JLTL

The Journal of Language Teaching and Learning™

2019 Volume 9/Issue 2 Article 5

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Recommended Citations:

APA
Bozdogan, D., & Kasap, B. (2019). Writing Skills and Communication Competence of Undergraduate Students in an Engineering English Course. *The Journal of Language Teaching and Learning*, 9(2), 49-65.

MLA
Derya Bozdogan and Buket Kasap. "Writing Skills and Communication Competence of Undergraduate Students in an Engineering English Course" The Journal of Language Teaching and Learning 9.2 (2019): 49-65.

The Journal of Language Teaching and Learning, 2019(2), pp.49-65

Writing Skills and Communication Competence of Undergraduate Students in an Engineering English Course

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ARTICLE INFO

Article History:
Received, May 1, 2018
Revisions completed December 27, 2018
Published July 10, 2019

Key Words:
Engineering English
National qualifications framework
Needs analysis
Communication competence

ABSTRACT

Engineering graduates are facing problems in technical writing and communication during and after their studies. The professional life requires language proficiency in minimum one foreign language, and effective communication and teamwork skills. Hence, to examine the gap, this case study explores Engineering English undergraduate course in an English-medium of instruction setting with a focus on technical writing skills and communication competence. Following the needs analysis design by Serafini, Lake and Long (2015), the lacks, necessities and wants of the Engineering English course students are identified aligned with the National Qualifications Framework for Higher Education in Turkey. Engineering English writing course needs a syllabus revision that incorporates a variety of tasks and genres, and the instructors need training on how to balance the content and foreign language in their classrooms. Moreover, engineering students need to be exposed to communicative competence building activities in different genres and through different modes of instruction.

English language education, especially in non-native English speaking countries, aims to prepare competent graduates for the workforce. Graduates from many disciplinary areas such as business, science and education experience difficulties in their professional life in terms of their English language skills. Specifically, for engineering graduates, the gap between their English proficiency level and the language requirements of professional life risks their chances of becoming 'ideal' and 'global' engineers (Riemer, 2002). Companies highlight effective communication skills in English as an engineering employability skill considering the necessity of alignment to the international standards in the globally competitive world. Hence, foreign language proficiency and communication skills in engineering education need

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 ISSN: 2146-1732

attention. To that end, research by the language specialists as social scientists necessitates in engineering education (de Graaff, 2016).

Communication competence mediates the demands between the globalisation and mobility, and the professional life (Markes, 2006). Therefore, International Accreditation Boards have been attempting to address this issue (ABET Student Outcomes, 2017). For instance, Accreditation Board for Engineering and Technology (ABET, 2015) updated the student outcomes criteria of effective communication covering multiple correspondence (Criterion 3). Plus, OECD (2011) revisited its learning outcome statements on generic skills emphasizing effective communication in 'the engineering community and society at large'. MÜDEK (2015) in Turkey (Association for Evaluation and Accreditation of Engineering Programs) added two related program outcomes stated as 'communication ability in Turkish, both orally and in writing and knowledge of a second language'. These adjustments require engineering programs to reconsider how these competencies are reflected in their curricula.

In Turkey, Bologna process and European Higher Education Area membership accelerated the program accreditation processes. These are aligned with the accreditation criteria of ABET and National Qualifications Framework for Higher Education in Turkey (NQF-HETR, hereafter *The National Framework*). The National Framework facilitates quality assurance and standardisation to meet the global requirements. As stated in the OECD report (2011), the Engineering Dean's Council of Turkey (2016) points out that academic content outweighs the professional content in the National Framework. This imbalance endangers building the necessary engineering competences and transferring the skills. The following figure illustrates the structure of engineering programs and their English courses in Turkey. Engineering programs offer academic English in the first year that is followed by Engineering/Business English in the second and third year. These Engineering English courses are vital as they facilitate transfer of competences to the professional contexts. Therefore, language courses in engineering programs need to integrate the core engineering competencies in their learning outcomes.

