

2023-10-10

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Recommended Citation

KHEFACHA, Ahlem and SÉLLEI, Beatrix, "Engineering Students Emotional Intelligence And Neuro-Linguistics Programming (NLP) As Developmental Tool" (2023). *Research Papers*. 28.
https://arrow.tudublin.ie/sefi2023_respap/28

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Engineering students emotional intelligence and neuro-linguistics Programming (NLP) as developmental tool

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Conference Key Areas: *Innovative Teaching and Learning Methods, Engineering Skills and Competences, Lifelong Learning for a more sustainable world*

Keywords: *Emotional intelligence, Emotional intelligence development, Engineering students skills, Neuro-linguistic programming*

ABSTRACT

Emotional intelligence has been increasingly recognized as a critical skill for successful personal, educational, and professional life.

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This article investigates the strengths and weaknesses of engineering students' emotional intelligence (EI) and the possibility of using neurolinguistics programming (NLP) as a developmental tool. Students' emotional intelligence was assessed using the Bar-On Emotional Quotient Inventory (EQ-I) with 5 points Likert scale. First-semester engineering students were approached by part of a broader study at the Budapest University of Technology during 2018-2022. In the article, we describe the emotional intelligence profile of more than 3600 students in various fields of engineering. NLP professionals around the world filled out the second questionnaire. We got answers from 35 professionals based in Tunisia, Hungary, the UK, the USA, and Australia who reported their own experiences using NLP to enhance EI. In this way, we got quantitative and qualitative data. Findings confirm the possibility of using NLP techniques to develop EI and that logical levels, reframing and rapport techniques are best suited to improve engineering students' weaknesses which we determined to be general mood, stress management, empathy, problem-solving, and interpersonal skills.

1 INTRODUCTION

1.1 Engineering Students' skills importance

In the modern world, education is often thought of as primarily focused on academic and technical skills.

However, the importance of human skills in education should be considered. Human skills, also known as soft or interpersonal skills, are becoming increasingly important for success in many industries and professions. These competencies became necessary for the future of engineering students. Having technical skills and knowing how to solve a technical problem is important, but so is having the competencies to be a good communicator and leader (Itani et Srour 2016). The importance of non-technical skills such as communication, teamwork, problem-solving, and adaptability for engineering students has been recognized by the Accreditation Board for Engineering and Technology (ABET) and was added to the criteria in 2001 (Felder 1998). The list of engineering skills, besides technical ones, required for engineering students to pursue their careers is in continuous change. This induces the need for adaptation of competencies to the new technologies' development. In the case of engineering students' skills not matching the job requirements, unemployment may occur. In a comparison study between the skills in demand in 2018 and 2022, it was found that not all the skills required in 2015 would be still needed in 2022 to be able to face the 4th industrial revolution (Kamaruzaman et al. 2019). For example, communication skills, teamwork, management, and leadership skills, other skills were identified as a gap that needs to be addressed. This list includes active learning and learning strategies; creativity, originality, and emotional intelligence (Kamaruzaman et al. 2019). These competencies can enable employees to achieve work results. Learning these skills before facing the employment search phase helps graduates lessen the possible skills gap between what they learned and the industry needs.

1.2 Emotional intelligence importance for engineering students

Studies on the emotional intelligence concept developed in the 1990s by Salovey and Meyer show its increasing importance as a set of skills for the workplace and the educational field.

Employers seek individuals who can effectively manage their emotions and understand their colleagues' emotions, as this leads to better collaboration and a more positive work environment (Masaldzhyska 2019). Employee productivity is increased by emotional intelligence, which helps the organization meet its objectives on time and with minimal expenses (Anand et al. 2019). According to Goleman and Chernis, it is possible to learn EI within an organization or even individually (Cherniss et Goleman 2001). In their book "the emotionally intelligent workplace," they mentioned the Dreyfus investigation made in 1990 regarding the team-building abilities of scientists and engineers' supervisors and discovered that these abilities were formed during their academic training. This emphasizes the importance of starting to develop EI before finishing formal education.

Higher education institutions are responsible for helping students to gain the proper skills demanded in corporate organizations to ensure the future of emerging engineering graduates (Rugarcia et al. 2000).

