# THE GLOBAL ENGINEERS LANGUAGE SKILLS (GELS) NETWORK: AN UPDATE

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## ABSTRACT

In 2015, three language teachers working with student engineers at different European universities founded the Global Engineers Language Skills (GELS) network. The teachers' aims were to investigate and categorize necessary and desirable language and communication skills for engineers and ensure that these findings actively support the teaching and learning of additional languages in technical universities and engineering departments. We presented preliminary results of our work at CDIO's international conference in 2016. In this paper, we summarize the network's development since then, interpret the results of our investigations, and describe our work to disseminate our results and promote effective language and communication skills for engineering students. We also summarize our more recent work on enhancing the GELS framework of skills, applying for Erasmus+ KA2 funding, developing the GELS network from three to thirty universities through training events, integrating intercultural communication skills in our work, and teaching and learning through the medium of English.

## KEYWORDS

Communication, Language for Specific Purposes, Intercultural Communication, Standards 2, 3, 7, 8, 10, 11

## INTRODUCTION

### *A history and definition of Language for Specific Purposes (LSP)*

In the aftermath of World War II, the United Nations and the Council of Europe sought to encourage understanding and enhance communication between various countries through better knowledge of each other's language and culture. The translation of specific vocabulary

into various languages was nothing new, but it is from this time that the number of student exchanges grew significantly in Europe, and more consideration was given to the specific language and communication (LC) needs of professionals (Dudley-Evans & St John, 1998). Although English was advanced as the lingua franca in many domains, research in Language for Specific Purposes (LSP) has been carried out in a number of languages (see Gollin-Kies et al., 2015, pp. 233-241).

There are numerous approaches to LSP, and varying definitions have been proposed. The definition and approach that have been the best guide for our work come from a 2015 article on current perspectives on LSP, where the domain is described as:

> "… 27 involv[ing] the teaching and learning of the foreign language for professional/working purposes in order to facilitate interaction on the part of a working person … at the international level. The interaction may extend along a continuum from passive interaction, as in the case of reading technical materials in the target language, to active interaction, for example, travel to other countries in order to participate in joint projects in the language. For this reason, cultural concerns are a fundamental component of courses alongside general, albeit formal language instruction and situational vocabulary, grammar, and functional structures." (Garcia Laborda & Litzler, 2015, pp. 6-7).

In the 1960s, Halliday et al. (1964) paid special attention to the vocational needs of workers in international settings. However, there was a focus on technical vocabulary and potentially demotivating lists of words to learn. A more thorough needs analysis system emerged in the 1970s with Munby (1978), which is generally considered the first example of a communicative approach in LSP. Hutchinson and Waters (1987) followed suit but focused rather on the learners' needs and motivations. Since then, it has been noted that LSP teachers' needs have largely been forgotten (e.g., Richards, 1997), and that more research is needed in the domain of LSP and teacher education (e.g., Basturkmen, 2014).

### An introduction to the GELS network

The Global Engineers Language Skills (GELS) network is an informal group of Language and Communication (LC) teachers working at technical universities and engineering departments. Our goal is to improve LC teaching and learning in our institutions by working together with a clear and confident focus on the specific communication needs of engineers. We LC teachers working with student engineers are often poorly placed on recognizing their broader learning needs because we seldom have a technical background or have tenured positions at universities (Tual et al., 2016). However, LC training is vital for engineers (e.g., European Society for Engineering Education, 2019). To integrate it more effectively in engineering education, we need a clearer picture of 1) what engineers really do and how they need to communicate, and 2) how engineers' typical communication tasks can be a source of inspiration for meaningful teaching and learning in the LC classroom.

The GELS network was established in 2015 with two aims: 1) to better prepare engineering students for international study and future employment by having a clear idea of engineers' specific language and communication needs, and 2) to provide opportunities for LC teachers working with engineers to network, share expertise and good practice, and ensure continued professional development. To fulfill these aims, teachers from the GELS network set themselves the following four objectives:

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1) Identify the communication skills most frequently required by engineers in the workplace by means of surveys

2) Create a progressive framework of communication skills specifically for engineers that prepares students for the CDIO's Communications syllabus

3) Develop a catalog of teaching and learning activities based on the framework

4) Disseminate the framework and the catalog to LSP teachers working with engineers.

The following sections of the paper summarize the GELS network's development according to these individual objectives.

