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Generative Artificial Intelligence and Usage in Academia

Üretken Yapay Zeka ve Akademide Kullanımı

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ABSTRACT

Artificial intelligence is not a new concept. However, it has reached an important point with technological development. Today, there are many software developed using artificial intelligence and various application areas where they are used. Generative artificial intelligence, one of these areas, is a technology in machine learning of artificial intelligence, aiming to generate new content by training on large data sets. Generative artificial intelligence is used in fields such as health, business, finance, e-commerce, academic studies, and R&D. This study evaluates the use of generative artificial intelligence applications in the academic field. In this context, the differences and similarities between texts generated by ChatGPT, Claude Sonet, and Google Gemini generative artificial intelligence applications and texts prepared by human intelligence were analyzed regarding subject integrity, language, ethics, and plagiarism rate. Descriptive content analysis, one of the qualitative methods, was used in the study. As a result, it was concluded that texts generated by generative artificial intelligence applications and texts prepared by human intelligence are similar in subject integrity and content, and plagiarism rates of texts generated by generative artificial intelligence vary according to language.

Anahtar Kelimeler
Yapay Zekâ,
Bilgi Yönetimi
Üretken Yapay Zekâ

ÖZ

Yapay zekâ yeni bir kavram olmamakla birlikte teknolojinin gelişmesiyle önemli bir noktaya gelmiştir. Günümüzde yapay zekâ kullanılarak ortaya çıkarılmış birçok yazılım ve bu yazılımların kullanıldığı farklı uygulama alanları vardır. Bu uygulama alanlarından bir tanesi olan üretken yapay zekâ, büyük veri kümeleri üzerinde eğitilerek yeni içerikler üretmeyi amaçlayan, yapay zekânın makine öğrenmesi alanında geliştirilen bir teknolojidir. Üretken yapay zekâ sağlık, işletme, finans, e-ticaret, akademik çalışmalar ve Ar-Ge gibi birçok alanda kullanılmaktadır. Bu çalışmada üretken yapay zekâ uygulamalarının akademik alanda kullanılması değerlendirilmiştir. Bu kapsamda, ChatGPT, Claude Sonet ve Google Gemini üretken yapay zekâ uygulamaları tarafından üretilen metinler ile insan zekâsı tarafından hazırlanan metinlerin farklılık ve benzerlikleri, konu bütünlüğü, lisan, etik ve intihal oranı açısından incelenmiştir. Çalışmada nitel analiz metotlarından betimleyici içerik analizi kullanılmıştır. Çalışma neticesinde üretken yapay zekâ uygulamaları ile üretilen metinler ile insan zekâsı tarafından üretilen metinlerin birbirine konu bütünlüğü ve içerik açısından benzediği, üretken yapay zekâ ile üretilen metinlerin intihal oranlarının lisana göre değişiklik gösterdiği sonucu ortaya çıkmıştır.

