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STUDENTS' AWARENESS AND EMBRACEMENT OF SOFT SKILLS BY LEARNING AND PRACTICING TEAMWORK

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ABSTRACT

Aim/Purpose	This paper presents a study about changes in computer science and software engineering students' perceptions of their soft skills during their progress through the Computer Science Soft Skills course.
Background	Soft skills are often associated with a person's social, emotional and cognitive capabilities. Soft skills are increasingly sought out and are well recognized by employers alongside standard qualifications. Therefore, high importance is attributed to soft skills in computer science and software engineering education.
Methodology	Content analysis was applied to interpret, categorize and code statements from students' course assignment answers. Data analysis was performed gradually at the three main stages of the course and by the two students' study populations.
Contribution	The paper highlights the variety of (a) soft skills that can be learnt in one course, both on the individual level and on the team level and (b) assignments that can be given to students to increase their awareness and motivation to practice and learn soft skills.
Findings	Data analysis revealed the following: (a) five individual soft skills categories, with 95 skills, and five team-related soft skills categories, with 52 skills (in total, the students mentioned 147 soft skills); (b) course assignments and particularly team-based activities elicited student awareness of their individual soft skills, both as

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	strengths and weaknesses; (c) students developed their reflection skills, particularly with respect to team-related soft skills; and (d) significant differences exist between the two groups of students in several categories.
Recommendations for Practitioners	It is important to provide undergraduate students with opportunities to integrate soft skills during their training. Establishing a meaningful learning process, such as project-based learning, enables students to apply and develop soft skills when accompanied by reflective thought processes.
Recommendations for Researchers	A similar course can be taught and be accompanied by similar analysis of students' learning outcomes, to examine the influence of local culture on the characteristics of soft skills.
Impact on Society	Increased awareness of soft skills in scientists and engineers' undergraduate education. University graduates who will strengthen their variety of soft skills in their academic training process and will be more meaningful employees in the workplace and in society.
Future Research	Our future research aims (a) to explore additional innovative ways to increase students' learning processes, awareness and practices in relation to soft skills and (b) to research how students' soft skills are developed during the entire undergraduate studies both on the individual level and the team level.
Keywords	computer science education, software engineering education, soft skills, individual soft skills, team-related soft skills

INTRODUCTION

Soft skills are often associated with a person's emotional and cognitive capabilities. They usually concern interacting and working with people, and hence involve social abilities, communication, interpersonal skills, collaboration, rhetoric, leadership, time management, etc. (several definitions can be found in Association for Computing Machinery [ACM] & IEEE, 2016, p. 39). Since software is an intangible product, and therefore cannot be sensed by our senses (hearing, seeing, etc.), the importance attributed to soft skills in Computer Science (CS) and Software Engineering (SE) careers is crucial. Specifically, soft skills enable users to overcome barriers associated with software intangibility by communicating the software essence and characteristics among the different stakeholders by soft skills, such as verbal skills (i.e., giving and getting feedback) and cognitive skills (i.e., reflection).

Soft skills are increasingly sought out and are well recognized by employers alongside standard qualifications (ACM & IEEE, 2016; Carter, 2011; Matturro et al., 2015; Pretko, 2018; Setor et al., 2018; Stevens, & Norman, 2016), and are therefore a recommended component of undergraduate study programs in CS and SE (ACM & IEEE, 2016; Lewis, et al., 2008). Awareness of the need to develop the soft skills of CS and SE graduates is reflected in the design and development of:

- courses in which students conduct research as part of the course requirements (ACM & IEEE, 2016; Badets et al., 2017; Chen et al., 2013; Hazzan & Har-shai, 2014; Hazzan & Lis-Hacohen, 2016; Jeschke et al., 2009; Zheng et al., 2015);
- simulation tools for practicing soft skills (Gaffney et al., 2008; Hoffmann, 2011);
- video-based learning activities designed to practice soft skills (Galster et al., 2018).

