Research Article

A Writing Needs Analysis of Moroccan Engineering Students

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Abstract: This study investigates the specific writing needs and document types in Moroccan engineering education through a needs analysis involving 253 participants, including engineers, teachers, and students. Using a quantitative approach, data are collected through questionnaires to identify key writing tasks and document requirements relevant to engineering professionals. The study reveals significant writing needs in areas such as technical reports, project documentation, and professional correspondence. Results indicate that students often struggle with technical writing sub-skills, including clarity, coherence, and appropriate use of technical vocabulary. The analysis highlights a gap between current writing instruction methods and practical needs. Data analysis using SPSS identifies common document types and their specific writing requirements. Descriptive statistics, and Cronbach's Alpha for reliability, are conducted to assess the relationship between identified needs and current instructional practices. The findings underscore the importance of aligning writing instruction with the engineering profession's requirements to enhance workforce preparedness. Tailored writing courses are recommended to address these needs effectively. This research offers valuable insights into the specific writing needs of engineering students and professionals and provides practical recommendations for curriculum development, advocating for teaching methods that align with modern engineering environments.

Keywords: needs analysis; engineering education; writing skills; technical communication; curriculum development

1. Introduction

The concept of Needs Analysis (N.A.) was first introduced by Michael West in 1920 during his work with Indian civil servants. This foundational idea was later expanded upon by Richterich and Chancerel in 1972, emphasizing the importance of understanding learners' needs in educational settings. Needs Analysis eventually evolved to include Target Situation Analysis (TSA), as highlighted by Wilkins (1976) and Munby (1978), who integrated it into communicative syllabus design.

Robinson (1991) describes Needs Analysis as a core principle in English for Specific Purposes (ESP) courses. Numerous scholars, including Richterich and Chancerel (1987), Strevens (1988), Nunan (1988), Dudley-Evans and St. John (1998), and Basturkmen (2006), have emphasized its crucial role in ESP curriculum design. Long (2005) asserts that incorporating Needs Analysis in language course design is essential, as it allows for the creation of specific and targeted objectives to meet learners' needs within the given timeframe.

1.1. Definition and Importance of Needs Analysis

The term "Needs Analysis" has been debated extensively, resulting in a variety of definitions. Pratt (1980) describes N.A. as a systematic method for identifying and prioritizing needs. Holec (1980) sees it as a traditional method for linking students with the syllabus. Sanghori (2008) defines Needs Analysis as the collection of data to design a syllabus tailored to a specific group of students.

West (1994) explains Needs Analysis as identifying the tasks and activities learners need to perform in the target language and the best strategies for acquiring this proficiency. Dudley-Evans and St. John (1998) describe N.A. as gathering specialized information about learners

and their language use, while Graves (2000) views it as an ongoing process of collecting and interpreting data to create an effective curriculum. Richards and Rodgers (2014) define N.A. as the methods used to gather information about learners' needs.

Needs Analysis is vital for enhancing and evaluating ESP curricula. Lindsay and Knight (2006) emphasize that it helps collect diverse data to make informed decisions about course content, language focus, and teaching methods. Needs Analysis ensures that the course design meets both student and institutional needs by identifying specific language requirements and the skills learners need to develop.

Dudley-Evans and St. John (1998) outline various terminologies related to "needs," such as objective needs, subjective needs, perceived needs, and felt needs. Objective needs refer to the factual information about students' language skills and barriers. Subjective needs encompass learners' cognitive and emotional requirements. Perceived needs are external assessments of students' linguistic requirements, while felt needs are learners' own perceptions of their needs. Hutchinson and Waters (1987) classify needs into requirements, desires, and deficits. They further divide needs into target needs and learning needs. Target needs involve the skills and knowledge learners must acquire to succeed in the target situation, while learning needs focus on how learners can progress from their current level to their desired proficiency.

1.2. English for Specific Purposes (ESP) Writing

English for Specific Purposes (ESP) writing is designed to meet the specific linguistic needs of students in particular disciplines, such as engineering. ESP writing involves tailoring language instruction to the specialized vocabulary, discourse styles, and communication strategies of a given field. This focus on discipline-specific language ensures that students develop the practical language skills they need to succeed in their professional careers.

The foundation of ESP writing is a thorough needs analysis, which identifies the specific linguistic requirements of students in their particular field. This process involves evaluating students' current language proficiency, examining the language used in professional contexts, and consulting with industry professionals to determine the key language skills needed for success.

ESP writing utilizes authentic materials that reflect real-world professional contexts. This includes technical documents, reports, case studies, and other genre-specific texts that students are likely to encounter in their careers. By engaging with these materials, students gain familiarity with the language and communication styles used in their field.

A significant component of ESP writing is the acquisition of discipline-specific vocabulary. This specialized vocabulary is crucial for effective communication in professional contexts. ESP courses focus on teaching the terminology, jargon, and language structures that are unique to a particular discipline.

ESP writing emphasizes contextualized language practice, where students apply their language skills in realistic scenarios related to their field. This practice helps students develop the ability to use language effectively in professional situations, such as writing reports, giving presentations, or participating in meetings.