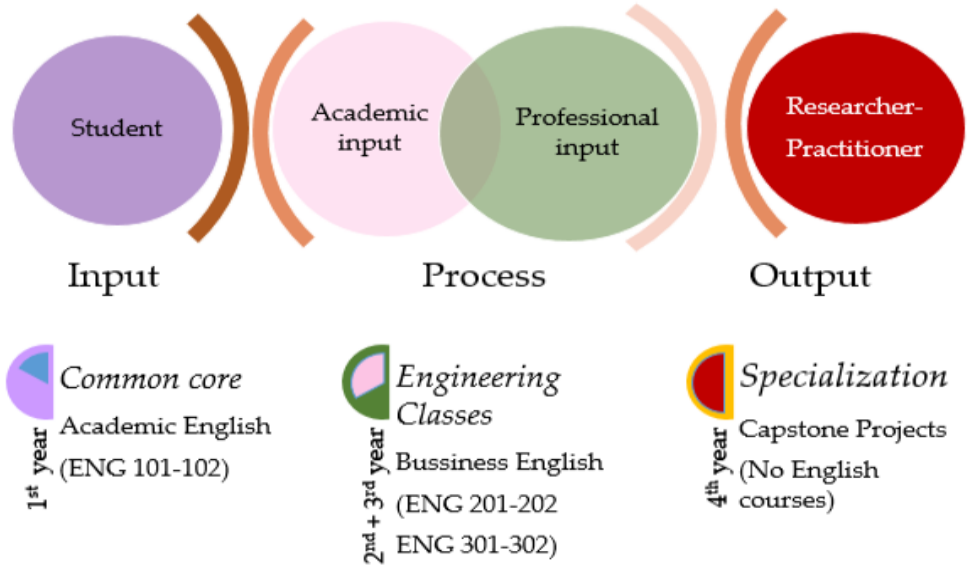

Figure 1. Undergraduate Engineering Program Structure in Turkey

This study reports a needs analysis of Engineering English writing course and its students in a Turkish University. It aims to identify the lacks, necessities and wants of the course and its students. It

follows the needs analysis design of Serafini, Lake and Long (2015) that has an eclectic approach to the identification of lacks, necessities and wants. The study is grounded on the layered literacies theoretical framework specifically designed for technical communication pedagogy (Cargile Cook, 2002). It aligns the course outcomes to the National Framework and the international accreditation criteria (ie. ABET). To that end, our research questions are:

RQ1: What are the lacks, necessities and wants of the Engineering English course?

RQ2: What are the lacks, necessities and wants of the students enrolled?

2. Review of Literature

Accreditation in the higher education institutions has been empowered in the early 21st century as an outcome of globalization. Turkish higher education institutes has devoted considerable effort into building a stronger culture of quality and quality assurance systems by adopting quality assurance measures. The cooperative initiatives by the Turkish Ministry of National Education and The Council of Higher Education (YÖK) try to implement and adapt the quality assurance measures at all areas and with full competence.

Developing the National Framework is significant in defining, understanding, developing and revising the qualifications for higher education, for students, and employers. These qualifications guide all stakeholders in the decision-making about the programs, employability possibilities and program development. The National Framework builds a unitary organization of qualifications, which are accredited both nationally and internationally. It caught the attention of a few researchers in different disciplinary areas, such as law (Kavak, Seferoğlu, Atalay Kabasakal, Şen & Uludağ 2015) and architecture (Aközer, 2013). However, there seems to be a lack of research in the area regarding foreign language education and communicative competence in a second language.

2.1. Engineering Competencies: The Role of Communication Skills

Engineering graduates are expected to master various communication skills both in speaking and writing by the end of their academic studies. In this sense, Riemer (2002) highlights the significance of language and communication skills of a modern engineer. Jesiek, Zhu, Thompson, Mazzurco and Woo (2014) point out that the global engineers need to be equipped with context-specific and appropriate set of skills. Vukadinovic, Djapan and Macuzic (2016) recommend to reform education programs at the intersection of what the industry performs and what the students need.

Reports (ABET, 2015; MUDEK, 2015; OECD, 2011) and researchers (Jesiek et al., 2014; McMahon & Escribano, 2008; Vukadinovic et al., 2016) list communication skills as an essential competence for an engineer. Under the Program Outcomes of EUR-ACE Framework Standards and Guidelines (EAFSG, 2015), one of the eight learning areas is communication and team working. It is reported that engineers are expected to work with teams across nations and cultures, and communication skills and task abilities of engineers have changed considerably (OECD, 2011). Given the profile of the 21st century engineer, educational programs have been struggling to recognize and adapt to these changes (Mcmahon & Escribano, 2008) and roles such as 'cooperation and coordination with others, supervision, monitoring, reporting work, and negotiating points of view in global settings' (Jesiek et al., 2014, p.5).

At this point, competence-based education aims to merge the industry-driven learning objectives to the engineering curriculum (Rajaee, Junaidi, Taib, Salleh & Munot, 2013). English language courses in the engineering programs are designed in respond to these concerns. They base themselves on industry-driven interaction and production tasks (Mcmahon & Escribana, 2008). Where Turkey positions itself in competence-based education can be traced back to the Dublin Descriptor, even if it is a top-town

transition (OECD, 2011). That is the reason for encouraging a bottom- up change at the course level (Akar, 2010; Jarvis, 2001).