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1. Introduction

The advancement of technology has brought new trends to the field of knowledge management. Generative artificial intelligence (GAI), an application area within artificial intelligence (AI), is an emerging trend. AI is based on the simulation of human intelligence (HI) and, as a metaphor, adapts HI's learning and reasoning processes to computer science. GAI applications are recognized as an application area within Natural Language Processing, the machine learning subfield of AI. While the rise of AI can be evaluated in the context of experts, the rise of GAI has been accepted in all segments of society. In fact, in terms of society, GAI applications have started to be called AI applications in general. In particular, ChatGPT, Claude Sonet, Dall-E, Gemini and Vertex applications have recently gained significant popularity. In addition, thanks to the AI support provided by ChatGPT to applications without AI support, such as text editors and PDF readers with AI support, have emerged. The ChatGPT GAI application, also selected for this study, is a GAI tool used to generate new content, including text and images, trained on large datasets (McKinsey, 2023; Varghese & Chapiro, 2023). Thanks to the API (Application Program Interface) support in GAI such as ChatGPT, Claude and Google Gemini, it can be integrated with software used in sectors such as health, education, automotive and manufacturing, and can enhance the capabilities of the software it is integrated with. For example, it can automatically generate product descriptions on e-commerce platforms or provide new ideas for those who need data on a specific topic. On the Android Playstore, the AI tool is used to generate descriptions and screenshots of some applications. For a student, it can help outline the scope of content when preparing a homework assignment, paper, or presentation (Farrelly & Baker, 2023; Habib, Vogel, Thorne, & Xiao, 2023; Yilmaz & Karaoglan Yilmaz, 2023). For a parent, it can serve as an assistant to help their elementary school child with homework. For an employee, it can function as a colleague who helps in preparing work-related documents. For a human resource manager, it can act as an assistant to provide the conceptual framework needed to evaluate employee performance (Prasad Agrawal, 2023). For a pharmacist, it can be a medical assistant that helps develop drug formulations (Colbran & Toker, 2023). For a physician, it can improve diagnostic accuracy by synthesizing patient information (Varghese & Chapiro, 2023). For an academic, it can be a complementary tool in scientific research (Dien, 2023; Farrelly & Baker, 2023; Ratten & Jones, 2023). In summary, GAI is being used in most sectors and is emerging as a kind of assistant for employees in business processes or as a structure in which processes are automated. However, the concept of ethics regarding the use of GAI, especially in the academic field, is also being discussed. In this context, the Council of Higher Education in Turkey has published a document on the ethical use of GAI in academic research. This document acknowledges the ethical drawbacks of GAI, but emphasizes its potential benefits. In particular, with the statement "GAI systems, which have great potential in education and research, can significantly improve the quality and effectiveness of education and research if they are used within the framework of ethical principles and scientific responsibility," it is stated that GAI applications can be used in the production of academic texts, but ethical principles should be taken into account (Yükseköğretim Kurumu, 2024).

The use of GAI in the academic field has been examined in the literature in two different ways. The first is the purposes for which GAI applications can be used in the academic field. For example, Farrelly and Baker (2023) and Ratten and Jones (2023) stated that GAI applications can be used in the generation of academic texts, that is, in the generation of their content, while Peres, Schreier, Schweidel, and Sorescu (2023) stated that texts can be translated, grammatically checked, and rewritten in an academic tone. They also emphasized that it is important for the researcher to have detailed knowledge of the topic to prepare content using GAI. Because the content generated by GAI may contain errors. He stated that the direct use of erroneous content in studies may reduce the quality of scientific studies. Habib et al. (2023) stated that GAI applications can be used to prepare students' homework and presentations. Second, studies in the literature have addressed the consistency of textual content and ethical processes related to the use of GAI in academia. Schlagwein and Willcocks (2023) examined the relationship between the use of GAI and ethics, particularly in terms of transparency. They argued that when a text is generated using GAI applications, it is imperative to be transparent about the assistance provided by these tools. Similarly, Leung et al. (2023) emphasized that GAI applications should not be cited as co-authors in research studies due to their lack of accountability. Researchers are advised to clearly indicate the extent to which GAI is used, in accordance with the principles of transparency.

A review of the literature reveals there isn't encountered any study that compares the texts generated by three distinct GAI applications with different AI technologies with a text prepared by human intelligence in terms of content, language and plagiarism rate. In this context, this study aims to fill this gap by exploring the application areas of GAI in the academic field and examining its ethical use. This study can be considered as a kind of practical application of the studies on GAI in the literature. In addition, the study also evaluates how plagiarism rates may change in language translations of texts generated by GAI applications.

