Technical Writers' Perceptions on the Effect of CEIT Undergraduate Courses on Technical Documentation

Yeşim Arslan[a]*, Ömer Delialioğlu[b]

[a](ORCID ID: 0009-0001-8226-2156), Middle East Technical University, Computer Education and Instructional Technology, Ankara, Türkiye, omerd@metu.edu.tr
[b](ORCID ID: 0000-0001-6515-3516), Middle East Technical University, Computer Education and Instructional Technology, Ankara, Türkiye, yesim.arslan@metu.edu.tr
*Corresponding author

ABSTRACT

This study investigates the professional knowledge, and skill sets of individuals employed in the technical documentation sector who have graduated from the Computer Education and Instructional Technologies (CEIT) program. The research further aims to propose enhancements to the CEIT curriculum through the inclusion of relevant elective courses tailored to this field. The study utilized a mixedmethods research design, incorporating surveys and semi-structured interviews, and involved a total of 40 participants. Data was gathered through a survey administered to 10 technical writers employed across various organizations, alongside semi-structured interviews conducted with 30 additional technical writers. The findings indicate that CEIT graduates employed as technical writers perceive themselves as competent in their field and regard the current curriculum as effective in supporting the production of technical publications. Participants also recommended the inclusion of an elective course within the CEIT undergraduate program to provide instruction on technical documentation tools and the documentation standard S1000D.

INTRODUCTION

In recent years, the importance of adhering to specific standards in the preparation of documents for corporate organizations and large-scale projects has been increasingly emphasized, both in Turkey and globally. This is particularly significant for the development of the Turkish military system, where technical documentation standards hold most importance (Bayrak, 2013). Despite the growing demand for technical documentation expertise, there is a notable shortage of professionals proficient in this rapidly evolving sector. Companies place a high value on competency-based skills, recognizing that prioritizing such expertise fosters organizational growth and development (Kratvetz, 1999).

When the curriculum catalogue of the Faculty of Education programs published by the Council of Higher Education (YÖK) for Computer Education and Instructional Technology (CEIT) - Undergraduate Program is examined, it is evident that no academic departments currently offer training specifically designed to equip students with the skills needed for technical documentation. A skilled workforce is indispensable for achieving success in the implementation of instructional technology (Hızal, 1983). However, it is critical that standardization processes are developed by professionals and that adequately trained personnel are available. Seferoğlu (2007) underscores the importance of instructional technology in the development, utilization, and evaluation of materials. Members of this emerging profession must possess a combination of operational procedural knowledge, specialized technical expertise, and proficiency with relevant tools and equipment. However, it has been reported that graduates of Computer Education and Instructional Technology (CEIT) programs in Turkey have undertaken such tasks professionally, particularly in the defense industry (Bayrak, 2013).

The main objective of this study is to assess the technical documentation proficiency of CEIT graduates and examine the effectiveness of the CEIT curriculum in preparing students for careers in this field. The study also seeks to determine the degree to which the curriculum aligns with the prerequisites for a career as a technical writer. The incorporation of courses such as "Computer Applications in Education" and "Instructional Technologies and Material Development" in teacher preparation programs, which is one of its key areas of focus (Durdu & Yıldırım, 2005). Given the dynamic nature of technical documentation, it is argued that the CEIT curriculum may struggle to adapt to these ongoing changes. This study focuses on technical writers, a growing group of professionals whose importance has gained prominence in Turkey.

The document preparation process, once handled by professionals in various countries, is also now carried out domestically using the S1000D standard. This international specification is primarily used in military projects and guides the creation, management, and exchange of technical documentation throughout the lifecycle of both military and civil aerospace projects. According to Dragić, Dević & Ivanišević (2016), the standard ensures efficient documentation practices. Bayrak (2013) notes that software tools like Framemaker, InDesign, or Microsoft Word are required to create documents within the S1000D framework. It provides

an up-to-date resource regarding the competence of Technical Writers who graduated from CEIT and the CEIT curriculum in the field.

