

Intrapersonal Communication As a Lifelong Learning Skill in Engineering Education

Mühendislik eğitiminde yaşam boyu öğrenme becerisi olarak içsel iletişim

Tanju Deveci¹, Roger Nunn²

¹Department of English, Khalifa University of Science and Technology, Abu Dhabi, the UAE

²Department of Writing Studies, The American University of Sharjah, Sharjah, the UAE

Özet

Mühendislerin yalnızca teknik becerilerle yetinebileceğine ilişkin tartışmalar artık geçerliliğini yitirmiş bulunmaktadır. Gerek mesleklerinde gerekse yaşam boyu öğrenme konusunda başarılı olabilmek için bir takım sosyal becerilere de sahip olmaları gerekmektedir. Ancak mühendislik eğitimi veren kurumlardaki müfredatlarda, öğrencilerin iletişim becerilerini geliştirmelerine yardımcı olacak türden ders içerik ve uygulamaları yeterince yaygın değildir. Bu becerilerin en önemlilerinden bir tanesi, kişinin kendisiyle (içsel) iletişimidir. Görüş türünde hazırlanmış bulunan bu makalede içsel iletişimin anlamı ve yaşam boyu öğrenmeye ilişkin önemi tartışılmaktadır. Bu iletişim türünün önemine dair farkındalık, kendimizi tanımamıza, bilinçli, etik ve topluma faydalı kararlar vermemize yardımcı olacaktır. Yaşam boyu öğrenmenin, bireylerin ve toplumun gelişmesine ilişkin hedefini göz önünde bulundurarak mühendislerin mesleklerinde yaşam boyu öğrenme tutumu geliştirmeleri gerektiğini savunacağız. Bunun için ise içsel iletişim becerilerinin geliştirilmesi gerektiğinin altını çizeceğiz. Ayrıca içsel iletişimin, kişiler arası iletişimin etkinliği açısından önemini tartışacağız. Bu amaçlar ışığında mühendislerin gerçekleştirmeleri gereken içsel iletişim becerilerini ve aktivitelerini betimleyeceğiz. Yapılandırılmış öğrenme kapsamında, yansımacı düşünme, imgeleme ve gelişim raporu gibi eğitim uygulamalarının öğrencilerin içsel iletişim becerilerine ve dolayısıyla yaşam boyu öğrenmeye katkılarını tartışacağız.

Anahtar sözcükler: Bireyler arası iletişim, içsel iletişim, mühendislik eğitimi, sosyal beceriler, yansımacı yazma, yaşam boyu öğrenme.

The engineering discipline is comprised of a range of specialized fields making it difficult to define. However, the roots of the word 'engineering' offer some insights. It derives from the Latin words 'ingenium' and 'ingeniare'. The former means 'cleverness' while the latter means 'to contrive, devise.' The term is defined in the Merriam-Webster dictionary as "the work of designing and cre-

Abstract

A discussion as to whether technical skills per se are enough for engineers may no longer be relevant. In order to succeed as lifelong learners, they also need a variety of soft-skills. Despite this, engineering curricula in general seem to pay relatively little attention to cultivating communication skills in students. One of the most essential of these is intrapersonal communication. In this non-research, discussion paper, we discuss the meaning and importance of intrapersonal communication in relation to 'lifelong learning': awareness of the importance of intrapersonal communication helps us understand ourselves as individuals and make informed, ethical and society-friendly judgments. Considering the overall goal of lifelong learning to make useful contributions to individual development and society, we will argue that improving intrapersonal communication is essential for engineers, who need to adopt a lifelong learning approach to their profession. Intrapersonal communication is also essential for effective interpersonal communication. This paper will briefly describe some intrapersonal activities engineers need to engage in, and the intrapersonal skills that they need to acquire with illustrative extracts from students' writing. We will also discuss how reflective writing, visualization, and progress reports can support intrapersonal communication and experiential learning within a constructivist approach to learning, allowing students to assume lifelong learning responsibilities.

Keywords: Intrapersonal communication, engineering education, reflective writing, lifelong learning, soft-skills.

ating large structures (such as roads and bridges) or new products or systems by using scientific methods." Taken together, these definitions suggest that the engineering discipline aims at inventing, designing and improving tools, materials, machines, etc. in clever and scientific ways with the overall aim of enhancing our lives. Neil Armstrong (cited in Landis, 2013, p. 37) agrees with this sentiment: "Engineering turns ...