In two previous papers (Hazzan & Har-shai, 2013, 2014), we described the development of a course on CS and SE soft skills offered by the Faculty of Education in Science and Technology at the Technion Institute of Technology. The course was developed in response to a call by the Israeli hi-tech industry to provide Technion CS graduates with such skills. This request reflects the industry's recognition of the importance of soft skills in software development processes, as discussed in many forums, on-line postings, and magazines by practitioners in the field. An online search for "soft skills",

"top soft skills" or a similar phrase, returns results demonstrating the richness of the discussion. Accordingly, this paper can guide computer science and software engineering educators in the design of courses on soft skills and promote both students' essential skills as well as the industry's needs.

In this paper, we describe ways in which the course structure was updated to accommodate these skills, the research that accompanied its implementation, and our findings in relation to soft skills, in general, and to soft skills that cultivate teamwork. Our data analysis is based on the common approach for discussing soft skills and related topics, such as organizational culture and leadership, i.e., on the three levels of individual, team and organizational (Ashkanasy, & Dorris, 2017; Cooke & Gorman, 2009). These three levels are relevant for many kinds of organizations in which teamwork is a crucial element for the organization's success on the one hand, and on the other hand the contribution of the individuals to this success. Thus, from an organizational behavior perspective, individuals should not only exhibit soft skills on the individual level, but each individual should also exhibit soft skills related to his or her being a team player and an organizational person. These three levels are interconnected and mutually influence each other, not only with respect to soft skills, but also with respect to performance, technological aspects, organizational structure, and making the employee more able to contribute to the workplace. In the sections that follow, we present the research questions and our recommendations, based on the research findings.

THE COURSE

PARTICIPANTS

Students who attended the course belonged to two study programs: CS major students and CS education major students, mainly Views program students (Hazzan, & Ragonis, 2014). The Views program invites Technion Institute of Technology graduates to study toward an additional bachelor's degree at the Faculty of Education in Science and Technology. This degree includes a high school teaching certificate in one of eight tracks: mathematics, physics, biology, chemistry, CS, environmental sciences, electrical engineering, and mechanical engineering. Table 1 presents the distribution of students by study program, for the two study years for which we analyzed data for this paper. The soft skills course was elective for CS major students, and mandatory for students who were enrolled in the CS education (CS-Edu) program.

Table 1. Course students by year and study program

Course Years	Number of students	Study program	
		CS	CS-EDU
1	34	25	9
2	17	10	7
Total	51	35	16

SCHEDULE AND ACTIVITIES

Based on the course-data analysis, we defined a 6-stage comprehension process of soft skills (Hazzan, & Har-shai, 2013, 2014). The main conclusion was that student involvement in various assignments should be increased, e.g., by creating opportunities to interact and reflect on soft skills. As a result of this finding, we increased the teamwork component in the course by adding product development for real customers and indoor/outdoor teamwork activities.

Two types of teaching methods were employed in the course: general teaching methods, such as active learning and semi-situated learning; and teaching methods that promote the development of soft skills, in both indoor and outdoor team-based environments, such as workshops, activities, discussions. teamwork, reflection and presentations. One of the main messages the course conveyed is that,

CS soft concepts (e.g., abstraction and readability) cannot be imparted rigidly using formal definitions, and similarly, soft skills, cannot be studied and taught formally, but rather should be learned and grasped gradually over a period of time, calling on students' engagement, active learning, practice, participation, and reflection. The proposed course tasks included verbal and written communication assignments. To illustrate the course orientation, Table 2 presents the structure and schedule of one instance of the course.

Table 2. Course structure and schedule

Week	Topic(s)
1	Course description, requirements, and grading Explaining the development component of the course o Customers present their desired product o Team allocation and defining the resources and schedule: 3 iterations; each student invests 2 weekly hours in the development process o Short introduction to agile development process
2	Giving and receiving feedback
3	Diversity in teamwork: Internal and external diversity, benefits and disadvantages of diversity, benefits of diversity in software development teams
4	Roles in software teamwork Presentation of application development - Iteration 1
5	Business writing: Email and more
6	Basic principles of effective presentations
7	Leadership workshop (see Table 3, Course 1, Task Stage 3): A teamwork game-based simulation, facilitated by an organizational psychologist (4th author of this paper).
8	Reflection based on the leadership workshop Presentation of application development - Iteration 2
9	Business writing – Email and more (cont.) Basic principles of effective pitching
10	Business writing: Dealing with customer complaints
11	Knowledge transfer in global companies: Cultural aspects and challenges
12	Guest lecture, CEO of an EdTech innovation accelerator Presentation of application development - Iteration 3
13	Internet of Things (IoT): presented by one of the Views students who works for a leading hi-tech company in parallel to his studies Time management Course conclusion

