophomores might have been exposed to more internship or project opportunities than the freshmen business students.

4.2.Soft Skill Assessment Results

Among the 32 soft skill categories assessed, 14 categories were observed in at least one subject's response. With a presence rate of 97.75%, soft skill 2-7-1, which is "Knows who to go to for the most appropriate information" under main category two "Understanding and Participating in the Socio-Technical/Organizational Environment", has been recognized as the most widely observed soft skill among undergraduate college student. Nine out of the 14 observed soft skills were under the first soft skill main category – Interpersonal Relationships, and the rest five were under the second main category.

Detailed soft skill presence rates for the subjects are shown in Table 5.

	No. of Subjects	**Percentage**
1-1-1	0	0.00%
1-2-1	41	46.07%
1-2-2	27	30.34%
1-2-3	24	26.97%
1-3-1	0	0.00%
1-3-2	7	7.87%
1-4-1	4	4.49%
1-4-2	0	0.00%
1-4-3	0	0.00%
1-5-1	1	1.12%
1-5-2	16	17.98%
1-5-3	0	0.00%
1-6-1	3	3.37%
1-7-1	0	0.00%
1-7-2	5	5.62%
1-7-3	0	0.00%
2-1-1	0	0.00%
2-1-2	15	16.85%
2-1-3	0	0.00%
2-2-1	10	11.24%
2-2-2	0	0.00%
2-2-3	0	0.00%
2-2-4	0	0.00%

2-3-1	5	5.62%
2-3-2	0	0.00%
2-3-3	0	0.00%
2-4-1	0	0.00%
2-4-2	0	0.00%
2-5-1	0	0.00%
2-5-2	0	0.00%
2-6-1	2	2.25%
2-7-1	87	97.75%

Table 5: Soft Skills Presence Rates for All Subjects

Through extracting the 14 soft skill categories from the full soft skill category list and calculating presence rates for each of the four subject groups, Table 6 is developed to demonstrate the detailed soft skill performance for each of the four groups.

	Entry-Level IST	**Senior-Level IST**	**Entry-Level Business**	**Senior-Level Business**
1-2-1	40.91%	50.00%	42.42%	50.00%
1-2-2	22.73%	41.67%	24.24%	36.36%
1-2-3	22.73%	33.33%	21.21%	31.82%
1-3-2	0.00%	0.00%	18.18%	4.55%
1-4-1	0.00%	0.00%	9.09%	4.55%
1-5-1	0.00%	0.00%	3.03%	0.00%
1-5-2	31.82%	0.00%	15.15%	13.64%
1-6-1	9.09%	0.00%	3.03%	0.00%
1-7-2	0.00%	0.00%	15.15%	0.00%
2-1-2	13.64%	25.00%	24.24%	4.55%
2-2-1	13.64%	33.33%	9.09%	0.00%
2-3-1	0.00%	25.00%	6.06%	0.00%
2-6-1	0.00%	0.00%	3.03%	4.55%
2-7-1	100.00%	91.67%	100.00%	90.91%

Table 6: Soft Skills Presence Rate for Four Subject Groups

Comparison 1: IST entry-level versus IST senior-level

As Figure 1 shows below, senior-level IST group has higher presence rates for soft skill 1-2-1, 1-2-2, 1-2-3 as well as 2-1-2, 2-2-1 and 2-3-1, which means that the senior-level students

tend to perform more maturely when dealing with conflicts and they are more aware of the importance of stakeholders and user needs. However, entry-level IST students possess better teamwork and negotiation skills as reflected in higher scores of 1-5-2 and 1-6-1.