İletişim / Correspondence:

Assistant Professor Tanju Deveci
Dept. of English, Khalifa University
of Science and Technology, Sas Al
Nakhl Campus (the Petroleum
Institute), Abu Dhabi, the UAE
e-mail: tanjudeveci@yahoo.com

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explanations and understandings into new or improved machines, technologies, and processes – to bring reality to ideas and to provide solutions to societal needs.” The idea of serving society and enhancing our lives is also intrinsic to the definition adopted by the Accreditation Board for Engineering and Technology (ABET) (2014):

“Engineering is the profession in which a knowledge of the mathematical and natural sciences gained by study, experience, and practice is applied **with judgment** to develop ways to utilize economically the materials and forces of nature for the benefit of mankind.”

We attach particular importance to the word ‘judgment’ in the above definition since it requires practicing engineers to make informed decisions in order to benefit society. Judgment is related to using reflection and critical thinking to address problems which arise or to prevent them through pre-emptive enlightened designs. Engineers also need to address ethical, environmental and safety issues. To this end, they need to engage in effective intrapersonal communication. Despite the role intrapersonal communication plays in engineers’ success, there seems to be limited attention paid to this soft skill. We believe that intrapersonal communication gives engineers the foundation on which they base their judgments. It supports their communication with other engineers and the public they serve. Effective use of intrapersonal communication also facilitates the process in which they engage in learning beyond their formal training.

Therefore, in this paper, we will consider the importance of intrapersonal communication in relation to lifelong learning and the ability to make informed, ethical and society-friendly judgments. We will also argue that faculty training future engineers need to provide their students with an awareness of intrapersonal communication skills as a basis for lifelong learning. To this end, we will first briefly discuss why soft-skills in general are essential for the engineering discipline according to ABET (2014), and why they are significant for engineers as lifelong learners. Following this, we will provide a definition of intrapersonal communication and some related-concepts such as ‘self’, ‘needs’, and ‘emotional intelligence’. This will be followed by discussion on why intrapersonal communication is important in engineering education. In doing so, we will list some of the intrapersonal activities that engineers often engage in and describe some learning activities from our teaching context that promote students’ intrapersonal communication.

Soft Skills for Engineers and Lifelong Learning

ABET criteria (2014) for the 2015–2016 cycle for engineering programs set certain educational objectives. Those that

address the skills we identify here appear to be embedded in the third criterion which highlights

- an ability to identify, formulate, and solve engineering problems
- an understanding of professional and ethical responsibility
- an ability to communicate effectively
- the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- a recognition of the need for, and an ability to engage in life-long learning
- a knowledge of contemporary issues.

We believe that these objectives cannot be achieved by teaching hard skills alone. While specialists may concur with this view, it is still not normally the case that sufficient resources are accorded to focus on essential soft skills. Watson (2013) points out that this leaves new graduates deficient in skills necessary for lifelong learning and effective communication. In a competition for employment against experienced rivals, they have to rely on hard skills that they have not yet applied in real life situations. This inevitably has a negative impact on their employability and their ability to serve society. Engineering education curricula, therefore, need to incorporate various soft skills such as learning the meaning of ethical responsibility (criterion 3f and 3h). In order to achieve this, they need to engage in both intra and interpersonal communication, which is emphasized in criterion 3g. These are not possible through small-scale occasional efforts, but require a serious commitment to life-long learning (criterion 3i). Lieb-Brillhart (1978, p. 140) also notes that “The overall goal of the life-long learning movement is that all of us participate fully in and contribute to society throughout our lives.” This requires individuals to continuously seek opportunities for new skills, knowledge and understandings (criterion 3j). To do this, engineers first need to gain awareness of their own personal and professional needs and abilities. We will argue that engagement in effective intrapersonal communication is a prerequisite for this. Therefore, it is essential that we activate the concept of intrapersonal communication and better understand how it relates to our communication with others more closely.

Intrapersonal Communication and Its Relationship with Interpersonal Communication

The adjective ‘intrapersonal’ is defined in the American Heritage Dictionary of the English Language (n.d.) as “exist-



ing or occurring within the individual self or mind.” Graeme and Dimbleby (2006, p. 1) define intrapersonal communication as “communication within the self, and of the self to the self.” We believe different communication styles cannot be separated from each other since they are interwoven and interdependent. That is, we cannot imagine intrapersonal communication taking place in a vacuum since “the process of communication is really one whole thing” (Graeme & Dimbleby, 2006, p. 1). Indeed our communication with others (interpersonal communication) leads us to communicate within ourselves, or our communication within ourselves more often informs our interaction with other individuals. Interestingly, critical thinking (Facione, 2011) also highlights “self-regulation”, the need for students to take control of their own thinking. Philosophers also (Gadamer, 1975 [2004] and Husserl, 1960 [1931]) have discussed the relationship between ‘subjective’ (intrapersonal) judgment, intersubjective (interpersonal) judgment and scientific (objective) judgment. We further discuss the reasons for this and its implications below. However, we will first elaborate the concept of intrapersonal communication.