The course requirements and grading addressed the individual and team levels equally. The purpose of the tasks was to elicit student reflective processes on the individual or team-based levels in the spirit of the reflective practitioner concept (Schön, 1983, 1987).

Reflective Assignments on Soft Skills

Four to six homework assignments required the students to reflect explicitly on their soft skills. Table 3 presents three tasks, which were assigned in both years, and are analyzed and discussed in this paper. The three tasks were given at the following stages of the course:

1. Exposure stage: The first task was given in the first lesson, when the students had not yet gained experience in performing and reflecting on their soft skills.
2. Deepening stage: This task was given in weeks 4-6, after students had experienced a team assignment in the course.

3. Following a teamwork stage: The third task was based on a meaningful teamwork experience. In Course 1 it included the development of a product for real customers, and in Course 2 it included an outdoor activity at the Technion ecological garden.

Table 3. Reflection tasks on soft skills

Course 1
Stage 1: Exposure a. List 5-10 soft skills to which you were exposed today. b. For each skill, describe why, in your opinion, it is a soft skill. c. List the skill that especially characterizes you and list the skills you would like to improve. Explain your choices. **Stage 2: Deepening** The attached file presents students' answers to Exercise #1. [A file is attached to the task] The answers are presented as they were submitted, without any editing; personal details were removed to avoid identification. a. Analyze the students' answers. b. List 3-5 soft skills you used during the analysis. c. List 3-5 things you have learned from the two above tasks. **Stage 3: Following teamwork** a. List 3 characteristics of your teamwork that you would like to preserve. b. List 3 characteristics of your teamwork that you would like to improve. c. Do you agree with the considerations for selecting the winning team? d. List at least 5 soft skills that you had to apply in the workshop. e. List at least 5 soft skills that you did not apply in the workshop but that you would have to apply in real life. f. List 3 things that you learned today about your soft skills.
Course 2
Stage 1: Exposure a. List 3-5 reasons that guided your decision to the register to this elective course. b. List 3-5 ways in which you anticipate the course will contribute to your professional development in the future. c. List 3 soft skills that you would like to learn. For each skill: - Share why you chose it. - Explain why it is a soft skill. - Rate your ability to perform the skill on a 1-10 scale (10 is the highest). **Stage 2: Deepening** a. List 7 soft skills you were exposed to during the outdoor activities we conducted. - For each skill, explain why it is a soft skill. - List 5 soft skills that you used during the exercise and how they were expressed. - Based on your experience in the exercise, list 3 soft skills that you think you should improve. b. Choose 4 soft skills from the list that in your opinion will help you overcome challenges in software development. Explain your choice c. Rank the skills you mentioned in (1) according to their importance in software development teams. Explain your ranking. **Stage 3: Following teamwork** List 10 soft skills that you used during the course or experienced their use by other students in the course. Describe each skill in one sentence.

Three pedagogical principles were integrated to achieve the course objectives:

1. learning content that focused on soft skills;
2. team-based active learning tasks that enabled the application of relevant soft skills; and
3. guided reflective processes that followed task execution and fostered the shift in the students' perceptions of soft skills from implicit to explicit.

For example, one of the outdoor activities, which enabled students to experience a new and unfamiliar environment, was facilitated in the institution's ecological gardens. The first stage began with a presentation of two alternative tasks, to be implemented in teams, using only recycled materials: creation of an environmental sculpture or building an irrigation system for the garden. In the second stage, a full cycle of project design was implemented until reaching a product. In the third stage, the teams were asked to include reflection in their project presentations in the course plenary, addressing what worked well and what did not work well, and why. In addition, each student wrote a personal guided reflection.