Specifically, this research examines how CEIT curriculum courses address the needs of graduates working in technical documentation and evaluates their professional competencies. The study, designed within this framework, seeks to answer the following research questions:

1. How do CEIT graduates working as technical documentation writers utilize the technical documentation environment?
1.1 What methods or strategies do technical writers employ to integrate relevant coursework from their undergraduate curriculum into the field of technical documentation?
2. Do CEIT undergraduate courses adequately support the skills required for technical documentation?
2.1 According to the perceptions of technical writers, what knowledge and skills are essential for performing technical documentation effectively?
3. What knowledge and skills courses should be added to the undergraduate curriculum for technical documentation?
3.1 What are the relevant factors affecting the integration of application software used in technical documentation into the curriculum?

METHOD

Research Design

This study, carried out in order to assess the technical documentation proficiency of CEIT undergraduate students, employed a mixed-method approach to integrate qualitative and quantitative data, ensuring more robust and reliable findings. The mixed-method approach, also referred to as methodological variation, leverages a range of analytical techniques to address research questions comprehensively (Dunning, Williams, Abonyi, & Crooks, 2008). According to Creswell (2013), mixed-methods research involves the collection and integration of both quantitative and qualitative data within various designs, which may include theoretical frameworks and philosophical assumptions. Similarly, Fetters, Curry, and Creswell (2013) emphasize that combining diverse approaches in mixed-method research provides effective tools for analyzing complex systems and processes, particularly in large-scale studies.

In this study, qualitative and quantitative research paradigms were applied through interviews and survey methods. The research was structured in three stages: (1) defining research questions and framing the study around these questions, (2) analyzing the collected data within the scope of these research questions, and (3) interpreting the analyzed data in the context of the same framework. Firstly, in order to understand the experiences of the participants in the study, semi-structured interviews (content analysis) were used for qualitative analysis and technical documentation survey form (descriptive analysis) was used for quantitative analysis to collect numerical data. Then, frequency and percentage analysis were conducted for Technical Documentation Survey Form. Qualitative data obtained from semi-structured interviews were analyzed by transcribing them word for word with word processing software to ensure accuracy and conduct a more detailed analysis. These methods allowed for a comprehensive evaluation of both qualitative and quantitative dimensions of the study.

Study Group

Convenience Sampling was used in the selection of the study participants for semi-structured interviews and Snowball Sampling for the survey. The selection criteria included participants holding a CEIT undergraduate degree and working in the field of technical documentation. Convenience Sampling involves selecting participants who are easily accessible and available, facilitating efficient data collection (Yıldırım & Şimşek, 2016).

The study involved a total of 40 voluntary participants: 10 technical documentation experts employed at various companies in Turkey participated in the interviews, while 30 additional participants completed the survey. The sample group was drawn from employees in the technical documentation field, particularly in the defense industry and related sectors. The researcher, being employed in a defense industry company in Ankara, leveraged this professional context to access and recruit participants within the relevant domain.

Table 1. Demographic Information of the Study Group

Gender	N	%
Male	12	30
Female	28	70
Total	**40**	**100**
Age	**N**	**%**
24-26	13	32.5
27-29	21	52.5

	N	%
30 and above	6	15
Total	40	100
Work Experience	**N**	**%**
0-1	10	25
2-4	23	57.5
5 and above	7	17.5
Total	40	100
Field of Activity	**N**	**%**
Defense Industry and Civil Sector High-Tech Products	35	87.5
Software Technologies and Cyber Security	4	10
Electrification, Automation and Digitalization Technologies	1	2.5
Total	40	100

As presented in Table 1, the study group comprises 40 technical publication experts, including 28 women and 12 men. The participants' ages are distributed as follows: 13 individuals are aged 24–26, 21 are aged 27–29, and 6 are aged 30 or older. Regarding professional experience, 10 participants have 0– 1 year of work experience, 23 have 2–5 years of experience, and 7 have over 5 years of experience. In terms of professional fields, 35 participants work in the Defense Industry and Civil Sector High-Tech Products, 4 are employed in Software Technologies and Cybersecurity, and 1 individual works in Electrification, Automation, and Digitalization Technologies.