The term communication is defined as “a two-way process in which there is an exchange and progression of ideas towards a mutually accepted direction or goal” (Kaul, 2015, p. 2). This definition appears to emphasize our communication with others (interpersonal communication). However, it can also be informative to consider the intrapersonal side of communication if a two-way process is perceived as ‘from self to self’. In interpersonal communication the sender and receiver of the message are two different “selves”. On the other hand, in intrapersonal communication both the sender and the receiver of the message is one self. On the surface, it may seem that such communication is simple and quick because the intended message may be expected to be clear to the self, and communication barriers may be thought to be eliminated more easily when the self does not involve others in the process. However, given the complexities of what constitutes the self, and the multitude of contexts in which communication occurs, how our needs trigger communication with ourselves and others, and the role of emotions in both types of communication, we may underestimate how complicated intrapersonal communication can be. Therefore, the following sections will discuss the different roles self, needs, and emotional intelligence (EI) play in communication processes.

Self

As can be seen in the discussion above, the notion of the self is at the heart of intrapersonal communication. Baumeister (1999) states that our self-concept is determined by our beliefs

about ourselves, which includes our personal attributes as well as who and what the self is. Therefore, the answer to the question ‘Who am I?’ gives indications of what the self is (Myers, 2009).

Possible answers to this question include our physical characteristics such as gender and age, as well as psychological ones such as identity and personality. A distinction is also made between the ‘outer’ self and the ‘inner’ self. The former refers to our physical characteristics mentioned above, while the latter refers to our values, beliefs and ideals (Ferguson, 2013). The inner self, or private self, cannot easily be observed by others, and we may not be fully aware of the inner self ourselves either. However, when we gain consciousness of our flow of thoughts and feelings, we can face our inner/private self (Markus & Kitayama, 1991). Individuals may choose to use their outer self to disguise their inner self for one reason or another. It is also important to note that individuals may project different selves depending on the social roles they play. This suggests that our self-concepts are influenced by our interactions with others within various social contexts (Roberts & Donahue, 1994).

There are several related words and concepts that are of importance in this respect such as self-concept, self-image, self-esteem, self-confidence, self-perception, and self-awareness. No two ‘synonyms’ have exactly the same meaning, but they are all related. When a social event such as failing a test is able to destroy our self-confidence, we may need to improve our self-awareness about this as it might affect the way we react to just one result. Good communication with others is a prerequisite for effective intrapersonal communication (Schafer, 1998). Taken together, these highlight the interplay between intra and interpersonal communication. We may need to work on improving the balance between interpersonal events and the impact this has on our self.

Passarelli and Kolb (2011) draw attention to the notion of ‘learning identity’ as a factor contributing to lifelong learning. They observe that many people fail to think about what learning means, and that they do not realize their unique way of learning, leaving them unaware of their characteristics as learners. This may lead them to have a fixed view of their selves, seeing themselves as ‘incapable of learning’. Such a negative perception of learning reduces individuals’ expectations, motivation and confidence, which McGivney (1993) calls ‘a dispositional barrier’. Research has shown that a lack of confidence is very likely to make learners self-critical, doubtful of their abilities, nervous and insecure, reducing their ability to communicate and interact with others (Norman & Hyland, 2003). Such negative feelings prevent them from engaging in lifelong learning activities.



These problems can be eliminated through self-awareness exercises engaging individuals in the identification of their self worth and inborn capacities to learn throughout life. Learners can be encouraged to reassess their beliefs about how they learn and what they are good at, to monitor the message they send themselves, to redefine their relationship to failure, to control emotional responses to learn from failure, to balance their success-failure accounts, and risk losing (Passarelli & Kolb, 2011), all of which are intrinsic to lifelong learning.

It is also important to consider how our communication is influenced by our needs. This is because the shift in our perception of self and consequent changes in behaviors and attitudes with others are largely dependent on our personal needs, which are briefly explained below.