ESP writing often integrates multiple language skills, including reading, writing, speaking, and listening. This holistic approach ensures that students develop comprehensive language proficiency, enabling them to handle the diverse communication tasks they will encounter in their professional lives.

Continuous feedback and opportunities for revision are integral to ESP writing. Instructors provide detailed feedback on students' writing, focusing on both language accuracy and the appropriateness of content for the specific discipline. This iterative process helps students refine their language skills and improve their overall writing proficiency.

1.3. Writing in the Context of Engineering

In the context of engineering, ESP writing courses are tailored to address the unique communication needs of engineering students. These courses focus on developing the technical writing skills necessary for effective communication in engineering professions. Key aspects of ESP writing for engineering students include:

Technical Documents: Engineering students learn to write various technical documents, such as project reports, technical specifications, research papers, and user manuals. These documents require precise language, clear structure, and the ability to convey complex technical information accurately (Eunson, 2012).

Problem-Solving Language: Engineers frequently engage in problem-solving tasks that

require clear and concise communication. ESP writing courses teach students how to articulate problems, propose solutions, and document the problem-solving process effectively (Doghonadze & Gorgiladze, 2008).

Collaboration and Communication: Engineering projects often involve teamwork and collaboration. ESP writing courses emphasize the development of communication skills necessary for effective collaboration, including writing emails, creating project proposals, and preparing presentation materials. (Hendarwati et al., 2021)

Presentation Skills: Engineers must be able to present their ideas and findings to diverse audiences, including colleagues, clients, and stakeholders. ESP writing courses incorporate training in creating and delivering presentations, focusing on language use, visual aids, and audience engagement (Abouabdelkader et al., 2023)

Industry-Specific Standards: The engineering field has specific standards for technical writing. ESP writing courses familiarize students with these standards, ensuring that their writing meets the expectations of the engineering industry (Jafari Pazoki & Alemi, 2020).

In the context of Moroccan engineering education, conducting a Needs Analysis is crucial for identifying the specific writing needs and document types relevant to engineering students. By understanding these needs, educators can design targeted ESP courses that help students acquire the necessary language skills for their professional and academic contexts. This involves analyzing the types of documents engineering students will encounter, such as technical reports, research papers, and project documentation, and tailoring the curriculum to address these specific requirements.

2. Materials and Methods

2.1. General Design

This study uses a comprehensive needs analysis to identify specific writing requirements and document types necessary for effective technical communication within different engineering fields. The aim is to inform the design of tailored courses in engineering curricula. Using structured questionnaires, a quantitative approach gathers data from 253 participants, including engineers, teachers, and students.

The study identifies several key writing requirements and documents. Technical reports are essential for communicating detailed findings and analyses, requiring clear and concise writing with data interpretation and conclusions. Memos and specifications provide clear instructions and requirements for projects, needing precision and clarity. Illustrations and diagrams are crucial for explaining complex concepts, necessitating high-quality visual representations. Writing formal articles for academic journals or industry publications demands proficiency in scientific writing, terminology, and structure.

The questionnaires capture detailed information on writing tasks, document types, and challenges participants face. Data collected are analyzed statistically to identify everyday writing needs and document types across engineering fields. This analysis highlights areas where engineering students need more support and identifies the most commonly used professional documents. The results inform the development of tailored writing courses that align with the actual needs of engineering students and professionals, enhancing their technical communication skills.

2.2. Participants and Samples

The needs analysis (see table 1) involves 253 participants, comprising 17 engineering teachers, 191 engineering students, and 45 professional engineers. These participants are selected based on their relevance to the engineering discipline, ensuring a comprehensive understanding of the writing needs and document types required in engineering education.

Table 1. Sample size and repartition

Category	Male	Female	N
Students	104	87	191
Engineers	41	4	45
Teachers	8	9	17

The selection process for participants is designed to capture a wide range of perspectives within the engineering field. The 17 engineering teachers are chosen from various educational institutions, ensuring that their insights reflect diverse teaching experiences and pedagogical approaches. These teachers bring valuable perspectives on the writing skills they emphasize in their courses and the common challenges students face in mastering technical writing.

The 191 engineering students participating in the study come from different academic

levels, including undergraduate and graduate programs. This diversity in student participants allows the study to capture a broad spectrum of writing experiences and needs, from introductory courses to advanced, specialized subjects. The students provide firsthand accounts of their writing tasks, the types of documents they produce, and the difficulties they encounter in meeting academic and professional writing standards.

The 45 professional engineers included in the analysis work in various sectors of the engineering industry, ranging from civil and mechanical engineering to electrical and software engineering. These professionals are selected based on their extensive experience and active involvement in engineering projects that require substantial written communication. Their participation ensures that the study encompasses the practical, real-world writing demands of the engineering profession, providing insights into the types of documents they regularly produce, such as technical reports, project proposals, and operational manuals.

Together, the perspectives of these teachers, students, and professional engineers create a comprehensive picture of the writing needs in engineering education. This diverse participant pool helps identify commonalities and differences in writing requirements across different stages of an engineering career, from academic training to professional practice. The resulting data provide a robust foundation for developing targeted interventions and curricular improvements aimed at enhancing writing skills in engineering education

2.3. Data Collection Instruments

Data collection is conducted using a structured questionnaire (see appendix A) designed to capture detailed information on the specific writing needs and document types in engineering education. The questionnaire is meticulously developed to include various sections aimed at gathering comprehensive data from the participants. It starts by collecting basic demographic data, including age, gender, educational background, professional experience, and current role (e.g., student, teacher, or professional engineer). This information helps in understanding the context and background of the respondents, which is crucial for analyzing the results accurately.