Data collection Tools and Analysis

The interview and survey instruments, developed by the researcher, included questions regarding participants' gender, age, professional background, and industry. Additional items explored participants' proficiency with software programs learned during their undergraduate education, their application of these programs in their current workplace, and their perceptions of the adequacy of undergraduate courses in preparing them for professional practice.

Demographic data were initially analyzed using frequency and percentage analysis. Qualitative data from the semi-structured interviews were transcribed verbatim using word processing software to ensure accuracy and facilitate a detailed examination. The study adopted an explanatory sequential mixed methods design, integrating qualitative and quantitative data for comprehensive analysis. The researcher worked with 40 CEIT graduates employed in technical documentation across various industries. 10 participants took part in semi-structured interviews, while the remaining 30 completed a Technical Documentation Survey Form. The data collected reflected the views and experiences of CEIT alumni. Additionally, in order to ensure the validity and reliability of the research findings, measures were taken regarding the validity and reliability of the data collection techniques. The validity and reliability techniques are shown Table 2.

Table 2. The validity and reliability techniques

	Semi-structured Interview	Technical Documentation Survey Form
Validity Measurement	The interview questions were chosen to align with the study's objectives and were reviewed by two experts in the field for consistency. Efforts were also made to arrange the questions logically and ensure their compatibility with one another.	A technical lead in technical documentation interviews and a recruitment specialist reviewed the survey's questions on professional knowledge and skills. The questions related to the course curriculum were based on the CEIT curriculum from the official Higher Education Institution (YÖK) website. Efforts were made to ensure the questions were organized coherently and consistently.
Reliability Measurement	To facilitate clearer responses, the interview incorporated both multiple-choice and open-ended questions. Demographic questions were posed initially to help participants feel comfortable and at ease. Additionally, participants were informed at the start of the interview about the total number of questions, the expected duration, and how their personal information would be safeguarded.	To help participants feel at ease and secure, demographic questions were asked first. They were also informed about the number of questions, the interview's duration, and how their personal information would be protected.

Additionally, Table 3 also provides the data collection tools used to answer the research questions and the data analysis methods that show how the findings were analyzed.

Table 3. Data Collection Tools and Analysis Methods

Research Questions	Data Collection Tool	Data Analysis Method
1	Semi-structured Interviews	Qualitative Analysis (Content Analysis)
	Technical Documentation Survey Form	Quantitative Analysis (Descriptive Analysis)
1.1	Semi-structured Interviews	Qualitative Analysis (Content Analysis)
2	Semi-structured Interviews Technical Documentation Survey Form	Qualitative Analysis (Content Analysis) Quantitative Analysis (Descriptive Analysis)
2.1	Semi-Structured Interview	Qualitative Analysis (Content Analysis)
3	Semi-Structured Interview	Qualitative Analysis (Content Analysis)
3.1	Semi-Structured Interview	Qualitative Analysis (Content Analysis)

FINDINGS

This section explains the extent to which a CEIT graduate working as a technical writer and the curriculum courses he/she took during his/her undergraduate studies are sufficient. Semi-structured interviews were conducted with 10 CEIT graduates working in the field of Technical Documentation and a 'Technical Documentation Survey Form' was conducted with 30 CEIT graduates working in the same field. In total, the following themes and codes emerged as a result of the interviews conducted with technical writers.

First, the results of the descriptive analysis of the quantitative data collected with the 'Technical Documentation Survey Form' are presented. The qualitative information obtained through semistructured interview questions is then discussed. Key themes that illuminate the results are provided after the gathered data were interpreted. This information offers insights into the professional qualifications of CEIT graduates and how the curriculum is applied in the workplace. In these surveys and interviews, questions were asked about the competencies that the participants used in their business life, the courses they took during their undergraduate studies, the extent to which these courses were useful in their business life, and the gains they needed to acquire. A comprehensive analysis was conducted based on the data received from a total of 40 participants and codes and categories were developed according to their relevance.