2.2. The Role of Needs Analysis in Syllabus Design

Identifying needs of learners functions as an indispensable part and a preliminary stage of syllabus design and curriculum development (Chovancova, 2014; Dudley-Evans & St. John, 1998; Long, 2005; Munby, 1978). Needs analysis (NA) furnishes the opportunity for 'the awareness of a target situation' (Hutchinson & Waters, 1987, p.53) with reference to skills, strategies, content knowledge, communicative and cultural competence (Munby, 1978). Necessities, lacks and wants of learners (p. 54) determine target needs where in some cases; wants do not necessarily coincide with learners' necessities. In English for Specific Purposes (ESP) performing needs analysis complements course design, materials selection, teaching and learning and evaluation (Dudley-Evans & St. John, 1998).

Needs analysis for Engineering English courses (Kaewpet, 2009; Skinner & Mort, 2009; Spence & Liu, 2013) serves to improve the overall program efficiency. In that sense, Spence and Liu (2013) highlight genre-specific writing training, technology-mediated communication and writing feedback as means to such efficiency. In Turkish context, Canbay (2006) and Gözüyeşil (2014), who worked with students and instructors in intensive English language program (IELP) and also in engineering program, highlighted the need for reading practice to master the content courses and to achieve learning outcomes. Additionally, Kahraman (2013) identified the language necessities, wants and lacks of engineers. Şahan, Çoban and Topkaya (2016) reflected the differences in perspectives of the parties involved. That is, while engineering students, engineers and employers value the English skills for communication, English language instructors focus on receptive skills- reading and listening.

2.3. English Medium Instruction (EMI) in Engineering Programs

Engineering programs in Turkey exercise EMI with the highest rate among current undergraduate programs (Arık & Arık, 2014), consistent with the results in Europe (Maiworm & Wachter, 2002) and Asia (Kim & Shin, 2014). An engineering undergraduate student is expected to be a competent writer of English (British Council Turkey, 2015). However, Engineering undergraduate students are reported as unenthusiastic language learners and writers. British Council's report (2015) shows that low English proficiency levels and poor communication skills as the main causes (Li & Li, 2013), in addition to their negative attitudes towards writing courses (Arms, Duerden, Green, Killingsworth & Taylor, 1998). Kim, Kweon and Kim (2016) also report low perceived levels of English and an overall pessimistic approach of engineers to content courses in English. It is observed that their unwillingness to participate in content classes in English (Lee, 2014) and English learning demotivation (Al-Tamimi & Shuib, 2009) limit the classroom interaction. As a possible solution, Kırkgöz (2009) suggests the delivery of content courses in English to advance foreign language proficiency.

2.4. Writing in the Engineering Context: Genre Approach and Layered Literacies

Silyn-Roberts (1998, p. 13) recaps writing attitude of engineers as 'They believe they do not write well and actively dislike writing'. The roots of engineers' reluctance to write are generally linked to the mismatch between their preferred learning styles (i.e. active and visual) and the teaching style (i.e. passive and auditory) (Goldsmith & Willey, 2016). Arms et al. (1998) suggest incorporating team teaching, active and collaborative learning to minimize such a mismatch. Further, Badger and White (2000) introduce

process genre approach to teaching writing, while Li and Li (2013) design technical writing through task-based approach.

Robinson and Blair (1995) apply a synthesis of genre and reader oriented approach to composition teaching in an engineering writing class, and call for a need to integrate real world tasks into the program. In process-genre approach, the instructor presents example texts which students analyse, then students model these texts by either working on language exercises or co-constructing the text with the instructor, and as a final step, they work on their own to finalize the text of a specific genre (Badger & White, 2000). Flowerdew (2000, p. 373) suggests reconstructing a text, comparing texts, identifying content and relating content to different sections. Likewise, Yasuda (2011) practices email-writing tasks through genre-based teaching, and reports that students' awareness, linguistic knowledge and writing competence develops drastically. All in all, genre-based approach enables a contextualised discourse to learners by relieving them from the stress of mastering a pile of isolated structures and organizational patterns (Kay & Dudley-Evans, 1998).