Participants are then asked to identify and rate the frequency and importance of various writing tasks they perform or encounter in their educational or professional roles. These tasks include writing technical reports, project documentation, emails, memos, and other forms of professional correspondence. This section aims to pinpoint the specific writing tasks that are most relevant to engineering professionals. Additionally, the questionnaire focuses on identifying the types of documents that are most commonly used in engineering education and practice. Participants list and rate the importance of different document types, such as technical manuals, project proposals, research papers, and instructional materials. Understanding the common document types helps in tailoring writing instruction to meet the actual needs of engineering students and professionals.

The survey is administered both online and in paper format to accommodate the participants' preferences and availability. The online version is distributed via email invitations, which include a link to the survey hosted on a secure online platform. The paper version is distributed in person during classes or professional meetings, with participants given a two-week period to complete and return the survey. This dual-mode administration ensures a higher response rate and allows for greater flexibility in participation. The structured questionnaire is designed to be user-friendly, ensuring that participants can easily understand and respond to the questions. The collected data is then entered into a secure database for analysis, ensuring accuracy and completeness. The use of both quantitative and qualitative questions provides a comprehensive view of the writing needs and challenges faced by engineering students and professionals, informing the development of targeted writing instruction and curriculum improvements.

2.4. Ethical Considerations

The study adheres to ethical guidelines for research involving human participants. Ethical approval is obtained from the institutional review board of the respective institution. Before participation, all participants are informed about the study's purpose, and their informed consent is obtained. This process includes a signed consent form by the director of the establishment (see appendix B) and its translation to English, ensuring institutional support and compliance. Confidentiality and anonymity are rigorously maintained throughout the study, and participants are assured that they have the right to withdraw at any time without any consequences. This approach ensures that the study upholds the highest ethical standards in protecting the rights and privacy of all participants.

2.5. Data Analysis

The collected data are analyzed using the Statistical Package for the Social Sciences (SPSS). Descriptive statistics are used to summarize the demographic information and identify common document types and writing tasks. Reliability analysis is conducted using Cronbach's Alpha to ensure the internal consistency of the questionnaire. Further statistical tests, including paired sample tests and correlations, are performed to assess the relationship between identified needs and current instructional practices.

3. Results

This section presents the findings from a comprehensive needs analysis conducted to identify specific writing requirements and document types necessary for effective technical communication within different engineering fields. The needs analysis involved a quantitative approach using structured questionnaires administered to a diverse stakeholder group of 253 participants, including engineers, teachers, and students.

The results are organized as follows: first, an overview of the participant demographics is presented, followed by a detailed examination of the specific writing tasks identified as important by the participants. Next, the types of documents most frequently used and their relevance to the participants' roles are analyzed. Statistical analyses, including descriptive statistics and reliability tests, support the findings. Comparative analyses between different participant groups highlight significant differences and commonalities. Finally, the key findings are summarized, and their implications for curriculum development in engineering education are discussed.

3.1. Reliability Coefficient

Table 2 shows that the sample sizes for each group vary, with 191 engineering students, 45 professional engineers, and 17 engineering teachers participating in the study. The Cronbach's Alpha coefficients for these groups are .755, .835, and .806, respectively, indicating the reliability of the questionnaire used in the needs analysis.

Cronbach's Alpha is a measure of internal consistency, showing how closely related a set of items are as a group. According to George and Mallery (2016), coefficient of .7 or higher is generally considered acceptable, indicating that the questionnaire items are reliably measuring the same underlying concept.

The mean Cronbach's Alpha coefficient across all groups is .806, reflecting a high level of reliability for the entire questionnaire. This suggests that the data collected from engineering students, engineers, and engineering teachers are consistently reliable, providing a solid foundation for the needs analysis.

Table 2. Cronbach's Alpha coefficient

	Sample size	Cronbach's Alpha coefficient
Engineering students	191	.755
Engineers	45	.835
Engineering teachers	17	.806
Mean		.806

3.2. Needs Analysis Objectives

The focus of the analysis is to explore the objectives of English language usage and identify the prevalent written documents in engineering (see table 3). The collected data provides insights into the specific language needs in this field. Mean and standard deviation statistics offer an overview of the data, helping to understand central tendencies and variability.

The questionnaire responses are analyzed to compute the sum and mean, providing an overview of collective perceptions towards English language usage and common written documents in engineering. This comprehensive understanding forms the basis for designing practical language courses tailored to future engineers.

The analysis of mean scores across different groups – students, teachers, and engineers – offers distinct insights into writing skills development. For instance, in Objective 1, focusing on extracting main ideas from a text, students score highest with a mean of 4.03 (SD = 0.929), compared to teachers at 2.18 (SD = 0.951) and engineers at 3.40 (SD = 1.388). This suggests that students are better at identifying core concepts in written material. Similarly, in Objective 2, related to recording key points from lectures, students outperform other groups with a

score of 4.06 (SD = 0.884), while teachers score highest overall at 4.24 (SD = 0.664) and 3.02 (SD=1.438) for engineers.