THE RESEARCH

TARGET AND QUESTIONS

The research objective was to investigate how the reflective assignments contributed to students' awareness of soft skills development.

The following research questions were posed:

1) How do the course assignments enhance students' awareness of soft skills at the three stages of the course?
2) Do course participants from the two study programs – CS and CS education – differ with respect to their awareness of soft skills?

DATA ANALYSIS

Our data analysis is based on the common approach for discussing soft skills and related topics, such as organizational culture and leadership, i.e., on three levels: the individual, the team and the organizational (Ashkanasy & Dorris, 2017; Cooke & Gorman, 2009). Since the organizational level would not be possible in the academic education framework discussed in this paper, our data analysis is based on *Individual soft skills* and *Team-related soft skills*.

The data analysis focused on the six reflective tasks described in Table 3. Content analysis was applied to interpret, code, and categorize statements from students' answers (Elo & Kyngas, 2007). The content analysis was done by the researchers in two stages as follows:

- *Stage 1*. Students' answers to the open questions were analyzed qualitatively and a list of all the soft skills mentioned was compiled. This analysis revealed 147 soft skills, and these soft skills were divided into *Individual soft skills* and *Team-related soft skills*, and five main categories were identified in each group (as presented in Tables 4 and 5). To ensure the analysis validity, this classification was carried out repeatedly until full agreement among the three researchers was reached (Cohen et al., 2017).
- *Stage 2*. For each of the 51 students, all of the 147 soft skills were examined at each stage (Stage 1 - Exposure; Stage 2 - Deepening; Stage 3 – Following teamwork). The purpose was to see at what stage(s) (if at all) each student mentioned the specific soft skill. This analysis enabled the researchers to follow each student's development over time with respect to soft skills in the different categories, and to see whether differences exist in terms of stage in course and study program. In spite of the student sample being relatively small (N=51), as the sample of soft skills is bigger (147), a descriptive statistical analysis was conducted to convey the importance students attribute to the various skills.

FINDINGS

The research findings are presented first according to the two research questions. Then, we present holistic analysis of students' reflective processes they went through while performing the reflective tasks.

QUESTION 1: STUDENTS' AWARENESS OF SOFT SKILLS

Soft skills categorization

The 147 soft skills mentioned by the students were divided into *Individual soft skills* and *Team-related soft skills*. Five categories were identified in each group, and additional sub-categories were identified in each category. Tables 4 and 5 present the categorization within the *Individual* and *Team-related soft skills* groups, respectively. For each category and sub-category, the number of soft skills mentioned by the students is presented in brackets, with examples of particular soft skills mentioned

Table 4. Categorization of Individual soft skills identified by students

Category	Sub-category	No. of soft skills in sub-category	Examples
1. Personal skills	Intellectual	14	Ability to self-learn, ability to ask questions, decision making, creativity, reflection
	Self-awareness at work	12	Planning, organization and order, self-responsibility
	Involvement	5	Entrepreneurship, concern, competitiveness
	Emotional control	5	Self-awareness, calm/pleasantness, humor
Total		36	
2. Interpersonal skills	Relations	15	Giving and receiving feedback, adaptation
	Effectiveness	7	Supporting other's ideas, reliability, consistency
	Underlying forces	7	Understanding group dynamics, joining a team, understanding expectations
	Leadership	6	Understanding the other's needs, leadership
Total		35	
3. Teamwork	Functioning	7	Writing a focused report, ability to convey messages
	Work spirit	4	Collaboration, the ability to trust, creating positive atmosphere
Total		11	
4. Presentation	Content centered	3	Submission for staff decision
	Personal centered	2	Body language, tone of voice
	Teaching and Education	2	Ability to teach others, ability to educate
Total		7	

Category	Sub-category	No. of soft skills in sub-category	Examples
5. Management skills	Task management	4	Management of time, financial and human resources, role distribution
	Team management	2	Negotiation skills, leadership
Total		6	
A total of 95 different *Individual soft skills* mentioned			

The richness of the collection of *Individual soft skills* mentioned by students expresses the deep reflection processes they experienced, in particular, in the "Personal skills" and "Interpersonal skills" categories. It is interesting to note that even though students carried out reflection processes and demonstrated high reflective skills, only one student listed "reflection" as a soft skill.