When writing integrates the demands of workplace and community with the needs of the specific discipline, it becomes more humanistic and holistic. In writing courses, students not only develop their writing skills but also perform in their disciplinary areas. They transfer these skills to their academic and social contexts. Moving technical writing further to the social context, Miller (1979) asserts a 'humanistic' approach that incorporates values. Like Kırkgöz (2009), Miller believes in achieving enculturation in technical writing through community understanding and community engagement. In support of that, Bushneil (1999) positions the community re/structuring within the technical writing program. Layer literacies approach is one way of achieving this. Using layered literacies approach in the professional writing process was born out of the need to meet the globalized workplace needs because they require more than competence on the professional writing process. Layered literacies approach integrates collaboration, team work, multicultural awareness, technology use from a critical eye. Layered literacies approach includes the teaching of basic, rhetorical, social, technological, ethical and critical literacies (Cargile Cook, 2002). Even if not all of these literacies can be explored in a single course, with their integration into the technical writing course learning outcomes (in our case, Engineering English) technical communication of engineers enhances on several levels.

Our perspective is shaped by Miller's statement (1979) of 'We teach writing as an expression of idea or technical effort, not as a part of that idea or effort.' (p.5). By identifying the necessities, wants and lacks of engineering students in an Engineering English course, this needs analysis aims to provide an overall picture of the course in line with the engineering competences for a syllabus revision to meet the global trends.

3. Method

3.1. Setting and Participants

This contextual case study was conducted in an Electrical and Electronics Engineering (EEE) undergraduate program in Turkey. The program was accredited by MÜDEK for four years (2004-2008) but the accreditation has not been renewed yet. The program originally started with 70% of classes in Turkish medium of instruction and only 30 % in English medium instruction. However, it shifted to 100% English medium of instruction in 2015-2016 academic year. This change aimed to improve the quality, internationalization and success of the program.

This study focuses on the writing course (ENG 301 Engineering English, see Figure 1). The Engineering English courses (ENG 301 and ENG 302) help facilitate the link between the undergraduate

study and professional life for the prospective global and modern engineers in terms of their writing and communicative competence.

An EEE faculty member has been offering this course for the last five years. The instructor follows the technical writing coursebook by Beer and McMurrey (2009). The learning outcomes (LO) of the engineering English course as stated in the syllabus can be listed as: writing a solution proposal with supporting details, writing a report following corporate guidelines, organizing a project report, composing a short analysis of a trend in engineering and writing a cover letter addressing specific information mentioned in a job posting.

The participants of the study were EEE third (n=28) and fourth year students (n=6) and EEE instructors (n=5). The participants were selected through convenience sampling.

Table 1.
Personal information of students

Gender	Age	L2 experience	IELP	Perceived L2 Proficiency
12 F 16 M	20-26 yrs old	9-16yrs	25 sts	12[CEFR B2] 6[CEFR B1] 6[CEFR A2] 4[CEFR A1]

Table 1 illustrates the profiles of the undergraduate engineering students enrolled in the Engineering English course. Twelve of these students are female, 16 of them are male. They are between 20 and 26 years old. They have been learning English, as the first foreign language offered in Turkey, for minimum 9 years. Their foreign language instruction started mostly at the primary education level, fourth grade, with some exceptions of earlier exposure. Twenty-five students took the intensive English language program (IELP) in the same university for a year. IELP aims to prepare students to pursue their studies in English. In our research context, the exit level of proficiency for IELP is set as B1+ CEFR. Perceived English language proficiency levels of the participants vary to a great extent as seen in the Table even if they successfully finished IELP. Finally, the students perceive their receptive skills (reading-listening) as strong and their productive skills (writing-speaking) as weak.

3.2. Data collection and analysis

This study uses an NA model by Serafini, Lake and Long (2015) that proposes a set of methodological guidelines. The five-step procedure of the model is followed in the current study is below:

Table 2.
NA Design (Serafini et al. 2015)

Steps	Procedure
Step 0	Identifying problems
Step 1	Conducting semi-structured interviews with a sample of domain experts and in-service learners
Step 2	Generalizing interview findings to target population
Step 3	Gathering and analysing follow-up data using additional instruments and procedures
Step 4	Triangulating findings by sources and methods to identify present situation and target situation

To start with (Step 0), the course instructor asked for assistance to increase classroom interaction, and motivation. In order to do so, the course syllabus needed to be analysed, revised and updated.

Henceforth, it was expected that within the grounded theory frame (Glaser & Strauss, 1967), the data gathered would guide in ascertaining program requirements and practices. An unstructured interview was conducted with the instructor. It contributed in setting the ground for identifying and contextualising the problem. Building on the collected raw data, questions for interviews were prepared.