In Objective 3, concerning producing illustrations and diagrams from texts, engineers score the lowest at 2.67 (SD = 1.206), indicating a potential training gap. Teachers consistently score highest across various objectives, emphasizing their comprehensive skill set. For example, in Objective 9, on the correct use of scientific terms, teachers lead with a score of 4.12 (SD = 0.781).

In writing about tables and charts (Objective 4), teachers again score highest at 4.00 (SD = 791), reflecting their skill in data interpretation. Engineers score lowest at 2.51 (SD = 1.121). Students score 3.76 (SD = 1.047), showing moderate proficiency.

Objective 5, focused on writing articles, shows students scoring 3.43 (SD = 1.287), lower than teachers (4.06, SD = 0.899) and engineers (2.93, SD = 1.156). In Objective 6, related to writing outlines and reports, all groups show competence, with teachers and students nearly aligned at 4.06 (SD = 0.827) and 3.90 (SD = 0.892), respectively. Engineers score slightly lower at 3.53 (SD = 1.440).

Objective 7 assesses grammatical accuracy, where engineers score 3.44 (SD = 1.617) and students 3.23 (SD = 1.009). In expressing personal opinions (Objective 8), teachers lead with 4.24 (SD = 0.664), while students score 3.83 (SD = 1.060). Finally, in using scientific terms (Objective 9), teachers score highest at 4.12 (SD = 0.781), and engineers lowest at 3.16 (SD = 1.580).

Regarding the total mean of the objectives, the needs analysis reveal that participants show varying levels of proficiency across different writing objectives. The highest total mean score is 4.04 for the "Correct and effective use of scientific terms and jargon when writing," indicating strong proficiency but notable variability (SD = 1.163). Other areas of high proficiency include "Record key points from lectures, documentaries, discussions, or scientific meetings" (Mean = 3.89, SD = 1.068) and "Express and defend your personal opinions in writing" (Mean = 3.8, SD = 1.141). Moderate proficiency is observed in "Extract the main ideas from a text" (Mean = 3.79, SD = 1.136) and "Write outlines, facts, scientific questions, reports, synthesis, and steps to follow" (Mean = 3.85, SD = 1.014). Lower proficiency levels are seen in "Writing articles" (Mean = 3.38, SD = 1.266) and "Produce illustrations and diagrams from written texts" (Mean = 3.6, SD = 1.100). These findings highlight the strengths in technical terminology and information recording while pointing to the need for improved training in writing articles and producing visual aids.

The analysis highlights strengths and objective areas in writing skills among students, teachers, and engineers, with engineers particularly benefiting from targeted enhancements to address specific challenges.

Table 3. Descriptive statistics – engineering objectives

		Obj. 1: Extract the main ideas from a text.	Obj. 2: Record key points from lectures, documentaries, discussions, or scientific meetings.	Obj. 3: Produce illustrations and diagrams from written texts.	Obj. 4: Write about tables and charts.	Obj. 5: Writing articles	Obj. 6: Write outlines, facts, scientific questions, reports, synthesis, and steps to follow.	Obj. 7: Correct use of the grammatical structures of the English language when writing.	Obj. 8: Express and defend your personal opinions in writing.	Obj. 9: Correct and effective use of scientific terms and jargon when writing.
Student	Mean	4.03	4.06	3.75	3.76	3.43	3.9	3.23	**3.83**	**4.24**
	Std. Deviation	0.929	0.884	0.983	1.047	1.287	0.892	1.009	**1.06**	**0.969**
Teacher	Mean	2.18	4.24	4.35	4	4.06	4.06	3.76	**4.24**	**4.12**
	Std. Deviation	0.951	0.664	0.493	0.791	0.899	0.827	0.809	**0.664**	**0.781**
Engineer	Mean	3.4	3.02	2.67	2.51	2.93	3.53	3.44	**3.53**	**3.16**
	Std. Deviation	1.388	1.438	1.206	1.121	1.156	1.44	1.617	**1.517**	**1.58**
Total	Mean	3.79	3.89	3.6	3.56	3.38	3.85	3.47	**3.8**	**4.04**
	Std. Deviation	1136	1068	1100	1152	1266	1014	1150	**1141**	**1163**

3.3. Needs Analysis Documents

Table 4 presents the mean scores, and standard deviations (SD) for various English written documents in engineering across the same sample of stakeholders in needs analysis (students, teachers, and engineers). The table is used to analyze the use and importance of different document types within the engineering domain.

For students, "Presentations" have a high mean score of 4.00 (SD = 0.900), indicating a strong emphasis on this document type in their academic environment. "Emails" also receive a high mean score of 3.80 (SD = 0.866). "Technical Specifications" score highly with a mean of 3.98 (SD = 0.899). In contrast, "Synthesis" and "Instruction Manuals" receive mean scores of 3.70 (SD = 0.884) and 3.59 (SD = 1.047), respectively. "Scientific Publications" have a mean score of 2.98 (SD = 0.945), indicating its limited interest.

