SOFT SKILLS IN STEM

by

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A thesis submitted in partial fulfillment of the requirements
for the Honors Undergraduate Thesis Program in the Department of
Industrial Engineering and Management Systems
in the College of Engineering and Computer Science
at the University of Central Florida
Orlando, Florida

Spring Term, 2023

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ABSTRACT

Those working in science, technology, engineering, and math (STEM) fields are delivering world-changing solutions to the problems we face and are saving lives every day. Some of them do surgeries, some design airplanes and cars, others study the wildlife around us, and others create processes to facilitate the manufacturing of devices we use often. To perform tasks, such as the ones stated, engineers, scientists, doctors, and other professionals in STEM disciplines need to possess hard skills to be able to do this. Hard skills are often called technical skills and are measurable abilities and skills that are needed to perform tasks effectively. The tasks done share something in common; they are intended to improve the lives of those around us. Additional examples include the work done to protect us from nuclear threats, the research done during pandemics to create vaccines, and learning about animals in the ecosystem. While hard skills are important and essential to have, when paired with soft skills, we have a more powerful and stronger combination of skills. Soft skills are often called interpersonal skills or people skills. They are related to how we build relationships and interact with others. They enhance our ability to do both technical and nontechnical work. If the work those in STEM disciplines do is intended to help individuals, society, and people, how can we do this effectively if we do not have strong soft skills? How are we to improve the lives of individuals through the work we do in STEM if we cannot fully interact effectively with those individuals? This study will explore how participants from STEM disciplines at an educational and industry level rated themselves in their effective use of soft skills and provide suggestions based on their feedback on how we can improve our soft skills.

ACKNOWLEDGMENTS

¡Mami y papi, por siempre creer en mí, por su apoyo y su amor incondicional, por inspirarme, por ser papás ejemplares, por ser mis mejores amigos, y por enseñarme a disfrutar todo lo que hago, gracias! Los amo.

To my sisters, for always making me laugh, for all the enjoyable memories we create together, and for all the love and unwavering support you give me, thank you.

To my significant other, for making me incredibly happy, for teaching me to enjoy all aspects of life, for reminding me to not focus too much on things of this world, for always making me feel like a priority, and for always being there for me, thank you.

To my grandparents, for always keeping us in your prayers and for the values you instilled in my parents that they now instill in us, thank you.

To Roxie and Brandy, for getting me through challenging moments, for being the most loyal companions, and for being my rays of sunshine, thank you.

To all my family, for always motivating me and supporting me, thank you.

To my friends, for supporting me through so many journeys, including this one, thank you.

To all my teachers, for planting seeds of curiosity and helping them grow, thank you.

To my mentors and all those that have helped me flourish and learn, that have taught me to care deeply for others, and that have played a role in shaping me into who I am, thank you.

To my mentors at NSDD, for the opportunities and support you have given me, thank you.

To the participants, for your time, thoughtfulness, and honest feedback, thank you.

To my committee, Dean Maggy Tomova and Michael Baham, for believing in my research and in me and for your support, thank you.

To my thesis chair, Dr. Kotnour, for your patience and guidance through this process, thank you. I express my deepest gratitude for your unparalleled support during this learning experience.

To God, for always strengthening me, for always being with me, for peace that surpasses understanding, for allowing me to be here and involved in all I am passionate about, and for teaching me and frequently reminding me that all things work together for good,

thank you!

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INTRODUCTION AND IMPORTANCE

Why?

If we know how to create a vaccine, but do not know how to communicate that to others, are we truly able to use what we know to help others? If we know how to identify nuclear threats based on data, but do not know how to resolve conflicts with others, are we truly able to use what we know to help others? If we know how to design a website, but are not empathetic as we build it to make it user-friendly and accessible, are we truly able to use what we know to help others? While hard skills are needed to perform technical work, without soft skills we cannot use our hard skills to our fullest potential in a capacity that helps others. Knowledge is best used when applied to improve the lives of others and learning how we can improve our soft skills can help us use our knowledge to its fullest potential and to our fullest ability.

What?

We will specifically examine how participants who are in STEM disciplines rate themselves in their effective use of soft skills and their suggestions on how they can be improved. Phrases such as, “I am a STEM major, I am not good at public speaking” or “I am an engineering major, I am not good at writing,” are often heard among those in STEM both in the workforce and in educational institutions. We will learn what soft skills participants felt they were lacking in that might cause some people to make statements such as those. Two main words that will be often used are “STEM” and “soft skills.” STEM is an acronym that stands for science, technology, engineering, and mathematics; the sciences that will be referred to are hard sciences, which are sciences that use math explicitly. “Soft skills” relate to how people interact

and work with others; they are often referred to as “people skills” because they characterize a person’s relationship with others (Oxford Languages Dictionary, 2022).

Who?

When referring to “those in STEM disciplines,” this research will refer to those that studied within a STEM major in undergraduate, graduate, and/or vocational schools, those that gained a STEM background serving in the military, those that have STEM backgrounds due to their experience in the workforce, and people who gained STEM backgrounds through their personal lives and work in a STEM field. All participants are from STEM disciplines in one way or another. The technical work we do produces a product that usually affects people, so having strong soft skills is important. As a previous professor of mine once stated, soft skills are pejoratively named, as if they were worth less than the “hard skills” we have. However, this research will highlight that contrary to frequent belief, soft skills are important and valuable skills to possess and display.

Where?

This research was conducted by collecting data from participants using three methods: a Google Form survey, a Qualtrics survey, and a Mentimeter presentation-styled survey. Leaders at colleges, universities, companies, and agencies chose how they wanted their students or employees to participate. Participants rated themselves on their effectiveness to use various soft skills and rated the soft skills they deemed most important across levels. They also included where they felt they gained the majority of their soft skills and ideas on how they can improve their soft skills.

LITERATURE REVIEW

How did people in STEM disciplines previously rate themselves on their soft skills?

Evidence from previous research conducted shows that those in STEM disciplines tend to rate themselves low on their soft skills and state that as they are in STEM disciplines, their effective use of soft skills decreases. One example can be demonstrated by examining a study where more than 120 colleges and universities had students participate and rate their commitment to global citizenship at the beginning and at the end of their four-year studies. Computer science majors' commitment to global citizenship decreased by 4.4%, engineering majors decreased by 4.1%, business majors decreased by 0.8%, and physical science majors decreased by 0.5%. Biological science majors increased by 0.3% and mathematics and statistics majors increased by 2.4% (Núñez, et al., 2021). We see based on the results that the soft skill of commitment to global citizenship decreased in the majority of STEM majors and increased very slightly in others.

Another example is that research during the pandemic showed that women in STEM rated their soft skills as having decreased, which made them more likely to leave STEM fields at a higher rate (Melin & Correll, 2020). In addition to the decrease in their soft skills while in STEM disciplines, this particular research showed that soft skills are often not strengthened in the workforce, which can lead to employees with weak soft skills and possibly even less retention in employees (Melin & Correll, 2020). During research conducted by the Association of American Colleges and Universities, 1000 business executives and hiring managers from diverse organizations and agencies rated the recent college graduates' preparedness in soft skills.

Their ratings were:

- Critical thinking in these recent graduates as 34% on average.
- Application of knowledge as 33% on average.
- Effective written communication as 33% on average.
- Self-motivation as 35% effective on average.
- Effective oral communication as 40% on average.
- Ability to work independently as 38% on average.
- Ability to work in teams effectively as 42% on average.

These low ratings reflect poor soft skills in those participants from STEM disciplines (Karimi & Piña, 2021). None of these averages demonstrate effective nor proficient use of soft skills in recent college graduates.

Why do the ratings matter?

The way people in STEM disciplines have rated themselves on their soft skills and that others have rated them matters because it is reflective of common poor soft skills and affects the individuals in STEM, the work they do, and our society. On a personal level, while hard skills might help someone get a job, it is soft skills that open the door wide to opportunities (Rego, 2017). How strong our use of soft skills is can also affect our emotions. For example, emotional competence is a soft skill that directly affects our emotions (Thompson, 2009). Our soft skills also affect the relationships in our lives on both a professional and personal level. For example, if we are not patient, we are more likely to lose friends. If we are not respectful, not accepting of diversity, or not responsible it can cause our family and friends to avoid us or simply not want to be around us. On a personal level, the lack of strong soft skills can cause us to feel negatively

emotionally or can cause employers, family, and friends to avoid or reject us. Having strong soft skills can improve our relationships.

On a professional level, having strong soft skills makes applicants more competitive for job opportunities and can help make up for some weaknesses in hard skills. Those who master soft skills are also more likely to get promoted (Schulz, 2008). As the demand for hard skills increases, particularly in STEM disciplines, the demand for soft skills does too, and being able to use them effectively puts individuals that can at an advantage to receive job opportunities and promotions easier (Börner, et al., 2018). Soft skills are important for the employability of STEM majors and can help them make important relations between their skills and the work presented (de Campos, et al., 2020). Many employers consider both technical and nontechnical skills equally important, putting those who lack one or another at a disadvantage (Lavy & Yadin, 2013). In terms of our soft skills affecting society, having strong soft skills also allows individuals to serve others. An example of soft skills serving a purpose to help others includes a civil engineer explaining a design for a bridge effectively before building it and a medical practitioner or surgeon explaining health information to patients empathetically and clearly. Soft skills can shape a person's personality and enable social competence (Schulz, 2008). Society can benefit in numerous ways, including with better health when those that practice medicine have strong soft skills. If a physician's attitude and approach are empathetic, they can create trust and a professional relationship with their patients that allows them to serve them better (Riess, 2010).

Strong communication skills in those in STEM disciplines is another notable example of how they can be used to benefit society. Communication is one of the most important elements used for influenza preparedness (Reynolds, 2005). We experienced first-hand during the Covid-

19 pandemic how important it was for scientists, medical professionals, and others working in STEM disciplines to communicate information effectively and in a way that was easy for all to understand. Melissa Marshall, during a Ted Talk presentation titled, “Talk Nerdy to Me” encouraged conversations between scientists and STEM professionals with non-technical folks, so that through collaboration they can change the world (Marshall, 2012). Knowledge is best when applied, shared, and used to educate and help others. The example of having effective communication during a pandemic shows how much good possessing one soft skill can do. It highlights how possession and application of strong soft skills can benefit society as a whole. Imagine if those in STEM disciplines possessed many soft skills and displayed them effectively… that would make for an even more powerful and better-equipped education, workforce, and society. Overall, the ratings and feedback of participants matter because they show us how we can improve our soft skills and be better as individuals, improve our relationships and the work we do, and help society as a whole.

How can we acquire stronger soft skills?

Previous research shows that we can learn soft skills in our academic, career, and personal lives. Of course, some believe that soft skills are genetic and cannot be taught. Based on the belief that soft skills can be taught, similar to the way hard skills are, examples of ways we can acquire soft skills at colleges and universities include doing long-term apprenticeships, playing sports, doing volunteer work and projects, creating art, designing solutions, attending workshops and classes, doing international and domestic travel, and learning to play instruments (Arat, 2014). Exploring some of the examples provided on a deeper level, examples of soft skills we may acquire are as follows: playing a sport can teach us responsibility by mandating that we

attend scheduled practices, traveling might make us more curious and accepting of diversity, and working on a project can teach us more critical thinking and problem-solving skills. In academics, doing extracurriculars is one way we can acquire stronger soft skills. Through working with industry partners while studying, we can also gain soft skills. Software engineering students that were assigned a project for real clients in a college course showed that with the students increased motivation, they performed better (González-Morales, Moreno de Antonio, Roda Garcia, 2011).

In our careers, we can improve our soft skills through experiences from client-based projects and through experiential learning activities (Bobbitt, Inks, Kemp, & Mayo, 2000). As we interact with others both inside and outside the company we work in, we practice the use of many soft skills including teamwork, adaptability, and active listening. There is also technology that exists to teach soft skills (Viswanathan, 2009). Podcasts can help us learn through the experiences of others. There are also mobile tools that teach us soft skills through simulations and examination of what our responses would be to different scenarios. Similarly, we can read books that teach us how to improve our soft skills in our careers. In our personal lives, we can also use multiple approaches to acquire stronger soft skills. One such way is through volunteering with non-governmental organizations and nonprofits (Khasanzyanova, 2017). With volunteer work often comes conscious reflection and a feeling of being enriched by experiences, which can be a motivation to improve our soft skills. Additional approaches include asking our loved ones for criticism and assistance to improve our soft skills and acquire new ones.

RESEARCH METHODOLOGY

Questions Asked

The overall question of the "Soft Skills in STEM" research is: "How can educational institutions and organizations improve soft skills that students and employees in STEM disciplines feel they are lacking in?"

Data will be gathered through a self-assessment survey to answer the following questions:

1. How do those in STEM disciplines rate themselves in various soft skills?
2. How do people's ratings of their soft skills vary in universities and the workforce?
3. Where did those in STEM disciplines think they gained the majority of their soft skills?
4. What soft skills do participants rate as most important for those in management to have compared to those not in management?
5. How can the soft skills they feel they are lacking in be strengthened at a university, industry, and personal level?

Development of Survey

Once the overall goal was determined and used to create the overall question, reading on past research was done to learn about what soft skills companies, agencies, and universities consider important. Honeywell lists the following as important soft skills for employees, including those in STEM disciplines, to have: a strong customer focus, team ethic, strong communication skills, the ability and desire to learn, problem-solving skills, a can-do attitude, and self-motivation. The University of Central Florida lists the following as important soft skills for their students to have as they enter the workforce: communication, self-management, critical

thinking, and teamwork. Broward College identifies dependability, courtesy, attitude, motivation, personal accountability, and time management as important to have. Los Alamos National Laboratory lists the soft skills in Table 1.