In Step 1, semi-structured instructor interviews and a focus-group student interview were conducted following an interview protocol. The instructor questions were piloted with a volunteer faculty member; thereby, a few questions were added and two of them were modified. The recorded interviews were transcribed; the text was then studied, and reduced. Data analysis model by Creswell (2009, p. 185) was adopted. The data were transcribed, read in detail, coded and then, emerging themes were identifies. Consequently interpretations were made based on the emerging themes. For reliability purposes, the codes for each item were cross-checked; and, validity concerns were met with interview triangulation.

In Step 2, in efforts to generalise the data, 'ideographic discipline' for interpretative research was considered (Williams, 2002). It helped to confirm the engineering program context. Additionally, member-checking procedure was performed with the course instructor interview (p. 191). As suggested in the constructionist approach to qualitative interviews, the data were co-construct in the form of 'analytic focus' (Roulston, 2011, p. 81). As a result, an exchange among the language instructor, engineering faculty and students was enabled. Hence, the qualitative method included open to closed data collection procedure and accumulated data were then triangulated. To generalize the interview outcomes, non-participant observations were conducted by using a checklist. Regular observations made it possible to validate data gathered through other sources and methods (Davis, 1992).

In step 3, follow-up data collection, survey administration (LSS, Course Material Evaluation Form) and assignment analysis, was performed. Learning Style Survey (LSS) (Cohen, Oxford & Chi, 2002), a five-point-Likert scale in the self-report format, has 11 dimensions and 23 subscales. The Course Material Evaluation Form has three dimensions: material attractiveness, content and ease of use followed by student suggestions for course materials and ways of integrating technology. An iterative and inductive data analysis approach to the assignments produced a list of writing problems.

In Step 4, the concurrent triangulation design (Creswell, 2009) was employed comparing the data from various sources. By triangulating methods and sources, we could identify necessities, lacks and wants (Hutchinson & Waters, 1987) that reflect the difference between the source and target situation. As we realise the inherent researcher bias in interviews, observation and survey as a limitation (Roulston, 2011; Talmy & Richards, 2011) and inclusion of subjective needs in the present situation analysis, we adopted the distinctiveness approach to contextual need identification.

4. Findings

Findings from the needs analysis identify the necessities, lacks and wants of Engineering English course and its students. They are illustrated with references to the source of data in the following Table.

Table 3.
Identified necessities, lacks and wants

Lacks	Necessities	Wants
ESP and/or CLIL integration (TI, O, AA)	Writing syllabus revision (TI, O, LSS)	Building communicative competence (TI, O, LSS)
Student motivation (O, TI, SI)	Task-based syllabus (TI, SI, O, LSS)	Higher levels of English proficiency (TI, SI, O, CME)
	Teacher training on ESP and writing	

Teacher motivation (TI, O) Technology integration (SI, O, CME) Instructor collaboration (TI, O)	(TI, O, CME, AA) Technology integration (LSS, SI, CE) Consistent English use (O, SI)	Authentic written genres (SI, CME, LSS) Metacognitive engagement in the writing process (AA) Peer writing (CME, O)

Note. O= Observation, SI= Student Interview, TI= Teacher Interview, AA= Assignment Analysis, LSS= Learning Style Survey, CME= Course Material Evaluation Form.

Table 3 reveals that students are not motivated enough to write. It is clearly seen that instructors need training about how to merge content and language, how to improve the communicative competences of their students in a second language and they need to collaborate with language instructors. The needs analysis shows that the course lacks technology integration. Students see technology as a medium to access authentic materials. A syllabus revision considering the demands of the professional work life and the needs of students seems to improve the overall proficiency and productivity of students in their further communications.

4.1. Interviews

To fully understand the views of students, a focus-group interview was conducted with senior engineering students (n=6) who were enrolled in the Engineering English writing course the previous year. Their evaluation concentrated on course materials, teachers' instructional approach and language use. They considered English medium instruction as advantageous for themselves both during and after the program because of the role of English in the global market. They reported terminology of the written engineering genres as the biggest challenge in comprehending the course content and textbook. Moreover, students demanded various modes of instruction with a more interactive and active teaching approach where technology and practice-oriented activities are embedded.

Five instructors were interviewed about English medium instruction (EMI) departmental policy, students' EMI attitudes and their proficiency levels; plus, instructors' perceptions on the Engineering English course. The majority of instructors objected to instructing courses in English pointing out the loss in content and the inadequate proficiency levels of students as well as instructors as negative sides. Some instructors saw it as a top-down imposition that took place without necessary and adequate preparation and planning. EEE faculty varied in their preferred medium of instruction; for instance, one instructor stated that he did not even read or grade the exam answers written in Turkish; another expressed indifference to the language (Turkish or English) of the written responses.

