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From the Editors

English language needs of Iranian students of civil engineering: Are the courses aligned with workplace needs?

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ABSTRACT

Although Iranian universities offer English for specific purposes (ESP) courses extensively, there are plenty of challenges in the process of teaching the courses. Drawing on multiple methods, this study explored what 5 civil-engineering ESP instructors, 5 company engineers, and 10 students expected to be included in their language courses suitable for workplace-specific requirements. It used multiple sources of data, including semi-structured interviews, classroom observations, field notes, and focus group discussions. Analysis of data showed that in addition to proficiency in general English, civil engineers need to discuss technical issues, attend conferences and seminars, read or write specific genres, and communicate orally, all of which require knowledge of both general and technical English. However, university programs are not specifically designed according to students' specialized needs. This study contributes to the importance of needs-based curriculum development pertinent to engineering English challenges and highlights the significance of tailor-made language instruction. Furthermore, ESP educators, policy makers, course planners, and other stakeholders can take advantage of needs-based resources to help engineering students solve problems pertinent to their specialization.

1. Introduction

The prevalence of English as a global means of inter-community and professional communication has created a significant demand for developing workplace-specific courses (Marra, 2013). In particular, English is the primary lingua franca in engineering workplace sectors (Hodges & Seawright, 2023; Kankaanranta & Lu, 2013). Therefore, understanding the role and practice of English among engineers is essential, as company policies welcome using English as the official language for work efficiency (Fredriksson, Barner-Rasmussen, & Piekkari, 2006; Heikkilä & Smale, 2011). These policies and global occupational demands have meant to take engineers' English language needs into account to help them reach their desired language level. Although English for specific purposes (ESP) courses in Iran are included in university curricula to provide engineer-specific language skills, some university graduates still face language-specific challenges at work that may not know how to deal with. In other words, some course outcomes fail to prepare students to perform specific English-related tasks outside the class (Aliakbari & Boghayeri, 2014). There is clearly a need to diagnose the problem in response to the lack of English skills required by civil engineers.

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It appears that part of the issue pertains to textbooks, inefficient instructional contents (Atai & Nazari, 2011), and flawed teaching methods (Mazdayasna & Tahririan, 2008). In Iran, the center for instructional material development has published discipline-specific textbooks covering various sub-disciplines. However, the textbooks "were inadequate, ineffective, and in some cases with obvious typographical and content-related errors below the dignity of university education" (Farhady, 2005, p. 5). This could be due to the massive publication and large number of copies sold each year with no systematic evaluation of the textbooks. Another point pertains to inefficient instructional content which is raised as a factor that contributes to ineffective teaching. Despite the importance of ESP courses in the university curriculum in terms of educational and academic staff investment, surprisingly few curriculum developers do systematic needs analysis to provide suitable instructional content (Atai, 2002). This is in contrast to ESP course design processes, which undergo several stages: needs analysis, materials selection, teaching methodology, assessment, and evaluation of the related course (Flowerdew, 2013). It is worth mentioning that the stages do not proceed linearly; instead they are interdependent activities in a cyclical process (Dudley-Evans & St John, 1998). The other issue pertains to ESP teaching methods that most often have been criticized for their lack of attention to newly required skills at the expense of focusing on reading skill promotion (Farhady, Hezaveh, & Hedayati, 2010; Soodmand Afshar & Movassagh, 2016; Vosoughi, Davoudi Sharifabad, & Raftari, 2013). In particular, ESP courses for civil engineering students at Iranian universities mainly focus on reading comprehension and vocabulary teaching. Although it is essential to enhance engineers' reading skill, engineering students demand skills other than reading to become expert members of their professional communities. Therefore, university graduates should have more precise English language skills that are essential for job positions.

This study intends to contribute to research on needs analysis by investigating the English language demands of engineering workplace. It is certainly necessary to provide a detailed profile of professional language needs of the engineering field. The findings can contribute to the incorporation of some crucial materials into the curricula. Furthermore, the results can bridge the gap between what is currently taught in courses and what is expected from students to perform in their future jobs. This study aims to pave the way for new directions and improvements related to needs analysis in ESP in Iran. Additionally, the ideas can be adapted for other contexts to save resources associated with conducting new studies.

2. Needs analysis

Needs analysis (NA) refers to "the techniques for collecting and assessing information relevant to course design: it is the means of establishing the *how* and *what* of a course" (Hyland, 2006, p.73). Previous studies have acknowledged the importance of conducting a needs analysis to identify academic and workplace needs (Chan, 2019; Spence & Liu, 2013). As for the meaning of the term needs, Hyland (2006) further explains that needs is an umbrella term that constitutes several aspects, including learners' aims and backgrounds, their teaching and learning preferences, and the conditions they must communicate in, which can be gathered and analyzed in different ways. An efficient needs analysis can generate an effective course design aimed to provide students with what they need to learn (Serafini, Lake, & Long, 2015).

In the early days of needs analysis, data collection approaches relied heavily on teachers' intuitions, instead of quantitative and qualitative research methods (West, 1994). Later, in the 1970s, ESP literature saw the formal entry of needs analysis, which was based on target situation analysis (TSA) with its focus on learners' 'needs' in target situations. TSA focused on what learners are required to do with the foreign or second language in the target situation. Later, the development of present situation analysis (PSA) emphasized learners' 'lacks' and 'wants' in their current situation (Hutchinson & Waters, 1987). Present situation analysis draws attention to the gap between what students can do with language at the beginning of the course and what they need to do at the end of the course which is referred to as their 'lacks'. While 'lacks' consider target needs in an objective sense, 'wants' consider needs in a subjective sense, with the actual learners playing an active role concerning what their needs are. As Richterich (1984, p. 29) put it: "… A need does not exist independent of a person. It is people who build the images of their needs based on data relating to themselves and their environment." It is quite probable that learners' perceptions oppose with views of other interested parties: instructors, course designers, and sponsors. However, learner-perceived wants cannot be overlooked as they can affect learner motivation (Mead, 1980).