Needs

In addition to our basic survival needs like food and shelter, we have personal needs such as recognition, affection and creativity and self-actualization at the higher levels of the hierarchy of needs (Maslow, 1943). Our engagement in intrapersonal communication prompts us to take action to meet our needs, which often requires interaction with others. For example, the basic need for shelter lead a fragile person to approach a friend whom he regards as protective. On the other hand, in a project-based environment, as is the case in our own teaching context, the need for recognition can determine a person's behaviors and attitudes towards members of his team. Self-actualization may be fulfilled through the successful completion of a demanding task such as a semester-long project (Nunn & Brandt, 2016). Our success in achieving our intrapersonal and interpersonal needs is greatly influenced by our ability to become aware of our own and others' emotions, and using this ability intelligently. This notion has been discussed in relation to emotional intelligence (EI), which is discussed in detail below.

Emotional Intelligence

Intrapersonal communication has brought about the mainly intrapersonal notion of emotional intelligence (EI). EI is defined as *"the ability to monitor one's own and others' feelings and emotions, to discriminate among them and to use this information to guide one's thinking and actions"* (Mayer, DiPaolo & Salovey, 1990, p. 189). Goleman (1995, p. 34) added to this definition *"[the] abilities such as being able to motivate oneself and persist in the face of frustrations; to control impulse and delay gratification; to regulate one's moods and keep distress from swamping the ability to think; to empathize and to hope."*

These definitions emphasize not only the awareness of our emotions, but also our recognition of others' emotions. They also require informative decisions and actions on personal and interpersonal levels. This, again, highlights the interdependency of the two communication types. That is, a person cannot be said to be an effective communicator if s/he only heeds her/his own emotions. In fact, some researchers study emotional intelligence as an integration of intrapersonal and interpersonal intelligences (Pishghadam, 2009a). Research has provided evidence for the relationship between the two types of communication. For instance, Pishghadam (2009b) found that learners engaging in more intrapersonal activities enhanced the communicative skills which are required for effective interpersonal communication. Deveci (2015), on the other hand, found a positive correlation between communication students' EI levels and team-work satisfaction levels, suggesting that emotionally intelligent students improved their interpersonal communication with their team-members; they, therefore, enjoyed increased harmony in their teams. Similarly, research by Aslan, Ozata and Mete (2008) showed that emotionally intelligent social work groups were respectful to each other, which provided positive energy and helped them work systematically in their teams. Taken together, the evidence from research indicates that intrapersonal communication benefits from emotional intelligence, which in turn improves our interaction with others. Consequently, individuals can meet their higher level needs such as recognition, acceptance and self-actualization.

This notion also has support from the world of philosophy, Husserl (1931, p. 34), for example, argues that a scholar must sometimes "withdraw into himself" and "build anew". According to Husserl, we inevitably enter and perceive the social world of others through our own perceptions and so do other people. *"I can enter no world other than the one that gets its sense and acceptance or status in and from me, myself"* (p. 61). However, significantly, Husserl also emphasizes the importance of accepting that other people also have a self, so (subjective) interpersonal communication and (intersubjective) intrapersonal communication need to be seen as closely related.

Honeycutt, Zagacki and Edwards (1989) also emphasize that intrapersonal communication is much more than talking to oneself. They suggest that we do more internally than talk to ourselves. We also imagine ourselves talking to others. *"Thus, we surmise that imagined interactions are an extended form of intrapersonal communication"* (Honeycutt et al., 1989, p. 168). Imagined interactions may help us prepare for real interaction. However, it is also clear that imagining or reliv-



ing interaction with others does also have an impact on our intrapersonal identity. There is therefore a two-way process.

Medel, Ohsako and Mauch (2001) note that awareness of EI helps integrate our thinking, feeling and action. They also add that it helps individuals to take advantage of different learning settings, whether in-school or out-of-school, formal or informal. This highlights the key role EI plays in promoting lifelong learning. According to Medel et al. (2001), learners with high EI are more likely to enjoy lifelong learning, which can prevent negative habits and behaviors from affecting their learning experiences. Lifelong learning helps learners in coping with past experiences, channeling their energy into constructive professional and social activities. This helps learners to develop positive attitude toward learning and higher-order thinking skills, which are among essential lifelong-learning skills (Cotton, 1998). Given its potential effect on motivation for learning, effective use of EI will encourage students as lifelong learners to assume greater responsibility for their own learning. Their self-awareness will also help them identify their strengths and weaknesses, allowing them to devise learning plans. Their awareness of others' needs, desires, and emotions will nurture a learning environment of care and cooperation, contributing to their success in interpersonal communication. These will contribute to students' success at school and in life beyond school.

The notions of self, needs, and emotional intelligence are of great importance in any field, and as a field aiming to enhance our overall life quality, engineering might be particularly required to recognize their significance, which we briefly discuss below giving examples from our teaching context.