4.2. Classroom Observation

The researchers situated themselves in a non-participant position and observed the naturally occurring interaction in EEE classrooms for six weeks of a ten-week-long course (excluding the official holidays and exam weeks). It is observed that a mainly single mode of direct instruction; that is, the instructor lectured without providing many opportunities for classroom interaction. The content delivery was followed by in class peer-writing task of genre-specific texts. Students lacked the motivation to interact in English, which in turn demotivated the instructor as well; the tipping point was when the instructor stopped interacting in English after the fifth week asserting that 'In response to students' lack of motivation, I want to make the classroom environment more interactive and lively in Turkish.' After the

fifth week, students were taught in Turkish how to write as an engineer in English. Pre and post-sessional meetings with the instructor revealed the instructors' dissatisfaction with students' interest, motivation, and engagement in the course.

4.3. Learning styles of engineering students

Learning Style Survey (LSS) (Cohen, Oxford & Chi, 2002) was administered to 23 students on the second week of observation. The data were analyzed by comparing the means for each dimension taking the standard deviation into consideration. Those with meaningful differences in their means demonstrate engineering students' dominant learning styles. In Table 4, the means of each dimension are compared and those with the biggest differences are chosen.

Table 4.
Learning styles

Learning Styles	**Means**	**St. Deviations**
Visual>Auditory>Tactile-Kinesthetic	28.26>23.35>22.83*	4.126>2.994<4.526
Introverted>Extraverted	15.09>14.83*	2.295>2.037
Concrete-Sequential>Random-Intuitive	16.57>16.13	2.777>2.528
Closure-Oriented> Open	11.22>9.35*	1.476<1.945
Particular> Global	13.57>13.09	2.212<2.729
Synthesizing> Analytic	13.30>12.87	2.098>2.007
Sharpener>Leveler	8.52>8.04	2.274>1.114
Deductive> Inductive	8.48>7.83*	1.806>1.466
Field-Independent> Field-Dependent	8.09>7.35*	1.345>1.945
Reflective >Impulsive	8.13>8.00	1.546>1.477
Metaphoric> Literal	5.04>5.00	1.718>1.508

Aiming to help students to self-discover their learning style preferences, LSS functioned as a reflective tool that depicted the dominant styles. Table 4 illustrates that EEE program engineering students are mostly visual, introverted, closure-oriented, deductive and field-independent. These dominant learning styles seem to match with those proposed by Felder and Silverman (1988) as the learning styles of engineering students. Their survey ascertains that engineering students are labelled as sensors in perceiving information. They process information actively through visual channels and organize it in an inductive way.

4.4. Course Assignment Analysis

The Engineering English course requirements for 2015 Fall semester were four assignments (40%) and a final exam (60%). Students collaborated on three in-class writing tasks and submitted a take-home assignment on the following genres: (1) a paragraph about the problems of engineers in written

communication, (2) a business letter to the Dean of the Faculty about the departmental problems, (3) a recommendation report on how to improve the departmental problems, and (4) textbook summary.

The coursebook (Beer & McMurrey, 2009) incorporates a variety of written genres in each chapter, followed by exercises for practice. In-class task performance included four stages just as the organization of the coursebook: The instructor presented each assignment in the first hour and showed an example from the book, students were expected to write their paper in the second hour. In the following week, each pair self-corrected and graded their paper. The course outline corresponds to competences and domains proposed by McMahon and Escribana (2008) such as the overall written production domains of reports and essays; instructions, description of mechanisms and processes; applications (CVs, cover letters, forms etc.); abstracts and research papers. The overall written interaction domains are listed as correspondence (letters and e-mails), and notes and messages.

4.5. Course Material Evaluation

At the end of the semester, students were given the Course Material Evaluation Form. Data about the materials were also collected through student and instructor interviews. In brief, the students perceive the book (Beer & McMurrey, 2009) difficult, boring, tiring, long and detailed, without sufficient visuals and examples. They want to be engaged in project-based learning. The students list the information-load and the advance level English as negative points and wish a simplified version of the course material to minimize rote learning.

Students' suggestions on course improvement include e-exercises, e-textbooks, multimedia use such as videos and continuous online/video interaction with the stakeholders. To exemplify, they want to practice error correction activities by posting their erroneous sentences to the micro/blogging websites and receive feedback from their peers. Social media sites are mentioned for material exchange opportunities. Moreover, students favour authentic materials and supplementary texts such as articles, project documents, and audio-visual materials. They prefer to have course materials both in English and Turkish. Lastly, students express their preference of mobile apps for practicing vocabulary (eg. dictionary aps) and writing skills (eg. informal writing).