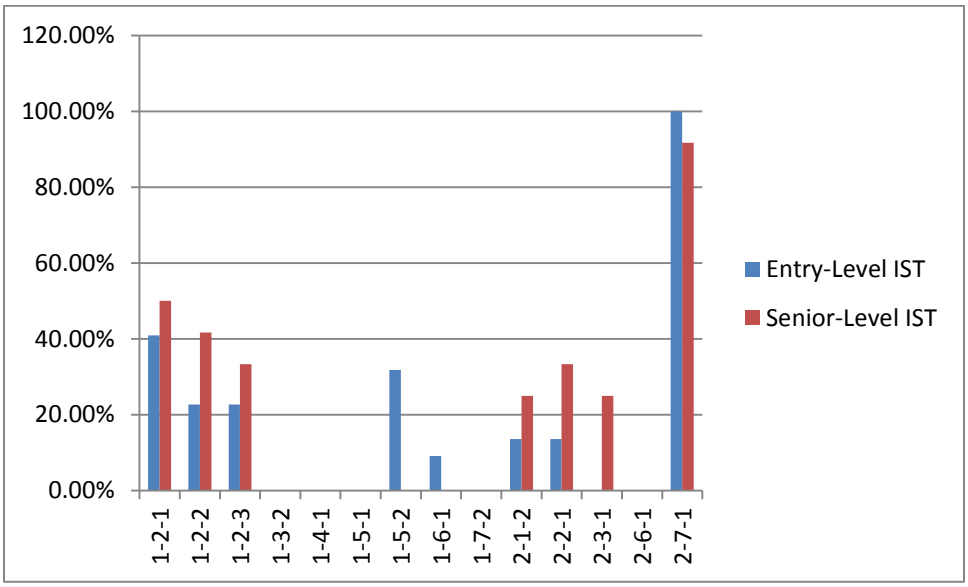

Figure 1: Presence Rates Comparison for IST subject groups

Comparison 2: Business entry-level versus Business senior-level

Similar to the first comparison, senior-level business students also indicate better soft skills while handling conflicts, however, the entry-level business students show impressive soft skill levels in the rest of the categories, as Figure 2 demonstrates.

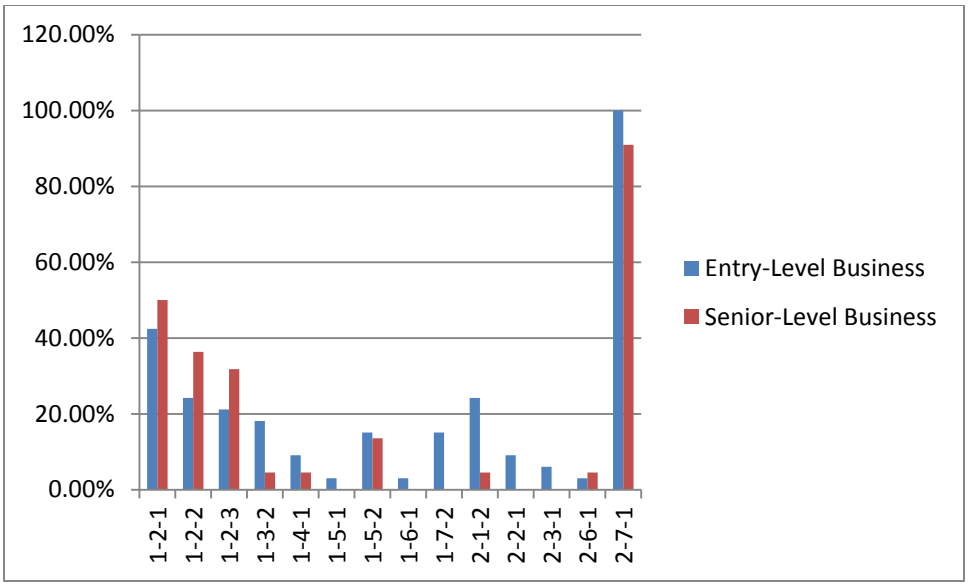

Figure 2: Presence Rates Comparison for Business Subject Groups

Comparison 3: IST entry-level versus Business entry-level

As depicted in Figure 3, IST and Business entry-level students perform similarly in categories 1-2-1, 1-2-2, 1-2-3 (ability to deal with conflicts). However, they perform very differently in the rest of the categories. In categories 1-5-2 (teamwork), 1-6-1(negotiation), and 2-2-1(awareness of user needs), entry-level IST students score much higher than business entry-level students. In the rest of the categories, business entry level students did better.