Table 5. Categorization of Team-related soft skills identified by students

Category	Sub-category	No. of soft skills in sub-category	Examples
1. Work process management	Design	11	Time management, role distribution
	Implementation	11	Adjustment to changing situations, coping with pressure
Total		22	
2. Interpersonal communication within the team	Required for development	10	Knowledge sharing, identification of team members' strengths and weaknesses, respecting others' opinions, objective judgment
	Required for supportive atmosphere	5	Listening, acceptance of diversity, encouragement and support
Total		15	
3. Individual skills at team level	Trouble-shooting	7	Motivation, creativity, fast and independent learning
	Position within team	2	Leadership, receiving authority
	Presentation	1	Ability to present ideas
Total		10	
4. Desire to excel and be recognized		4	Competitiveness, commitment, taking responsibility
Total		4	
5. Ethics		1	Ethics
Total		1	
A total of 52 different *Team-related soft skills* mentioned			

The soft skills included in the *Team-related soft skills* address teamwork and what a team needs to do to achieve its goals. The extensive variety of soft skills mentioned by the students attests to the importance they attribute to teamwork.

The sub-categories of the "Individual skills at the team level" category emphasize students' understanding that in addition to working together, there is a need for personal skills such as leadership. The implicit attention students gave to the category "Desire to excel and to be recognized" is interesting since teams need these types of skills to succeed in our contemporary competitive economy. The single reference to "Ethics" calls attention to the need to create appropriate opportunities to discuss this topic in the course.

Soft skills frequencies

After revealing the soft skills mentioned by the students, we examined the frequency of each soft skill at each time points: Stage 1 – Exposure to soft skills; Stage 2 – Deepening the understanding of soft skills; and Stage 3 – Following teamwork. Tables 6 and 7 present the frequency of each sub-category of *Individual soft skills* and *Team-related soft skills*, respectively, at each of the three stages. The percentage (presented in parentheses) represents the relative weight of each sub-category for each specific stage. In Table 6, sub-categories whose frequency are at least 14% are marked in gray cells; in Table 7, sub-categories whose frequency are at least 24% are marked in gray cells.

Table 6. Mentions of Individual soft skills by time stage

Category	Sub-category	No. of soft skills in sub-category	Stage 1	Stage 2	Stage 3
1. Personal skills	Intellectual	14	46 (14%)	70 (20%)	36 (10%)
	Self-awareness at work	12	47 (14%)	50 (15%)	53 (15%)
	Involvement	5	14 (4%)	16 (5%)	11 (3%)
	Emotional control	5	15 (5%)	14 (4%)	4 (1%)
Total		36	122 (37%)	150 (44%)	104 (30%)
2. Interpersonal skills	Relations	15	67 (20%)	74 (22%)	76 (22%)
	Effectiveness	7	20 (6%)	25 (7%)	38 (11%)
	Underlying forces	7	8 (2%)	6 (2%)	9 (3%)
	Leadership	6	13 (4%)	13 (4%)	24 (7%)
Total		35	108 (33%)	118 (35%)	147 (42%)
3. Teamwork	Content centered	3	17 (5%)	23 (7%)	25 (7%)
	Personal centered	2	14 (4%)	3 (1%)	14 (4%)
	Teaching and education	2	5 (2%)	0 (0%)	2 (1%)
Total		7	36 (11%)	26 (8%)	41 (12%)

Category	Sub-category	No. of soft skills in sub-category	Stage 1	Stage 2	Stage 3
4. Presentation (oral & writing)	Functioning	7	34 (10%)	22 (6%)	32 (9%)
	Work spirit	4	13 (4%)	9 (3%)	6 (2%)
Total		11	47 (14%)	31 (9%)	38 (11%)
5. Management skills	Task management	4	12 (4%)	17 (5%)	10 (3%)
	Team management	2	4 (1%)	0 (0%)	6 (2%)
Total		6	16 (5%)	17 (5%)	16 (5%)
Total			**329** (100%)	**342** (100%)	**346** (100%)