5. Discussion

Engineers are expected to be at the CEFR C1 proficiency level (Pierce-McMahon & Duran Escribana, 2008, p. 64). Layered literacies and genre approach to writing are believed to enhance students' strengths and motivation in writing that will influence their proficiency. For instance, writing periodic/progress reports (Kaewpet, 2009), emails, minutes of meetings and daily/weekly reports (Spence & Liu, 2013) not only apply basic literacy but also rhetorical and technological literacies. Embedding tasks (Flowerdew, 1993, p. 309) like metacommunicating (talking about instances of genres), learners doing genre analysis, concordancing, and translation of a given genre might activate the layers of literacies.

Masoud (2017) highlights writing skills for electrical engineering programs because 'students who understand the power of language to shape the workplace turn out to be the most effective, most successful professionals.'(Bushneil, 199, p. 175). Hence, the Engineering English writing course is reviewed to identify the problematic areas and gaps and to equip engineers with better communication and writing competences which are aligned with the qualification and national framework. The findings call for reconsidering technical writing communication instruction with references to the genre approach and layered literacies framework. Essentially, technical writing needs to go beyond following the

guidelines and format, rather students reflectively and critically need to situate themselves as actors and doers for community engagement.

The integrative frame of layered literacies (Cargile Cook, 2002) for technical communication can be applied in the Engineering English. Moving beyond the mechanics and rules for usage, basic literacy can be layered within the course by allowing the student writers to make decisions considering the audience and the writing situations. By reflecting on such decisions, instructors evaluate the writing. Likewise, rhetorical literacy can be performed by working on diverse genres while applying research strategies and providing rational for writing for specific purposes and audience. In our case, collaborative writing activities in class partially represent the social literacy; however, it can be improved by further discussion on the writing situation and process. These discussions might be extended over e-discussions and e-exchanges of feedback. Also, course materials serve to practice these layers. They can equip engineers with the competencies which enable them to identify audience needs, evaluate communication effectiveness, organize information and encourage collaborative work (Darling & Dannels, 2003; Sageev & Romanowski, 2001). Technological literacy is also not fully fulfilled as it only includes practice of information search and limited online communication between peers. The knowledge level of digital literacy can be improved by following students' suggestions on technology integration. Ethical literacy is mostly linked to the technology use, with the rise of issues of plagiarism. Finally, critical literacy approaches issues of power imbalance, awareness on technology use and self-reflection with consideration of the impact one has on others and vice versa.

Communication skills have been frequently revisited with references to the 'ideal', 'global', 'modern' or '21st century' engineer profile. Moreover, recent ABET document (2015) calls for reconsideration of the gap between what competencies employers demand and what competencies engineering graduates supply. Communicative competence for engineers has to be built strongly since an engineer's daily life requires continual communication with other engineers, scientists, system analysts, managers, and workers (Rugarcia et. al., 2000). Good communication skills have been an asset employers seek (Jesiek et al., 2014; McMahon & Escribano, 2008; Riemer, 2002; Vukadinovic et al., 2016).

Recently, Turkish Council of Higher Education (YÖK) started a collaborative initiation and announced a new reform on engineering education. Meanwhile, the National Framework (NQF-HETR) (2015) and MÜDEK (2016) revised engineering competencies by putting an emphasis on oral and written communication skills both in Turkish and in a foreign language. The results of the needs analysis suggest that the learning outcomes of the Engineering English writing course comply with the National Framework's level descriptors for a bachelor degree. These are also in accordance with Vest, Long and Anderson's (1996) recommendations for a technical writing course. By the end of their studies, engineering students are expected to compose a detailed proposal, analyze the engineering field deeply, and work on project documentation. However, not all objectives of the course are fully achieved as is displayed by the needs analysis. Numerous researchers expressed similar concerns regarding the writing courses in engineering education (Hossain, 2013; Kaewpet, 2009; Parker & Marcynuk, 2016).

As the EEE program adopted English medium instruction policy through a top down approach, instructors have a negative stance for two reasons. Their first concern is about the unpreparedness of the program for such a transition. Teacher training on balancing the content and language, and material development are the initial steps for the transition to be successful. Second, they believe students' low proficiency of English, especially poor command of writing and speaking hinder the success in courses taught in English. Similarly, Nunan (2003) investigates the perspectives in Asia-Pacific region towards EMI and concludes that EMI is approached cautiously in the region with similar reasons to the aforementioned. Contrary to what instructors believe, students favor the policy acknowledging the role of English as a lingua franca (Graddol, 2006; Seidlhofer, 2001) in disagreement with the studies Kim, Kweon and Kim (2016) and Kim and Shin (2014) where high student dissatisfaction is reported.