1. How does a CEIT graduate working as a technical writer use the technical documentation environment? (N=40)

In both the survey and interviews, participants were asked about the tools they use in their work environment. The table shows the tools that participants frequently answered, categorized and the rates (Table 4).

Table 4. Survey & Interview Question: Which tools do you use in your workplace?

	Software Tools	**f**	**%**
	Microsoft Office **Total**	37 **40**	92,5 **100**
	Adobe Illustrator **Total**	36 **40**	90 **100**
	Adobe Photoshop **Total**	39 **40**	97,5 **100**
Qualitative & Quantitative Results	Adobe Framemaker	38	95
	Total	**40**	**100**
	Design Tools	**f**	**%**
	Blender	3	7,5
	Total	40	100
	3D Max	**2**	**5**
	Total	**40**	**100**
	KeyShot	5	12,5
	Total	40	100

The findings showed that participants used the technical documentation environment in two distinct categories: design tools and software tools.

1.1 What methods/strategies does the technical writers use in the process of integrating the relevant courses in the undergraduate curriculum into the technical documentation field?
(N=10)

In the semi-structured interview, participants were asked how they used their undergraduate courses in their work. Participants generally answered for this question "By using presentation strategies and design skills effectively", "By using presentation and design skills, planning and analysis correctly" and "By using computer and design skills effectively". The table shows the theme that participants frequently answered, categorized and the rates (Table 5).

Table 5. Interview Question: How do you ensure the professional integration of the courses you have taken in your undergraduate life?

	Theme	f	%
Qualitative Results	Practical methods/strategies	2	20
	Theoretical methods/strategies	8	80
	Total	**10**	**100**

The results showed that CEIT graduates working in the documentation industry apply both theoretical and practical approaches and strategies.

2. Do CEIT undergraduate courses support the skills required for studies in the field of technical documentation? (N=40)

In both the semi-structured and survey studies, participants were asked whether their undergraduate courses were effective in their professional work lives. The table shows the theme that participants frequently answered, categorized and the rates (Table 6).

Table 6. Survey & Interview Question: Do you think the courses you have taken in your undergraduate life are sufficient to practice this profession?

	Theme	f	%
Qualitative &	Strongly Agree & Agree	28	70
Quantitative	Undecided	6	15
Results	Strongly Disagree & Disagree	6	15

According to the findings, the majority of participants agree that CEIT undergraduate courses help students develop the skills necessary for employment in the technical documentation industry. However, some participants disagreed with this notion, while others remained uncertain.

2.1. According to technical writers, what are the necessary knowledge and skills to be able to do technical documentation?

Participants were asked what skills and abilities they needed to work in this field. They answered this question as "Analytical and practical thinking, interpretation and understanding", "To know the principles of computer literacy, analysis, analytical and multidimensional thinking", "Correct and effective use of design, analysis and grammar" and "Framaker and Illustrator tools". The table shows the theme that participants frequently answered, categorized and the rates (Table 7).

Table 7. Interview Question: What abilities and skills do you need for the Technical Writer profession?

	Theme	f	%
Qualitative Results	Theoretical knowledge	8	80
	Practical knowledge for software tools	2	20
	Total	**10**	**100**

According to the findings, there are two main categories of knowledge and abilities needed to create technical documentation: theoretical knowledge and practical software expertise. Some individuals (N=2) assert that practical knowledge for software is necessary, but the majority of participants (N=8) claim that theoretical knowledge is necessary.

3. What knowledge and skill courses should be added to the undergraduate curriculum for technical documentation?

In semi-structured interviews, participants were asked what kind of additional courses/skills could be added to the CEIT curriculum. Participants generally answered, "Document preparation documents technical document standards (S1000D)," "Reading and writing technical documentation.", "Used for interactive content and written document preparation sections." and "The application I generally use is Adobe Framemaker, KeyShot and Siemens NX can be added.". The table shows the theme that participants frequently answered, categorized and the rates.

Table 8. Interview Question: What kind of additional courses can be added to the curriculum in your undergraduate education?