Table 7. Prevalence of *Team-related soft skills* by time

Category	Sub-category	No. of soft skills in sub-category	Stage 1	Stage 2	Stage 3
1. Work process management	Design	11	12 (63%)	41 (31%)	72 (40%)
	Implementa-tion	11	3 (16%)	13 (10%)	19 (10%)
1. Total		22	15 (79%)	54 (41%)	91 (50%)
2. Interpersonal communica-tion within the team	Required for development	10	0 (0%)	40 (31%)	44 (24%)
	Required for a supportive atmosphere	5	0 (0%)	8 (6%)	14 (8%)
2. Total		15	0 (0%)	48 (37%)	58 (32%)
3. Individual skills at team level	Trouble-shooting	7	1 (5%)	17 (13%)	13 (7%)
	Position within team	2	1 (5%)	3 (2%)	3 (2%)
	Presentation	1	0 (0%)	3 (2%)	4 (2%)
3. Total		10	2 (11%)	23 (18%)	20 (11%)
4. Desire to ex-cel and be rec-ognized		4	2 (11%)	6 (5%)	12 (7%)
4. Total		4			
5. Ethics		1	0 (0%)	0 (0%)	1 (1%)
5. Total		1			
Total			**19**	**131**	**182**

As Table 6 shows, students are mainly aware of *Individual soft skills* in three sub-categories. In the category of Personal skills, they were aware of the sub-categories of Intellectual and Self-awareness at work, and in the category of Interpersonal skills, they were aware of the sub-category Relations. This is manifested in the number of soft skills mentioned in each of these sub-categories respectively: 14, 12, 15, which are the highest among all sub-categories, and the percentages of their frequency is more than twice the percentages of the frequency of the other sub-categories. It is also evident from the table that reference to these sub-categories is stable over time, except for the case of the sub-category Intellectual, which dropped off significantly at the end of the course, when students probably no longer felt that this soft skill contributed to their performance. A possible explanation for the low frequencies of other sub-categories could be that some of the students are more skilled in reflective processes and are more conscious, which allow them to be more precise in identifying the variability of the soft skills

As Table 7 shows, student awareness of *Team-related soft skills* in all sub-categories increased significantly over time. We offer two possible explanations for this increase: first, the team assignments encouraged students to experience and reflect upon these specific types of skills; and second, students became more conscious of the role of soft skills in teamwork functioning and, thus, did not restrict their answers to the individual aspect.

Two additional aspects were examined at the individual level:

1. Does the number of soft skills a student mentioned in each category, in Stages 1, 2 and 3, reflect their personal growth over time?
2. How many categories did each student mention?

Table 8 presents, for the Individual and Team categories:

1. the number of students who consistently increased the number of soft skills they mentioned over time (between either two- or three-time stages); and
2. the number of students who mentioned soft skills in each particular category, at least at one stage.

It can be seen that about half of the students consistently expanded their perspective of soft skills over time. Specifically, more students enriched their soft skills collection between two stages than between all three stages. Also, students mentioned skills in the categories of the *Individual soft skills* more than in the *Team-related soft skills*.

Table 8. Count on mentions of soft skills, N=51

Category	No. of students who advanced over times	No. of students who mentioned the category
Individual soft skills		
Personal skills	20	51
Interpersonal skills	20	50
Team-related skills	15	40
Presentation skills	10	45
Management skills	9	21
Team-related soft skills		
Work process	22	33
Individual skills	22	40
Communication	15	27
Desire to excel	10	16
Ethics	1	1

Table 9 presents the number of students who mentioned some or all of the 5 *Individual* or *Team-related soft skills* categories, taking answers from all three stages into consideration. For example, in relation to *Individual soft skills*, 12 students mentioned three different sub-categories, in any stage, and 20 students mentioned all five different sub-categories, in any stage. None of the students mentioned all the five sub-categories of the *Team-related soft skill* categories. In general, it can be seen that students expressed more variety in relation to *Individual soft skills*, where almost all (49 out of 51) mentioned 3-5 different aspects. At the same time, in relation to *Team-related soft skills*, only about half of the students (28 out of 51) mentioned 3-4 different aspects, none of the students addressed all five categories, and 10 students did not indicate any of the *Team-related soft skills* at all.