## SUMMARY OF THE GELS NETWORK'S DEVELOPMENT

### *Objective 1: Identify the communication skills required by engineers*

Online surveys were chosen as the most effective method for collecting quantitative data from engineers. The primary survey included seven questions, in which respondents were asked about their use of additional languages for professional purposes, their most common communication tasks, and the importance of language skills for their organization's recruitment process. The survey was disseminated via social and professional networking websites, and all who were qualified in engineering and/or worked on the design, construction or maintenance of engines, machines, ICT, or structures were invited to respond to the survey. For a more detailed description of the data collection process, see Rinder et al. (2016).

To date, 219 engineers from various backgrounds and working in various engineering disciplines have taken the survey and shared their experiences. Analysis of the data in Rinder et al. (2016) indicated that engineers primarily needed language skills for their participation in meetings, telephone conversations, casual correspondence, and writing short documents. Furthermore, additional language skills were primarily used for interacting with colleagues, but also clients, suppliers, and the organizational head office.

A new analysis of a greater data set shows similar results. An important question addressed in the GELS survey concerns the situations in which LC skills are needed. The answers to this question (see Figure 1) provide insights into the communicative contexts frequently encountered by engineers and offer indications for the kind of formal and informal registers required for such situations.

The different communication situations presented in Figure 1 can be seen as part of a continuum regarding their interactivity, which consequently affects the communication modalities relevant to them. Analysis of our data shows that LC skills are primarily used for reading documents, more often short documents (n=173; 79%), and writing for specific audiences (e.g. casual correspondence (n=165; 75%), formal correspondence (n=155; 71%), brief documents (n=155; 71%), and long documents (n=134; 61%)).

**For which purposes are language skills needed? (N=219)**
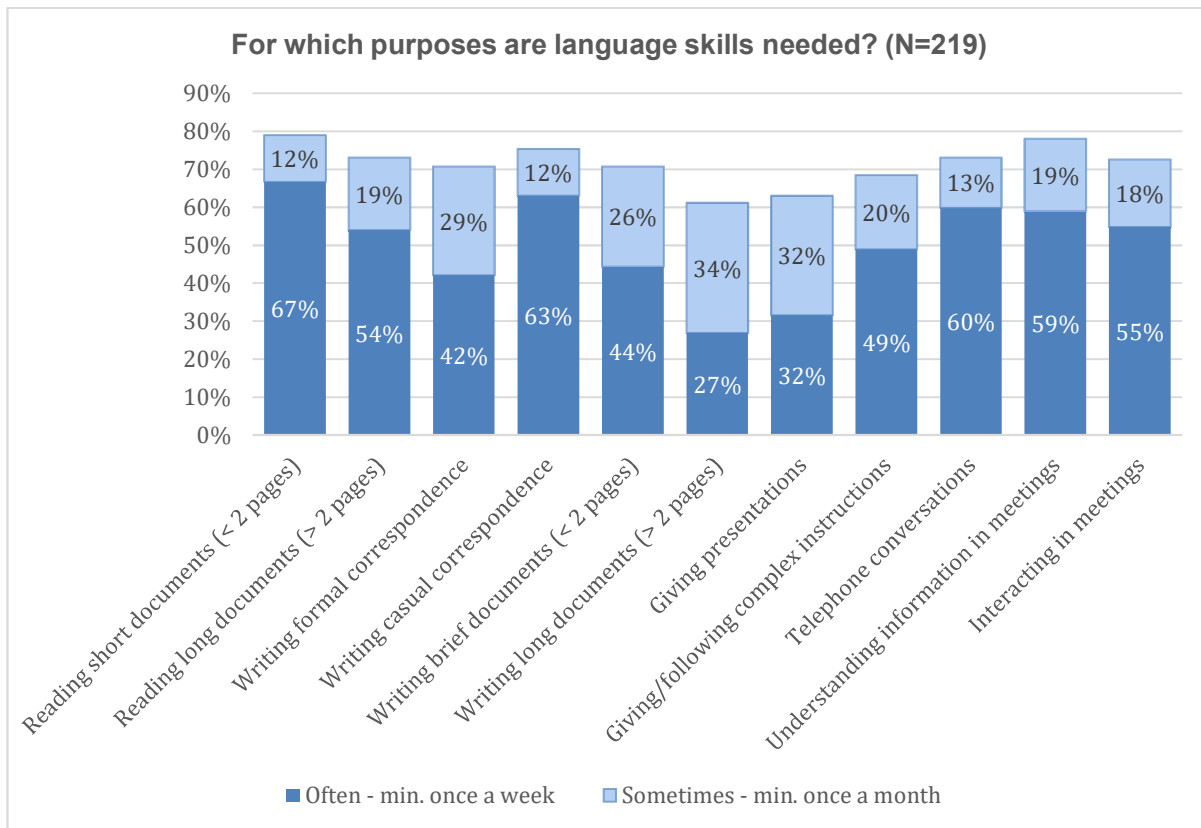
Figure 1. Answers to the question *How often do you do the following in any language?*