To put it in a nutshell, TSA focused on the requirements of the target situation, while PSA addressed the present context in terms of learners' experiences, their personal information, and the teaching environment. TSA presents what the learner has to know to function successfully in the target situation. For example, a nurse may need to communicate with foreign patients to collect reliable information and inform patients of a diagnosis. PSA aims to gather information about the students' level at the beginning of their language course, investigating their strengths and weaknesses. Robinson (1991, p. 9) comments, "one is likely to seek and find information relating to TSA and PSA simultaneously. Thus, needs analysis may be seen as a combination of both."

Following a radical departure from this period, different approaches to needs analysis emerged. These included a functional orientation (Long, 2005), genre-analytic perspective of target community discourse analysis, socio-rhetorical genre-analytic perspective, and ethnographic approaches. The functional orientation utilized structural syllabi that embodied lexical and grammatical structures. Genre-analytic perspective approached needs in terms of genres in target communities. Ethnographically oriented needs analysis emphasized insiders' perspective, thick description, and multiple sources of data collection (Hyland, 2006). Despite being enlightening, all approaches have been criticized on several grounds. For example, Long (2005) indicated that notional-functional syllabi were based on intuitions of teachers provided as itemized lists resulted in synthetic syllabi. Thereupon, Long (2005) identified task-based needs analysis that used tasks rather than linguistic items

as the unit of analysis. The task-based analysis led to the formulation of analytic syllabi through non-linguistic units of analysis, reflecting more dynamic rather than static qualities of target situation discourse (see Johnson, 2009).

Regarding data collection methods, inductive and deductive procedures are employed (Berwick, 1989). Inductively-oriented methods constitute participant and non-participant observation, expert intuitions, and unstructured interviews, while deductively-oriented methods include questionnaires, structured interviews, and less frequently, criterion-referenced performance tests (Long, 2005). As for data sources, Long (2005) mentions various categorized sources of information including insiders and outsiders. Insiders are domain experts with expertise in a specific professional area, namely employees, employers, professionals, and graduate or in-service students. On the other hand, outsiders are non-experts in a particular profession with knowledge of the second language. They include applied linguists, language instructors, and pre-experience EFL/ESL learners. Researchers (Holliday, 1995; Hyland, 2006; Cohen, Manion, & Morrison, 2007) emphasize triangulation of methods and sources or using several sources of information and multiple methods of data collection to increase validity and reliability. In other words, if common data is elicited from different sources, the likelihood of getting comprehensive and precise information increases. Moreover, Hyland (2006) highlighted three crucial factors, namely triangulation, prolonged engagement, and participant verification to achieve validity and reliability in NA studies. As noted by Hyland, triangulation involves the use of multiple data sources, methods, and investigators. Prolonged engagement constitutes the use of persistent observation and enough data collection in the long run. As pointed out by Lincoln and Guba (1985), prolonged engagement is considered crucial in qualitative research in supporting credibility. Participant verification involves the discussion around the analysis with participants and its 'reality' confirmed by them (Hyland, 2006).

It is important to note here that needs analysis has been suggested to be done on several occasions: before, at the beginning, and during an ESP course (West, 1994). The first approach involves analysis prior to the course so that the course designer has enough time to create a syllabus and develop appropriate teaching materials. The second approach also called on-line or first-day needs analysis, is conducted when the instructors arrive to start their course. Although an instructor or a course designer has little time to create a comprehensive course outline, a researcher has the chance to obtain relevant and accurate information. The third approach is considered as a response to the limitations of the second approach. The shortcomings of the second approach are addressed by the third, which takes into account the fact that learners' needs—or, at the very least, their perceptions of them—will evolve as the course progresses (Richterich & Chancerel, 1977). Nunan (1988) highlights the vital role of re-analysis of needs during the course, because learners may find it easier to identify their needs in the middle rather than at the beginning of a course. Similarly, as the course progresses, the instructors' perceptions of the students' needs and potential solutions may change (Henderson & Skehan, 1980). Researchers often characterize the process of needs analysis as ongoing and end-less (Brown, 1995), and as flexible and regular (Richards, 2001).

2.1. Research on language needs of professionals and engineers

Several studies carried out ESP-oriented NA, focusing on language-specific aspects of workplace needs (Atai & Shoja, 2011; Chan, 2019; Conrad, 2017; Conrad, Pfeiffer, & Lamb, 2018; Evans, 2010; Spence & Liu, 2013). It is difficult to conduct these studies since many companies restrict access to workplace to reduce the risk of data leaks and to keep their business more secure. Despite restricted access to workplace settings, some studies investigated the language needs of engineers to resolve the demands of workplace communities. For example, Conrad et al. (2018) investigated civil engineering student writing to address the problem of inconsistency between the writing skills of program graduates and the demands of writing in the workplace. The study involved the integration of new teaching materials into the existing courses to measure improvements in student report writing. Findings revealed a positive effect of new materials on some aspects of student writing such as improvement on sentence structure and precise word use. In another study, Conrad (2017) identified differences between characteristics of civil engineering students' writing and practitioners' writing in the workplace. The findings showed that unlike practitioner writing, student writing exhibited complicated sentence structures, more grammatical and punctuation errors, less accurate word choice, weak language skills. This indicates that students need to be taught a wide variety of characteristics of practitioner writing and faculties need to be responsible for delivering appropriate civil engineering courses. NA studies of other fields also highlighted the importance of the English language for specialized groups of students. For instance, Arias-Contreras and Moore (2022) considered it as a tool to improve career opportunities that could give them advantages of working abroad.