Table 9. Number of students mentioning multiple categories (N=51 students)

No. of categories mentioned	0	1	2	3	4	5
Individual soft skills categories	0	1	1	12	17	20
Team-related soft skills categories	10	3	10	18	10	0

Further analysis shows that most students (31 of 51) mentioned at least 7 different categories (15 students mentioned 7 different categories, 10 students mentioned 8, and 6 students mentioned 9). This spread indicates that students exhibited a deep and wide range of thinking processes with respect to the types of possible soft skills.

Question 2: Study Program Perspective

Analysis with respect to study program yields significant differences in some of the sub-categories, at specific time points. Table 10 presents the categories in which significant differences were found, between the Faculty of Computer Science students (CS) to the Faculty of Education in Science and Technology (CS-Edu) students.

Table 10. The effect of study program on awareness to soft skills

Category	Stat. Sig.	Description
Individual soft skills		
Personal skills	0.041	Stage 2: CS-Edu > CS
Interpersonal skills	0.040	Stage 1: CS-Edu > CS
Team-related skills	0.041	Stage 3: CS-Edu > CS
Team-related soft skills		
Work process	0.003	Stage 2: CS-Edu > CS
Individual skills	0.001	Stage 2: CS-Edu > CS
Communication	0.000	Stage 2: CS-Edu > CS
Desire to excel	0.023	Stage 2: CS-Edu > CS

It can be seen, in all instances, that the CS-Edu students mentioned more soft skills than the CS students. Most of the differences occurred at Stage 2 - Deepening. This can be explained by the fact that most of the CS-Edu students were enrolled in the Views program and already had some work experience in the hi-tech industry, and specifically in teamwork. Hence, their exposure to the new concept of soft skills fell on fertile ground and enabled them to reflect more deeply on its meaning.

REFLECTIVE PROCESSES

Students experienced deep reflective processes while working on the course assignments. This was clearly noticeable when students were required explicitly to write reflection. In this section, we highlight two topics – teamwork and students' learning – accompanied by excerpts from student assignments. The identification of the students consists of the characteristic of the study group and a number within the group is recorded in parentheses at the end of each citation.

(a) Reflective processes related to teamwork:
- Awareness of the need to practice team work: "It was meaningful for me because it highlighted the fact that I will not always be able to work with a team in the same ideal atmosphere as it has been until now [in my studies] when I work with only one best friend." (CS-Edu 12)
- The power of teamwork: "The event taught me the power of teamwork; I am more used to working on my own and to trusting only myself. but the whole development process, and this event in particular, taught me about sharing responsibility and proper teamwork. it taught me that there are cases where it does not matter how much we try - without help and cooperation of others, we will not get results." (CS-Edu 3)
- Awareness to the power balance within the team: "Personally, I was always used to taking the lead, to be the one who speaks and presents. this time I was on a team with other female students, whom I did not know before, who were also used to being dominant. I decided to take a step back and contribute to different areas, instead of being the one who makes the decisions. it was a very nice experience. I learned to trust other people and to accept different opinions." (CS 14)
- The duality between "the same" skill at the personal or the team level: "There are skills which if examined on the personal level, are considered strong in a positive way, but when it comes to teamwork, it does not work out so well. it might be the dynamic within the group that creates a greater challenge. for example, time management within the team was not good enough, despite the fact that each team member could have managed his own personal time well." (CS 7)

(b) Reflective processes related to students' learning
- The course learning experience vs. industry working experience: "The choice of the team and the work during product development was different than what I experienced so far in industry, where team members often compete, even hurt others in the process. they do not always share information and are involved in some kind of organizational politics. the work with my team was a refreshing change." (CS 10)
- The power of reflection as expressed in the course assignments: "while investigating student answers to task 1, I learned that most of the students have a high self-awareness, and they did not list skills just to fulfill the requirements. But they honestly identified their strengths and weaknesses. they really want to improve their weaknesses and awareness is a meaningful step to that end." (CS-Edu 29)