Teachers show high mean scores for "Synthesis" and "Instruction Manuals," both at 4.24 (SD = 0.562 and SD = 0.562, respectively), highlighting their value in teaching and practice. "Scientific Publications" receive the lowest mean score of 2.80 (SD = 0.866) among teachers.

Engineers assign high ratings to "Memos" and "Technical Specifications," with mean scores of 3.82 (SD = 1.284) and 3.75 (SD = 1.305), respectively, underscoring their critical roles in engineering practice. The "Business Plan" has a substantial mean score of 3.36 (SD = 1.265), indicating its importance for entrepreneurial activities in engineering. In contrast, "Scientific Publications" and "Resume and Cover Letters" have lower mean scores of 2.89 (SD = 1.402) and 2.64 (SD = 1.048), respectively.

The overall analysis of the needs assessment questionnaire reveals the following insights into the proficiency levels of students, teachers, and engineers across various document types in engineering communication. The total mean scores indicate that proficiency levels are highest for "Memorandum (memo)" (Mean = 3.94, SD = 1.025), "Technical Specifications" (Mean = 3.91, SD = 1.028), and "Instruction Manual" (Mean = 3.90, SD = 1.107). These document types are essential for effective communication in engineering practices. Conversely, lower proficiency levels are observed in "Resume and Cover Letters" (Mean = 3.41, SD = 1.041), "Minutes and Reports" (Mean = 3.49, SD = 1.004), and "Scientific Publications" (Mean = 2.89, SD = 1.100). These findings suggest a need for enhanced training and focus on writing resumes, minutes, reports, and scientific publications to meet the communication demands in engineering.

The data underscores the importance of tailoring writing courses to address these specific areas, ensuring that students, teachers, and engineers can effectively communicate through various essential document types.

Table 4. Descriptive statistics – engineering documents

Groups		Document1: Presentations	Document2: Email	Document3: Resume and cover letters	Document4: Minutes and reports	Document5: Synthesis	Document6: Memorandum (memo)	Document7: Technical specifications	Document8: Instruction manual	Document9: Scientific publications	Document10: Business plan
Student	Mean	4.00	3.80	3.76	3.71	3.70	4.00	3.98	3.59	2.98	3.84
	Std. Deviation	.900	.866	.941	.869	.884	.916	.899	1.047	.945	.868
Teacher	Mean	3.69	3.68	3.85	3.94	4.24	4.01	4.00	4.24	2.80	3.5
	Std. Deviation	.857	.636	.437	.966	.562	.562	.712	.562	.866	.728
Engineer	Mean	2.93	2.91	2.64	2.82	3,2	3.82	3.75	3.88	2.89	3.36
	Std. Deviation	1.195	1.345	1.048	1.211	1.099	1.284	1.305	1.125	1.402	1.265
Total	Mean	3.54	3.46	3.41	3.49	3.71	3.94	3.91	3.90	2.89	3.56
	Std. Deviation	1038	1020	1041	1004	1022	1025	1028	1107	1100	1015

4. Discussion

4.1. Summary of Key Findings

The analysis focuses on the objectives of English language usage and identifies prevalent written documents in the engineering field. Mean and standard deviation statistics provide insights into the specific language needs and writing proficiency levels across students, teachers, and engineers. The study highlights that students generally exhibit higher proficiency in English language usage compared to teachers and engineers. For instance, students scored the highest in extracting main ideas from a text and recording key points from lectures. Teachers consistently scored high in using scientific terms correctly, while engineers showed lower proficiency in producing illustrations and diagrams. The highest total mean score was observed in the correct and effective use of scientific terms, while the lowest proficiency levels were seen in writing articles and producing illustrations and diagrams. These findings highlight strengths in technical terminology and information recording but also point to the need for improved training in writing articles and producing visual aids.

Regarding the various written documents in engineering, students, teachers, and engineers exhibit varying levels of proficiency. Students scored highest in presentations and emails, while scoring lowest in scientific publications. Teachers showed high proficiency in synthesis and instruction manuals but lower proficiency in scientific publications. Engineers rated memos and technical specifications as their strongest areas, while showing lower proficiency in resumes and cover letters and scientific publications. The highest total mean scores were observed in memos, technical specifications, and instruction manuals. The lowest proficiency levels were found in resumes and cover letters and scientific publications. These findings underscore the importance of focusing on areas with lower proficiency to enhance communication skills in engineering.

4.2. Interpretation of Results

The results reveal that students tend to excel in basic comprehension and note-taking abilities, as evidenced by their strong performance in extracting main ideas and recording key points. This is consistent with research by Tsui (2002), who noted that students often show proficiency in tasks that involve summarizing and note-taking. However, their challenges in producing illustrations and diagrams, writing articles, and using scientific terms effectively suggest gaps in training that align with findings by Boud & Falchikov (2006), who highlighted the need for enhanced instructional strategies in scientific writing and visual communication. Teachers, on the other hand, demonstrate a deep familiarity with the specialized language of engineering, reflected in their high scores for scientific terms and jargon use, as supported by Hyland (2004). This suggests that teachers' extensive experience and training in academic writing significantly enhance their performance in these areas.