Wolfe (2006), conducted a study with three experienced engineers working in international companies. The study found that writing minutes were significant for engineers to fulfill their commitment to their work. Findings also revealed that, despite the frequent practice and benefits of composing minutes, most professional and technical writing textbooks gave poor attention to meeting minutes. In another study, Wolfe (2009) analyzed 12 technical communication textbooks to evaluate how well they equip engineering students to handle rhetorical situations and negotiate engineering documents. The findings revealed that most popular textbooks focus on rhetorical situations that are appropriate for someone with an occupation of *technical writer* rather than one of *engineer*. In another study, Luzon (2009) conducted a corpus-based study made up of writing assignments by undergraduate EFL engineering students to explore how they use first-person plural pronouns in report writings. The findings revealed that students were unaware of the conventionalized use of phraseological patterns including 'we' to perform various functions in academic writing. The study provided important insights into the importance of incorporating consciousness-raising tasks.

Some studies (Ford, 2004; Paretti, 2006) focused on the shortcomings of technical communication courses for engineering students. They criticized the courses based on the fact that graduates learned format issues such as page numbers rather than higher-order rhetorical concerns such as audience. As pointed out by Paretti (2006), communication assignments in disciplinary courses equip students with the content and format without any focus on higher-level analytical skills required to fulfill specific tasks. Therefore, Paretti (2006) designed a study to address the issue of work adaptation in transition from education into employment. The study presented principles for using problem-based learning for engineering education and focused on student awareness assignments to help them in the adaptation process. Paretti's (2006) model of teaching helped students to develop critical analysis skills essential for the success of professional practice at work.

Spence and Liu (2013) conducted a needs analysis at a manufacturing company in Taiwan in response to the lack of sufficient English skills needed by engineers. Findings showed that emails, reports, and memos constituted highly frequent writing and reading events. Additionally, meetings, teleconferences, and presentations included common oral events. Moreover, the results implied that engineering courses should encompass genre-specific writing activities (i.e., email vs. reports vs. memos) to improve students' awareness of different writing styles. Furthermore, they emphasized the inclusion of authentic training activities for computer mediated communication (i.e., telephony and teleconference) and presentation skills. Here, it is pertinent to note that genre contains recurrent formal patterns that can be identified by a specific group of people who use it (Hymes, 1974). Scholars have worked to create and investigate genre-based pedagogy for EAP writing classrooms over the last few decades (e.g., Hyon, 2018). Researchers have recommended to develop a broad understanding of what genres are and how they function, which is known as genre awareness (Tardy, Sommer-Farias, & Gevers, 2020). Despite a well-established theoretical potential for genre awareness, language teachers face difficulties when they put teaching and assessment strategies into practice in the classroom (Tardy et al., 2022).

In Iran, previous studies showed that ESP courses focus on developing technical vocabularies and reading skills as the set objectives (Jafari Pazoki & Alemi, 2019). Moreover, previous investigations (Atai & Shoja, 2011; Soodmand Afshar & Movassagh, 2016) on ESP program shortcomings reported students' low motivation, the use of teacher-centered methods, and inappropriate instructional materials as significant problems in ESP training programs. Additionally, researchers (Mazdayasna & Tahririan, 2008; Atai, 2000) reported a low level of general English language proficiency in ESP courses and a need to improve it. For instance, Mazdayasna and Tahririan (2008) investigated the English language needs of undergraduate medical students studying in nursing faculties. The findings revealed that students felt the need to master English language before their attendance to ESP courses. Similarly, ESP instructors expressed that students moderately need to develop general English language proficiency prior to ESP course attendance.

This study explores civil engineering workplace English language needs to glean a rich understanding of academic and professional contexts that provide implications for ESP curriculum developers, policy makers, and ESP instructors. The current study, then, intends to shed more light on specific English requirements of civil engineering students. The present article addresses the following research questions:

1. What problems affect the success of current civil engineering ESP courses?
2. In terms of workplace-specific English skills, what are the main difficulties experienced by Iranian civil engineers?
3. How might the ESP courses best go about addressing students' language needs to ameliorate the identified problems?
4. What are the civil engineers' perceptions of the engineering English language needs?

3. The study

3.1. Methodology and procedures

In this study, the researcher adopted a qualitative approach to explore the authentic English language needs of civil engineers by analyzing university ESP instructors, company engineers, and civil engineering students' perceptions of what was incumbent on them to perform in English within job-specific contexts. Drawing on recommendations from the pioneers of needs analysis, (Hoadley-Maidment, 1983; West, 1994), the methodological design of this study employed three principal parties as informants of language needs which has come to be called the needs analysis triangle. Although, as Jones (1991) notes, each party may also impose constraints, the three can ideally interact cooperatively (Figure 1).

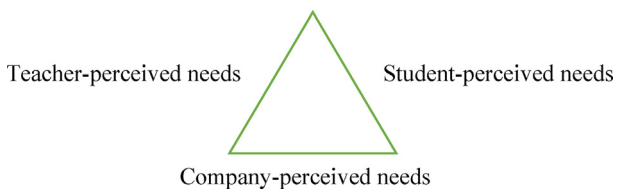

Figure 1. Needs analysis triangle (Adopted from West, 1994, P.6).

It is now widely accepted that an essential component of course and program evaluation is the views and beliefs of students about ESP in higher education (Kazar & Mede, 2015; Lu, 2018; Trinder, 2013; Wang, 2017). Thus, to accurately identify the English language requirements of civil engineers within their job context; the current study explored students' beliefs along with stakeholders in the process of needs analysis. The procedure involved ESP course observations at the university. In addition, one-to-one interviews were conducted with all three study groups to add further sources to the needs analysis. Furthermore, the researcher incorporated a focus group discussion after analyzing the interview data due to finding some mismatches between what the interviewees from the three groups said. Thus, the researcher followed up to get more clarity on focus group discussions through supplementary questions. In other words, focus group discussions were held as a further means of verifying reported information through triangulation.

3.1.1. The company and the university

This study was conducted in a large private construction company that provided engineering and construction services to civil projects in the planning, management, and implementation process. The researcher employed the company due to their willingness to participate in the research process. Additionally, graduates of the university's ESP program had good chances of working in such companies. Furthermore, it was a typical company that shared similar tasks with comparable civil engineering companies in the country. The company's participants were all engineers who often completed some tasks in English. The interview questions focused on the civil engineers' English-speaking goals and tasks and not on other aspects of the company.