1.3 Neurolinguistic Programming as a tool to enhance Emotional Intelligence

Over the past few decades, different techniques have been developed and identified as beneficial in developing emotional intelligence. These techniques include teamwork, self-reflection and empathy-building exercises within emotional intelligence trainings (Nelis, Quidbach et Mikolajcza 2009; Tucker et al. 2000; Groves, Pat McEnrue et Shen 2008) Through the use of these techniques and interventions, individuals can learn to better understand and manage their own emotions as well as recognize and empathize with the emotions of others.

The Neurolinguistic programming (NLP) approach to developing EI is a new and innovative way to enhance emotional intelligence skills. NLP is a psychological approach that employs various methods and techniques that focus on the connection between the neurological processes of language and behavior, aiming to develop techniques for personal growth and communication improvement. In addition, it can also enhance knowledge, self-management, and mental health while minimizing work stress (Nompo, Pragholapati et Thome 2021).

There needs to be more scientific research on NLP and EI. In search of literature associating the keywords "neurolinguistic programming" and "emotional intelligence" on Google Scholar, we could only find the study of Bin Ahmad, 2019, associating NLP and EI. Bin Ahmed's research focused on providing training to students. He associated 5 NLP techniques for each EI category: self-awareness, self-regulation, self-motivation, empathy, and social skills (Bin Ahmad 2019). The training took him two and a half hours and was administered to 35 students, with another 35 students in a control group.

We found only one article tackling this topic at the study's starting point. A second research published online in 2023 emerged, which we considered for our analysis. The study focused on “The effect of neurolinguistic programming on academic achievement, emotional intelligence, and critical thinking of EFL learners” (Zhang, Davarpanah et Izadpanah 2022). When researching “emotional intelligence” as a keyword in the NLP database, only 2 articles emerged.

The NLP techniques which we used for our research and which are used in the business environment and for the benefit of students are summarized in Table1:

Table 1. NLP techniques cited in the literature

	Objective setting	Rapport	Logical levels	Meta-program	Mirroring
(Joey et Yazdanifard 2015)	x	x		x	x
(Yemm 2006)	x	x	x		
(Kotera et Van Gordon 2019)	x		x	x	
(Singh et Abraham 2008)					x
(Bin Ahmad 2019)	x				
(Javadi, et al. 2014)	x	x			

1.4 Research questions

The lack of research on emotional intelligence and neuro-linguistic programming variables and the importance of EI for students’ future in the workplace induced research on NLP techniques used by professionals in the business environment.

The aim of the research is to:

- Determine weaknesses and strengths in the EI of engineering students.
- Determine which techniques would be suitable for the enhancement of the weaknesses of engineering students
- Confirm if the techniques cited in the literature are suitable for coaching techniques for EI improvement, according to other NLP professionals.

2 METHODOLOGY

This research aims to study the degree of emotional intelligence of engineering students and the possibility of using neurolinguistic programming as a developmental tool for their weaknesses. The research is divided into 2 phases. A mixed method approach was used for this study, using descriptive statistics for the first part and qualitative data for the NLP analysis.

2.1 1st research phase: emotional intelligence

The first phase is based on the data gathered anonymized from first-year engineering students between 2018 and 2022. Participants studied at the Budapest University of

Technology and Economics (n=4075-447). They were approached for a broader research purpose with online questionnaires.

In this paper, we focus on their emotional intelligence profile. We used the Emotional Intelligence Inventory test developed by Bar-On (Bar-On 1997a; Bar-On 1997b; Bar-On 2004). The (EQ-I) questionnaire is based on a 5 points Likert scale, and we used the Hungarian version. The inventory contains 121 items, divided into 5 factors, assessed with 15 subscales:

- Intrapersonal scale, which assesses self-awareness and self-expression. Its subscales are self-regard, emotional self-awareness, assertiveness, independence, and self-actualization);
- interpersonal scale, which measures social awareness and interpersonal relationships Its subscales are empathy, social responsibility, and interpersonal relationship);
- Stress management scale, which assesses emotional management and regulation. Its subscales are stress tolerance and impulse control;
- Adaptability scale, which measures change management. Its subscales are reality-testing, flexibility, and problem-solving;
- General mood scale, which measures competencies of self-motivation. Its subscales are optimism and happiness (Bar-On 1997a; Bar-On 1997b).