Engineers also have to find ways to present information for a variety of purposes. Interestingly, our results show that formal correspondence appears to be much less frequent than casual correspondence. In similar regard, delivering oral presentations (n=138; 63%) appears to be less relevant than might be expected. This shows that LC courses focusing on formal correspondence and presentations may not be ideal for preparing student engineers for the world of work. The data also suggests that LC courses and assessment for engineers could be improved by including more dialogic exercises, such as telephone conversations (n=160; 73%) and interactions during meetings (n=159; 73%).

Another important factor affecting communication situations is the specific interaction partner(s) (see Figure 2). The results of our survey show that engineers' communication partners in additional languages are primarily colleagues (n=134, 61%), followed by clients (n=107, 49%), suppliers (n=74, 34%), "others" (n=60, 28%), and the head office (n=57, 26%).

We can also infer from these results that engineers primarily need to be able to share their technical knowledge and understanding with their peers. Such communication among colleagues is likely to require a neutral register; however, this is a generalization and does not take into account cultural and organizational differences (Moll, 2012).
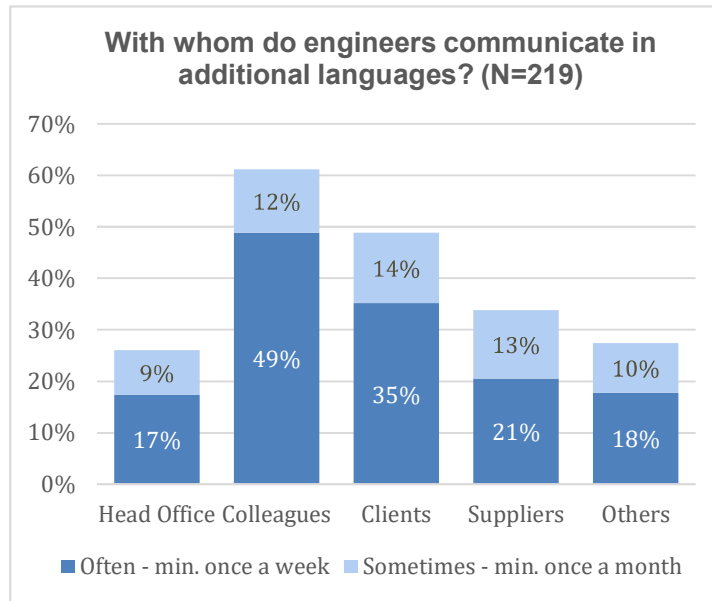
**With whom do engineers communicate in additional languages? (N=219)**

Figure 2. Answers to the question *With whom do you communicate in additional languages?*

## Objective 2: Create a progressive framework of LC skills

The GELS framework is intentionally similar to the self-assessment grid of the Common European Framework of Reference for Languages (CEFR) (Council of Europe, 2001): it is language-neutral, the vertical axis (A1 – A2 – B1 – B2 – C1 – C2) represents progress in proficiency from "basic user" to "independent user" (Council of Europe, 2018), and the horizontal axis includes five broad communication skills: listening, reading, spoken interaction, spoken production, and writing.

The GELS framework aims to prepare additional language learners and users for the Communications topics outlined in the CDIO syllabus and the demands of studying and working within the field of engineering in international and intercultural contexts. For a detailed description in English of the GELS framework's creation and compatibility with both the CEFR and the CDIO syllabus, see Rinder et al. (2016); for French see Sweeney-Geslin et al. (2016).

We updated the GELS framework in 2016 to highlight the importance of both audience awareness for writing tasks, and distance communication when speaking and listening. GELS network members are currently working on additional "layers" of skills specifically for e-communication and intercultural communication (see Objective 4).