The second context of this study was an Iranian engineering university. The ESP course in the university was a typical English course held for civil engineering students in Iran and was the only one the university offered. It had a set curriculum that instructors must follow and a textbook that should be used. At the beginning of the course, the university provided the instructors with two to three selected textbooks from the published textbooks. According to the university, English for specific purposes has been planned as a compulsory course for all majors including civil engineering, computer engineering, mechanical engineering, electrical engineering, industrial engineering, agricultural engineering, and architectural engineering. Although the courses were held separately for each major, the textbooks were not specifically tailored for each of the majors listed above.

3.1.2. Participants

A purposive sampling strategy was employed to access three different groups of informants who were major beneficiaries of ESP courses: a total of 20 participants including ESP instructors, company employees, and students. All participants were informed of the details of the research project, and anonymity and confidentiality were assured. Moreover, informed consent was obtained at the beginning of the study. The researcher assured participants' video-recorded data would be deleted after the research procedure. In this study, pseudonyms were used for all participants.

One group consisted of five instructors who were native speakers of Azeri and Persian and were formal employees at the same university. Of these, three were female and two were male. Table 1 details the specific information related to their professional experience. As for their academic backgrounds, three of them held Ph.D.'s in English language teaching; the other two were doctoral candidates in the same field. This is the typical training level for University instructors in Iran. The instructors had teaching experience across various universities, either as discipline-specific or English teaching specialists. Although the instructors had the experience of teaching in different fields of engineering, they have been teaching solely for civil engineering students for 3 years. Despite slight differences among the participating instructors regarding their teaching experience, given their shared academic context and educational background, they were treated as one group. Thus, 5 ESP instructors with an average teaching experience of 5–9 years were selected from the same university.

Table 1
Demographic information of instructors.

Participants	Teaching experience	Age	Degree	Expertise
Rezayi	8 years	40	Ph.D.	Discipline-specific
Chavoshi	9 years	37	Ph.D.	Discipline-specific
Javadi	5 years	36	Ph.D.	Discipline-specific
Eskandari	5 years	29	Doctoral candidate	English teaching specialists
Babazade	6 years	28	Doctoral candidate	English teaching specialists

The second group consisted of the chairmen and managers of the company who often had to complete English tasks (see Table 2). Therefore, they have been selected based on their use of English. This group consisted of five civil engineers exclusively who were graduates of the same university and passed ESP courses during their BAs.

Table 2
Demographic information of engineers from the company.

Participants	Job position	Age	Working experience
Ali	Chairman of the board	42	15 years
Rasoul	Vice chairman of the board	38	10 years
Mohsen	Member of the board of directors	36	12 years
Peyman	Construction manager	29	4 years
Kamran	Engineering manager	28	5 years

The third group was an ESP classroom consisting of 23 students at an Iranian university who were required to take intensive technical English courses in their second year of study (see Table 3). The entire enrollment for the course was 50 but for class quality purposes they were grouped into two different classes. Our research group included 23 civil engineering participants who were present during the ESP course and were observed by the researcher. Their ages ranged from 20 to 22. Out of 23 students, 10 agreed to participate in the interview.

Table 3
Demographic information of the student participants.

Variables	Category	N
Age	20	9
	21	6
	22	8
Gender	Male	12
	Female	11
Major	Civil engineering	23
Year at university	Year 2	23
L1 Background	Azeri	15
	Persian	8
English language proficiency	heterogeneous	23

Note: heterogeneity refers to a feature of language classes where learner differences exist in terms of variables like levels, age, educational background, sex, motivation (Richards & Rodgers, 2003).

Table 4 presents demographic information of the interviewed student participants. The interviewed students have the opportunity for language learning outside the classroom through various activities. Table 4 displays these activities and the time spent by the students on them.

Table 4
Demographic information of student interviewees.

Pseudonym	Age	Educational level	Gender	Out of class English practice	Out of class English Exposure
Shiva	20	undergraduate	female	3 h	TV, Social media
Mina	21	undergraduate	female	4 h	Institution
Nasim	20	undergraduate	female	1 h	games
Darya	22	undergraduate	female	6 h	Institution
Shadi	22	undergraduate	female	6 h	Institution
Reza	20	undergraduate	male	3 h	books
Abbas	21	undergraduate	male	2 h	books
Amir	21	undergraduate	male	2 h	music
Sina	22	undergraduate	male	none	–
Mehrshad	21	undergraduate	male	1 h	games

3.1.3. Instruments

Based on previously mentioned recommendations from the literature, particularly Hyland (2006), the present study employed multiple methods of data collection to increase the validity of the research. The data were collected through classroom observations, in-depth semi-structured interviews, focus group discussions, and field notes. To begin with, non-participant observations (Mackey and Gass, 2005) were conducted at the university to capture proper perspectives on contextual features and class activities. To employ prolonged engagement, the researcher was present during 18 h of the ESP course instruction and took field notes about course features for 12 sessions. Classroom observations were audio and video recorded and transcribed by the researcher. In order to carry out a more systematic observation, the researcher adapted an observation checklist from Basturkmen's (1998) protocol. The main components of the observation protocol were background information, the significance of English workplace-specific skills, self-assessment of English abilities, and evaluation of English instruction at the university. The classroom observation protocol was designed to identify task types that undergraduate civil engineering students perform while enrolled in the ESP course at the university. In order to overcome some of the

limitations of classroom observation such as observer's paradox, the observer began attending the class a few sessions before conducting the research to make the participants more accustomed to her presence. Furthermore, the observer sat in the back and off to the side of the classroom to be minimally intrusive. Another important consideration was to obtain the permission from the instructor in advance. This was not only a professional courtesy, but it would also assist the instructor in minimizing any potential impact of the observation. The researcher debriefed the instructors about the research objectives, and the instructor introduced the researcher into the classroom and informed them about the study goals as much as necessary.