The Place of Intrapersonal Communication in Engineering Design Education

The discussion above suggests that engineers whose main responsibility is to enhance people's lives at large need to engage in intrapersonal communication for various reasons. For one thing, improving others' lives requires them to be aware of their own as well as others' needs. This requires increased levels of EI and the ability to empathize. For example, a physically fit engineer whose EI is low may not feel the urge to improve the life of disabled people through innovative design initiatives. However, it is possible to make minor modifications to design project teaching that inevitably integrates EI. Petroleum Engineering students in our context for example are required to consider ethical issues of design including health and safety and environmental impact. Topics that have been required in early design courses also

require students to support society whether at home or abroad. These have included designing a sustainable village. One team chose the Northern Emirates as their location, another an Ethiopian village. This required students to self-evaluate their designs in terms of sustainability, health and safety and ethical considerations, which often includes environmental impact and other relevant ethical considerations.

While it is not our specific focus in this paper, it is interesting to note that reports of such projects often favor a strong first-person voice. Projects do not only adopt an impersonal scientific approach, they also include a personal engagement to society and to sustainability. This is notable in extract 1 below, where first-person uses are underlined.

Extract 1

Following the requirements from our client, we have perceived a design for a sustainable village. We named it after the great leader late Sheikh Zayed bin Sultan Al Nahyan. Our client was looking for a village which in itself will be a community to support 50 culturally diverse families. A sustainable living, energy, architecture and construction were our main focus. Sustainable energy for us means free energy. By that we mean that the source of energy should not pollute the environment or the surroundings such as wind power and solar energy. While designing the village, we faced many constraints and limitations which hindered progress of our design.

In extract 2 below, students reflect on their intrapersonal/interpersonal thought processes in writing. Again they are considering sustainability.

Extract 2

By referring to this definition, we comprehend that sustainability is about maintaining the production and consumption rates of products equal for a very long time. To achieve this goal, we had to work out methods of saving all the natural resources, therefore, we decided to use water and electrical sensors and timers that will control the supply and reduce the wastage of these resources. We thought of timers for the water supply, that will time the amount of water supplied to the user, in order to prevent its wastage or misuse.

As the first person plural in the extracts above indicate, engineers need to work in collaboration with other engineers from the same or different engineering disciplines as well as other fields. As is discussed above, technical skills they possess will not suffice per se. They need the aptitude and skills to understand their thought processes and feelings. This entails that they be emotionally intelligent in order to have a working interpersonal relationship with them. Therefore, EI as a soft-skill should be incorporated into engineering education curricula which engage students in project work requiring



them to use various elements of intrapersonal communication, as illustrated briefly above. Riemer (2003) notes that such an approach promotes student-centeredness and supports the underpinnings of experiential learning and the constructivist approach. However, Lappalainen (2011) argues that limited training and lack of reward for social competence in engineering education may reduce future engineers' EI abilities, and suggests that higher education needs to be reformed to address this by focusing on intrapersonal skills in general, and on EI in particular. One such initiative was taken by Rensselaer Polytechnic Institute in the States where rapport, empathy, persuasion, cooperation and consensus building skills were incorporated into the syllabus. Students' awareness was increased through recognition exercises conducted in groups, which enhanced their interpersonal skills in teams (Goleman, 1998).

Despite the acknowledged benefits of intrapersonal communication for engineering students, it seems that not all engineering education practice emphasizes it enough. In a study carried out with 10 recent engineering graduates employed in the States, Watson (2013) identified certain intrapersonal skills that were lacking in university courses. The first one was time management skills, required when engineers had to cope with technical and nontechnical tasks in their design work. The stress caused by lack of training in time-management during their stay at university obliged them to acquire the necessary skills on the job at an individual level. The second theme was related to confidence. The need for this attribute emerged when the engineers had to defend their projects communicating their confidence to others. Another ability that they appeared to neglect was the ability to respond to criticism, which they did not practice sufficiently at university either. Efficient response to criticism requires high levels of EI since one would need to have control over one's feelings, and respond to criticism intelligently. Adapting to the real world emerged as another necessary skill which involved decision making not necessarily stipulated in course-books. This requires the intrapersonal skill of decision making 'on the go' by being logical and emotionally stable.

Given the place of intrapersonal communication skills for engineering education discussed above, it is important to create opportunities for students to develop their intrapersonal communication skills. Therefore, in addition to the design projects mentioned above, we identify below some common intrapersonal communication activities and describe how we use them in our own teaching context.