Communications – verbal, written, active listening, netiquettes, body language.
Strategies – decision making, problem-solving, critical thinking, creativity, ability to locate and use information.
Self-management – professionalism, emotional intelligence, work ethic, time management, attitude, integrity, resilience, predictability
Teamwork – collaboration, ability to operate effectively in a team environment.
Leadership – negotiation, compromise, conflict management, managing diversity and inclusion, cultural awareness, negotiation, delegation.

Table 1. Soft Skills Listed by Los Alamos National Laboratory.

The soft skills chosen for the survey were based on feedback from people interviewed. Those that assisted in the development of the survey were from the Office of Nuclear Smuggling Detection and Deterrence (NSDD), within the federal government. Those that chose to participate in the interviews expressed the soft skills they believed were important for those in STEM disciplines to have. The soft skills used in the survey for this research were based on the interviews conducted and the research others have done, which is discussed in the literature review. During the interviews with employees from NSDD, the questions in Table 2 were asked to a number of professionals both in and out of STEM disciplines.

Which soft skills do you think those in STEM disciplines are strongest in?
Which soft skills do you think those in STEM disciplines are weakest in?
Which soft skills do you think are most important for those in STEM disciplines to have?
Do you think people learn more soft skills while in college/university, in their personal lives, or in the workforce?
How do you think organizations can strengthen the soft skills the survey participants feel they lack in?
If you had to hire an employee in a STEM discipline with five maximum soft skills, what would they be?

Table 2. Questions asked during interviews.

A compilation of soft skills was made from the most frequently mentioned as "important soft skills for those in STEM disciplines to have and display" during interviews. The survey was developed through literature findings and answers gathered during the interviews; the questions are in Table 5. The soft skills in the survey include the definitions in Table 3. The definitions in Table 3 were all provided by the 2022 Oxford Languages Dictionary publisher and are alphabetized. The soft skills presented are divided into categories in Table 4 for the purpose of visualizing them easier. While people from industry, in the public and private sectors, participated in the development of the survey and taking the survey, the findings and opinions of this research do not, in any way, reflect the view of the companies or organizations those individuals work in. The opinions and participation of the students also do not reflect the opinions of the universities nor colleges.

#	Soft Skill	Definition
1	Acceptance of diversity	Acceptance of differences in racial, spiritual, and ethnic backgrounds.
2	Active listening	A conscious effort to hear both the words and the complete message being communicated.
3	Adaptability	Being able to adjust to new conditions.
4	Adaptable with people	Can navigate and engage with different personality types.
5	Bravery	Confident and strong in the face of difficulty.
6	Creative Thinking	Ability to come up with unique, original solutions.
7	Critical Thinking	The objective analysis and evaluation of an issue in order to form a judgment.
8	Cross-cultural communication	Process of recognizing the communication style of both to effectively engage within a given context.
9	Curiosity about STEM	A desire to learn or know about topics in science, technology, engineering, and mathematics.
10	Curiosity about topics other than STEM	A desire to learn or know about topics not about science, technology, engineering, and mathematics. Examples include theater, international relations, literature, art, and other topics.
11	Cultural awareness	Sensitivity toward other countries and the culture of the people from those countries.
12	Diplomacy	Achieve peaceful resolutions and can facilitate discussions while keeping multiple parties happy.
13	Emotional Intelligence	The capacity to be aware of, control, and express one's emotions, and to handle interpersonal relationships with good judgment.
14	Empathy	Able to understand others' emotions and share them with them.
15	Ethics	The moral principle governing and guiding behavior.
16	Fearless with failure	Do not fear failure.
17	Nonverbal communication	Use of appropriate gestures, facial expressions, and body positions.
18	Patience	The bearing of delay or trouble without loss of temper or irritation.
19	Presenting expectations	The ability to present expectations in a way that is easy for an audience to understand.
20	Prioritizing people	Put people and their well-being as a priority. This means thinking about people before machines, equipment, and processes.
21	Problem-solving	Able to identify a problem and fix it creatively.
22	Professionalism	Polite behavior that is consistent.
23	Relationship development	Ability to connect on a personal level.
24	Respect	Due regard for the feelings, wishes, rights, or traditions of others.
25	Responsibility	The state or fact of being accountable.
26	Self-awareness	Conscious knowledge of one's character, feelings, motives, and desires.
27	Sympathy	Feeling or showing care and compassion for someone or a situation.
28	Teamwork	The process of working collaboratively with a group of people to achieve a goal.
29	Time management	Use time effectively and productively.
30	Understanding audiences	Able to know who the audience is and tailor content for that audience.
31	Understanding perspectives	Balancing and taking into account others' considerations and views.
32	Verbal communication	Selection of words to communicate with others in a concise and clear manner. Able to express ideas effectively.
33	Written communication	Conveying messages through emails, letters, and text messages concisely and clearly. Providing needed details.

Table 3. Definitions of soft skills in survey.

Group	Soft Skill
Accountability	1) Responsibility 2) Time management
Collaboration	3) Diplomacy 4) Teamwork
Communication	5) Active listening 6) Nonverbal communication 7) Presenting expectations 8) Understanding audiences 9) Understanding perspectives 10) Verbal communication 11) Written communication
Confidence	12) Bravery 13) Fearless with failure
Cultural Awareness	14) Acceptance of diversity 15) Cross-cultural communication 16) Cultural awareness
EQ	17) Emotional Intelligence 18) Empathy 19) Self-aware 20) Sympathy
Ethical	21) Ethics 22) Professionalism
Flexible	23) Adaptability 24) Adaptable with people 25) Patience
Relationships	26) Prioritizing people 27) Relationship development 28) Respect
Thinking	29) Creative Thinking 30) Critical Thinking 31) Curiosity about STEM 32) Curiosity about topics other than STEM 33) Problem-solving

Table 4. Soft skills in groups.

Figure 1 demonstrates the soft skills divided into groups. This allows us to better visualize how we can and do apply these soft skills.

Figure 1. Soft skills in groups.

Once development of the survey was completed, the questions in Table 3 were developed.

1. What are your name and gender? (Optional)
2. If in the workforce: What company, agency, or university do you work in? If studying: What educational institution (college or university) do you study at?
3. What is your educational background? Please list your majors for your Bachelor(s) Degree(s), Master(s), and/or Ph. D(s).
4. Select the level you rate yourself in regard to when you use the skill below successfully: 1 = Never 2 = Rarely 3 = Sometimes 4 = Often 5 = Always Please ask yourself the following: "I use the skill of ----- successfully --------." Will ask this question for each of the 33 skills below: • Acceptance of diversity • Active listening • Adaptability • Adaptable with people • Bravery • Creative thinking • Critical thinking • Cross-cultural communication • Cultural awareness • Curiosity about STEM • Curiosity about topics other than STEM • Diplomatic • Emotional intelligence • Empathetic • Ethical • Fearless with failure • Nonverbal communication • Patience • Presenting expectations • Prioritizing people • Problem-solving • Professionalism • Relationship development • Respect • Responsibility • Self-awareness • Sympathetic • Teamwork • Time management • Understanding audience • Understanding perspectives • Verbal communication • Written communication
5. What are the top three soft skills you think are most important for those in management to have and display?
6. From the skills listed above, what are the top three soft skills you think are most important for those in laboratories and machine shops to have and display?
7. From workforce, education, and personal life, where do you believe you gained most of your soft skills? Which of these three did you gain the least in? Rank from 1-3, with 1 being where you gained most of the soft skills you possess.
8. How can the soft skills you feel you lack most in be improved within the companies and agencies?
9. How can the soft skills you feel you lack most in be improved within colleges and universities?
10. How can the soft skills you feel you lack most in be improved in your personal life?
11. If you would like to provide any comments about your responses, please do so here:

Table 5. Questions in “Soft Skills in STEM” survey.

There was one survey for those in education (Appendix D) and another survey for those in the workforce (Appendix E).

Research Process

Once the Institutional Review Board approved for an exempt status (Appendix A), the survey information was distributed to companies and agencies from industry by reaching out to contacts from past networking and from my current internship using the flyer in Appendix C. The survey was distributed to students through UCF's College of Engineering and Computer Science and through messages and emails at various universities using the flyer in Appendix B. Students from other colleges were reached through newsletters such as from the Knights of Distinctions, through Discords for different organizations in STEM, and through personal contacts.

The research consisted of five steps, which are demonstrated in Figure 2.

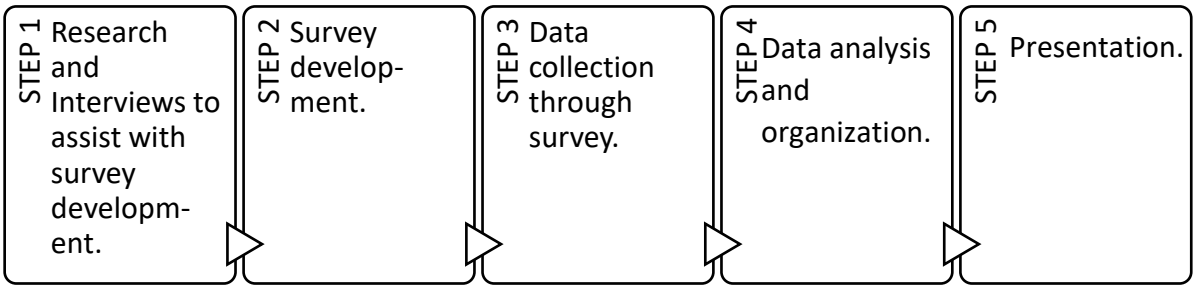

Figure 2. Steps of research.

Step one was completed through the questions asked in Table 2 during interviews on Teams and Zoom with students and industry professionals. Step two was accomplished by using the information from the interviews and literature to create the survey in Table 5. During step three, the two surveys were distributed: One to students, which created the education component

(phase one), and the second to employees, which created the industry component (phase two). Through the voluntary electronic survey, people either completed it individually using a Google Form or Qualtrics or completed it as an interactive survey that was verbally guided during a presentation and that showed live results for that group.

Steps three and four were completed twice, in phase one and then again in phase two, which are shown in Table 6, below. Phase one focused on collecting data in the workforce, which includes government and nongovernmental companies and agencies. Phase two entailed data collection in educational institutions, which includes universities and colleges.

Phase 1- Workforce	**Phase 2- Education**
a. Company/Agency 1	a. University/College 1
b. Company/Agency 1	b. University/College 2
c. Company/Agency 3	c. University/College 3
d. Company/Agency 4	d. University/College 4
e. Company/Agency 5	e. University/College 5

Table 6. Phases of research.

Once steps one through three were completed, the data were analyzed as part of step four. The results from the participant's input in both phases were compared and contrasted to create the output.

During step five, the presentation of the results consisted of three outputs: this undergraduate thesis, a presentation, and a data analysis tool on Microsoft Power BI (Appendix F). The Power BI component is interactive and allows users to choose what data they want to see and compare in an organized way. With the Power BI software created, users can multi-select the skills they want to compare either for just the education or industry component or to see the difference between the soft skills in education versus in industry using a double bar graph. This

allows users to compare skills either among one group of participants or between the two. My soft skills partnered with my technical skills are what allowed me to make a user-friendly software to visualize the results of this research. The three components together share the findings and suggestions on how soft skills can be improved in those in STEM disciplines at an educational, industry, and personal level. The five steps led to our data analysis that answered the overall question: “How can educational institutions and organizations improve soft skills students and employees in STEM disciplines feel they are lacking in?”

RESULTS

Get to Know the Participants from Colleges and Universities

As part of phase one, the education component, a total of 309 students from colleges and universities participated in the survey. 39 students identified as male, 64 as female, two as non-binary, three as agender, and 201 preferred not to say. The universities the 309 students attended are shown in Table 7. The colleges they are a part of within the universities are listed in Table 8.

University/College	Number of Students Participants
University of Central Florida	194
Preferred not to say	73
Atlantic Technical College	21
Florida Atlantic University	7
University of New Hampshire	4
University of Connecticut (Storrs Campus)	1
University of Minnesota Twin Cities	1
McMaster University	1
Broward College	1
Florida Agricultural and Mechanical University	1

Table 7. Colleges and universities participants attend.

College within University	Number of Student Participants
College of Engineering and Computer Science	176
College of Sciences	19
College of Arts and Humanities	1
College of Medicine	6
College of Health Professions and Sciences	1
College of Liberal Arts	1
College of Optics and Photonics	1
College of Arts and Humanities	3
College of Nursing	1
College of Undergraduate Studies	1
Burnett Honors College	3
Manufacturing- Technical Trade School	21

Table 8. Colleges within universities participants are a part of.

Please note that all of these participants are in STEM disciplines. Some are double-majoring.