2. Literature Review

AI models abilities such as problem solving, reasoning, and learning specific to human intelligence through computer software, serving as a metaphorical concept (Copeland B.J., 2023). The origins of AI research can be traced back to the 9th century. Important milestones in the history of AI include Al-Khwarizmi's work on algebra and algorithms in the 9th century and Al-Jazari's contributions to cybernetics and programmable automata in the 13th century. The term "automaton" was used before the term "robot" and served as an early precursor in the nomenclature of the time. In 1021, Ibn al-Haytham's research on the human brain's perception of images laid the groundwork for modern visual recognition studies in computer science. In the 1300s, Ibn al-Nafis laid the foundation for systematic data collection using scientific techniques and data analysis in medicine (Külcü, 2015; Türkiye Gazetesi Ansiklopedi Grubu, 2005). In 1595, Taqî al-Dîn Effendi, an astronomer of the Ottoman Empire, discovered a mechanical clock, now considered an analog computer. Although primarily used for astronomical calculations, Taqî al-Dîn Effendi successfully analyzed the relationship between geometry and mechanics, forming the basis of modern computing systems (Gökdoğan, 2024). In 1726, Jonathan Swift introduced a fictional machine on the island of Laputa in his novel Gulliver's Travels, representing an early form of imaginary technology that influenced the development of computing (Rodgers, 2017). This discovery allowed individuals to write about topics outside of their expertise. In 1844, Ada Lovelace developed an algorithm for a machine, earning her the title of the world's first programmer (Carlucci Aiello, 2016). In 1936, the development of the Turing machine marked another significant advancement in the field (Wu, Qiu, & Xing, 2012). Following these and other key developments, AI research progressed steadily, culminating in the first mention of AI by John McCarthy at the Dartmouth Conference in 1955 (Morgenstern & McIlraith, 2011). That same year, The Logic Theorist became the first AI software, and in 1959, Arthur Samuel introduced the term "machine learning" (Fogel, 2002). The first industrial robot, Unimate, was developed in 1961 (Cannataro, Guzzi, Agapito, Zucco, & Milano, 2022). The 1970s saw the emergence of natural language processing, while the 1980s saw the development of autonomous vehicles, business intelligence systems, and neural networks. In 1988, Jabberwacky became the first chatbot. In the late 1990s, big data was introduced (Jabberwacky, 2024). In 2007, IBM developed Watson, a system similar to ChatGPT (Cannataro et al., 2022). The development of AI since 2010 can be divided into three major phases. From 2010 to 2016, advances in neural-network design led to major advances in AI, particularly in image recognition and deep learning, exemplified by models such as AlexNet and AlphaGo, which achieved remarkable success. In the period from 2016 to 2022, these developments were extended with influential neural network models, including Google's BERT (Bidirectional Encoder Representations from Transformers) and OpenAI's GPT, which further advanced the capabilities of AI. From 2022 to the present, generative AI has advanced rapidly, with tools such as ChatGPT, Bard, Claude, DALL-E, and Midjourney becoming available to the public. This proliferation has sparked discussions about the potential impact of AI on work and society (Orrell & Veldran, 2024).

There are three different forms of AI. These are artificial narrow intelligence (ANI), artificial general intelligence (AGI), and artificial superintelligence (ASI). ANI includes all current AI systems whose limitations are defined by human input. AGI, on the other hand, operates without human-imposed limits and is believed to have the potential to rival human intelligence. ANI represents a level of AI that is expected to far exceed human cognitive abilities. (Anyoha, 2017; O'Carol, 2017; Saghiri, Vahidipour, Jabbarpour, Sookhak, & Forestiero, 2022). Since human emotions and dreams cannot be defined as software, AGI and ASI level artificial intelligence cannot be achieved. However, with the collaboration of artificial intelligence and human beings, the maximum efficiency of artificial intelligence can be achieved.

The most prominent subfields of AI include machine learning (ML), deep learning (DL), natural language processing (NLP), computer vision (CV), expert systems (ES), robotics (RBS), and artificial neural networks

(ANN) (de-Lima-Santos & Ceron, 2022; Esengönül, Marta, Beirão, Pires, & Cunha, 2022; Kanimozhi & Jacob, 2019). These subfields have applications in numerous domains. For example, GAI applications are being developed in the context of machine learning. ChatGPT is an example of a GAI application.

GAI falls within the machine learning domain of AI. It can be characterized as an application that uses deep learning models to generate content, including text and visual elements (Lim, Gunasekara, Pallant, Pallant, & Pechenkina, 2023a). Through the collaboration of GAI and human intelligence, high-quality content can be generated more efficiently. This synergy combines the unique interpretive, emotion-driven reasoning and learning capabilities of human intelligence with the rapid scanning, learning and analytical capabilities of GAI, leading to the concept of hyperintelligence (Liu & Zeng, 2021; Prasad Agrawal, 2023).