Figure 3 presents a section of the GELS framework (for the full updated version, see The GELS network, 2019). As shown in the figure, the GELS framework is similar to the CEFR's descriptor scales to the extent that the tasks focus on outcomes rather than the vocabulary and grammar needed to achieve them (Council of Europe, 2018). However, the GELS framework is adapted to the needs of engineers, paying consideration to pertinent tasks such as correspondence, reading for detail, dealing with logical proofs, and problem-solving.

|  | **A2** | **B1** | **B2** |
|---|---|---|---|
| **Reading**<br><br>simple → complex texts | I can read simple paragraphs and can infer meaning where necessary in more complex text. I can follow instructions given in simple everyday correspondence. | I can understand correspondence and recognize distinctive differences in a register. I can scan texts for information and learn from instructive texts on familiar engineering topics. | I can find the answers to specific questions in texts on familiar but complex topics. I can read journalistic texts on a range of subjects and follow potentially complex arguments and counterarguments. |
| **Spoken interaction**<br><br>face-to-face & distant communication and networking | I can exchange more detailed personal and professional information and can cope in brief, routine situations with my peers. I can inform others about common difficulties. | I can use a range of simple language to deal with formal and informal situations and suggest solutions. I can interact in a conversation about my work and ask questions to develop the topic of conversation. | I can interact effectively on a range of topics within my engineering field and address specific problems. I can substantiate my opinions with evidence, negotiate with colleagues, and interact effectively to reach a consensus. |

Figure 3. A section of the updated GELS framework (The GELS network, 2019).

***Objective 3: Develop a catalog of teaching and learning activities***

Once we established the GELS framework, we encouraged LC teachers to create teaching and learning activities and lesson plans inspired by it. This work was undertaken in various department meetings held at our partner universities and as part of GELS training or other professional development events. A selection of these activities is shown in Figure 4, and a full catalog will be shared on the BADGE project's Open Educational Resources (OER) platform.

| | |
|---|---|
| A1 | Spell out short field-specific terms, e.g. KTH, EDF, IoT, MP3, 75%, $CO_2$. |
| A2 | Telephone to report a broken item of equipment and ask for assistance. |
| B1 | Make a list of recommendations for e-communication for an engineering firm. |
| B2 | Synthesize previous research on an engineering-related topic. |
| C1 | Participate in a negotiation exercise as part of a conference call. |
| C2 | Rewrite a research paper/ degree project/ thesis as a press release. |

Figure 4. A sample of teaching and learning activities based on the GELS framework

***Objective 4: Disseminate the work to LSP teachers working with engineers***

In this section, we present a summary of our training events, our work on the intercultural communication needs of student engineers, our policy on English as a Medium of Instruction (EMI), and the Becoming A Digital Global Engineer project (BADGE).

*Developing the GELS network*

The GELS network now counts LC teachers from 30 technical universities and engineering departments among its members (for more detail, see The GELS network, 2019). We have developed the network through associations made at international conferences, where we have presented our work (e.g., CDIO 2016), and we have also organized a number of training events to attract new members (see Figure 5). The aim of our first training events was to present the findings from our surveys, share the initial draft of the GELS framework, and receive feedback from LC teachers. We consequently improved the framework and encouraged teachers to begin using it to plan progressive LC courses with engineers' communicative needs in mind. In more recent workshops (2017-2019), the focus of our work has gone beyond LSP as we seek funding for our future work. Some of our work is summarized in the following sections.

| | | |
|---|---|---|
| 2015 | University of Cambridge, UK | Two-day event |
| 2016 | Aalto University, Finland | One-day event |
| | Poznan University of Technology, Poland | Two-day event |
| 2017 | KTH Royal Institute of Technology, Sweden | One-week event |
| 2018 | Aristotle University of Thessaloniki, Greece | One-week event |
| 2019 | IMT Mines Albi-Carmaux, France | Three-day event |

Figure 5. Summary of the GELS network's training events

*Introducing intercultural communication competence (ICC)*

The value of intercultural communication competence (ICC) for engineers in an ever more interconnected world has become increasingly apparent as the industry, research, accreditation bodies, and professional organizations have highlighted the lack of graduates' global competence (e.g., Atadero et al., 2018; European Society for Engineering Education, 2019). For us, intercultural communication competence comprises effective and appropriate communication with individuals of diverse backgrounds. ICC competence encompasses not only language and the appreciation of additional languages (Arasaratnam-Smith, 2016), but also behaviors and interactional strategies (Fantini, 2009). Taking a closer look at the professional realities of engineers in the 21st century, one can clearly see how the engineering world is full of diversity: work teams, organizations, customers, clients, and users come from intercultural backgrounds and have different norms and expectations of what constitutes "good" communication practices. Therefore, the perspective of engineers as isolated entities in their own world is passé, and if we teachers want our students to succeed, we have to prepare them for the new global realities encountered by today's engineers.

The Global Engineers Language Skills (GELS) network, as its name indicates, focuses on additional LC skills, and this is indeed what originally brought its members together. However, we recognize the need to include cultural dimensions in student engineers' training, and this has always been a feature of our discussions at GELS meetings and training events. The expertise brought in by new GELS members in recent years has led to a shift in our outlook, whereby the cultural dimension of LC training has gone well beyond that of national cultures to encompass the multilayered dimensions of culture.