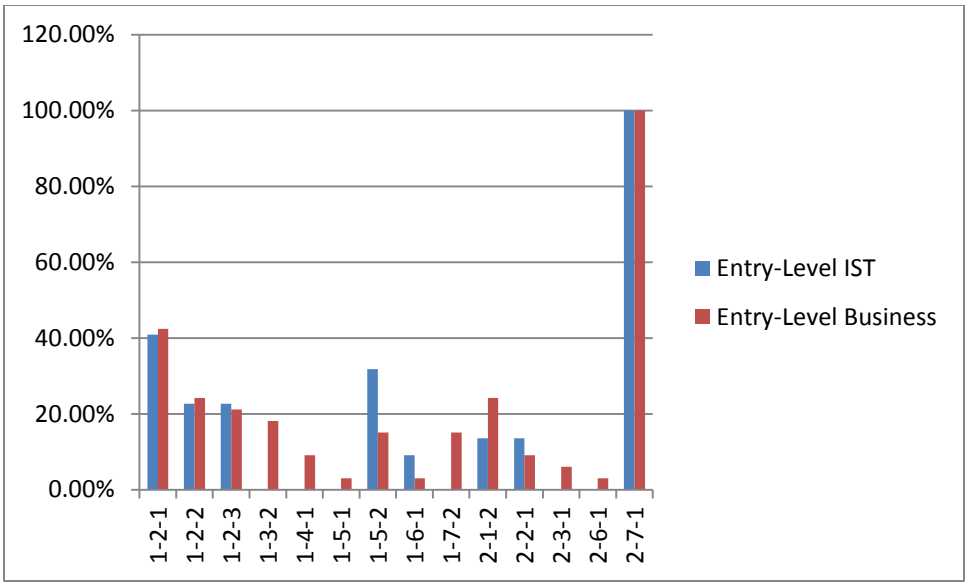

Figure 3: Presence Rates Comparisons for entry-level Subject Groups

Comparison 4: IST senior-level versus Business senior-level

According to Figure 4, IST and Business senior groups performed similarly while dealing with conflicts. However, the IST senior students are better at understanding and participating in the socio-technical environment since they are more focused on user needs, stakeholder involvements as well as accommodating complementary objectives as reflected in higher scores of categories 1-1-2, 2-2-1, and 2-3-1. On the other hand, Business senior-level students perform better in categories 1-3-2, 1-4-1, and 2-6-1, which demonstrates better collaboration, teamwork and research skills respectively.

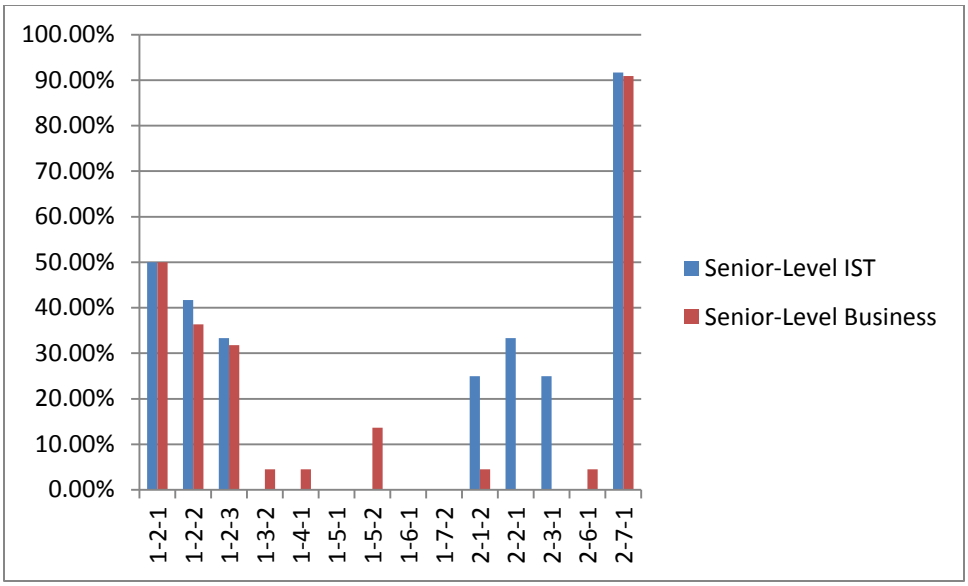

Figure 4: Presence Rates Comparison for senior-level Subject Groups

In answering research questions 1, when comparing the students within the same college, IST senior-level students tend to perform better in most categories than IST entry-level students. However, in the business college, entry-level students perform better in most categories than senior-level students with the exception of the ability to handle conflicts where senior-level students have better scores. When comparing the same grade standing among the two colleges, business entry-level students score better than IST entry-level students in most categories while business senior-level students perform similar to IST senior-level students with the exception of user needs and stakeholder awareness where IST performs exceptionally well. Both colleges have similar overall scores in the ability to handle conflicts.