Other colleges and universities the participants have attended before are listed below:

- Broward College
- Century College
- Daytona State College
- Eastern Florida State College
- Embry-Riddle Aeronautical University
- Florida International University
- Florida Southwestern State College
- Florida State College
- Florida State University
- Florida Technical Institute
- Georgia Southern University
- Harper College
- Hillsborough Community College
- Indian River State College
- Lake Sumter State College
- Lee University
- Polk State College
- Miami Dade College
- Missouri Western State University
- Northwest Florida State College
- Palm Beach State College
- Ringling College of Art and Designs
- Seminole State College
- St. John's River State College
- Tallahassee Community College
- University of Iowa
- University of Puerto Rico at Mayaguez
- University of South Florida
- University of St. Thomas
- University of West Florida
- University of the West Indies
- Valencia College

Additional current information from the participants that chose to answer additional questions is listed below:

Academic Status:

- 214 full-time students.
- 18 part-time students.
- 14 online students.
- 99 in-person students.
- 4 international students.
- 36 transfer students. 128 undergraduate students.
- 8 graduate students.
- 47 freshmen.
- 31 sophomores.
- 52 juniors.
- 39 seniors.

Job Status:

- 131 students stated that they currently have an internship.
- 101 stated they do not have an internship right now.
- 77 students did not make a selection.

Current Academic Level:

- 79 have a high school diploma or equivalent.
- 4 have a technical or occupational certificate.
- 70 have an associate degree.
- 57 have some college coursework completed.
- 10 have a bachelor's degree.
- 2 have a master's degree.
- 10 listed other.
- 87 students chose not to answer.

Highest Academic Level Planned:

- 3 students chose a high school degree or equivalent.
- 5 students chose a technical or occupational certificate.
- 3 students chose an associate's degree.
- 144 students chose a bachelor's degree.
- 53 students chose a master's degree.
- 23 students chose a doctorate degree.
- 1 student selected other.

The student's majors are included in Table 9:

• Artificial Intelligence • Astronomy • Astrophysics • Biology • Biomedical Sciences • Biotechnology • Chemistry • Civil Engineering • Computational Physics • Computer Engineering • Computer Science • Data Science	• Digital Media Game Design • Electrical Engineering • Environmental Engineering • Finance • Health Sciences Pre-Clinical Track • Industrial Engineering • Information Technology • International Affairs • Marine Science • Math	• Mechanical Engineering • Medical Laboratory Sciences • Molecular Cellular Biology • Music • Music Composition • Neuroscience • Nursing • Ocean Engineering • Photonics Sciences and Engineering • Planetary Sciences • Psychology • Spanish

Table 9. Majors' participants in phase 1 are currently pursuing.

Get to Know the Participants from Industry

As part of phase two, the industry component, employees from the workforce in industry participated in the survey. Out of 61 participants, 28 employees identified as male, 22 as female, and 11 preferred not to say. The companies and agencies they currently work at are shown in Table 10.

Company/Agency/Office	Number of Employee Participants
National Laboratories	30
Offices within the National Nuclear Security Administration Headquarters	14
Honeywell	4
Travel and Leisure	1
Federal Reserve Board	2
Did not specify	10

Table 10. Companies and agencies participants currently work at.

Additional current information from the answers participants chose to answer is listed below:

- 11 participants stated they have a Ph.D., seven have a master's degree, 34 have a bachelor's degree as their highest level of education, and nine did not specify.
- 14 stated they are part of management, 33 are not a part of management, one person was unsure, and 13 did not specify.

The majors they pursued are included in Table 11.

• Anatomy • Biochemistry • Biology • Business Administration • Cell Biology • Chemical Engineering • Chemistry • Civil Engineering • Communications • Computer Information Systems • Computer Science • Electrical Engineering • Foreign Affairs • Global Development	• History • Industrial Engineering • Information Technology • Inorganic Chemistry • International Affairs/Relations • International Trade • Journalism • Law • Leadership • Linguistics • Environmental Engineering • Marine Science • Material Science and Engineering	• Mathematics • Mechanical Engineering • Mechatronics Engineering • Nuclear Engineering • Nuclear Technology and Applications • Organizational Change • Physics • Political Science • Project Management • Public Safety Security • Russian • Secondary Education • Sociology • Spanish • Zoology

Table 11. Majors' participants in phase 2 pursued.

Please note some of the participants were in multiple areas of study in undergraduate and graduate school. Some double-majored and some completed minors as well. All of the participants in phase two are also in STEM disciplines.

How do those in STEM disciplines rate themselves in various soft skills?

Students rated themselves on how effectively they use their soft skills, as seen in Figure 3. A shared characteristic between students and employees' responses is that the highest rating of effective soft skills is in acceptance of diversity and the lowest rating is in fearless with failure. Table 12 demonstrates the ratings for the students that participated in the survey, with the soft skills being alphabetized.

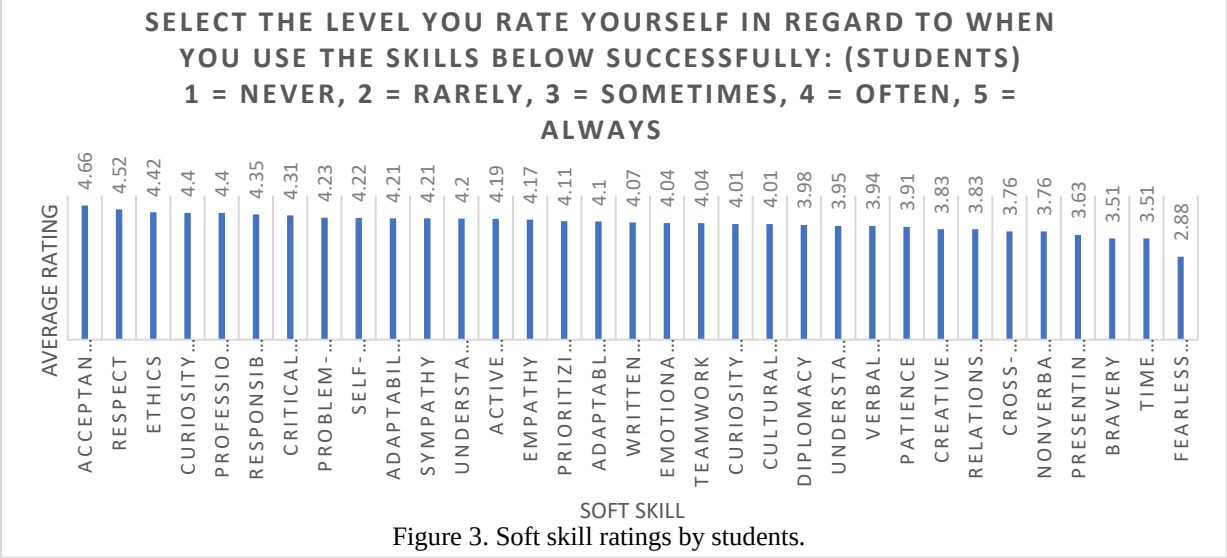

Figure 3. Soft skill ratings by students.

Soft Skill	Average Rating
Acceptance of diversity	4.66
Active listening	4.19
Adaptability	4.21
Adaptable with people	4.1
Bravery	3.51
Creative Thinking	3.83
Critical Thinking	4.31
Cross-cultural communication	3.76
Cultural awareness	4.01
Curiosity about STEM	4.4
Curiosity about topics other than STEM	4.01

Soft Skill	Average Rating
Diplomacy	3.98
Emotional Intelligence	4.04
Empathy	4.17
Ethics	4.42
Fearless with failure	2.88
Nonverbal communication	3.76
Patience	3.91
Presenting expectations	3.63
Prioritizing people	4.11
Problem-solving	4.23
Professionalism	4.4

Soft Skill	Average Rating
Relationship development	3.83
Respect	4.52
Responsibility	4.35
Self-awareness	4.22
Sympathy	4.21
Teamwork	4.04
Time management	3.51
Understanding audiences	3.95
Understanding perspectives	4.2
Verbal Communication	3.94
Written Communication	4.07

Table 12. Self-rated effectiveness of soft skill usage by students in colleges/universities.

Employees also rated their effective use of soft skills as seen in Figure 4 and Table 13. While some ratings are similar compared to students, such as acceptance of diversity and fearless with failure, some vary, such as professionalism as the second highest ranked and respect as the third highest ranked for the industry component. Time management is ranked as the second lowest for both students and employees.

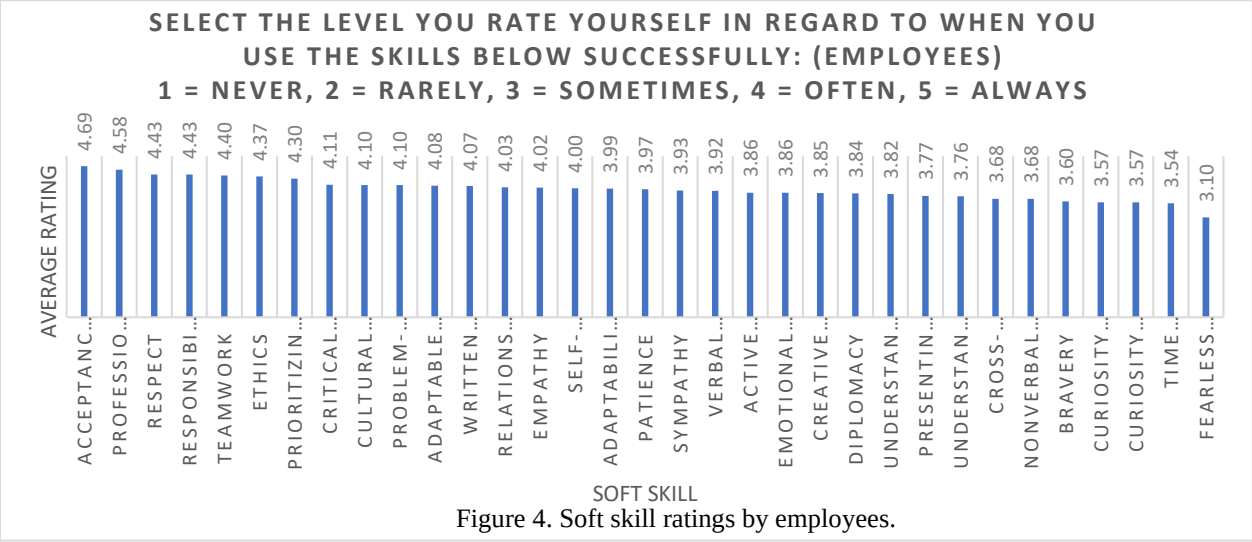

Figure 4. Soft skill ratings by employees.

Soft Skill	Average Rating
Acceptance of diversity	4.69
Active listening	3.86
Adaptability	3.99
Adaptable with people	4.08
Bravery	3.60
Creative Thinking	3.85
Critical Thinking	4.11
Cross-cultural communication	3.68
Cultural awareness	4.10
Curiosity about STEM	3.57
Curiosity about topics other than STEM	3.57

Soft Skill	Average Rating
Diplomacy	3.84
Emotional Intelligence	3.86
Empathy	4.02
Ethics	4.37
Fearless with failure	3.10
Nonverbal communication	3.68
Patience	3.97
Presenting expectations	3.77
Prioritizing people	4.30
Problem-solving	4.10
Professionalism	4.58

Soft Skill	Average Rating
Relationship development	4.03
Respect	4.43
Responsibility	4.43
Self-awareness	4.00
Sympathy	3.93
Teamwork	4.40
Time management	3.54
Understanding audiences	3.76
Understanding perspectives	3.82
Verbal Communication	3.92
Written Communication	4.07

Table 13. Self-rated effectiveness of soft skill usage by employees in the workforce.

Conclusion: Students and employees both rated themselves the lowest on “fearless with failure.” Students and employees both rated themselves the highest on “acceptance of diversity.” An observation is that as some of the soft skills improve, others can improve along with them. For example, as people become more unafraid to fail, they are more likely to think creatively, which can also help their problem-solving skills. The average score from the 33 soft skills for the education component was about 4.04 compared to about 3.97 for the industry component. A reservation to this research includes that the education component had 248 participants more than the industry component. Another reservation includes that about 64% of the students that listed the university they attend are from the same university and about 90% of the employees that listed the organization they work in are part of the federal government. This could have influenced the participants’ responses, making students’ average of their effective use of soft skills slightly larger. The overall average was 4.005 out of 5 in the effective use of soft skills, which demonstrates there is room for improvement in educational institutions and companies.

How do people’s ratings of their soft skills vary in universities and the workforce?

Comparing the responses from students and employees, we see that an overlap within the top five skills they believe they use most effectively are acceptance of diversity, respect, and responsibility. Within the top five they believe they used least effectively, fearless with failure, time management, bravery, and nonverbal communication are shared, as seen in Table 14.

Feedback from students from universities/colleges		Feedback from employees in industry/workforce	
TOP 5 USED MOST EFFECTIVELY	**TOP 5 USED LEAST EFFECTIVELY**	**TOP 5 USED MOST EFFECTIVELY**	**TOP 5 USED LEAST EFFECTIVELY**
Acceptance of diversity	Fearless with failure	Acceptance of diversity	Fearless with failure
Respect	Bravery, Time management	Professionalism	Time management
Ethics	Presenting expectations	Respect, Responsibility	Curiosity about STEM, Curiosity about topics other than STEM
Responsibility	Cross-cultural communication, Nonverbal communication	Teamwork	Bravery
Critical Thinking	Relationship development, Creative thinking	Ethics	Nonverbal communication

Table 14. Feedback on most and least effective use of soft skills from phases 1 and 2.

Conclusion: As seen in Tables 11,12, and 13, there are common trends between what soft skills students and employees rated themselves highest and lowest on. Acceptance of diversity was the one ranked as most effectively used. Fearless with failure was ranked as least effectively used. An additional similarity for the ones that are most effectively used is responsibility. For least effectively used, they both share time management in common.