Engineers' strengths in technical documentation such as memos and technical specifications align with the practical demands of their profession, corroborating studies by Kustepeli (2014), who identified technical writing as a critical skill in engineering. However, their lower proficiency in writing resumes, cover letters, and scientific publications indicates a gap that previous research has also noted (Perry, 2009). This gap suggests a need for targeted training in formal writing forms, which is crucial for career advancement and research dissemination.

The results of this study also reveal significant variations in the proficiency levels of students, teachers, and engineers across different writing objectives and document types in the field of engineering. Students exhibit strong skills in extracting main ideas from texts and recording key points from lectures, suggesting a solid foundation in basic comprehension and note-taking abilities. However, their proficiency in producing illustrations and diagrams, writing articles, and using scientific terms effectively shows room for improvement, indicating potential areas for further training and development.

Teachers consistently demonstrate high proficiency across most objectives, reflecting their extensive experience and comprehensive skill sets. Their high scores in using scientific terms and jargon correctly underscore their familiarity with the specialized language required in academic and professional engineering contexts. Teachers also excel in writing about tables and charts, which is crucial for data interpretation and presentation.

Engineers, on the other hand, show notable strengths in creating memos and technical specifications, essential documents in engineering practice. However, their lower proficiency in writing resumes, cover letters, and scientific publications points to a gap in skills that are increasingly important for career advancement and dissemination of research findings. This suggests that while engineers are adept at technical documentation, there is a need for targeted training in more formal and structured writing forms.

The analysis highlights the necessity for tailored language courses that address specific weaknesses and enhance the strengths of each group. By focusing on the areas where proficiency is lower, educational programs can better prepare students and professionals to meet the diverse communication demands of the engineering field. These findings provide a clear direction for future curriculum development, emphasizing the importance of a balanced skill set that includes both technical and formal writing capabilities.

4.3. Implications

The findings from this study have significant implications for both educational institutions and the professional engineering community. The variations in writing proficiency across different groups – students, teachers, and engineers – highlight the need for targeted and contextualized instructional strategies. In terms of curriculum development, the data suggests that current curricula may not fully address the diverse writing needs of future engineers. While students show strong proficiency in some areas, such as extracting main ideas from texts and recording key points from lectures, they struggle with producing visual aids and writing formal documents. This calls for a more comprehensive approach to curriculum design that integrates these skills across various subjects and projects. Instructional approaches can be improved by leveraging teachers' high proficiency across most writing objectives. Educational institutions should encourage collaborative learning environments where teachers can share their expertise through workshops, peer reviews, and one-on-one coaching sessions. This mentorship can help students develop the skills they are lacking, particularly in areas like scientific writing and the creation of technical illustrations. Integrating real-world engineering scenarios into coursework can make learning more relevant and engaging for students. Case studies, project-based learning, and partnerships with industry can provide students with hands-on experience in producing and using various types of engineering documents. This practical application of skills can bridge the gap between theoretical knowledge and professional requirements.

In the professional realm, continuous professional development is essential as engineers show lower proficiency in certain areas, such as scientific publications and formal documentation. Engineering firms and professional bodies could offer regular training sessions, workshops, and certification programs focused on enhancing writing and communication skills, helping engineers stay competitive and effective in their roles. Mentorship and peer learning within organizations can also foster continuous improvement, with senior engineers providing guidance and feedback on writing and documentation tasks. Establishing strong partnerships between academic institutions and the engineering industry is crucial. Collaborative efforts can include internships, co-op programs, guest lectures from industry professionals, and joint research projects, allowing students to gain firsthand experience and understand the writing and documentation standards expected in the professional world.

Creating feedback loops between academia and industry ensures that educational programs remain relevant and up-to-date with current industry practices. Regular consultations with industry stakeholders can inform curriculum adjustments, ensuring that students acquire the skills that are in demand. Implementing capstone projects that mimic real-world engineering challenges can provide students with a comprehensive learning experience, requiring them to produce a variety of documents such as technical specifications, reports, and scientific publications, thereby simulating the professional environment. Assessments should be based on real-world criteria, with input from industry professionals to ensure relevance. Utilizing advanced tools and technologies commonly used in the engineering field can also bridge the gap between academia and the workplace. Familiarity with software for technical writing, data visualization, and project management will better prepare students for the demands of their professional careers.

The study highlights the need for a more integrated and responsive educational framework that can adapt to the specific needs of different stakeholders in the engineering field. By addressing the identified gaps and leveraging the strengths of teachers and industry professionals, educational institutions can better prepare students for the diverse communication challenges they will face in their careers. Collaboration between academia and industry is essential to ensure that the skills taught in educational programs are aligned with professional standards and requirements, ultimately leading to a more competent and effective engineering workforce.

4.4. Limitations

Despite the insightful findings, this study has several limitations that should be acknowledged to provide a comprehensive understanding of its scope and applicability. Firstly, the sample size, while representative, may not fully capture the diversity of proficiency levels among students, teachers, and engineers in the engineering field. A larger, more varied sample could offer a more comprehensive view of the writing skills landscape, encompassing different sub-disciplines within engineering, diverse educational backgrounds, and varying levels of professional experience. This would help to better understand the full range of proficiency and the specific needs of each subgroup within the engineering community.