Examples of Intrapersonal Activities and Their Exploitation in Our Teaching Context

Intrapersonal communication involves both internal and external activities. Former is related to thought processes not spoken out loud, while the latter involves verbalized communication between the self and the self (Graeme & Dimbleby, 2006). Some examples of every day internal activities are thinking what to do tomorrow, trying to decide what to wear, etc. On the other hand, external activities are those that involve external expression of thoughts, such as talking to ourselves or keeping a journal or diary. Some activities, however, involve both. For example, self-talk can be an internal or externalized inner voice. Moran (1996) emphasizes that self-talk can be negative or positive. Negative self-talk involves criticism and self-preoccupation, the results of which are generally undesirable. On the other hand, positive self-talk involves praise and encouragement. Hackfort and Schwenkmezger's (1993, p. 355) definition of self-talk underscores the use of self-talk: "*an internal dialogue [in which] the individual interprets feelings and perceptions, regulates and changes evaluations and convictions, and gives him/herself instructions and reinforcement.*" The idea of self-talk is related to reflective thinking and writing, which we explain in detail below.

Reflective Thinking and Writing

Defined as "*the kind of thinking that consists in turning a subject over in the mind and giving it serious and consecutive consideration*" (Dewey, 1933, p. 3), reflective thinking engages individuals in intensive intrapersonal communication through introspection. It engages individuals in the analysis of their own and others' ideas, feelings and emotions about experiences. Gibbs (1988) notes that having an experience per se is not sufficient for learning to take place since it can easily be forgotten without reflection, and states that "*[i]t is from the feelings and thoughts emerging from this reflection that generalizations or concepts can be generated. And it is generalizations that allow new situations to be tackled effectively*" (p. 9). Reflective thinkers are self-directed learners performing intellectual tasks by employing a variety of critical thinking strategies (Lewittes, 2009), which helps them in becoming lifelong learners.

Reflective writing, on the other hand, is the external expression of some of the mental processes of reflection (Moon, 2004). Through reflective writing, we increase our awareness about ideas, feelings and gain new insights into every day experiences. However, it is unlikely that the expression of reflection may be exactly the same as what takes place in the head (Moon, 2004). Reflective writing emphasizes a reflective cycle through which the writer activates emotional



intelligence as well as rational intelligence to reflect on experience. In this sense, reflective writing engages people in intrapersonal communication. An initial description of experience includes not only what happened in context but also a description of the writer's feelings about this experience. In a second phase, the writer then stands outside the experience to evaluate and analyse what happened. This also includes EI in that a reflection includes evaluating our initial affective reaction to the experience. The final stage is normally an attempt to suggest what we have learnt from the experience in order to improve future experience. This cycle can be embedded in almost any curriculum.

Reflective writing also helps us engage in interpersonal communication since it allows us to explain our rationale and thought processes to others (Brown, 2016). Considering Gibbs' argument (cited in Rodgers, 2002, p. 845) that "reflection requires attitudes that value the personal and intellectual growth of oneself and of others" and "reflection needs to happen in community, in interaction with others", the value of sharing reflection through writing where applicable becomes more evident.

From the educational standpoint, we pay close attention to reflection since it allows for higher order thinking skills such as analysis, evaluation, and application. These skills lend themselves to critical thinking and problem solving. Students who reflect on subject-specific topics in relation to their own experiences can have an easier time integrating different pieces of information, comprehending concepts. This strengthens the integration of learning and experience, and supports the formation of memories (Dzubak, 2013). Reflection gives students the opportunity to identify their strengths and weaknesses and devise learning goals, which reduces anxiety (Perez & Ruz, 2014). These are among the key lifelong learning skills. Below we will provide a recent example of how we normally do it in our local context.

Reflective writing is an integral part of a variety of courses in our teaching context. For example, after reading a text on interpersonal communication and another text on intrapersonal communication, and after a seminar discussion on these topics, the Communication Department students are asked to reflect in writing on a specific experience in which intrapersonal experience influenced interpersonal experience. The following example illustrates the way one student describing her experience used the texts to help understand the experience better. (The numbers in square brackets denote the IEEE references the student used to argue her points):

Extract 3

Last semester I was a floor supervisor in the Petroleum Institute dorms. As this job required me to communicate a lot with PI female students and with the residence supervisors, I was put in many situations. Today, I will share with you one of those situations in order to explain intrapersonal and the interpersonal communication.