Where did those in STEM disciplines think they gained the majority of their soft skills?

Students feel that they gain the majority of their soft skills in their personal life. Following their personal life, students believe that they have gained the next majority in education. The category the majority believe they gained the least amount of their soft skills in is the workforce. The data implies that there may be a correlation between acquiring the second most soft skills in the current stage of their lives. Figure 5 demonstrates the ratings of those in education and Figure 6

of those in industry. Participants from industry rated the second highest place where they learned their soft skills as the workforce.

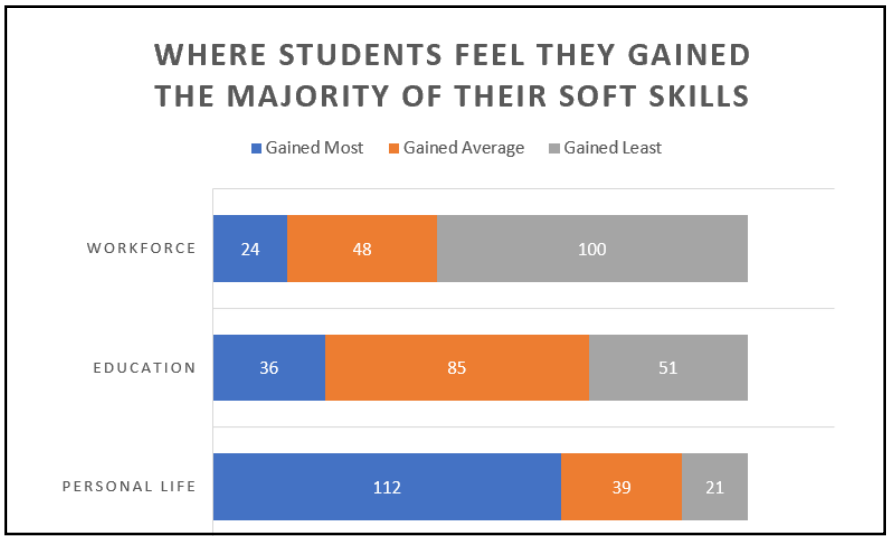

Figure 5. Where students gained the majority of their soft skills.

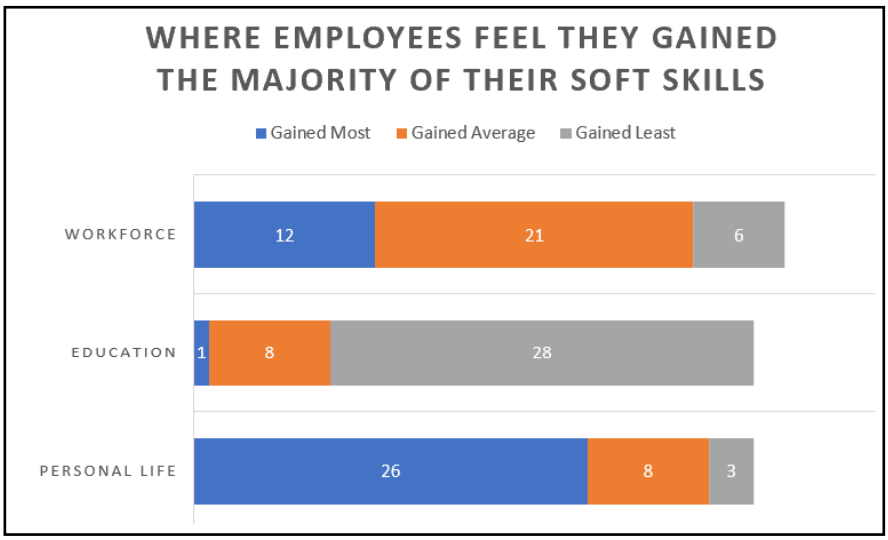

Figure 6. Where employees gained the majority of their soft skills.

Conclusion: Students and employees that participated in answering this question both rated that they gained the majority of their soft skills in their personal life. Those in colleges and universities rated that the second place they gained the majority of their soft skills was in their education and that they gained the least of their soft skills in the workforce. Those in the

workforce and industry rated that the second place they gained the majority of their soft skills was in the workforce and that they gained the least amount of their soft skills in their education. There might be a correlation between where people are in their current life and how they view where they gained their soft skills.

What soft skills do people rate as most important for those in management to have compared to those not in management?

Students and employees each rated the soft skills they thought were most important for those in management and those that are not in management to have and display. Acceptance of diversity was rated by students as the most important for those in management to have and display, as seen in Table 15. This might be because since they rate themselves high on their effective use of this soft skill, they want those around them to have this soft skill as well. Or the opposite could also be truth; because they deem acceptance of diversity as important to have, they could work harder to possess and display this soft skill effectively. Employees valued relationship development, teamwork, understanding perspectives, adaptability, professionalism, and prioritizing people as important for those both in management and not in management to have and display. Teamwork and respect overlapped in students' responses for those in management and not in management to have and display.

Answers from Students		Answers from Employees	
For those in Management:	For those NOT in Management:	For those in Management:	For those NOT in Management:
Most important to have and display:	Most Important to have and display:	Most important to have and display:	Most Important to have and display:
• Acceptance of diversity • Prioritizing people • Respect • Active listening • Adaptable with people • Teamwork • Critical thinking • Presenting expectations	• Active listening • Respect • Adaptability • Problem-solving • Critical thinking • Teamwork • Responsibility • Problem-solving	• Adaptability • Relationship development • Acceptance of diversity • Active listening • Emotional Intelligence • Ethical • Prioritizing people • Understanding perspectives • Presenting expectations • Teamwork • Professionalism	• Relationship development • Teamwork • Adaptability • Professionalism • Critical Thinking • Verbal communication • Teamwork • Prioritizing people • Adaptability • Professionalism • Understanding Perspectives • Relationship development • Acceptance of diversity

Table 15. Important soft skills for management and non-management.

Conclusion: As seen in Table 15, students and employees both rated acceptance of diversity and prioritizing people as the number one most important soft skill for those in management to have and display. They both voted for adaptability as the number one most important soft skill for those that are not in management to have and display. Another place of overlap was voting for teamwork as the second and third most important soft skill for those not in management to have and display. Teamwork and adaptability were voted as the third most important soft skill for those in management to have and display. The most common soft skill seen as important for both management and nonmanagement to have and display is teamwork. There might be a correlation

between the soft skill people rated themselves as using most effective, which is acceptance of diversity, and them rating it as the most important soft skill for those in management to have. When people value a skill, they often want those that lead them, such as in management, to have those skills they value.

How can the soft skills they feel they are lacking in be strengthened at a university, industry, and personal level?

When asking students and employees how they can improve their soft skills, the combination of responses showed that we can improve in the various aspects of our lives, such as within our education, in the workforce, and in our personal lives. Working on these three aspects simultaneously can help us possess and display stronger skills more effectively.

Below are the recommendations that were made by students on how soft skills can be improved within colleges and universities:

- Doing more projects within organizations outside of STEM and then with some that are in STEM.
- Having more team projects earlier on, including in lower-level classes.
- Asking for help when we need it.
- Taking classes, such as speech, which help improve our soft skills.
- Attend office hours and coaching sessions.
- Networking with industry professionals.
- Taking on leadership roles in registered student organizations.
- Careful observation of the excelling students around me.
- Through therapy and medication if someone has a mental disability.
- Professors can incentivize “failure” and help students understand it is part of the learning process. They can have fewer repercussions for one bad move on an exam.
- Universities can create a soft skills class.
- They can be taught by example. The teachers need to make us feel like we can experiment and try new things in order to expand our skills.
- Collaborate and push yourself out of your comfort to meet new people.
- Collaborating with more people of diverse backgrounds and with different perspectives and approaches.
- Using the resources we are offered that can help us improve our soft skills.

- By making an effort. Actively try to improve them.
- Being around like-minded individuals.
- Being organized with courses because that can improve other skills as well.
- Directly address them and create a plan for how to improve them.
- Stick to a study/work schedule.
- Join the workforce while studying.
- Repetition of situations where they are used.
- Learn how to calm oneself in any situation and observe all elements.
- Balancing priorities.
- Dedication to grow and further oneself.
- Community engagement.
- More inclusion of online students in training.
- Including more courses on the requirements (exp: philosophy, ethics, etc.) during senior year.
- Making an internship a requirement.
- Universities should stop perpetuating stereotypes about STEM students and their communication skills.
- Offer more classes that focus less on theory and more on real-life skills.
- Encouraging self-reflection of soft skills as well as independent-study form materials to improve them.
- Offer more mentoring and coaching on soft skills.
- Teach professors better soft skills.
- Providing books about soft skills.

Below are the recommendations that were made by employees on how soft skills can be improved within colleges and universities:

- Provide opportunities to make attempts and learn from mistakes.
- Give students work opportunities where developing soft skills is part of the experience.
- Additional courses on tough conversations, building empathy, active listening, and communication. There needs to be a focus on understanding your audience, taking technical details, and translating them to those that are not technical, and building empathy for the person you are creating this tech solution for.
- Offer opportunities in after-school activities, clubs, projects, events, and others that improve them.
- Integrate soft skills into the curriculum.
- Students can get involved with other classmates.

Below are the recommendations that were made by students on how soft skills can be improved within the workforce:

- Having mentors that oversee us along our professional journey.
- Providing better training programs after hiring.
- Team bonding events, where you get to know everyone on a deeper level (Exp: parties, social outings, etc.)
- By bringing awareness to the need for these skills.
- Managers can lead by example and foster a safe space.
- More diversity and diversity training.
- Annual employee review feedback
- Allow for trial and error.
- Being assigned to teams to work on certain projects together.
- Employees can ask for guidance and feedback.
- Setting goals for yourself and reflecting on them.
- Being allowed to change.
- Being given additional responsibilities.
- Sharing opinions and perspectives of others and sharing yours.
- Getting to know a professional environment as well as how company teams and co-workers interact with clients, projects, higher-ups, and people working under them. Understanding structure.
- Talk with coworkers and management more.
- Companies and agencies can care for and take care of each individual person.
- With practice and experience.
- Clear workplace policy and ethics/dynamic/culture encouraging meaningful interaction for individual development.
- Allow for more managers to associate communication with clear boundaries and an accepting work environment.
- Acknowledge accomplishments.
- Increase the number of technical problems.
- Have workshops that cultivate an environment of openness, communication, and feedback.
- Getting paid more is an incentive to want to improve on soft skills and maintain one's job.
- Allow employees to guide their own growth.
- Employees can attend more meetings.
- Set deadlines for when work is due.
- Offering counseling appointments.
- Convey clear goals and impact.
- Offering coaching sessions/activities per month about topics, such as emotional intelligence.
- Employees can watch, listen, and learn.

- Teach to adapt to different customers.
- Making the effort to bring the gap between what we do and what others in the company do and how it comes together to create the company's vision.
- Better distribution of responsibilities.
- Conversations with trained professionals.
- Mandatory sensitivity training.
- Observing and being aware of the soft skills of those who have reached high places within the company.
- By stepping out of our comfort zone to improve in areas we knowingly avoid.
- Encouraging those with beneficial soft skills and discouraging those with negative behaviors/ not tolerating those behaviors.

Below are the recommendations that were made by employees on how soft skills can be improved within the workforce:

- Mentoring.
- Recognizing people for accomplishments in using effective soft skills.
- Receiving feedback from colleagues.
- Holding more engagement activities and empowerment events.
- Having on-the-job developmental opportunities to practice soft skills, such as workshops.
- Teaching mindful practices.
- Having more small group interactions.
- Raising awareness of what soft skills are and why they are important.
- Incorporating breakout groups for more discussions.
- Offering foreign language training.
- Holding each other accountable by having transparency with others when they fail to show effective soft skills.
- Providing books that build soft skills.
- Training that teaches multiple soft skills. Target training to each level. Can be part of the onboarding process.
- Focus on the importance of how soft skills can help even with technology and product development.
- Provide opportunities to make attempts and learn from mistakes.
- Promoting events where different departments within the building can interact with each other or at least can be joined together in events.

Below are the recommendations that were made by students on how soft skills can be improved within our personal lives:

- By stepping out of our comfort zone.
- Discuss with those closest to you that know you well how you can improve your character and what you need to improve on.
- Educate oneself in soft skills.
- Surround yourself with good friends and people that have strong soft skills.
- Through more self-reflection to gauge what soft skills are most lacking in my personal life.
- Go to therapy.
- Listen to podcasts.
- Read self-help books.
- Listen to the wisdom and advice of others.
- By taking on more leadership and responsibility.
- By meeting new people and building relationships.
- Consciously attempting to be less afraid of failure and making mistakes.
- Make an effort to interact with others.
- Try to understand where people come from.
- Set intentional goals.
- Try to go out of your way to take risks.
- Spend less time on social media.
- Exercise control over how we feel.
- Pay close attention to how we act and how our actions affect consequences.
- Learn to read people better.
- Try to understand there is no shame in wrong answers or asking questions that do not seem smart.
- Do not make excuses.
- Better parenting.
- Engage more with family and friends.
- Set reminders for oneself.
- Form routines.
- Volunteer.
- Be mindful of what you choose to do during your free time.
- Rebuild and redefine relationships.
- Visit new places.
- Explore non-stem avenues.
- Find hobbies.