DISCUSSION

As described in the introduction (e.g. Cárdenas-Castro et al., 2019; Pretko, 2018; Setor et al., 2018; Stevens & Norman, 2016), the world of industry emphasizes the need for engineers to express soft skills and emphasizes the need to develop these skills already in academic studies. The emphasis in undergraduate programs, of the importance of students to acquire soft skills, is reflected also in attempts to integrate and evaluate it in capstone courses (Carter, 2011; Zheng et al., 2015). Several suggestions to enhance undergraduate students' soft skills was done, for example through project base learning (Badets et al., 2017; Chen et al., 2013), by using active video watching (Galster et al., 2018), or by using improvisation theater (Hoffmann, 2011). The study presented here continues our previ-

ous work (Hazzan & Har-shai, 2013; 2014), presenting a "soft skills" course, emphasizing the learning and practicing of soft skills by different course assignments. Here we illuminate and backup our intentions by the research. The importance of conducting a written and continuous reflection throughout the course demonstrates the significant impact of the process that students go through in the course. Based on our data analysis, we attempted to answer two research questions:

In relation to Question 1: How do the course assignments enhance the students' awareness of soft skills at three different stages of the course? It appears that the course assignments enhanced student awareness and the importance they attribute to soft skills on many levels: (a) the rich collection of 147 soft skills in two main groups, *Individual soft skills* and *Team-related soft skills*, each of which was divided into five different meaningful categories and their sub-categories; (b) the development of the variety of soft skills over time, particularly with respect to the Team-related skills; and (c) examples of how the course experiences fostered this development.

In relation to Question 2: Do course participants from the two study programs – CS and CS education – differ with respect to their awareness of soft skills? Differences were found in relation to the study program perspective with respect to time point stages. The students' background may explain this difference: Views students have work experience in the industry and are usually older, while CS students took this elective and unusual course in order to learn about the topic and enrich their conceptions before starting their work in the industry.

CONCLUSIONS

This paper addressed the development of student awareness of soft skills while carrying out team-based activities and reflective assignments in a course, which was modified to enhance CS soft skills development. Data analysis revealed the following: (a) five individual soft skills categories, with 95 skills, and five team-related soft skills categories, with 52 skills. In total, the students mentioned 147 soft skills; (b) course assignments and particularly team-based activities elicited student awareness of their individual soft skills, both as strengths and weaknesses; (c) students developed their reflection skills, particularly with respect to team-related soft skills; and (d) significant differences exists between the two groups of students in several categories.

Our findings highlight the dominant role that reflective processes found in various course assignments play in raising student awareness to their own wide range of soft skills, both those they possess, those they wish to improve, and those they are missing. The learning characteristics of the course activities and assignments, as reflected in the structure of the course (as described in Tables 2 and 3), are significant in order to enable growth in relation to soft skills. The course content itself dealt with soft skills such as receiving and giving feedback, effective presentations, effective oral and written communication, etc. In addition to the students' growing awareness of their personal soft skills, it is clear that they have come to the realization that without soft skills, efficiency of functioning and performance in the work environment are greatly reduced.

It is essential that the reflective process take place continuously throughout the entire course and not serve as a one-time event, as evidenced by the awareness of soft skills that developed along the course. Since teamwork and a diverse and undefined assembly of soft skills are of central importance in any engineering workplace, we recommend that team-work assignments follow by guided reflection assignments, be incorporated in the course as a central component. A noteworthy contribution to the authentic exposure of soft skills can be achieved when the main team work task is such that it moves students from their comfort zone and thus accelerates recognition of the importance of coherent teamwork (for example, the ecological garden assignment mentioned above).

Our future research aims (a) to explore additional innovative ways to increase students' learning processes, awareness and practices in relation to soft skills and (b) research on how students' soft skills are developed during the entire undergraduate studies both on the individual level and the team level.

We believe that educators who wish to teach such a course can benefit from the analysis presented in this paper and redesign their course assignments to include reflective elements, according to the environment in which the course is taught. It would be interesting to examine what cultural and social influences exist in relation to soft skills. That is, if a course is taught in a similar spirit whose content focuses on soft skills and includes assignments that require written reflection, will the collection of skills that arise be similar or different.

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