The residence supervisors used to give me some duties daily such as doing the attendance for the students on my floor, checking if any apartment in the floor has problems for example with the electricity or with water supply and then tell them about it, solving the floor's small problems if there was no need for them to intervene, ...etc. One day, I entered the apartment no 506 to do the attendance for the students. One of the residence supervisors was there. She asked me in front of the students "Maitbab why are the lights not working here?" I was shocked and I asked myself "does she think I am a technician to ask me about this or what?" I felt very sad and I was very embarrassed because it happened in front of my friends. Therefore, I left the apartment without saying anything and then I went to my room. Moreover, I kept thinking about why she asked me about that and what my friends would think of me. After a while, I remembered that one day I was checking if the lights were working in the floor and in the apartment no 506, there was nobody when I was checking so that is why the students did not know that I had come and checked the lights. On the other hand, I was surprised because I have alerted the residence supervisors about the problem and they knew about it. A day later, I asked my supervisor about why she asked me about that in that way. She told me that she did not mean to despise me in front of the others or to show them that I was not committed in doing my work, but she just wanted to check if the problem persisted because of the lac in the lamps supply.

From this situation, it seemed that words do not mean anything in the dictionary but mean something between you and the other person. In fact, "the words we say can mean very different things depending on how they are said or in what context" [1]. So everyone should try to understand what the others mean by saying this thing or that to you. I believe that silence and leaving without saying anything are not the proper things to do in those situations because this may damage a good self-image [1] which I was trying to establish between me and the floor students as after this argument they might think that I was not committed in doing my work so they would not trust me anymore.

On the other hand, leaving the place on that day let me think about the situation in order to find a reason behind what had been said to me. Furthermore, when you engage in intrapersonal communication it helps you reflect, evaluate and solve the matter [2]. The intrapersonal communication between me and the supervisor helped me a lot to understand the correct reason behind what had been said. Overall, the intrapersonal and the interpersonal communications are very important to use together as the intrapersonal communication motivate me to understand the other person and the interpersonal communication completely clarified the misunderstanding [2,3].

The excerpt above indicates that reflective writing helped the student become aware of her own emotions as well as those of others involved in the incident. Through reflection, she seems to have gained more understanding of the interplay between different events, and how her feelings could predict the way she behaves. This shows how her increased awareness



regulates her thinking processes. Her reflection on experience seems to have provided her with some insight into the importance of suspending judgment to think before acting, and controlling moods, which is defined as self-regulation by Goleman (2004). Reference to academic texts on inter- and intra-personal communication (as is indicated by the numbers in the square brackets) helped her evaluate her own subjective experience. Kolb (1984) also suggests that reflection on experience as part of an experiential learning cycle, encourages learners to become life-long learners with a greater potential for success in life. It helps students exercise skills they will need as reflective practitioners upon graduation. Reflection equips them with problem-solving skills, and teaches them learn how to learn (Helyer, 2015), both of which are intrinsic to lifelong learning. Reflection also helps develop learning identity which “*is determined not by past learning successes and failures alone but by the self-attributions about these successes and failures that a person makes*” (Passarelli & Kolb, 2011, p. 86).

Visualization

Defined in the Merriam-Webster dictionary as “*formation of mental visual images*” and “*the act or process of interpreting in visual terms or of putting into visible form*”, visualization is used by engineers extensively. It is particularly important for engineers since they often need to visualize in three dimensions. Lieu and Sorby (2009) note that this is a skill engineers need to perform when they are given a drawing on a page. To do this effectively, they need to use their intrapersonal skill of visualization. This is also linked to creativity in design, for which they need to think critically.

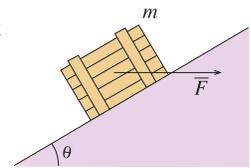
For science and engineering students, visualization is acknowledged as a useful stage in problem solving. Boonen, Van Wesel, Jolles and van der Schoot (2014, p. 1), have even reported a research finding that “*an accurate visual-schematic representation increased the chance of solving a word problem correctly almost six times.*” Visualization is seen as being especially important in the engineering domain and can of course include an internal mental representation of a word problem or an external sketch. Our own recent classroom observation indicates that self-awareness as to whether we have accurately visualized a problem is often vital in generating a correct solution.

The following example from a Physics class illustrates the point. If the diagram is provided, the visualization is no longer an issue, but it is no longer done by the students. Observation indicated that where the students failed to visualize correctly, for example failing to notice the importance of key words such as ‘horizontal’, they ended up with an incorrect solution.

Example

In the figure, a crate of mass $m=97$ kg is pushed at a constant speed up a frictionless ramp ($\theta=26^\circ$) by a horizontal force F . The positive direction of an x axis is up the ramp, and the positive direction of a y axis is perpendicular to the ramp. (a) What is the magnitude of F ? (b) What is the magnitude of the normal force on the crate?