With reference to Dudley-Evans and St. John's (1998) English for Specific Purposes (ESP) framework, the teaching methodology begins with identifying learners' existing knowledge and skills. Therefore, students' proficiency levels in English need to be analyzed in depth. It is seen that EEE students' self-reported English proficiency levels do not match the CEFR exit level B2 or C1 (CEFR, Council of Europe, 2011) recommended by British Council (2015), and also by McMahon and Escribana (2008). Further, McMahon and Escribana (2008) and The Engineering Dean's Council of Turkey (2016) endorse minimum CEFR C1 exit level. The current perceived proficiency level CEFR B1 might be a factor limiting the classroom interaction as stated by Kim, Kweon and Kim (2016) or can make comprehension of course content and learning materials difficult.

Overcoming the difficulties likely to emerge during and after the process can be overseen and long-term precautions can be considered. Strategy training might instruct students on the language learning strategies. Or else, the learning styles of engineering students, and teaching styles and pedagogical approach of the instructors are revisited. Their alignment with reference to the competences and the national framework builds a sound program structure.

Felder and Silverman (1988) identified the dominant learning style of engineering students as visual (Arms et al., 1998; bin Nordin et al., 2013; İctenbas & Eryilmaz, 2011). According to their learning styles index for engineering students, the majority are visual, sensing, inductive, and active where pedagogy tends to be auditory, intuitive, deductive, passive and sequential. Bin Nordin et al. (2013) observed a dominance of converger learning style of 'abstract conceptualization' until the fourth grade in engineering programs and diverger learning style of 'concreteness and reflection' right before their graduation. The mismatch between our findings on learning styles and our classroom observation needs attention of the EEE curriculum writers and instructors. Jarvis (2011) suggests that we should move away from the traditional views of universities where bulks of knowledge are transferred from instructors to students, and encourage teaching approaches where students' engagement is fostered through their learning styles. For a more student-tuned curricula, Rugarcia, Felder, Woods and Stice (2000) point out the role of 'conscious effort from those who design the curriculum' (p. 23) and the need for a shift from teaching engineering knowledge to teaching engineering skills.

The needs analysis on Engineering English (Kaewpet, 2009; Skinner & Mort, 2009; Spence & Liu, 2013) highlights the necessity of improving the writing courses to better the communicative competence. As Salehi (2010) reports in the needs analysis of engineering students in Iran, students perceive their writing skills as the weakest communication skill. To strengthen writing skills, real life tasks with different genres can be used (Nelson, 2000; Walker, 1999). Collaborative writing and peer review can be exercised (Henderson & De Silva, 2006; Nelson, 2000; Wheeler & McDonald, 2000) considering the complexity and multidisciplinary nature of engineering projects (Ullman, 2009). For instructors, Smith (2003) remarks the specific characteristics of engineering writing and advises regular teacher training and workshops. Kim, Olson, Wandro, Sundararajan, and Adesope (2017) held a four- day workshop to train instructors on teaching and evaluating engineering writing, in which they report promising results of success and positive feedback from the participants.

6. Results

As a solution to meet the foreign language and communication needs in English Medium of Instruction (EMI) programs, Content and Language Integrated Learning (CLIL) approach is suggested that balances content and language while instructing a content course with/through a foreign language (Marsh, 2012). Adopting this approach extends the attention paid to communication in a second language in EMI settings. Content delivery in a second language embraces the language features as well as the subject matter. The programs might benefit from the CLIL dimensions of scaffolding, tolerance to mother

tongue use, authentic material selection and having language learning among the course learning outcomes.

A new Engineering English course syllabus following a genre-based approach with authentic and communicative tasks in line with the National Framework is suggested as another way to meet the identified needs. Further study with multiple stakeholders like the engineers on the job and recent graduates might bridge the undergraduate engineering education to the workplace settings (de Graaff, 2016). Such a link helps students see the competences in action; realize its importance and role. Needs analysis as a part of syllabus design needs further attention in the engineering classrooms especially when the program is in the process of making major changes.

Funding: This work was supported by TED University Scientific Research Project under Grant [BAP 15A101].

Acknowledgements: The authors would like to thank TED University for the research grant. We also owe thanks to Dr. Aykut Kalaycıoğlu for his cooperation and contribution.

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