Next, semi-structured interviews were conducted to supplement the data collected from classroom observations. Based on the researcher's prior knowledge from the observed ESP course, interview questions were divided into three parts for each group of participants through a pilot study. Pilot samples provided the necessary information to modify and reduce the number of questions. Overall, the instructors' and students' part consisted of eleven to fourteen questions that scrutinized their perceptions of ESP program requirements. Similarly, the company employees' interview questions were utilized to ask about their English language needs in the engineering workplace. The prompt questions were already tested by two experts of the field to ensure content validity. Altogether, one-to-one in-depth interviews were conducted and video recorded with 20 participants in Persian. Each interview was scheduled for half an hour in a private room at the company and the university. Finally, the interviews were transcribed and all the transcriptions were double-checked against video recordings by an expert to ensure accuracy. Samples of interview questions are included in appendix A.

Finally, in order to access participants' shared views (Denscombe, 2017) on the requirements of ESP courses and employ participant verification, focus group discussions were held with all three groups and were audio-taped. The study conducted two focus group discussions which composed of mixed participants from the three groups amounting to 10 members in each one. To dive deeper into the topics, the insights from the first discussion were considered in the second discussion. The researcher acted as the facilitator to promote communication and keep the discussion as specific as possible (Mackey & Gass, 2005). The stimulus for the discussion included numerous questions on the tasks' components (e.g. task objectives, settings), procedures of the ESP course, and participants' perceptions on ESP course requirements. For instance, the members of the discussion group compared the tasks designed by teachers in the classroom with the tasks that engineers should perform in the workplace.

3.1.4. Data analysis

The three data sets including class observation data, semi-structured interviews, and focus group discussions were transcribed to identify patterns in the data. The analysis included a selection of the subtext, definition of the content categories, sorting materials into the categories, and drawing conclusions from the results. The first stage identified the relevant texts out of the elicited data and placed them in new subtexts. The second stage generated the categories or themes out of the produced sub-texts. Next, the researcher placed actual sentences or quotations from the participants in each category or theme. The last stage processed the sentences of the texts descriptively and created a coherent representation of the content. Therefore, recurring themes from the written documents were identified and categorized. The themes emerged through thematic content analysis based on the process identified by Lieblich, Tuval-Mashiach, and Zilber (1998). Thematic content analysis enables researchers to translate observations and other qualitative data to generate new insights. (Boyatzis, 1998).

Lastly, triangulation by methods (data obtained from observation, interviews, and focus group discussions) and sources (data obtained from instructors, students, and company engineers) was carried out to reduce research bias and to enhance the validity and credibility of the interpretation of results. Research results can be validated and reinforced through triangulation by offering multiple perspectives on the same phenomenon and identifying areas of discrepancies or complexities.

4. Research findings

The following section offers findings from classroom observation, followed by summaries of the semi-structured interview responses and focus group discussions. In this paper, eight major themes emerged from the analysis. The themes identified important functions of English language at the engineering workplace. Moreover, they revealed the language-related challenges faced by the employees of the company. Additionally, some discrepancies between the ESP course objectives and the real-world workplace were identified.

4.1. Classroom observation results

Non-participant classroom observations of the university courses revealed extensive use of technical English vocabulary books, engineering journal articles, and websites. Moreover, instructors often provided Persian translations of what they provided in English. It seemed that oral translation was used due to students' low level of general English language proficiency. In addition to technical English provision, instructors focused on the basics of English language skills and sub-skills for about one-third of the course hours. Reading English textbooks constituted skimming and scanning activities, answering comprehension questions, and unscrambling sentences. Moreover, most course activities were teacher-centered with a focus on textbooks. As this study's course observation indicates, technical vocabulary memorization was the most frequently practiced activity. Other activities included reading journal articles, websites, textbooks, and translations.

The instructor suggested students to study both within and outside the classroom. Therefore, students were informed about the available resources such as the university library and computer suite. Moreover, the instructor stressed the value of

students creating their own goals and planning to achieve them from the first day of the course. The instructor emphasized that besides class work, the students would need to learn independently outside of the class.

According to the data, the university's suggested textbooks were the primary source of teaching materials in the program. The textbooks were commercially published materials and were not appropriate in terms of specificity, learning objectives, and students' preferred learning styles. Therefore, it appeared necessary to design and tailor the materials according to the needs of the specific group of students. However, for various reasons, including a lack of time and cooperation among ESP experts, this urgent need was not accomplished.

4.2. Themes from interviews and focus group discussion

4.2.1. Communication with international colleagues

Most of the company participants highlighted the need to communicate with colleagues globally as a vital need in the workplace. They stated that native-like English language proficiency could decrease the rate of miscommunication that occurs due to linguistic barriers and can unite continents in creativity. Peyman, the construction manager, emphasized that "engineering is a very competitive and challenging field and requires engineers to be fluent in English beyond the general level, so that they can be successful internationally." Mohsen, member of the board of directors, mentioned that "the engineering world has become a platform where everyone should express their opinion, share ideas and interact with others". All company employees emphasized effective communication with international colleagues as an essential tool to keep up with the latest technological developments. This theme was first introduced and emphasized by the interviewed engineers from the company as absolutely critical. Later on, during focus group sessions, most of the students and instructors stated that ESP programs should teach how to communicate effectively with international companies. It seemed they were unaware of the importance of international communication in the workplace before it was emphasized in the focus group session. To put it in a nutshell, employees recognized the importance of this need, but students showed no awareness of it until it was emphasized during the focus group discussions, and courses did not address it.

4.2.2. Job opportunities

Four interviewed company members indicated that by international communication they could increase their chances of getting a job around the world, and they felt they could build trust by effective connections. Additionally, they stated that knowing English was helpful for previous employees to get a job in reputable global companies. For instance, as one engineer mentioned, "some of the engineers from this company who could read and interpret English contracts and project documents found well-paid jobs overseas at a higher level" (Kamran). Similarly, most of the interviewed instructors and students acknowledged the importance of understanding English for getting a job in other countries and international companies. As Babazade, one of the instructors mentioned, "an increasing number of international companies are using English as a common language for communication; therefore, learning English is the first step in getting ahead in your career." Likewise, one student said, "if you wish to be able to negotiate with international companies, English proficiency is essentially required."