Correlation Analysis

Two steps were performed in preparation of the correlation analysis. First, the means of the member criterion measures within each subject group were calculated as the criterion measure of groups (Table 7). Second, the subject groups' presence rates of each soft skill category were computed and assembled in Table 8. In order to determine the correlation between

the criterion measures and the soft skill presence rates of the groups, a correlation coefficient was calculated using the four means of one of the criterion measures (age, GAP, intern, projects, credits, and job offer in Table 7) as the first dataset paired with the four presence rates of one of the soft skill categories in Table 8 as the second dataset. For example, when trying to determine the relationship between age and the presence rate of soft skill category 1-2-1, the correlation coefficient was calculated on 20.82, 24.08, 18.76, and 21.64 as the age dataset and 40.91%, 50%, 42.42%, and 50% as the presence rate dataset.

	age	**GPA**	**Intern**	**projects**	**credits**	**job offer**
entry-level IST	20.82	3.39	0.59	0.36	15.86	1.68
senior-level IST	24.08	3.32	2.09	2.09	16.14	1.83
entry-level Business	18.76	3.86	0.36	0.30	16.39	1.33
senior-level Business	21.64	3.52	1.32	1.54	11.60	3.23

Table 7: Mean Criterion Measures of the Subject Groups

	1-2-1	**1-2-2**	**1-2-3**	**1-3-2**	**1-4-1**	**1-5-1**	**1-5-2**	**1-6-1**	**1-7-2**	**2-1-2**	**2-2-1**	**2-3-1**	**2-6-1**	**2-7-1**
entry-level IST	40.91%	22.73%	22.73%	0.00%	0.00%	0.00%	31.82%	9.09%	0.00%	13.64%	13.64%	0.00%	0.00%	100.00%
senior-level IST	50.00%	41.67%	33.33%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	25.00%	33.33%	25.00%	0.00%	91.67%
entry-level Business	42.42%	24.24%	21.21%	18.18%	9.09%	3.03%	15.15%	3.03%	15.15%	24.24%	9.09%	6.06%	3.03%	100.00%
senior-level Business	50.00%	36.36%	31.82%	4.55%	4.55%	0.00%	13.64%	0.00%	0.00%	4.55%	0.00%	0.00%	4.55%	90.91%

Table 8: Soft Skill Presence Rates of the Subject Groups

The correlation coefficients for the criterion measures and the presence rates of the soft skill categories are shown in Table 9 below:

Correlation Coefficient	**1-2-1**	**1-2-2**	**1-2-3**	**1-3-2**	**1-4-1**	**1-5-1**	**1-5-2**	**1-6-1**	**1-7-2**	**2-1-2**	**2-2-1**	**2-3-1**	**2-6-1**	**2-7-1**
Age	0.750	0.862	0.881	-0.796	-0.762	-0.777	-0.588	-0.437	-0.777	0.019	0.663	0.682	-0.422	-0.776
GPA	-0.388	-0.505	-0.603	0.990	0.976	0.938	0.092	-0.059	0.938	0.186	-0.542	-0.354	0.618	0.472
Internship	0.885	0.967	0.951	-0.605	-0.547	-0.622	-0.779	-0.672	-0.622	0.067	0.602	0.741	-0.218	-0.881
Projects	0.956	0.995	0.985	-0.521	-0.423	-0.581	-0.808	-0.774	-0.581	-0.034	0.459	0.659	-0.035	-0.950
Credits	-0.555	-0.358	-0.495	0.168	-0.094	0.408	0.025	0.412	0.408	0.885	0.651	0.458	-0.724	0.621
Job offer	0.681	0.515	0.651	-0.324	-0.067	-0.549	-0.141	-0.480	-0.549	-0.841	-0.485	-0.299	0.603	-0.749