	Theme	f	%
Qualitative Results	Theoretical courses about documentation	6	60
	Software tools used to document for preparing	3	30
	Total	**9**	**90**

The findings indicated that the knowledge and skills required to create technical documentation can be divided into two categories: software tools for document preparation and theoretical courses on documentation. Some participants (N=3) suggested that software tools for document preparation should be introduced, while the majority of participants (N=7) advocated for the inclusion of theoretical courses on documentation. One individual (N=1) did not provide any indication.

3.1. What are the relevant factors affecting the integration of application software used in technical documentation into the curriculum?

The table 9 shows the theme that participants frequently answered, categorized and the rates.

Table 9. When did you first hear about the profession of Technical Writer?

	Theme	f	%
	During undergraduate years	2	20
	From a friend	3	30
	While searching for a job	5	50
Qualitative Results	**Total**	**10**	**100**
	Were you considering becoming a technical writer in your undergraduate life?"		
	Theme	f	%
	Not considering	10	100
	Total	**10**	**100**

According to the findings, most participants stated that they learned about this field from acquaintances employed in it, as well as while searching for a career after graduation. It was also acknowledged that, prior to graduation, CEIT graduates had not considered technical writers.

DISCUSSION AND CONCLUSION

Discussion

According to Bayrak (2013), standardizing and integrating technical documentation poses numerous challenges. While many CEIT graduates believe they possess the competencies required for technical documentation, there is a consensus that the undergraduate curriculum does not fully address their needs in this field. Torun, Güler, and Şanal (2021) highlight that while some students prefer careers in the software and networking industries, others pursue teaching, with limited interest or clarity regarding technical documentation. This lack of clear orientation towards technical documentation among graduates suggests ambiguities in both the curriculum and professional expectations. The study suggests that the CEIT curriculum should be updated and improved to better align with the needs of the technical documentation field.

Although many CEIT graduates feel equipped with the requisite knowledge and skills, some emphasize the need for more specialized training. Interviews conducted in this study reveal that participants' main concerns relate to instructional material creation, design techniques, documentation standards, and effective language use. Graduates believe their education provides a solid foundation but recommend adding optional courses on technical documentation, covering topics like software applications, documentation standards, and specialized training to address current gaps. It is recommended to update the CEIT curriculum to align with technological advancements and improve instructor quality and teaching methods to better support graduates in their careers, as suggested by Özen, Akar & Horzum (2017). Additionally, in semi-structured interviews, most participants reported using knowledge gained during their undergraduate education, such as design principles, grammar and spelling rules, reading skills, and presentation techniques, to integrate into their profession.

The findings of this study suggest that the CEIT curriculum needs to be updated and enhanced to better meet the demands of the technical documentation field. While most graduates believe their undergraduate education provides an adequate foundation, the inclusion of optional courses focused on technical documentation would be beneficial. Participants specifically recommended adding topics such as software applications, documentation standards, and specialized training in this area. Additionally, offering

elective courses to address the lack of awareness and understanding of technical documentation within the undergraduate curriculum is strongly advised.

Conclusion

The primary objective of this study was to evaluate the professional knowledge and skills of CEIT graduates in technical documentation, identify gaps in the curriculum, and provide recommendations for improvement. The findings indicate that the current undergraduate CEIT program only partially satisfies graduates' educational needs in this area. Participants highlighted the importance of competencies in language proficiency, visual and creative design, and the use of documentation tools, all of which are essential for technical documentation.

Through semi-structured interviews and surveys, this study assessed the alignment of the CEIT program with the standards required for technical documentation. The data collected from CEIT alumni revealed both the strengths and weaknesses of the curriculum. In conclusion, the study emphasizes the need for the CEIT curriculum to address the requirements of technical documentation more comprehensively, recommending the inclusion of relevant courses and practical applications to prepare graduates effectively for this field.