Below are the recommendations that were made by employees on how soft skills can be improved within our personal lives:

- Therapy.
- Take opportunities to make attempts and learn from mistakes.
- Read books and attend webinars.
- Taking time to improve.
- Not being so reactionary. Wait and think before you respond.
- Hang out with friends.
- Socialize with people you do not know.
- Educate yourself.

Conclusion: There are changes that can happen at universities, in industry, and in our personal lives that can improve our soft skills. Leadership can provide training, do evaluations, and have opportunities for students and employees to grow. Part of improving our soft skills is up to us and as my Machining instructor has always said, having intrinsic motivation, to learn and grow.

Table 16 shows the overall most common suggestions from participants. The most common suggestions include pushing ourselves out of our comfort zone to join clubs and socialize with other students and coworkers, participating in team projects, and educating ourselves on what soft skills are and why they matter—which you are likely doing if you have gotten to this point, reading books, listening to podcasts, learning from leaders in our lives, and seeking help when we need it. In our personal lives, we can start by doing self-reflection to become more mindful and aware. We can use "I" statements to help us do this (Wheeler, 2016). An example is, "I am not patient; I need to work on my patience by forcing myself to wait for more things to practice this soft skill." Be aware, hold yourself accountable, lean on your support system, make a plan, and start improving your soft skills today!

OVERALL MOST COMMON SUGGESTIONS FROM PARTICIPANTS		
UNIVERSITY/COLLEGE	**INDUSTRY**	**PERSONAL LIFE**
• Listen and read to learn. • Professors can have fewer repercussions for failure. • Having more team projects earlier on, including in lower-level classes. • Universities can create a soft skills class. • Professors can lead by example. • Attend office hours, networking events, and coaching sessions. • Taking on leadership roles in registered student organizations. • Doing more projects within organizations outside of STEM. • Careful observation of the excelling students around me.	• Having more team project tasks. • Providing better training programs after hiring. • Team bonding events, where you get to know everyone on a deeper level. • More diversity and diversity training. • Management can foster a safe space where employees are not fearful of making mistakes. • By bringing awareness to the need for these skills. Rewarding good usage of them. • Annual employee review feedback. • Allow for trial and error.	• Educate oneself on soft skills. • Through going to therapy. • Setting goals for yourself and reflecting on them. • By stepping out of our comfort zone. • Discuss with those close to you. • Community engagement and volunteering. • Self-reflection and effort to improve. • Join clubs, push yourself out of your comfort zone, to meet new people. • Learn from those around you.

Table 16. Overall most common suggestions from participants.

LESSONS LEARNED

My first time doing research has been an experience I do not take for granted; it is one I am incredibly grateful for. It has been remarkably interesting to learn about how people perceive soft skills differently and valuable to be able to share these results with others. Research involves a lot of recruiting, data analysis, and communication using visualization. Using my soft skills and hard skills combined allowed me to make findings and deliver a product that can be used to help others. As stated in the beginning, I highly believe that knowledge is best used when applied and to be able to share my findings to help others improve their soft skills and provide suggestions to universities, colleges, and organizations on how they can help students and employees improve on their soft skills is impactful and a true blessing. I believe we should all often put work and effort into improving ourselves, the lives of those around us, and the world around us. Through this research, we can use the suggestions provided by participants to do just that. We can improve our soft skills, which can improve our lives and allow those in STEM disciplines to use these skills in their everyday work and continue to improve the lives of others!

Below are additional lessons I learned about research in general, soft skills in STEM, and about life in general.

About research in general

- When we do our own research, we should first learn a lesson from those that have already done similar research.
- The correct way to ask someone to be on your thesis committee.
- What Institutional Review Board is and what that process looks like.

- How to sort data and use it to author a thesis.
- What the structure of a thesis should be.
- Having a focus group before releasing the survey is helpful.
- Starting backward when writing your undergraduate thesis is helpful. Make the presentation and then write the thesis.
- Students are more likely to participate in another student's research than someone from industry is. This is likely because they understand what it feels like to try to gather participants for research.
- How to make an accessible table of content on Microsoft Word.

About soft skills in STEM

- The majority of people, whether students or employees, are afraid of failure.
- The majority of those in college/university believed they gained more soft skills there than in the workforce. The majority of people in the workforce believed they gained more of their soft skills there than in education. The stage of our life we are in can affect our answers, so they are fluid and can change over time.
- Many of the participants believe in order to gain stronger soft skills, they must expose themselves to non-STEM concepts, yet the average overall rating for “Curiosity about topics other than STEM” was 3.79/5 as opposed to 3.985/5 for “Curiosity about STEM”.
- As participants self-reflected when they answered the questions, they realized they need to self-reflect more and a common trend in how they think they can improve their soft skills was to go to therapy, ask for help when we need it, ask for criticism from those around us, and learn from the role models around us.

About life

- Just like with anything else, when completing an honors undergraduate thesis we must lean on our strong support system for motivation and guidance.
- When we do things we enjoy we tend to excel at them.
- To do research, we must be willing to do what we ask our participants to do, such as the survey.
- Hard work and dedication pay off.
- Enjoy the process! It is about the journey more than it is about the destination.

POTENTIAL CONTRIBUTIONS

This research can be used to create training and workshops in colleges and universities that can help to improve soft skills in their students and employees. Learning how the participants rated themselves on their soft skills, how this varies between education and the workforce, where they believed they gained the majority of their soft skills, and the soft skills they valued as most important are helpful in decision-making, recruitment, and training. It can also encourage leaders to build on the soft skills those within their companies value in others and that they value. Additional research could also be conducted using the information provided. We can learn how ratings of soft skills vary between genders, and how others view the participants soft skills, or we could even focus on one soft skill, such as acceptance of diversity, and learn how participants rate their acceptance of diversity in subgroups, such as of nationality, religion, and race. Below are additional suggestions on how we can use the findings to improve soft skills in our personal lives, education, and in the workforce.

- Training can be created at both the university level and in the workforce. The training can vary between diversity training, how to communicate, how to solve conflicts, and others.
- Demonstration that people care about acceptance of diversity and thus, we should promote diversity, equity, and inclusion efforts.
- Schools could create a course that teaches soft skills through scenario assignments or advertise the class more if they already have one.
- Leaders at schools and companies can emphasize to those they lead that it is okay to make mistakes because we learn from them.

- For the organizations of those that participated to know what kinds of books and podcasts they can provide for those within the organization.
- Clubs that are focused on STEM concepts can collaborate with some that are not focused on STEM concepts to have more interdisciplinary collaboration.
- People's desire to improve their soft skills can increase and they can actively work on improving them.
- People can learn and understand the importance of soft skills more.
- Managers and leaders can feel encouraged to lead by example.
- Increased collaboration between people in STEM and non-STEM disciplines.
- Additional research could be done. For example, research could be done on how people of different genders rate themselves on their soft skills, or how those in non-STEM disciplines' ratings on their soft skills would be in comparison to those in STEM disciplines, or how others rate the participants in their soft skills from a second-person point of view perspective.
- This research could be done with more questions added such as, "would you take a class focused on building your soft skills," "do you think a class on improving soft skills would be beneficial to your personal life, career, and or/or education."
- This research could branch out into more focused research, such as examining how people rate themselves on their acceptance of diversity of race, religion, and gender identity to examine if there is a difference or areas where participants are less accepting.
- Conferences that improve the soft skills of those in STEM and consequently, work done by those in STEM that helps more individuals and that better serves others and society.

Using the suggestions provided by participants and in the literature review, we can improve our soft skills. Those in STEM disciplines can pair these skills with their hard skills and utilize them to deliver world-changing solutions, create positive change, and improve their community and the lives of those around them. We must make a conscious effort to improve our soft skills in our education, career, and personal lives. The world and society would be better because of it. We should not lose sight of the "people" aspect of the technical work we do. As professionals in STEM fields, we should build our people skills, our soft skills, especially since the work we do will affect them! This does not mean eliminating our hard skills or deterring from building on them. It means we can build on our soft skills and hard skills simultaneously, which makes for a dynamic duo of skills that allows us to do a lot of good!

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APPENDIX A: IRB APPROVAL EXEMPTION DETERMINATION

UNIVERSITY OF CENTRAL FLORIDA

Institutional Review Board
FWA00000351
IRB00001138, IRB00012110
Office of Research
12201 Research Parkway
Orlando, FL 32826-3246

EXEMPTION DETERMINATION

March 8, 2023

Dear Timothy Kotnour:

On 3/8/2023, the IRB determined the following submission to be human subjects research that is exempt from regulation:

Type of Review:	Initial Study, Exempt 2
Title:	Soft Skills in STEM
Investigators:	Timothy Kotnour and Mariana Sorroza
IRB ID:	STUDY00005012
Funding:	None
Documents Reviewed:	• HRP-254 - FORM - Explanation of Research.pdf, Category: Consent; • HRP-255-Form-Soft-Skills-in-STEM, Category: IRB Protocol; • Recruitment.docx, Category: Recruitment Materials; • Soft Skills in STEM- Education Version.pdf, Category: Survey • Soft Skills in STEM- Industry Version.pdf, Category: Survey

This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made, and there are questions about whether these changes affect the exempt status of the human research, please submit a modification request to the IRB. Guidance on submitting Modifications and Administrative Check-in are detailed in the Investigator Manual (HRP-103), which can be found by navigating to the IRB Library within the IRB system. When you have completed your research, please submit a Study Closure request so that IRB records will be accurate.

If you have any questions, please contact the UCF IRB at 407-823-2901 or irb@ucf.edu. Please include your project title and IRB number in all correspondence with this office.

Sincerely,

Renea Carver
UCF IRB

APPENDIX B: EDUCATIONAL RECRUITMENT FLYER

Soft Skills in STEM

Seeking students studying in STEM disciplines!

This research project at the University of Central Florida seeks to better prepare students for industry!

https://tinyurl.com/SSS-UCF

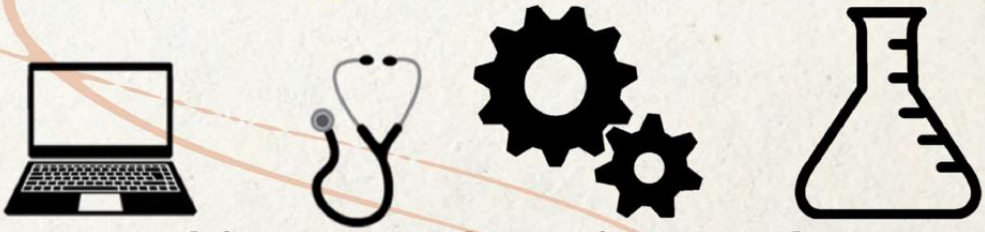
"Soft Skills" and "STEM" are defined on the first page of the survey. Contact information is on survey.

APPENDIX C: INDUSTRY RECRUITMENT FLYER

SOFT SKILLS IN STEM

Seeking participants to participate in a 10-15 minute survey to answer the overall question:
"How can we improve soft skills in those in STEM disciplines at an education and industry level?"

https://tinyurl.com/SSS-Industry



This research project at the University of Central Florida seeks to better prepare students for industry!
Thank you for your participation!

APPENDIX D: EDUCATION SURVEY

Soft Skills in STEM - Education

Start of Block: Background

Soft Skills in STEM Research- Student version

Greetings,

Please support the research of undergraduate student, Mariana Sorroza, by completing this 10-15 minute survey to assist with her research. Mariana is a junior double-majoring in Mechanical Engineering and International and Global Studies and she is passionate about learning how we can improve soft skills in those in STEM disciplines. The survey can be completed on any electronic device.

Below is important information:
The data gathered through this self-assessment survey will support research being done at the University of Central Florida to answer the following questions:
• How do those in STEM disciplines rate themselves in various soft skills?
• How do ratings of people's soft skills vary in companies, agencies, and universities?
• What soft skills do people rate as most important in management versus laboratories and machine shops?
• Where did those in STEM disciplines think they gained the majority of their soft skills?
• How can the soft skills they feel they are lacking in be strengthened at a university and at an industry level in the workforce?

Overall question: How can we improve the soft skills those in STEM disciplines feel they are lacking in?

Definitions:
-Soft Skills: Relate to how people interact and work with others. Often referred to as "people skills" because they characterize our relationships.
-STEM: Science, Technology, Engineering, Mathematics.
Thank you in advance for your participation!

This research involves a soft skills self-assessment survey containing three parts. Once this data is collected, a study-wide analysis will be completed. Your participation is voluntary and without compensation. If you have questions, please email Mariana Sorroza at msorroza@knights.ucf.edu. If you would like a copy of the results, you will be asked for your name and email address, which will be deleted once you receive the results. In accordance with the Institutional Review Board, please select "I agree" to confirm you are completing this survey voluntarily and without compensation. If you would select "I do not agree", please do not proceed taking the survey. Thank you.

- ○ I agree
- ○ I do not agree

Part 1 of 3: Career and Education Information

First Name, Last Name (Optional)

_____

What is your email address? (Optional)

_____

What is your gender? (Optional)

_____

What is the name of the university/community college you attend?

_____

What is the name of the college(s) you are a part of? Examples: College of Sciences, College of Engineering and Computer Science, etc.

_____

Only if applicable: Other colleges and/or universities you have attended.

_____

Which of the following are you? (Select all that apply.)