Additionally, the study relied on self-reported data, which introduces the potential for response bias. Participants might overestimate or underestimate their actual abilities, influenced by their self-perception or desire to present themselves in a favorable light. This bias can affect the accuracy of the data, potentially skewing the results. Future studies should consider incorporating objective measures of writing proficiency, such as direct assessments or analysis of writing samples, to complement self-reported data and provide a more accurate depiction of skills.

The study's focus on a specific region or institution further limits the generalizability of the results. Educational practices, language usage, and writing standards can vary significantly across different regions and institutions. Therefore, the findings from this study may not be directly applicable to other contexts or educational systems. Expanding the research to include multiple regions and institutions would enhance the external validity of the results, allowing for broader application and comparison across different educational settings.

The cross-sectional design of this study provides only a snapshot of proficiency levels at a single point in time. This approach fails to account for longitudinal changes and the impact of ongoing educational interventions. Writing skills can develop significantly over time with proper training and practice. Longitudinal studies, which track the same individuals over an extended period, would provide valuable insights into how writing proficiency evolves and the long-term effectiveness of various educational strategies.

Moreover, the study primarily utilized quantitative measures, which do not capture the qualitative aspects of writing proficiency. While quantitative data provides a useful overview of general trends and proficiency levels, it lacks the depth needed to understand the creativity, complexity, and context-specific nuances involved in writing tasks. Qualitative research methods, such as in-depth interviews, focus groups, and detailed analysis of writing samples, can provide richer, more detailed insights into the challenges and strengths of writers in the engineering field.

Another limitation is the potential variability in the interpretation of survey questions by different respondents. Misinterpretation or varying understandings of the questions could lead to inconsistent responses, further affecting the reliability of the data. Future research should ensure that survey instruments are thoroughly validated and pre-tested to minimize such issues.

Finally, the study did not explore the potential impact of external factors such as access to resources, language support services, or prior training in technical writing. These factors can significantly influence writing proficiency and should be considered in future research to provide a more nuanced understanding of the determinants of writing skills in engineering.

In summary, while this study provides valuable insights into the writing proficiency of students, teachers, and engineers, its limitations highlight the need for a more comprehensive and multi-faceted approach in future research. By addressing these limitations, subsequent studies can build on the findings presented here and contribute to a more detailed and accurate understanding of writing skills in the engineering domain. To this end, future research should incorporate larger and more diverse samples to enhance the generalizability of the findings. Including participants from different regions, institutions, and engineering disciplines could provide a broader understanding of writing proficiency levels. Longitudinal studies are recommended to observe how writing skills evolve over time and to assess the long-term impact of educational interventions. Additionally, employing qualitative research methods, such as in-depth interviews and analysis of writing samples, can offer richer insights into the complexities and context-specific nuances of writing proficiency. Exploring the integration of advanced technologies, such as AI-based writing tools and data visualization software, could provide innovative approaches to enhance writing skills. Future studies should also examine the effectiveness of different instructional strategies and curriculum designs in various educational and professional settings, determining best practices for developing writing proficiency. Collaborative research involving partnerships between academic institutions and engineering industries is essential to develop more relevant and

effective training programs, ensuring that graduates are well-prepared to meet the communication challenges in their professional careers. Finally, creating feedback loops between academia and industry will help keep educational programs aligned with current industry practices, thereby improving the readiness of engineers.

5. Conclusions

This study provides a detailed analysis of writing proficiency levels among students, teachers, and engineers in the field of engineering, revealing significant variations in their abilities across different writing objectives and document types. The results underscore that students generally demonstrate strong comprehension and note-taking skills, excelling in tasks such as extracting main ideas from texts and recording key points from lectures. However, there is a noticeable need for improvement in areas such as producing illustrations and diagrams, writing formal articles, and effectively using scientific terms.

Students, while proficient in basic comprehension and summarization tasks, struggle with more complex writing tasks that require a higher level of precision and technical knowledge. This gap in proficiency is particularly evident in their ability to produce professional-quality illustrations and diagrams, write formal articles, and use scientific terms accurately. These skills are crucial for success in engineering, where clear and precise communication of complex ideas is essential.

Teachers consistently show high proficiency across most objectives, reflecting their extensive experience and comprehensive skill sets, particularly in the correct use of scientific terms and data interpretation. Their ability to effectively communicate complex ideas and guide students in developing their writing skills is a testament to their expertise and dedication. However, even among teachers, there is room for improvement, particularly in areas where rapid advancements in engineering technology demand continuous learning and adaptation.

Engineers, while adept at creating technical documents such as memos and technical specifications, exhibit lower proficiency in writing resumes, cover letters, and scientific publications. This highlights a gap in skills essential for career advancement and research dissemination. Engineers' proficiency in technical writing does not always translate to other forms of professional communication, which are equally important for career development. These findings suggest that a tailored approach to language instruction, incorporating practical engineering scenarios and collaborative learning environments, can better prepare individuals for the diverse communication demands of the engineering profession. By addressing the specific needs of students, teachers, and engineers, educational programs can enhance writing proficiency across the board, ultimately leading to more effective communication and collaboration within the engineering field.