One example of our discussions is about the concept of VUCA (Volatility, Uncertainty, Complexity, and Ambiguity), which we have found very useful to guide LC teachers wanting to better prepare their students for a professional environment. The VUCA world can be described as "the new de-globalizing world, the era of "post-globalization" (Shliakhovchuk, 2019, p.14), and in order to navigate a VUCA world, students need to be culturally intelligent so that they can communicate in a fast-moving, unpredictable, multilayered and unclear environment. All of the above obviously requires excellent LC skills, but these must develop alongside ICC and other soft skills if effective communication is to be achieved.

*Teaching and learning through the medium of English (EMI)*

The GELS network supports the teaching and learning of languages in technical universities and engineering departments. We have demonstrated how all LC teachers can successfully include LSP in their courses for student engineers and, similarly, we encourage students to make use of their full range of language competencies (including, e.g., home language and other languages learned in school) in academic and professional contexts. This does not mean, however, that we ignore the reality of English as a growing lingua franca in both industry and academia. Indeed, we are sensitive to the opportunities and challenges that have been created by the exponential rise in the use of EMI in non-English-dominant universities (Wächter & Maiworm, 2014) and the diversity of linguacultural backgrounds encountered at universities.

GELS network teachers have discussed these opportunities and challenges at training events, and three members (Nicola Cavaleri from the University of Cambridge; Anna Krukiewicz-Gacek from AGH University of Science and Technology, Krakow; Divya Madhavan from CentraleSupélec Paris) have produced guiding principles for effective EMI. The aim of these principles is to protect the value of cultural diversity in our classes and on our campuses through sustainable shifts in language policy, as the following examples demonstrate:

- An EMI curriculum should focus on equipping its participants with the confidence and skills required in a global world using English as a lingua franca

- An institution's EMI vision should be made transparent so that all key players ascribe to the same clear purpose, and participants understand its implications, benefits, and challenges

- A needs analysis should be conducted to ascertain the requirements of all key players before an EMI policy is implemented.

For the complete list of guiding principles, see The GELS network (2019).

*The Becoming A Digital Global Engineer (BADGE) project*

Under the coordination of IMT Mines d'Albi-Carmaux, France, 14 institutions from the GELS network (from Croatia, Finland, France, Germany, Greece, Italy, Lithuania, Poland, the Russian federation Spain, Sweden, and the United Kingdom) have successfully sought Erasmus+ KA2 funding to help develop the GELS network's work. BADGE is an extension of the GELS network's founding aims. Its members create pertinent, practice-oriented, and innovative ways for student engineers to learn the linguistic, intercultural, and communicative skills needed for their international studies and future careers. The multinational and multidisciplinary teams, including teachers and students, work on eight intellectual outputs (Ios) connecting different aspects relevant for engineering competence in our globalized, digitalized world (see Figure 7).

IO1   Communication course for future engineers
IO2   Sustainable writing skills
IO3   E-communication skills
IO4   Global competence and entrepreneurship
IO5   Architectural voices: student-produced podcasts and videocasts
IO6   Soft skills for engineering students
IO7   Global competence through IT and serious games
IO8   EMI for teachers

Figure 7. Intellectual outputs of the BADGE project

The progress of the individual intellectual outputs is continually assessed for relevance by experts from engineering faculty and industry and will be further developed into learning materials and lesson plans for LC teachers. These materials will be hosted on a multilingual Open Educational Resources (OER) platform that will also provide the opportunity for students to collect digital badges by completing individual courses. By collecting five badges, students will be able to earn a certificate attesting their LSP, ICC, and digital skills, which can be included in their Europass Diploma Supplement, thus making their skills clearly visible for potential employers.

**CONCLUSION**

The GELS network started as three teachers with two broad aims: 1) to find out how engineers communicate, and 2) to ensure that these findings actively support the teaching and learning of additional languages in technical universities and engineering departments. Since our presentation at the 2016 CDIO conference, GELS has grown into a network of LC teachers from thirty universities. Our shared enthusiasm for and expertise in e.g., Languages for Specific Purposes, Intercultural Communication, English as a Medium of Instruction, and Project Management have ensured that we continue to fulfill and further develop our original aims of ensuring sound LC training for student engineers. However, the world is changing rapidly, and we will have to combine our strengths to find new avenues to address current and future developments affecting engineers. With the GELS network's original vision expanding into new directions, we aim to continue to provide relevant LC materials capturing the complex realities of the engineering profession of the 21st century.

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