- [ ] Full-time student
- [ ] Part-time student
- [ ] Online student
- [ ] In-person student
- [ ] International student
- [ ] Not an international student
- [ ] Transfer student
- [ ] Undergraduate student (pursuing Associates and/or Bachelors)
- [ ] Graduate student (pursuing Masters and/or PhD)
- [ ] Freshman
- [ ] Sophomore
- [ ] Junior
- [ ] Senior

What is your highest level of education up to now?

- ○ High school or equivalent
- ○ Technical or occupational certificate
- ○ Associate degree
- ○ Some college coursework completed
- ○ Bachelor's degree
- ○ Master's degree
- ○ Doctorate
- ○ Other

What is the highest level of education you are pursuing?

- ○ High school or equivalent
- ○ Technical or occupational certificate
- ○ Associate degree
- ○ Some college coursework completed
- ○ Bachelor's degree
- ○ Master's degree
- ○ Doctorate
- ○ Other

Only if applicable: Major(s) for Bachelor Degree(s). Please put comma after each one if you have or are pursuing more than one.

_____

Only if applicable: Master(s). Please put comma after each one if you have or are pursuing more than one.

_____

Only if applicable: PhD(s). Please put comma after each one if you have or are pursuing more than one.

_____

Only if applicable: Technical diploma(s). Please put comma after each one if you have or are pursuing more than one. Example: Machining Technologies, Carpentry, Welding, etc.

_____

Do you currently have a job and/or internship?

- ○ Yes
- ○ No

If you do have a job and/or internship, where do you work?

_____

End of Block: Background

Start of Block: Self-rate

Part 2 of 3: Self-rating on Soft Skills

As you answer each question, please ask yourself the following:

"I use the skill of ----- successfully --------."

Exp: I use the skill of verbal communication successfully always (would rate this as #5).

They are slider questions, so please slide the dot to the number you wish to put or click on the line under the number you wish to click. If you wish to leave the slider at 1, click the dot to activate it. The slider corresponding to each skill is below the name of the skill.

Select the level you rate yourself in regard to when you use the skills below successfully:

1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Often, 5 = Always

Acceptance of diversity: Acceptance of differences in racial, spiritual, and ethnic backgrounds.

Active listening: Conscious effort to hear both the words and complete message being communicated.

Adaptability: Being able to adjust to new conditions.

I use the skill of _____ successfully _____.

	Never	Rarely	Sometimes	Often	Always
	1	2	3	4	5
Acceptance of diversity					
Active listening					
Adaptability					

Select the level you rate yourself in regard to when you use the skills below successfully:

1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Often, 5 = Always

Adaptable with people: Can navigate and engage with different personality types.

Bravery: Confident and strong in the face of difficulty.

Creative thinking: Ability to come up with unique, original solutions.

I use the skill of _____ successfully _____.

	Never	Rarely	Sometimes	Often	Always
	1	2	3	4	5
Adaptable with people					
Bravery					
Creative thinking					

Select the level you rate yourself in regard to when you use the skills below successfully:

1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Often, 5 = Always

Critical thinking: The objective analysis and evaluation of an issue in order to form a judgment.

Cross-cultural communication: Process of recognizing the communication style of both to effectively engage within a given context.

Curiosity about STEM: A desire to learn or know about topics in science, technology, engineering, and mathematics.

I use the skill of _____ successfully _____.

	Never	Rarely	Sometimes	Often	Always
	1	2	3	4	5
Critical thinking					
Cross-cultural communication					
Curiosity about STEM					

Select the level you rate yourself in regard to when you use the skills below successfully:

1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Often, 5 = Always

Curiosity about topics other than STEM: A desire to learn or know about topics not about science, technology, engineering, and mathematics. Examples include theater, international relations, geography, literature, art, and other topics.

Cultural awareness: Sensitivity toward other countries and the culture of the people from those countries.

Diplomacy: Achieve peaceful resolutions and can facilitate discussions while keeping multiple parties happy.

I use the skill of _____ successfully _____.

	Never	Rarely	Sometimes	Often	Always
	1	2	3	4	5
Curiosity about topics other than STEM					
Cultural awareness					
Diplomacy					

Select the level you rate yourself in regard to when you use the skills below successfully:

1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Often, 5 = Always

Emotional intelligence: The capacity to be aware of, control, and express one's emotions, and to handle interpersonal relationships with good judgment.

Empathy: Able to understand others' emotions and share them with them.

Ethics: Moral principle governing and guiding behavior.

I use the skill of _____ successfully _____.

	Never	Rarely	Sometimes	Often	Always
	1	2	3	4	5
Emotional intelligence					
Empathy					
Ethics					

Select the level you rate yourself in regard to when you use the skills below successfully:

1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Often, 5 = Always

Fearless with failure: Do not fear failure. If you are afraid to fail, you are closer to 1. If you are not afraid to fail, you are closer to 5.

Nonverbal communication: Use of appropriate gestures, facial expressions, and body positions.
Patience: The bearing of delay or trouble without loss of temper or irritation.

I use the skill of _____ successfully _____.

	Never	Rarely	Sometimes	Often	Always
	1	2	3	4	5
Fearless with failure					
Nonverbal communication					
Patience					

Select the level you rate yourself in regard to when you use the skills below successfully:

1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Often, 5 = Always

Presenting expectations: The ability to present expectations in a way that is easy for an audience to understand.

Prioritizing people: Put people and their wellbeing as a priority. This means thinking about people before machines, equipment, and processes.

Problem-solving: Able to identify a problem and fixing it creatively.

I use the skill of _____ successfully _____.

	Never	Rarely	Sometimes	Often	Always
	1	2	3	4	5
Presenting expectations					
Prioritizing people					
Problem-solving					

Select the level you rate yourself in regard to when you use the skills below successfully:

1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Often, 5 = Always

Professionalism: Polite behavior that is consistent.

Relationship development: Ability to connect on a personal level.

Respect: Due regard for the feelings, wishes, rights, or traditions of others.

I use the skill of _____ successfully _____.

	Never	Rarely	Sometimes	Often	Always
	1	2	3	4	5
Professionalism					
Relationship development					
Respect					

Select the level you rate yourself in regard to when you use the skills below successfully:

1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Often, 5 = Always

Responsibility: The state or fact of being accountable.

Self-awareness: Conscious knowledge of one's own character, feelings, motives, and desires.

Sympathy: Feeling or showing care and compassion for someone or a situation.

I use the skill of _____ successfully _____.

	Never	Rarely	Sometimes	Often	Always
	1	2	3	4	5
Responsibility					
Self-awareness					
Sympathy					

Select the level you rate yourself in regard to when you use the skills below successfully:

1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Often, 5 = Always

Teamwork: The process of working collaboratively with a group of people in order to achieve a goal.

Time management: Use time effectively and productively.

Understanding audiences: Able to know who the audience is and tailor content for that audience.

I use the skill of _____ successfully _____.

	Never	Rarely	Sometimes	Often	Always
	1	2	3	4	5
Teamwork					
Time management					
Understanding audiences					

Select the level you rate yourself in regard to when you use the skills below successfully:

1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Often, 5 = Always

Understanding perspectives: Balancing and taking into account others considerations and views.

Verbal communication: Selection of words to communicate with others in a concise and clear manner. Able to express ideas effectively.

Written communication: Conveying messages through emails, letters, and text messages concisely and clearly. Providing needed details.

I use the skill of _____ successfully _____.

	Never	Rarely	Sometimes	Often	Always
	1	2	3	4	5
Understanding perspectives					
Verbal communication					
Written communication					

End of Block: Self-rate

Start of Block: Most Important Soft Skills

Part 3 of 3: Important Soft Skills and Building Soft Skills

Which of the following soft skills do you think is the FIRST most important for those in management at companies to have and display?

- ○ Acceptance of diversity
- ○ Active listening
- ○ Adaptability
- ○ Adaptable with people
- ○ Bravery
- ○ Creative thinking
- ○ Critical thinking
- ○ Cross-cultural communication
- ○ Cultural awareness
- ○ Curiosity about STEM
- ○ Curiosity about topics other than STEM
- ○ Diplomatic
- ○ Emotional intelligence
- ○ Empathetic
- ○ Ethical
- ○ Fearless with failure
- ○ Nonverbal communication

- ○ Patience
- ○ Presenting expectations
- ○ Prioritizing people
- ○ Problem-solving
- ○ Professionalism
- ○ Relationship development
- ○ Respect
- ○ Responsibility
- ○ Self-awareness
- ○ Sympathetic
- ○ Teamwork
- ○ Time management
- ○ Understanding audiences
- ○ Understanding perspectives
- ○ Verbal communication
- ○ Written communication

Which of the following soft skills do you think is the SECOND most important for those in management at companies to have and display? Please select a skill other than the one you chose for the previous answer.

- ○ Acceptance of diversity
- ○ Active listening
- ○ Adaptability
- ○ Adaptable with people
- ○ Bravery
- ○ Creative thinking
- ○ Critical thinking
- ○ Cross-cultural communication
- ○ Cultural awareness
- ○ Curiosity about STEM
- ○ Curiosity about topics other than STEM
- ○ Diplomatic
- ○ Emotional intelligence
- ○ Empathetic
- ○ Ethical
- ○ Fearless with failure
- ○ Nonverbal communication
- ○ Patience

- ○ Presenting expectations
- ○ Prioritizing people
- ○ Problem-solving
- ○ Professionalism
- ○ Relationship development
- ○ Respect
- ○ Responsibility
- ○ Self-awareness
- ○ Sympathetic
- ○ Teamwork
- ○ Time management
- ○ Understanding audiences
- ○ Understanding perspectives
- ○ Verbal communication
- ○ Written communication

Which of the following soft skills do you think is the THIRD most important for those in management at companies to have and display? Please select a skill other than the ones you chose for the two previous answer.

- ○ Acceptance of diversity
- ○ Active listening
- ○ Adaptability
- ○ Adaptable with people
- ○ Bravery
- ○ Creative thinking
- ○ Critical thinking
- ○ Cross-cultural communication
- ○ Cultural awareness
- ○ Curiosity about STEM
- ○ Curiosity about topics other than STEM
- ○ Diplomatic
- ○ Emotional intelligence
- ○ Empathetic
- ○ Ethical
- ○ Fearless with failure
- ○ Nonverbal communication
- ○ Patience

- ○ Presenting expectations
- ○ Prioritizing people
- ○ Problem-solving
- ○ Professionalism
- ○ Relationship development
- ○ Respect
- ○ Responsibility
- ○ Self-awareness
- ○ Sympathetic
- ○ Teamwork
- ○ Time management
- ○ Understanding audiences
- ○ Understanding perspectives
- ○ Verbal communication
- ○ Written communication

Which of the following soft skills do you think is the FIRST most important for those NOT in management at companies to have and display?

- ○ Acceptance of diversity
- ○ Active listening
- ○ Adaptability
- ○ Adaptable with people
- ○ Bravery
- ○ Creative thinking
- ○ Critical thinking
- ○ Cross-cultural communication
- ○ Cultural awareness
- ○ Curiosity about STEM
- ○ Curiosity about topics other than STEM
- ○ Diplomatic
- ○ Emotional intelligence
- ○ Empathetic
- ○ Ethical
- ○ Fearless with failure
- ○ Nonverbal communication
- ○ Patience

- ○ Presenting expectations
- ○ Prioritizing people
- ○ Problem-solving
- ○ Professionalism
- ○ Relationship development
- ○ Respect
- ○ Responsibility
- ○ Self-awareness
- ○ Sympathetic
- ○ Teamwork
- ○ Time management
- ○ Understanding audiences
- ○ Understanding perspectives
- ○ Verbal communication
- ○ Written communication

Which of the following soft skills do you think is the SECOND most important for those NOT in management at companies to have and display? Please select a skill other than the one you chose for the previous answer.

- ○ Acceptance of diversity
- ○ Active listening
- ○ Adaptability
- ○ Adaptable with people
- ○ Bravery
- ○ Creative thinking
- ○ Critical thinking
- ○ Cross-cultural communication
- ○ Cultural awareness
- ○ Curiosity about STEM
- ○ Curiosity about topics other than STEM
- ○ Diplomatic
- ○ Emotional intelligence
- ○ Empathetic
- ○ Ethical
- ○ Fearless with failure
- ○ Nonverbal communication
- ○ Patience

- ○ Presenting expectations
- ○ Prioritizing people
- ○ Problem-solving
- ○ Professionalism
- ○ Relationship development
- ○ Respect
- ○ Responsibility
- ○ Self-awareness
- ○ Sympathetic
- ○ Teamwork
- ○ Time management
- ○ Understanding audiences
- ○ Understanding perspectives
- ○ Verbal communication
- ○ Written communication

Which of the following soft skills do you think is the THIRD most important for those NOT in management at companies to have and display? Please select a skill other than the ones you chose for the two previous answer.

- ○ Acceptance of diversity
- ○ Active listening
- ○ Adaptability
- ○ Adaptable with people
- ○ Bravery
- ○ Creative thinking
- ○ Critical thinking
- ○ Cross-cultural communication
- ○ Cultural awareness
- ○ Curiosity about STEM
- ○ Curiosity about topics other than STEM
- ○ Diplomatic
- ○ Emotional intelligence
- ○ Empathetic
- ○ Ethical
- ○ Fearless with failure
- ○ Nonverbal communication
- ○ Patience

- ○ Presenting expectations
- ○ Prioritizing people
- ○ Problem-solving
- ○ Professionalism
- ○ Relationship development
- ○ Respect
- ○ Responsibility
- ○ Self-awareness
- ○ Sympathetic
- ○ Teamwork
- ○ Time management
- ○ Understanding audiences
- ○ Understanding perspectives
- ○ Verbal communication
- ○ Written communication

Where do you believe you gained most of your soft skills?