Informed Consent Statement: The study required an informed consent from the school's administration (see appendix B). Teachers and engineers' consents are not applicable

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Needs Analysis Questionnaire On EEP

This questionnaire aims to conduct a needs analysis in order to determine the purpose of English and the most used documents in engineering.

Personal information

1. Full name

Enter your answer

2. Gender *

○ Female
○ Male

3. Age *

Enter your answer

4. Institution/company *

Enter your answer

5. Occupation *
○ Engineering teacher
○ Engineering student
○ Engineer

6. Experience *
○ 1-5
○
○ 5-10
○
○ 10-15
○ More than 15 years

7. Educational level *
○ 1st year
○ 2nd year
○ 3rd year
○ 4th year
○ 5th year
○ Ph.D student
○ Other:_____

8. The objectives I am looking for in learning English *

	Very Important	Important	Neutral	Not Important	Not important at all
Extract the main ideas from a text.	○	○	○	○	○
Record key points from lectures, documentaries, discussions, or scientific meetings.	○	○	○	○	○

Produce illustrations and diagrams from written texts.	○	○	○	○	○
Write about tables and charts.	○	○	○	○	○
Writing articles	○	○	○	○	○
Write outlines, facts, scientific questions, reports, outlines, synthesis, and steps to follow.	○	○	○	○	○
Correct use of the grammatical structures of the English language when writing.	○	○	○	○	○
Express and defend your personal opinions in writing.	○	○	○	○	○
Correct and effective use of scientific terms and jargon when writing.	○	○	○	○	○

9. The documents I am using or likely to use

	Very Important	Important	Neutral	Not Important	Not important at all
Presentations	○	○	○	○	○
Email	○	○	○	○	○
Resume and cover letters	○	○	○	○	○
Minutes and reports	○	○	○	○	○
Synthesis	○	○	○	○	○
Memorandum (Memo)	○	○	○	○	○
Technical specifications	○	○	○	○	○
Instruction manual	○	○	○	○	○
Scientific Publications	○	○	○	○	○
Business Plan	○	○	○	○	○

10. Other document type:

Appendix B

Institutional Consent 1 (French): Needs Analysis Questionnaire

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Madame la directrice, Nadia Kouicem
EMSI Marrakech, 40000, Marrakech

Marrakech, le 03/05/2023

Chère Madame la Directrice,

Object : Demande pour une étude empirique

Dans le cadre de ma recherche de thèse doctorale intitulé: "Investigating the Problem-Based Learning on developing students' writing skill in Moroccan ESP classes : EMSI Marrakech as a Case Study", je vous écris pour solliciter votre autorisation afin de mener une recherche empirique visant à collecter des données auprès des étudiants et des professeurs de notre établissement. Cette recherche sera menée à l'aide d'un questionnaire qui sera distribué de manière confidentielle.

L'objectif principal de cette recherche est de mieux comprendre les attentes des membres de notre communauté universitaire, en particulier en ce qui concerne leurs besoins en anglais. Les données collectées nous permettront également de mieux établir un syllabus basé sur les besoin et attentes de nos étudiants.

Je tiens à noter que les participants le feront volontairement et librement. De la même manière, qu'ils peuvent se retirer à tout moment sans conséquence. En outre, il est important de souligner que les données fournies par les étudiants, ainsi que leurs identités, resteront strictement confidentielles et que les résultats obtenus ne représenteront aucun préjudice pour les performances académiques de la matière.

Je suis convaincu que les résultats de cette recherche seront bénéfiques pour notre établissement et pour notre communauté universitaire dans son ensemble. Je vous serais reconnaissant de bien vouloir accorder votre autorisation pour la conduite de cette étude.
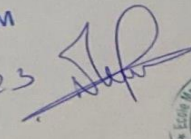
Je vous prie d'agréer, Madame la Directrice, l'expression de ma plus haute considération.

Cordiazement,

Ait Hammou Marouane

Mme. N.KOUICEM
Directrice
Date & visa :
12/05/2023

Institutional Consent 1 (English): Needs Analysis Questionnaire

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Madam Director, Nadia Kouicem
EMSI Marrakech, 40000, Marrakech

Marrakech, May 05, 2023
Subject: Request for an Empirical Study

Dear Madam Director,

As part of my doctoral thesis research titled "Investigating Problem-Based Learning in Developing Students' Writing Skills in Moroccan ESP Classes: EMSI Marrakech as a Case Study," I am writing to request your permission to conduct empirical research aimed at collecting data from students and teachers at our institution. This research will be carried out through the distribution of a confidential questionnaire.

The primary objective of this research is to gain a better understanding of the expectations of members of our academic community, especially concerning their English language needs. The data collected will also help us in establishing a syllabus based on the needs and expectations of our students.

I would like to emphasize that participants will be entirely voluntary, and they may withdraw their participation at any time without consequences. Furthermore, it is important to highlight that the data provided by the students, as well as their identities, will remain strictly confidential, and the results obtained will have no bearing on their academic performance.

I am confident that the results of this research will be beneficial for our institution and our academic community as a whole. I would be grateful if you could grant your permission for the conduct of this study.

Please accept, Madam Director, the expression of my highest consideration.

Sincerely,

Ait Hammou Marouane

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