By asking the students to sketch and then solve, it is possible to check whether a correct internal mental image of the problem has been created (intra-personally). See the image students would be expected to create.



Progress Report

The project-based courses our students are offered require them to exercise critical thinking about their own research process and the quality of their research in the form of a structured discussion attended by all the team-members. The discussion is often built round a data retrieval system and a time management system such as a Gantt chart.

One important purpose of a progress report is to make sure that the team is on track to complete the project as successfully as possible within the deadlines set. The discussion is structured by dividing it into three parts: work completed, work in progress and work planned but not yet started. In each section there is normally some discussion of any problems faced or expected and how these problems have been or will be solved. This requires students to engage in both intra- and interpersonal communication to solve any problems that are preventing progress. They must, for example, identify and show awareness of their own problems. For work in progress and to be completed contingency plans are also likely to be discussed. They are also expected to identify and explain significant achievements already accomplished. Other general topics for discussion include the team’s ability to meet deadlines, reasons for any changes in the schedule or modifications in the original plan and things that have been learnt from problems faced at earlier stages of the project. Teams also need to be able to exploit the discussion to generate constructive and useful ideas to improve their project and show readiness and ability to adapt their plan in response to any reasonable criticisms that arise from the discussion. They should also be able to defend their project where they don’t agree with criticism and counter any arguments that they do not agree with, based on evidence gathered so far. The progress report ends with teams’ summary of what they have learnt from it, identifying actions to be taken as a result of the discussion. The process, as a whole, engages students in inten-



sive intrapersonal communication encouraging students to identify how effectively they have been working individually and as a team. This further requires them to communicate with their team members efficiently using a variety of intrapersonal communication skills such as self-talk, reflective thinking, response preparation and emotional intelligence.

Conclusion

In this paper, we have defined intrapersonal communication and established its relationship with interpersonal communication, which are among the key soft skills engineering students need to acquire to remain both employable and valuable to society. We argue that intrapersonal communication, along with other so-called soft skills, is on an equal footing with technical subject knowledge for engineers who wish to engage in lifelong learning as an essential part of their professional and personal development. Engineers as lifelong learners need to engage in effective intra and interpersonal communication to enhance their own and their society's well-being and to ensure that engineers' intrapersonal make-up continues to evolve apace with technical knowledge itself. This is supported by ABET (2014) that emphasizes the need for engineers to use a variety of intra and interpersonal communication skills to solve engineering problems and engage in lifelong learning. We have argued that this need can only be met if individuals are aware that their emotions are heavily influenced by the extent to which their needs are addressed. An awareness and effective use of emotional intelligence is essential for our self-concept to be improved. Assessment of our beliefs about who we are as learners will open doors to a variety of learning opportunities throughout our lives and help us achieve self-actualization.

We have argued that engineering departments need to provide their students with ample opportunity to acquire intrapersonal and interpersonal skills alongside their technical education. This will allow them to exercise and develop critical thinking skills alongside emotional intelligence. Both are necessary to be lifelong learners. In addition to every day intrapersonal activities, we have discussed some of the intrapersonal activities engineers often engage in and the importance of the intrapersonal when generating a society-friendly design. We have also described some of the teaching activities showing how we try to develop students' intrapersonal communication in our local teaching context. In doing so, we particularly emphasized the role of reflection on personal experience followed by reflective writing. We have also briefly discussed project-based learning as a broad platform for developing technical and non-technical skills in parallel. Students engage both with themselves and others in order to complete a technical project. Again students need to consider intrapersonal issues

related to their own contribution, their own needs, the needs of others when working with others, their own and others' motivation within project teams. We have given the example of progress-reports as a venue where all of these could be discussed in great detail using intra and interpersonal communication skills. We have argued that 'self-regulation' is at the heart of critical thinking (Nunn, Brandt & Deveci, 2016). In a project team, all members are potentially self-regulated thinkers who need to cooperate. But, more importantly for this discussion, we have also argued that there is an emotional and a rational side to academic and scientific behavior and that both need to be taken into account equally. Purely rational scientific notions such as "objectivity" are philosophically untenable when they present so-called objectivity as something that is somehow external to the intrapersonal self. We argue that its meaning and value is inevitably negotiated through oneself and with others. When we claim to be "objective", we are also making an intra- and interpersonally mediated claim by communicating what we mean by objectivity to ourselves and to others. Engineering students do not just draw on scientific or mathematical intelligence, they also need emotional intelligence to enable them to achieve inner stability and to function successfully in society (Deveci & Nunn, 2016).

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