1=gained most of my soft skills here, 3=gained least of my soft skills here

Please click on the three options and move the order, if you wish to do so, to reflect your answer.

_____ Workforce
_____ Personal life
_____ Education

How can the soft skills you feel you lack most in be improved within the college/university you currently attend?

_____

How can the soft skills you feel you lack most in be improved within companies/agencies in the workforce?

_____

How can the soft skills you feel you lack most in be improved within your personal life?

_____

If you would like to provide any comments about your responses, the research and/or the survey, please do so here:

_____

Thank you for participating! If you have any questions, comments, or concerns, please email msorroza@knights.ucf.edu. Thank you! By clicking this next arrow you will be submitting your answers!

End of Block: Most Important Soft Skills

APPENDIX E: INDUSTRY SURVEY

Soft Skills in STEM- Industry

Start of Block: Background

Soft Skills in STEM Research- Industry version

Greetings,

Please support the research of undergraduate student, Mariana Sorroza, by completing this 10-15 minute survey to assist with her research. Mariana is a junior double-majoring in Mechanical Engineering and International and Global Studies and she is passionate about learning how we can improve soft skills in those in STEM disciplines. The survey can be completed on any electronic device.

Below is important information:
The data gathered through this self-assessment survey will support research being done at the University of Central Florida to answer the following questions:
• How do those in STEM disciplines rate themselves in various soft skills?
• How do ratings of people's soft skills vary in companies, agencies, and universities?
• What soft skills do people rate as most important in management versus laboratories and machine shops?
• Where did those in STEM disciplines think they gained the majority of their soft skills?
• How can the soft skills they feel they are lacking in be strengthened at a university and at an industry level in the workforce?

Overall question: How can we improve the soft skills those in STEM disciplines feel they are lacking in?

Definitions:
-Soft Skills: Relate to how people interact and work with others. Often referred to as "people skills" because they characterize our relationships.
-STEM: Science, Technology, Engineering, Mathematics.
Thank you in advance for your participation!

This research involves a soft skills self-assessment survey containing three parts. Once this data is collected, a study-wide analysis will be completed. Your participation is voluntary and without compensation. If you have questions, please email Mariana Sorroza at msorroza@knights.ucf.edu. If you would like a copy of the results, you will be asked for your name and email address, which will be deleted once you receive the results. In accordance with the Institutional Review Board, please select "I agree" to confirm you are completing this survey voluntarily and without compensation. If you would select "I do not agree", please do not proceed taking the survey. Thank you.

- ○ I agree
- ○ I do not agree

Part 1 of 3: Career and Education Information

First Name, Last Name (Optional)

_____

What is your email address? (Optional)

_____

What is your gender? (Optional)

_____

What is the name of the company you work at?

_____

What is the name of the lab/office/department you work for?

_____

Which of the following are you? (Select all that apply.)

- ☐ Full-time employee
- ☐ Part-time employee
- ☐ Intern
- ☐ Fellow
- ☐ Federal employee
- ☐ Contractor
- ☐ Other

Are you part of management?

- ○ Yes
- ○ No
- ○ Unsure

What is your highest level of education?

- ○ High school or equivalent
- ○ Technical or occupational certificate
- ○ Associate degree
- ○ Some college coursework completed
- ○ Bachelor's degree
- ○ Master's degree
- ○ Doctorate
- ○ Other

Only if applicable: Major(s) for Bachelor Degree(s). Please put comma after each one if you have more than one.

_____

Only if applicable: Master(s). Please put comma after each one if you have more than one.

_____

Only if applicable: PhD(s). Please put comma after each one if you have more than one.

_____

Only if applicable: Technical diploma(s). Please put comma after each one if you have more than one. Example: Machining Technologies, Carpentry, Welding, etc.

_____

End of Block: Background

Start of Block: Self-rate

Part 2 of 3: Self-rating on Soft Skills

As you answer each question please ask yourself the following:

"I use the skill of ----- successfully --------."

Exp: I use the skill of verbal communication successfully always (would rate this as #5).

They are slider questions, so please slide the dot to the number you wish to put or click on the line under the number you wish to click. If you wish to leave the slider at 1, click the dot to activate it. The slider corresponding to each skill is below the name of the skill.

Select the level you rate yourself in regard to when you use the skills below successfully:

1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Often, 5 = Always

Acceptance of diversity: Acceptance of differences in racial, spiritual, and ethnic backgrounds.

Active listening: Conscious effort to hear both the words and complete message being communicated.

Adaptability: Being able to adjust to new conditions.

I use the skill of _____ successfully _____.

	Never	Rarely	Sometimes	Often	Always
	1	2	3	4	5
Acceptance of diversity					
Active listening					
Adaptability					

Select the level you rate yourself in regard to when you use the skills below successfully:

1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Often, 5 = Always

Adaptable with people: Can navigate and engage with different personality types.

Bravery: Confident and strong in the face of difficulty.

Creative thinking: Ability to come up with unique, original solutions.

I use the skill of _____ successfully _____.

	Never	Rarely	Sometimes	Often	Always
	1	2	3	4	5
Adaptable with people					
Bravery					
Creative thinking					

Select the level you rate yourself in regard to when you use the skills below successfully:

1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Often, 5 = Always

Critical thinking: The objective analysis and evaluation of an issue in order to form a judgment.

Cross-cultural communication: Process of recognizing the communication style of both to effectively engage within a given context.

Curiosity about STEM: A desire to learn or know about topics in science, technology, engineering, and mathematics.

I use the skill of _____ successfully _____.

	Never	Rarely	Sometimes	Often	Always
	1	2	3	4	5
Critical thinking					
Cross-cultural communication					
Curiosity about STEM					

Select the level you rate yourself in regard to when you use the skills below successfully:

1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Often, 5 = Always

Curiosity about topics other than STEM: A desire to learn or know about topics not about science, technology, engineering, and mathematics. Examples include theater, international relations, geography, literature, art, and other topics.

Cultural awareness: Sensitivity toward other countries and the culture of the people from those countries.

Diplomacy: Achieve peaceful resolutions and can facilitate discussions while keeping multiple parties happy.

I use the skill of _____ successfully _____.

	Never	Rarely	Sometimes	Often	Always
	1	2	3	4	5
Curiosity about topics other than STEM					
Cultural awareness					
Diplomacy					

Select the level you rate yourself in regard to when you use the skills below successfully:

1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Often, 5 = Always

Emotional intelligence: The capacity to be aware of, control, and express one's emotions, and to handle interpersonal relationships with good judgment.

Empathy: Able to understand others emotions and share them with them.

Ethics: Moral principle governing and guiding behavior.

I use the skill of _____ successfully _____.

	Never	Rarely	Sometimes	Often	Always
	1	2	3	4	5
Emotional intelligence					
Empathy					
Ethics					

Select the level you rate yourself in regard to when you use the skills below successfully:

1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Often, 5 = Always

Fearless with failure: Do not fear failure. If you are afraid to fail, you are closer to 1. If you are not afraid to fail, you are closer to 5.

Nonverbal communication: Use of appropriate gestures, facial expressions, and body positions.
Patience: The bearing of delay or trouble without loss of temper or irritation.

I use the skill of _____ successfully _____.

	Never	Rarely	Sometimes	Often	Always
	1	2	3	4	5
Fearless with failure					
Nonverbal communication					
Patience					

Select the level you rate yourself in regard to when you use the skills below successfully:

1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Often, 5 = Always

Presenting expectations: The ability to present expectations in a way that is easy for an audience to understand.

Prioritizing people: Put people and their wellbeing as a priority. This means thinking about people before machines, equipment, and processes.

Problem-solving: Able to identify a problem and fixing it creatively.

I use the skill of _____ successfully _____.

	Never	Rarely	Sometimes	Often	Always
	1	2	3	4	5
Presenting expectations					
Prioritizing people					
Problem-solving					

Select the level you rate yourself in regard to when you use the skills below successfully:

1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Often, 5 = Always

Professionalism: Polite behavior that is consistent.

Relationship development: Ability to connect on a personal level.

Respect: Due regard for the feelings, wishes, rights, or traditions of others.

I use the skill of _____ successfully _____.

Select the level you rate yourself in regard to when you use the skills below successfully:

1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Often, 5 = Always

Responsibility: The state or fact of being accountable.

Self-awareness: Conscious knowledge of one's own character, feelings, motives, and desires.

Sympathy: Feeling or showing care and compassion for someone or a situation.

I use the skill of _____ successfully _____.

	Never	Rarely	Sometimes	Often	Always
	1	2	3	4	5
Responsibility					
Self-awareness					
Sympathy					

Select the level you rate yourself in regard to when you use the skills below successfully:

1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Often, 5 = Always

Teamwork: The process of working collaboratively with a group of people in order to achieve a goal.

Time management: Use time effectively and productively.

Understanding audiences: Able to know who the audience is and tailor content for that audience.

I use the skill of _____ successfully _____.

	Never	Rarely	Sometimes	Often	Always
	1	2	3	4	5
Teamwork					
Time management					
Understanding audiences					

Select the level you rate yourself in regard to when you use the skills below successfully:

1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Often, 5 = Always

Understanding perspectives: Balancing and taking into account others considerations and views.

Verbal communication: Selection of words to communicate with others in a concise and clear manner. Able to express ideas effectively.

Written communication: Conveying messages through emails, letters, and text messages concisely and clearly. Providing needed details.

I use the skill of _____ successfully _____.

	Never	Rarely	Sometimes	Often	Always
	1	2	3	4	5
Understanding perspectives					
Verbal communication					
Written communication					

End of Block: Self-rate

Start of Block: Most Important Soft Skills

Part 3 of 3: Important Soft Skills and Building Soft Skills

Which of the following soft skills do you think is the FIRST most important for those in management to have and display?

- ○ Acceptance of diversity
- ○ Active listening
- ○ Adaptability
- ○ Adaptable with people
- ○ Bravery
- ○ Creative thinking
- ○ Critical thinking
- ○ Cross-cultural communication
- ○ Curiosity about STEM
- ○ Curiosity about topics other than STEM
- ○ Cultural awareness
- ○ Diplomatic
- ○ Emotional intelligence
- ○ Empathetic
- ○ Ethical
- ○ Fearless with failure
- ○ Nonverbal communication

- ○ Patience
- ○ Presenting expectations
- ○ Prioritizing people
- ○ Problem-solving
- ○ Professionalism
- ○ Relationship development
- ○ Respect
- ○ Responsibility
- ○ Self-awareness
- ○ Sympathetic
- ○ Teamwork
- ○ Time management
- ○ Understanding audiences
- ○ Understanding perspectives
- ○ Verbal communication
- ○ Written communication

Which of the following soft skills do you think is the SECOND most important for those in management to have and display? Please select a skill other than the one you chose for the previous answer.

- ○ Acceptance of diversity
- ○ Active listening
- ○ Adaptability
- ○ Adaptable with people
- ○ Bravery
- ○ Creative thinking
- ○ Critical thinking
- ○ Cross-cultural communication
- ○ Curiosity about STEM
- ○ Curiosity about topics other than STEM
- ○ Cultural awareness
- ○ Diplomatic
- ○ Emotional intelligence
- ○ Empathetic
- ○ Ethical
- ○ Fearless with failure
- ○ Nonverbal communication
- ○ Patience

- ○ Presenting expectations
- ○ Prioritizing people
- ○ Problem-solving
- ○ Professionalism
- ○ Relationship development
- ○ Respect
- ○ Responsibility
- ○ Self-awareness
- ○ Sympathetic
- ○ Teamwork
- ○ Time management
- ○ Understanding audiences
- ○ Understanding perspectives
- ○ Verbal communication
- ○ Written communication

Which of the following soft skills do you think is the THIRD most important for those in management to have and display? Please select a skill other than the ones you chose for the two previous answer.

- ○ Acceptance of diversity
- ○ Active listening
- ○ Adaptability
- ○ Adaptable with people
- ○ Bravery
- ○ Creative thinking
- ○ Critical thinking
- ○ Cross-cultural communication
- ○ Curiosity about STEM
- ○ Curiosity about topics other than STEM
- ○ Cultural awareness
- ○ Diplomatic
- ○ Emotional intelligence
- ○ Empathetic
- ○ Ethical
- ○ Fearless with failure
- ○ Nonverbal communication
- ○ Patience

- ○ Presenting expectations
- ○ Prioritizing people
- ○ Problem-solving
- ○ Professionalism
- ○ Relationship development
- ○ Respect
- ○ Responsibility
- ○ Self-awareness
- ○ Sympathetic
- ○ Teamwork
- ○ Time management
- ○ Understanding audiences
- ○ Understanding perspectives
- ○ Verbal communication
- ○ Written communication

Which of the following soft skills do you think is the FIRST most important for those NOT in management to have and display?