4.2.3. Article presentation in seminars and conferences

All three groups indicated that English is essential for professionals because most international conferences and congresses are presented in English. One of the students described an experience of his conference presentations in which he felt linguistic barriers as obstacles during conference meetings, as he stated, "Regardless of being an expert in the field, the lack of English language skills necessary to communicate effectively made me feel embarrassed." Members of the company voiced similar concerns regarding seminar participations and they said "In one of my presentations during spontaneous discussions on related technical topics I failed to get my point across in explaining plans and diagrams in English" (Ali).

Overall, both interviews and focus group discussions showed that all three groups were aware of the importance of presentation skills in seminars and conferences. Engineers considered high-quality paper presentation as a means of establishing their credibility. Students identified presentation skills as significant educational goals that are crucial for prospective employees. Similarly, instructors recognized the significance of presentation competency for the success of students' future professional careers. Yet, observation of the ESP class showed that the courses did not offer training on the targeted presentation skills. Instructors attributed the lack of instruction to the limited time allotted by the university to ESP courses. Thus, it seemed that there was an urgent need to design programs based on students' real-life professional needs.

4.2.4. Writing email messages to international companies

Four of the company employees talked about difficulties associated with English email writing. They indicated that adequate instruction during ESP courses was a fundamental requirement for creating professional email writers. They felt an urgent need to write accurate emails both in terms of lexico-grammatical features and English emailing conventions. One engineer from the company said: "we have to write approximately 60 email messages per month to other international companies, and poorly written emails can cause our company's reputation to suffer" (Rasuol). Another engineer expressed: "English email writing is an important skill that was not focused upon during our ESP courses and now we face a great difficulty in getting across our messages to professionals we do not personally know" (Peyman). As he expressed: "to answer daily emails, we need to first read and interpret them correctly which requires instruction during ESP courses" (Peyman).

With respect to difficulties associated with email writing, one of the engineers mentioned "good email writing requires language and intercultural backgrounds" (Mohsen). One engineer reported that "It is difficult for me to switch between formal and informal language and to start a polite greeting and to express a polite request" (Kamran). Altogether, they considered email writing as the most difficult and common part of their communication.

This theme was first introduced during the interview sessions with company employees and instructors. However, students did not report any need to write emails until it was emphasized during the focus group discussions. Related to this component, one of the students said: "in order to improve our email writing ability, we should be provided with some sample email messages and be engaged in the writing activity" (Shiva). Furthermore, the instructors viewed email writing as a basic indicator of any successful engineer, declaring that "when students graduate and start a new job, they will need to write accurate emails in terms of structure and language so they should be prepared to write professional emails" (Rezayi). However, course observations revealed no email writing practice. As a result, the findings indicate inconsistency between the instructors' expressed beliefs and their practices. The instructors attributed the reasons to the influence of external factors such as prescribed teaching formats and time limitations that restrict their freedom of action.

4.2.5. Reading and writing job-related documents

The interviewees from the company indicated their most common reading and writing activities that comprised of emails, contracts, project documents, procedure manuals, and reports. The construction manager indicated an urgent need to fulfill students' needs to learn to read authentic documents as it would be required for their future jobs. During course observation, none of the above-mentioned genres were observed to be analyzed or practiced, which constitute important job-related documents. Rasoul noted: "Although academic and workplace settings are worlds apart, practitioners should put effort on how to transfer genre knowledge from university to workplace settings." Mohsen stated that: "when I left the university to enter the workplace, I felt that my immediate attention was required to learn new genres of discourse". They commented that discrepancy exists between university and workplace values and that they need more guidance from instructors to prepare them to cope with creation and negotiation of genres in the professional communities.

Interestingly, all the interviewed instructors considered the inclusion of job-related documents as necessary for carrying out a successful job in the workplace. However, they mentioned the lack of time as a hindrance toward bringing such tasks into classroom. As one of them stated, "students are unfamiliar with important job-related documents needed for effective performance in English, but most of the time we face with time management challenges" (Chavoshi). Students also expressed that they were unfamiliar with job-related documents and felt an urgent need to learn about them. They considered it necessary to include written model documents in ESP courses for effective job performance. As Sina stated, "we really need to read and write documents that other engineers wrote, so we can see authentic models of job-related documents and follow the same steps until we become independent writers".

4.2.6. Listening and speaking skills

As for speaking communication tools with international companies, the interviewed company members mentioned teleconferencing and telephones as essential. Moreover, they highlighted the need to speak in professional contexts such as seminars and meeting situations. Additionally, this skill was perceived to be essential for professional job interviews. Engineers from the company mentioned the importance of speaking and listening skills for academic and professional success. Kamran indicated: "listening and speaking skills are paramount for professional success, influencing new opportunities and career growth". They all agreed that ESP courses should give equal importance to all four skills. An engineer from the company mentioned: "unfortunately, our ESP courses gave importance to reading over speaking skills and examinations only tested reading and writing at the end of the semesters" (Ali).

Students highlighted that listening and speaking skills were important for real-world communication. Darya noted: "the ability to present university lectures and oral presentations in academic settings is a critical skill that needs practice". Students expected the instructors to provide them with target-oriented activities that would improve their speaking and listening skills and enable them to participate in oral exchanges effectively. They mentioned feelings of anxiety, fear of making mistakes, and fear of being laughed at or mocked that prevented them from acquiring the skills. The students experienced those feelings during classroom conversations with peers.

Although the interviewed instructors acknowledged that they should prepare students to communicate effectively in the workplace, their teaching method did not address the professional workplace requirements. Most instructors complained about the hours allotted to ESP course that was not sufficient to conduct enough speaking and listening activities. Therefore, they blamed universities to introduce more time to the course. According to one of the instructors, "because of time constraints, we have to prioritize teaching activities" (Eskandari).