Table 9: Correlation Analysis

For the purpose of this study, only correlation coefficient of absolute value of 0.85 or higher is considered statistically significant. According to Table 9, first, one's age directly correlates with one's ability to handle conflicts as shown by high correlation coefficients of 0.862 and 0.881 between age and soft skill categories 1-2-2 and 1-2-3. Second, the GPA has strong direct influences on soft skill categories 1-3-2, 1-4-1, 1-5-1, and 1-7-2, which involve working with others to solve problems, understanding own and other team members' roles, responsibilities and limitations, and appreciating the abilities and skills of others. Although some researchers have argued that individuals who have distinguished academic performance are not the ones that are the most successful in their occupations (Wagner and Sternberg, 1985), according to these results, better GPA does have a major positive impact on some soft skill categories that are needed to perform well in the workplace. Third, internship and project experiences have similar impacts on all soft skill categories and they have the strongest direct relationship with students' abilities to handle conflicts reflected in correlation coefficients of 0.885, 0.967 and 0.951 between number of internships and 1-2-1, 1-2-2, and 1-2-3 respectively, and correlation coefficients of 0.956, 0.995 and 0.985 between number of project experiences and categories 1-2-1, 1-2-2, and 1-2-3 respectively. Finally, no statistically significant relationship exists between any of the soft skill categories and the number of credits current taking by the students or their job offer statuses.

Surprisingly, I have noticed one strong inverse relationship between soft skill category 2-7-1, which is the ability to find who to go to for the most proper information and student's project experiences. This might be due to some limitations of the study. Otherwise, I cannot offer any meaningful interpretation for this.

5. Conclusion and future research directions

My research suggests that students who have higher grade standings have better performance than the lower grade standing students in certain soft skill categories. Students that have the same grade standings but enrolled in different colleges, do have some differences among their soft skill sets, however, they perform similarly with regards of their abilities to handle conflicts. In addition, while age, internship, and project experiences have direct strong relationships to one's abilities to maturely handle conflicts, there also exists an unexplainable inverse relationship between one's internship and project experiences and one's ability to find the appropriate people for information. GPAs, whilst many researchers identified as non-influential factors to soft skills, are actually strongly affecting one's team interactions and logical listening and communicating processes. I also found no relationship between any soft skill categories and one's job offer status or credits current taking.

There are several limitations of my research study which imply potential research directions of soft skill assessments. First, due to the limited time to conduct surveys and restricted exposure to research resources, I was only able to collect data from a number of courses in both the IST and business colleges. The students in each of the course might not be enough to represent the whole group (e.g. entry level IST students). As a result, the analysis might not be as accurate as I expected. A future research study could collect sample data from a number of courses to represent each student group. Another limitation of this research is that it does not consider the influences of students enrolled in multiple majors. In order to ensure the correctness of the research results, these students should be removed from the sample and be categorized into a distinct group. Lastly, this research only examines the relationship between external factors and the soft skill presence rates in groups because the metric used in the study

only determines if a soft skill is present in the subject or not. It does not evaluate the level of soft skill in the subjects. A future research could utilize other soft skill metrics examine the relationship between external factors and soft skill levels.

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7. Appendices

Appendix A: Sample Background Survey

PSU Student Id: ___
Gender: __
Age in years: __
Standing (Freshman-Senior): __
Current GPA: __
GPA in the Major: __
Number of years at University Park campus: ___
Number of internships prior to taking the class: ___
Number of credits taken during the semester including this class: ___

Do you have any internship experiences? ( )Yes ( )No

- If Yes, how many internship experiences do you have? ___
- Tell us a little more about which organization you work for and what your responsibilities are:

Status of job offer acceptance (1-4)

Before term began (4) Midway through (3) End of term (2) Not yet (1)

Do you have any team projects that involve working with external clients? ( )yes ( )No

- If yes, how many such projects do you have?
- Please list the courses_____
- Tell us a little more about what you did in these projects and which organizations you worked with:

What is your intended career path?

ACADEMIC VITA

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