- ○ Acceptance of diversity
- ○ Active listening
- ○ Adaptability
- ○ Adaptable with people
- ○ Bravery
- ○ Creative thinking
- ○ Critical thinking
- ○ Cross-cultural communication
- ○ Curiosity about STEM
- ○ Curiosity about topics other than STEM
- ○ Cultural awareness
- ○ Diplomatic
- ○ Emotional intelligence
- ○ Empathetic
- ○ Ethical
- ○ Fearless with failure
- ○ Nonverbal communication
- ○ Patience

- ○ Presenting expectations
- ○ Prioritizing people
- ○ Problem-solving
- ○ Professionalism
- ○ Relationship development
- ○ Respect
- ○ Responsibility
- ○ Self-awareness
- ○ Sympathetic
- ○ Teamwork
- ○ Time management
- ○ Understanding audiences
- ○ Understanding perspectives
- ○ Verbal communication
- ○ Written communication

Which of the following soft skills do you think is the SECOND most important for those NOT in management to have and display? Please select a skill other than the one you chose for the previous answer.

- ○ Acceptance of diversity
- ○ Active listening
- ○ Adaptability
- ○ Adaptable with people
- ○ Bravery
- ○ Creative thinking
- ○ Critical thinking
- ○ Cross-cultural communication
- ○ Curiosity about STEM
- ○ Curiosity about topics other than STEM
- ○ Cultural awareness
- ○ Diplomatic
- ○ Emotional intelligence
- ○ Empathetic
- ○ Ethical
- ○ Fearless with failure
- ○ Nonverbal communication
- ○ Patience

- ○ Presenting expectations
- ○ Prioritizing people
- ○ Problem-solving
- ○ Professionalism
- ○ Relationship development
- ○ Respect
- ○ Responsibility
- ○ Self-awareness
- ○ Sympathetic
- ○ Teamwork
- ○ Time management
- ○ Understanding audiences
- ○ Understanding perspectives
- ○ Verbal communication
- ○ Written communication

Which of the following soft skills do you think is the THIRD most important for those NOT in management to have and display? Please select a skill other than the ones you chose for the two previous answer.

- ○ Acceptance of diversity
- ○ Active listening
- ○ Adaptability
- ○ Adaptable with people
- ○ Bravery
- ○ Creative thinking
- ○ Critical thinking
- ○ Cross-cultural communication
- ○ Curiosity about STEM
- ○ Curiosity about topics other than STEM
- ○ Cultural awareness
- ○ Diplomatic
- ○ Emotional intelligence
- ○ Empathetic
- ○ Ethical
- ○ Fearless with failure
- ○ Nonverbal communication
- ○ Patience

- ○ Presenting expectations
- ○ Prioritizing people
- ○ Problem-solving
- ○ Professionalism
- ○ Relationship development
- ○ Respect
- ○ Responsibility
- ○ Self-awareness
- ○ Sympathetic
- ○ Teamwork
- ○ Time management
- ○ Understanding audiences
- ○ Understanding perspectives
- ○ Verbal communication
- ○ Written communication

Where do you believe you gained most of your soft skills?

1=gained most of my soft skills here, 3=gained least of my soft skills here

Please click on the three options and move the order, if you wish to do so, to reflect your answer.

_____ Workforce
_____ Personal life
_____ Education

How can the soft skills you feel you lack most in be improved within the company/agency you currently work for?

_____

How can the soft skills you feel you lack most in be improved within colleges/universities?

_____

How can the soft skills you feel you lack most in be improved within your personal life?

_____

If you would like to provide any comments about your responses, the research and/or the survey, please do so here:

_____

Thank you for participating! If you have any questions, comments, or concerns, please email msorroza@knights.ucf.edu. Thank you! By clicking this next arrow you will be submitting your answers!

End of Block: Most Important Soft Skills

APPENDIX F: POWER BI TOOL

LEARN HOW STUDENTS AND EMPLOYEES RATE THEMSELVES ON THEIR EFFECTIVE USE OF SOFT SKILLS!

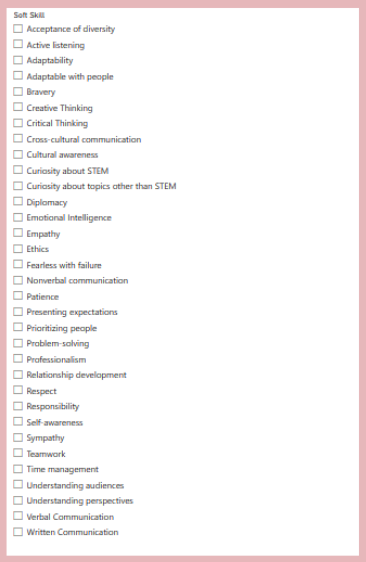
Tip: Click Ctrl on your keyboard to select multiple soft skills to compare at once.

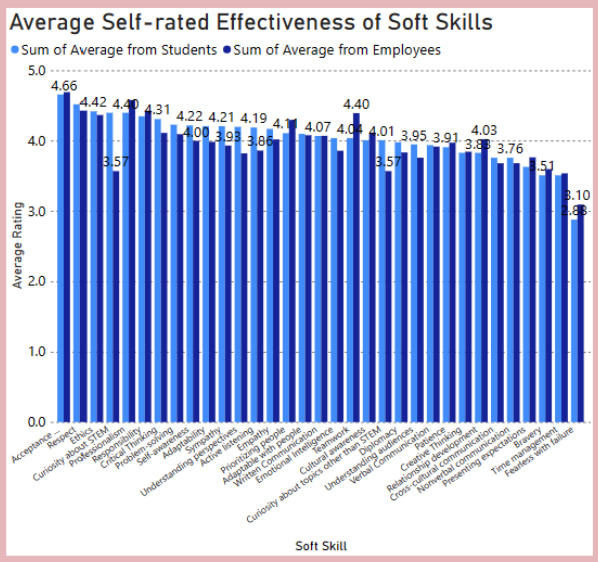
I use the skill of _____ successfully _____.

Self-rated responses from students in colleges and universities:

Self-rated responses from employees in companies and agencies:

1= Never, 2= Rarely, 3= Sometimes, 4 = Often, 5 = Always





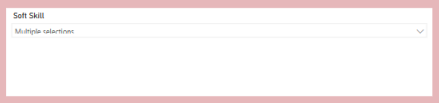
Example 1:

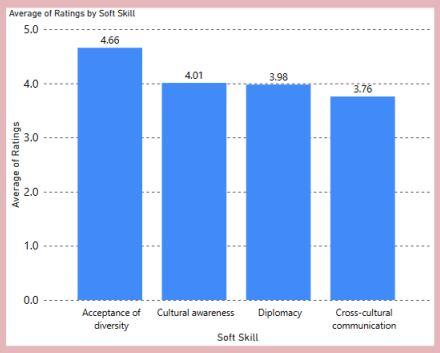
LEARN HOW STUDENTS AND EMPLOYEES RATE THEMSELVES ON THEIR EFFECTIVE USE OF SOFT SKILLS!

Tip: Click Ctrl on your keyboard to select multiple soft skills to compare at once.

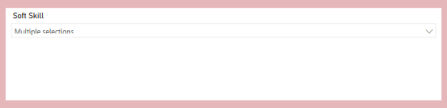
I use the skill of _____ successfully _____.

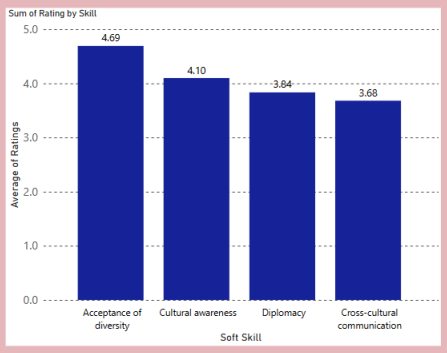
Self-rated responses from students in colleges and universities:



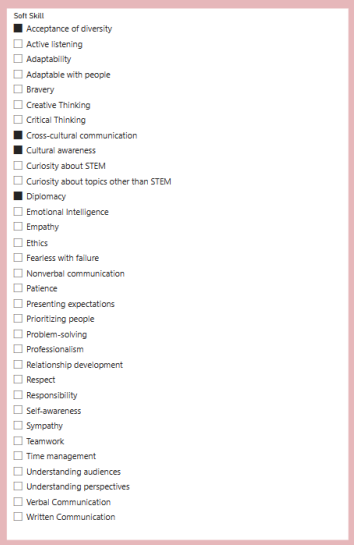


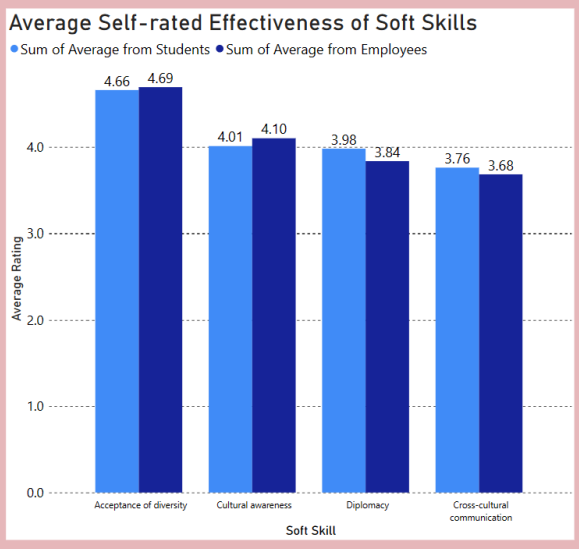
Self-rated responses from employees in companies and agencies:



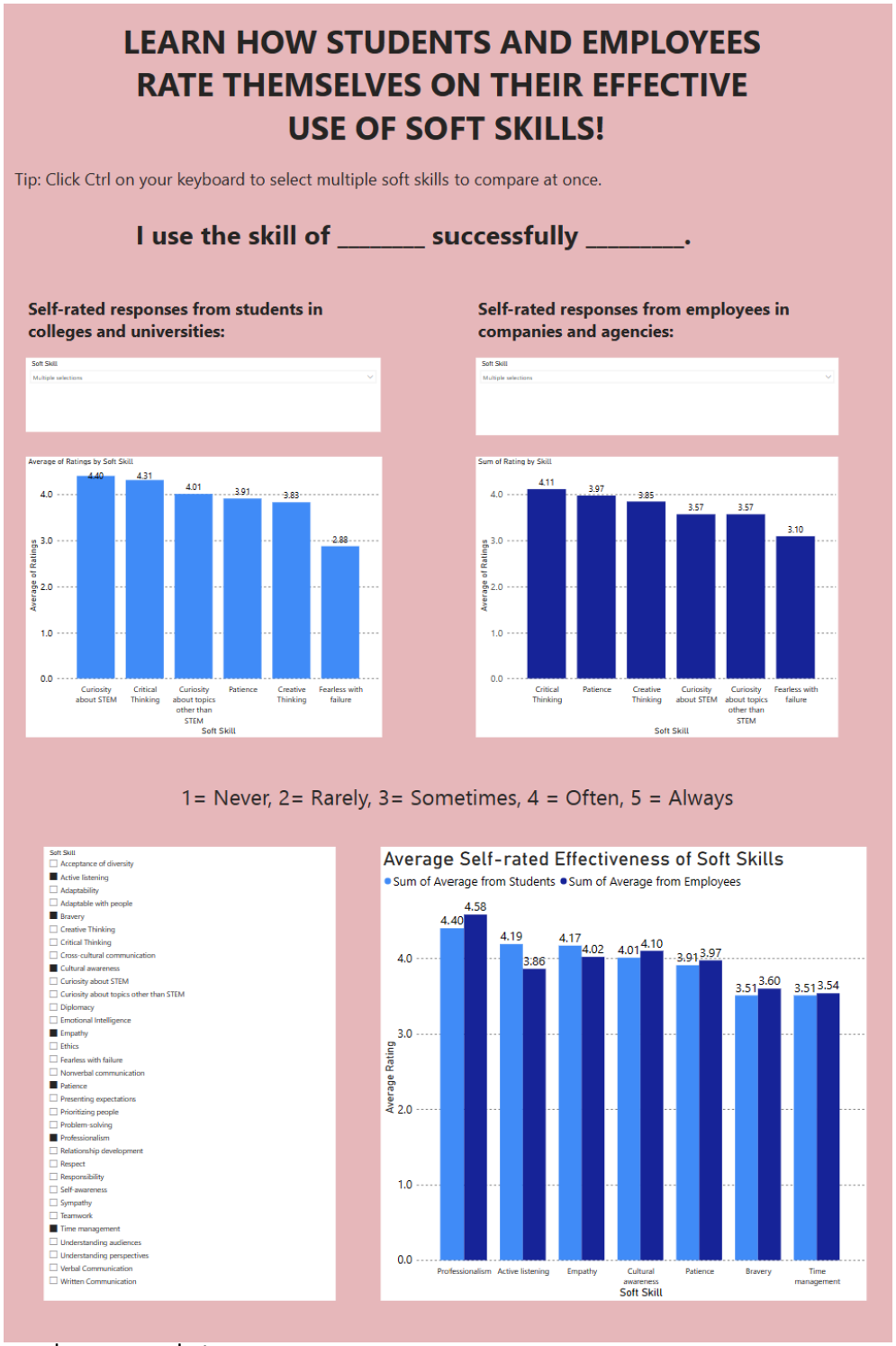


1= Never, 2= Rarely, 3= Sometimes, 4 = Often, 5 = Always





Example 2:



The software can be accessed at:
https://app.powerbi.com/view?r=eyJrIjoiYWNhYTFlZWItOTI3Yy00NWY0LTliMzktZGRiOTE4ZDYyOTQ4IiwidCI6IjViMTZlMTgyLTc4YjMtNDEyYy05MTk2LTY4MzQyNjg5ZWViNyIsImMiOjF9 OR https://tinyurl.com/UCF-SSS