Özen, Akar & Horzum (2017) suggest updating the CEIT curriculum to align with technological advancements and improving instructor quality, which will benefit graduates in their careers. Arslangilay (2019) notes that the CEIT curriculum reflects 21st-century skills and adapts to global changes. Findings show that most participants were unaware of technical documentation during their undergraduate education and only learned about it after graduation, highlighting the potential benefit of adding elective courses on technical documentation to the curriculum to raise awareness.

The findings of this research showed that;
1. CEIT graduates meet the necessary knowledge and skills for technical documentation, making them qualified candidates for the field.
2. CEIT graduates lack awareness of technical documentation as a career path, often pursuing fields like software, networking, or teaching. Only a few explore this field during job searches, and their competence in technical documentation is unclear.
3. CEIT graduates feel competent in technical documentation, though they acknowledge the need to learn specific software and document creation techniques to fully excel in the field.
4. Participants' skills in technical documentation primarily include designing educational materials, design methods, document preparation standards, and effective language use. Durmaz (2012) also notes that CEIT graduates are competent in technical and communication skills at an average level.

Ethical Approval and Participant Consent: The necessary ethical approval for the study was obtained from Middle East Technical University Research Ethics Committee, (Date: 19.06.2023, Ethical Clearance No: 42-ODTUIAEK-2023).

REFERENCES

Arslangilay, A. S. (2019). 21st century skills of CEIT teacher candidates and the prominence of these skills in the CEIT undergraduate curriculum. *Educational Policy Analysis and Strategic Research, 14*(3), 330-346.

Bayrak, A. H. (2013). Bayrak, Ayşe Hilal. *Title Business process definition for technical publication needs: a defense company case (Master's thesis*, Middle East Technical University).

Creswell, J. W. (2013). *Araştırma Deseni, Nitel, Nicel ve Karma Yöntem Yaklaşımları (Çev. S. B. Demir)*. Ankara: Eğiten Kitap.

Dragić, B., Dević, V., & Ivanišević, M. (2016). A New Approach to Creating and Managing Technical Publications for Aircraft Lasta Usıng S1000D Standard. *7th International Scientific Conference on Defensive Technologies*.

Dunning, H., Williams, A., Abonyi, S., & Crooks, V. (2008). A mixed-method approach to the quality-of-life research: A case study approach. *Social indicators research, 85*, 145-158.

Durdu, P. O., & Yildirim, Z. (2005). Bilgisayar ve Öğretim Teknolojileri Eğitimi Programına İlişkin Öğrencilerin ve Öğretim Elemanlarının Algıları. *Eurasian Journal of Educational Research (EJER), (19)*.

Durmaz, T. (2012). Competencies of instructional technologists graduated from computer education and instructional technology department as required by information technology firms (Master's thesis, Middle East Technical University).

Fetters, M. D., Curry, L. A., & Creswell, J. W. (2013). Achieving integration in mixed methods designs—principles, and practices. *Health services research, 48(6pt2),* 2134-2156.

Hızal, A. (1983). Uzaktan eğitim süreçleri ve yazılı gereçler. Ankara: Ankara Üniversitesi. Eğitim Bilimleri Fakültesi.

Kratvetz, D. J. (1999). Building a job competency database: What the leaders do. In Training Best Practices, Kravetz Associates. Retrieved January 2012, from

Özen, S., Akar, S. G. M., & Horzum, M. B. (2017). Evaluation Of CEIT Curriculum in Universities Which Followed Different Curriculum Toward Students Opinions. *Cukurova University Faculty of Education Journal, 46*(2), 587-602.

Seferoğlu, S. S. (2007). Preservice teachers' perceptions of their computer self-efficacy. In *Fourth International Conference on E-learning for Knowledge-based Society (pp. 18-19)*. http://www.kravetz.com/art2/art2.doc

Torun, F., Güler, T. D., & Şanal, S. Ö. (2021). An Overview of the Current Career Status of CEIT Department Graduates. *Eğitim Kuram ve Uygulama Araştırmaları Dergisi, 7*(1), 21-47.

Yıldırım, A. ve Şimşek, H. (2016). *Sosyal bilimlerde nitel araştırma yöntemleri (10. Baskı).* Ankara: Seçkin Yayıncılık.