4.2.7. Out-of-date ESP books

Four of the interviewed instructors highlighted some significant problems with ESP books in Iran. Instructors complained about out-of-date books and considered the issue as one of the major challenges in ESP education. As indicated by one of the instructors, "old textbooks put sustainable development at risk and prevent us from providing our students with credible information" (Rezayi). One of the instructors mentioned that "ESP textbooks are commercially produced materials and hide general English series behind their title" (Eskandari). Other interviewees mentioned that there had never been an ideal ESP book, however, they all acknowledged the role that books played in providing the base of the materials needed. In spite of the

negative attitude implied in interviewees' comments about ESP books loaded with vocabulary and grammar, they considered them as key tools in paving the way toward the production of tailored-made learning materials according to specific teaching-learning methods and local needs.

The interviewed students believed that their books did not cover all of their current specific needs. They laid emphasis on using complementary materials by the instructors if the textbooks offered by the university did not deal with their specific needs. As mentioned by one of the students, "although the university asks instructors to follow prescribed textbooks that may not meet our needs, they should not be confined by the books or feel restricted. Instead, they can use supplementary materials to fulfill our individual needs" (Amir). Despite their declaration that books did not satisfy their needs completely, all students agreed that they were of great value in the learning process.

4.2.8. Heterogeneous and low general English proficiency

The issue of general English proficiency was a macro theme that recurred in all the interviews. Instructors complained about students' low general English proficiency and heterogeneous classroom skills as serious obstacles against achieving ESP goals. As one of them stated: "when we prepare professionals to write specific genres, we need to first spend a lot of time developing their general English proficiency" (Javadi). According to the instructors, it seems unmanageable to both focus on a range of genres and general language in tertiary education context. Moreover, generally the courses constitute heterogeneous grouping as mentioned by one of the instructors: "to handle heterogeneity efficiently, I often encourage learners to find self-study materials and help them to become autonomous language learners to be able to find fresh English sources after course periods" (Babazadeh). The instructors agreed that the proficiency level of students plays a significant role in success in ESP instruction. Some of the students welcomed to receive guidance from the instructors to help them become autonomous learners to meet their own needs. For example, Maryam commented, "it's efficient that the instructor shows us how to self-direct our own way of learning, and to reflect on any learning opportunity to satisfy our needs". Kazem said, "it is helpful that the instructor shows us how to overcome our problems by introducing strategies for out-of-class learning". In contrast, other students complained about excessive time required by self-study. This was especially emphasized by students who self-assessed themselves as having poor English language skills.

5. Discussion

This study was inspired by the fact that it is crucial to discover actual workplace needs to provide students with well-organized and authentic course materials. As this study has revealed, there are significant gaps between ESP courses at the university and the tasks engineers need to fulfill in the company. The significant shortcomings of the course was found to be time management issues, teaching methods, inappropriate textbooks, and class heterogeneity. In terms of teaching methods, the findings revealed that there was a need to pay equal attention to all four language skills. Our analysis of instructors' rationale for the existing inadequacy was outdated ESP textbooks, and the proficiency levels of students. As for the necessary tasks engineers needed to fulfil, the current study found reading and writing emails, contracts, projects, documents, procedure manuals, and reports. Our study further showed that besides acquiring the writing skill, another essential skill was being able to participate in numerous technical oral communications.

Instructors emphasized the students' low level of general English proficiency as a disadvantage in pursuing ESP-oriented goals, which led class activities to focus on translating original books. This finding is in line with (Atai & Shoja, 2011), whose results indicated that translation was a dominant instructional technique in ESP courses due to students' low general English proficiency in Iran. Previous studies have documented low general English proficiency as a hindrance to taking advantage of ESP courses (Mazdayasna & Tahririan, 2008) along with English-medium classes (Cho, 2012; Kang & Park, 2005). This lends support to the idea of passing compulsory general language courses prior to enrollment in ESP courses for low proficiency students. According to Chan (2019), ESP programs in tertiary education lack enough time dedicated to developing students' general language skills. Therefore, it is suggested to highlight the importance of general English proficiency development as a prerequisite to enrollment in specialized courses. This confirms the recommendation of Carrell and Eisterhold (1983) who emphasized general language proficiency as a prerequisite to participation in ESP courses.

As for challenges concerning textbooks, instructors pointed to the discrepancy between ESP books and actual language use outside the classroom. Previous research (Wolfe, 2006, 2009; Chan, 2009; Barbieri & Eckhardt, 2007; Angouri, 2010) questioned the relevance of textbook materials by showing a significant mismatch between authentic language use and the representations included in the textbooks. Moreover, instructors in this study complained about out-of-date ESP books as one of the main challenges in the learning and teaching process. This finding is consistent with results of Atai and Shoja (2011) who suggested updating the contents of ESP textbooks as an instant step towards altering the status quo. Harwood (2005) suggested that instructors use the materials and contents of textbooks selectively as a reference rather than as the main source of teaching. This suggestion presumes the awareness of practitioners about what constitutes workplace or authentic needs. According to this research, developing ESP textbooks requires continuous revision of texts, drills, and exercises. Instructors are recommended to pay attention to the date of book revision prior to the start of any course.

As a non-technical workplace genre, emails were considered the most challenging and common part of workplace written communication. Similar results have been indicated in previous research (Evans, 2010; Kassim & Ali, 2010; Spence & Liu, 2013), in which emails were found to be among the common genres of writing in workplace analysis. In line with Chan (2019), this study showed that emails were difficult to cope with for employees and company members. The interviewed

participants' reasons concerning difficulties associated with email writing were corroborated with findings of previous studies in which they related the challenges to pragmatic factors such as politeness (Biesenbach-Lucas, 2007), and emailing conventions such as greetings (Economidou-Kogetsidis, 2015). In addition to email, participants also identified other communication tools including teleconferencing and telephony as equally important. Although they were common communication tools in the workplace, no instruction on them was observed in ESP programs. This implies that it is essential for ESP courses to include email writing tasks, teleconferencing, and telephony in their course design. This finding is consistent with the results of Spence and Liu (2013), as they emphasized the importance of instruction based on common authentic workplace activities, such as email writing or teleconferencing. In addition to email writing, other writing genres included contracts, project documents, procedure manuals and reports. Overall, these findings recommend a systematic analysis of the written target genres prior to any ESP course design. This can allow ESP practitioners to identify the structural variation of the written genres and consequently offer a more suitable instruction. This might be applicable through corpus-based studies of various genres of writing.