2.2 2nd research phase: an exploration of NLP practices

The second phase of the research is an explorative qualitative study seeking to confirm NLP techniques that would be most suitable for emotional intelligence enhancement, including stress management.

Existing research on NLP techniques used in the workplace and for EI cites different techniques. Each article represents an individual opinion based on practice and/or literature.

To provide a better view of which techniques would be best used in the work environment in general and in developing EI, we gathered the opinion of several NLP professionals worldwide.

We contacted 20 professionals, training academies, and 1 NLP university sending emails, LinkedIn requests, and Facebook messages on their pages. We asked for their help in sharing the survey with other professionals, and the anonymity of the answers was confirmed. The NLP questionnaire was based on a yes/no answer for most of our questions such as “ Are you familiar with the EI (Emotional Intelligence) concept ?” with a matrix representing the question “Please choose the NLP technique(s) that can be used to enhance emotional intelligence (EI) taking in consideration the below definitions” where we provided definitions of different parts of EI and definitions of the NLP techniques.

To avoid misunderstanding or confusing technical terms of neurolinguistic programming, the NLP survey was prepared in 3 languages; French, English, and Hungarian. This is because it might be harder to understand in English for those who learned in French or Hungarian. Timeframe for collecting the answers was starting

November 2022 until February 2023. This research is part of a broader one aiming to study NLP use in the workplace and with EI.

3 RESULTS

3.1 Emotional intelligence of engineering students

Table 2. shows the emotional intelligence profile of engineering students. We converted the results on the scales to percentages to make the comparison more manageable, which means that the scales' ranges are between 1-100. Even more percent a student reach on a scale that higher is his/her named emotional competence.

Table 2. Descriptives of Students' emotional intelligence

Factor	Subscale	n	mean	std. dev.
intrapersonal		4075	60,50	6,334
	assertiveness	4363	58,04	8,211
	self-awareness	4384	57,31	8,721
	self-regard	4421	61,20	9,904
	independence	4407	62,86	13,175
	self-actualization	4399	62,80	11,930
interpersonal		4214	56,19	6,198
	empathy	4441	54,81	9,676
	social responsibility	4382	59,12	7,380
adaptation	interpersonal relationship	4358	54,78	7,640
		4207	57,24	6,882
	reality testing	4379	60,11	8,430
	flexibility	4388	62,15	10,552
stress management	problem-solving	4394	49,56	10,519
		4283	62,39	5,846
	stress tolerance	4396	57,04	7,308
mood and motivation	impulse control	4365	67,75	15,826
		3671	51,13	6,630
	optimism	4369	45,86	10,123
	happiness	4385	56,33	7,290

Table 2. shows that engineering students' strongest skill is impulse control, and they are the weakest in optimism and social-emotional problem-solving skills. They have low-moderate points in interpersonal relationships, empathy, stress tolerance, and happiness.

3.2 NLP techniques for EI enhancement

We asked through a shared survey the opinion of NLP professionals worldwide and gathered 35 answers from professionals practicing in Tunisia, Europe (UK, Estonia, Hungary, Romania, France), the USA, and Australia. 5 observations were removed from the dataset, resulting in a final sample size of 30 answers. The responses

provided by those five observations needed to be more consistent or complete, which could have affected the accuracy of results if included in the analysis. 60% of the respondents have more than 5 years of experience using NLP. Three experts had more than 30 years of experience with one of them reporting more than 45 years of experience, which is a great addition to our research knowing that NLP started 48 years ago.

The choice of the techniques to be studied was based on a review of relevant literature. NLP techniques were cited at least twice in different articles as beneficial to enhance emotional intelligence, for students' skills in general, or the business environment.

Table 3. shows the vote of these 30 NLP professionals on the techniques best to be used for emotional intelligence and its factors enhancement. For a better understanding of the results, we made them into percentages. The percentage represents how many experts considered a technique suitable to enhance each emotional intelligence factor.

Table 3. Emotional intelligence and NLP techniques

	Objective-setting	Reframing	Rapport	Logical-levels	Meta-program	Mirroring
Self-awareness	60% 18	63.33% 19	53.33% 16	76.66% 23	53.33% 16	43.33% 13
Self-regulations	50% 15	56.66% 17	43.33% 13	60% 18	50% 15	33.33% 10
Empathy	20% 6	46.66% 14	66.66% 20	33.33% 10	43.33% 13	53.33% 16
Motivation	73.33% 22	60% 18	13.33% 4	53.33% 16	63.33% 19	13.33% 4
Social-skills	30% 9	50% 15	63.33% 19	56.66% 17	53.33% 16	50% 15
Stress management	36.66% 11	60% 18	13.33% 4	56.66% 17	36.66% 11	20% 6
Emotional Intelligence	46.66% 14	63.33% 18	40% 12	53.33% 16	50% 15	26.66% 8

According to the results in Table 3, there is a variation in the degree of agreement among experts on implementing the researched strategies for improving emotional intelligence and stress management. The findings show that all techniques can enhance the studied skills. According to our experts, the Logical levels technique is best suited for self-awareness (76.66%), and self-regulation (60%). Reframing for stress management (63.33 %). The rapport technique is mainly linked to empathy (66.66%) and social skills (63.33%). 73.33% of the respondents confirmed that motivation could be better enhanced using the well-defined outcome technique. The technique mostly voted as beneficial for emotional intelligence improvement is reframing.

3.3 Analysis

The research aim was to study the strengths and weaknesses of engineering students' emotional intelligence (EI) and the possibility of using neurolinguistics programming (NLP) as a developmental tool. Results showed that NLP techniques cited in the literature are suitable for coaching techniques for EI improvement.

We shared the Bar-On Emotional Quotient Inventory (EQ-I) with first-year engineering students between 2018 and 2022. Results showed they mostly lack general mood skills, including optimism and happiness, problem-solving skills, empathy, stress tolerance, and interpersonal relationship skills. According to our research, their general mood abilities are low-moderate, with low optimism scores and moderately high happiness marks. When it comes to managing emotions, self-regulation can be a valuable tool (Cameron et Nicholls 1998). Our study findings suggest that logical-level neurolinguistic techniques would best help individuals self-regulate for mood management.

Engineering students are also generally expected to have strong cognitive and problem-solving abilities (Kamaruzaman et al. 2019). The outcome of our sample emotional intelligence profile showed that they have low problem-solving skills. Working on improving social skills, in general, helps improve problem-solving skills (Dereli 2009). Our study suggests rapport from the studied NLP techniques is the most beneficial to enhance social skills.

Empathy is an essential skill for professionals in most fields, it is crucial to provide students with appropriate resources and opportunities to develop their empathy skills, especially because, in our research, students scored low to moderate on this skill. Experts in NLP voted mainly for the rapport technique and developing empathy skills. Stress tolerance could be increased with stress-management skills, for which using the reframing NLP technique is believed to be a practical approach.

Interpersonal relations play a crucial role in our personal and professional lives. Self-awareness skills have been identified as a critical factor in improving interpersonal relations. According to our findings, logical levels technique would be beneficial to increase self-awareness and, thus, interpersonal relations skills of engineering students.

4 SUMMARY

Educational institutions aim to provide learners with the knowledge, skills, and values required for their future development. Educational institutions aim to shape individuals who can contribute positively to society and meet the workforce's needs. Emotional intelligence, critical thinking, and creativity are some of the skills that these institutions strive to develop in their students. To do so, determining the weaknesses and strengths of engineering students' skills is crucial. Data gathered from first-year engineering students between 2018 and 2022 showed that their highest strengths were impulse control, while their areas of weakness were general mood which

includes optimism and happiness, problem-solving skills, interpersonal relationships, empathy, and stress tolerance.

Our research confirmed that neurolinguistic programming tools can be used to enhance their EI. It also confirmed the possibility of using reframing, objective setting, rapport, logical-levels, meta-programming, and mirroring techniques to enhance students' emotional intelligence. In addition, the most efficient methods to improve emotional intelligence weaknesses points determined in this study are logical levels for self regulation development, and self awareness for their general mood skill, and interpersonal relationship skills. Reframing for stress management. The rapport technique is recommended mostly for empathy and social skills for students empathy and problem-solving skills.

While 30 professional answers may be too few to obtain true representativeness of the entire population being studied, the diverse range of experts who answered the survey with different years of experience means that the data collected should be sufficiently generalizable. Additional responses on the questionnaire are needed to provide a more profound statistical significance.

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