Another finding of this study was that engineers from the company considered English communication as a tool to achieve employment in other reputable and international companies. This finding correlates with Arias-Contreras and Moore's (2022) study which emphasized the important role of English language for professionals to obtain employment opportunities. In the present study, company members indicated effective cross-cultural communication as an essential aspect of their occupational domain. Moreover, instructors confirmed the of English language as vital in paving the way toward better employment opportunities through tailored cultural training. However, they had no clear perception of culture-specific English language needs at workplace. It seemed that instructors customized their courses to the students' occupational needs based almost on their intuitions. Observations of the courses also confirmed that there was no learning program aimed at adapting the materials, methods, and techniques to better suit cross-cultural engineering needs. It is suggested that syllabus designers cultivate tailored instruction to develop cultural awareness to bridge gaps in a global workplace. This finding, in line with those of Spence and Liu (2013), highlights the need for the inclusion of cross-cultural topics and the creation of interaction opportunities for engineers in ESP programs.

As mentioned previously, all four English skills (listening, reading, writing, and speaking) were emphasized for inclusion in ESP courses. On the other hand, some other studies did not report the same importance for all four skills. For instance, Spence and Liu (2013) indicated that reading and writing skills were among the most common and of high importance, while Kassim and Ali (2010) found listening and speaking as the most essential skills for the engineering field. Additionally, Evans (2010) reported that reading and writing were of high importance for professionals in a range of disciplines. Given that authentic contexts and job-related tasks require all four skills for efficient task accomplishments, it is suggested to emphasize all four skills. For example, concerning speaking skills, students mentioned feelings of embarrassment during spontaneous English communication in seminars and conferences. This finding is similar to that of Spence and Liu (2013), in which engineers reported feelings of anxiety during teleconferencing with customers. Undoubtedly, public speaking or impromptu communication can be anxiety-inducing regardless of the number of times one has performed it. Nonetheless, it seems that simulated situations in ESP courses can help engineers to manage their emotions associated with public or spontaneous speaking. In addition to speaking skill, the engineers from the company reported reading and writing as essential skills to accomplish job-related tasks such as contracts, project documents, manuals, and reports. It is suggested to expose to examples of the genres they need to handle properly in real work situations. For instance, courses should teach how to write emails, contracts, project documents, procedure manuals, and reports. Regarding speaking skills, more authentic classroom activities such as how to present in seminars and conferences, or how to speak in job interview situations must be used that correspond to real world tasks. Other speaking activities that align with engineers' career development could be practicing teleconferencing and telephones in the classroom.

6. Conclusion

This study addressed the actual language needs of civil engineers through a comprehensive analysis of data from a university and a company. By observing ESP courses and interviewing with engineers and students, it was revealed that there some mismatches between the curricular choices of the ESP program and the authentic language needs of engineers. As the study found, students were primarily exposed to receptive skills, such as reading articles and textbooks. Therefore, it is suggested that curriculum developers provide opportunities to develop writing and speaking skills. Moreover, as the study findings suggest, the approach to writing instruction should prepare students to cope with different genres of writing. In addition, updating course contents and textbooks seems necessary to address engineers' and students' goals by including different rhetorical structures and genres. The written genre examples include emails, reports, letters, project and office documents, while oral events include teleconferences, meetings, telephone communications, and presentations.

As this study found, instructors raised concerns regarding the low and heterogeneous English language proficiency of students in ESP courses. However, instead of seeing that this problem exists, practitioners should take action to solve it. For instance, using proficiency tests to ensure some degree of homogeneity or determine a cut-off score for course entrance is suggested. Moreover, it seems imperative that teaching English in ESP courses should aim to address cross-cultural language needs to prepare students to communicate internationally.

It is worth mentioning that due to qualitative analysis and the small sample size in this study, future research could combine quantitative and qualitative analysis to address English language needs of civil engineers. Moreover, future ESP

research may also draw on insights from other fields, including electrical engineering, mechanical engineering, systems engineering, and industrial engineering, to investigate additional facets of workplace communication and to pinpoint additional strategies for equipping students for their future careers. This type of multidisciplinary research is thought to be able to assist college students in acquiring the attributes and competences required in professional contexts.

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Appendix A

- **Sample interview questions for ESP instructors**
  1. What are the necessary language skills and components required by undergraduate students of civil engineering for future workplace?
  2. Can you mention the teaching activities do you do in your ESP classes?
  3. What are the main language challenges and difficulties that civil engineering undergraduates face?
  4. In your ESP classes, how often and when do you use English? On which occasions do you use Persian?
  5. Do you think ESP courses should focus more on ESP or general English? Why?
  6. Does the ESP course at the undergraduate civil engineering level have the required number of credits?
  7. What are the main issues and difficulties associated with ESP education in Iran?
- **Sample interview questions for engineers from the company**
  1. What are the main language barriers and challenges faced by civil engineers at workplace?
  2. What are the necessary language skills and components required by civil engineers at workplace?
  3. What teaching activities or tasks do you do think should be included in ESP courses?
- **Sample interview questions for students**
  1. Can you mention the teaching activities do you do in your ESP classes?
  2. In the ESP classes, when do you use English? On which occasions do you use Persian?
  3. What are the necessary language skills (speaking, listening, reading, and writing) required by undergraduate students of civil engineering for future workplace?
  4. What language-related difficulties do you face at your part-time job in the company?

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