GAI can be applied in various sectors, including healthcare, chemistry, education, automotive, and finance (Gülbaşı & Karahan, 2023), as well as in specialized areas such as pharmaceutical drug development (Chui, Roberts, & Yee, 2022). Examples of GAI applications include ChatGPT, Dall-E, Google Gemini (Lim et al., 2023a), Midjourney, Claude Sonet (Sætra, 2023), and GitHub Copilot (Chui, Roberts, & Yee, 2022).

The use of GAI in academia has become increasingly common. GAI can assist with tasks such as content generation, paraphrasing, language translation, grammar checking, assignment and presentation preparation, data analysis, data visualization, and language learning. While GAI applications offer significant benefits in terms of time and labor efficiency in academic research, they also present ethical challenges. Table 1 provides detailed information on the various applications of GAI in academia and the specific tasks they can support.

Table 1. Uses of GAI in Academia

Fields	How Gen. AI can be used in Academia	Applications	References
Content Production	- Content (text, image, video, etc.) production for academic articles - Rewriting the prepared contents in an academic tone -Content production for students' assignments -Paraphrasing	ChatGPT, Spinbot, Bard AI, Quillbot Deepl, Grammarly, Apple Intelligence, Claude, Google Gemini	(Dai, Liu, & Lim, 2023; Fitria, 2021; Google LLC, 2023; Lim, Gunasekara, Pallant, Pallant, & Pechenkina, 2023b; Moorhouse, Yeo, & Wan, 2023; Quillbot, 2023)
Translation	- Language translations of academic articles and grammar checks of language translations	Deepl, Grammarly, Google Translate, ChatGPT, Claude, Google Gemini, Microsoft Office	(DeepL, 2023; Grammarly, 2023; Peres, Schreier, Schweidel, & Sorescu, 2023b)
Learning and Education	- Presentation preparation - Language learning - Infographics	Presentations AI, SlidesGo, Visme	(Galaczi, 2023; Presentations.AI, 2023; Slidesgo, 2023; Visme, 2023)
Analysis	- Analysing data sets - Simulation and data visualisation	Tableau, Microsoft Azure Machine Learning, Amazon Q, Google Cloud Auto ML, ChatGPT, Google Gemini, Claude	(Microsoft, 2023; Tableu, 2023; Walle, 2023)
Reading	- AI supported reading - AI-assisted translation and summarisation of documents	UPDF, Microsoft Office 365	(UPDF, 2024)

Based on Table 1, the following are descriptions of artificial intelligence applications that can be used in the academic field.

a. ChatGPT, Google Gemini, Claude: All three GAI applications have their own artificial intelligence model. All three are web-based applications. All three have free and paid versions. All three applications can perform

operations such as content generation, language translation, bibliography editing according to the desired format (such as APA v6, APA v7), and data analysis. Thanks to these applications, data analysis can be performed, including data analysis that can be performed with applications such as SPSS, Amos and Stata. Paid versions should be preferred for solutions at the data analysis level (Claude, 2024; Google Gemini, 2024; Varghese & Chapiro, 2023).

b. Microsoft Office: The GAI feature of the Microsoft Office application can be provided by Copilot developed by Microsoft, the Apple Intelligence plug-in developed by Apple (specific to the Mac operating system), or Microsoft Office plug-ins developed by other third-party developers. Text translation can be used to write texts in different tones (academic, formal or informal tones) (Apple, 2024; Microsoft, 2024).

c. UPDF: A PDF viewer with GAI support. Thanks to the application's GAI support, it allows summarizing scientific documents, translating them into other languages, and quickly retrieving the desired information from the document by asking questions about the document's content. In particular, the literature review process can be efficiently accelerated using this tool (UPDF, 2024).

d. DeepL: It can be used for language translation of texts and for writing in different tones (academic, formal or informal tones) (DeepL, 2023).

e. Grammarly: It can be used for grammar correction in language translation of texts and for writing in different tones (academic, formal or informal tones) (Grammarly, 2023).

f. Tableau: Can be used to make sense of big data, business analytics, and data visualization (Tableu, 2023).

g. Microsoft Azure Machine Learning, Amazon Q, and Google Cloud ML: These are cloud computing-based solutions used to develop AI projects (Amazon AWS, 2024; Google Cloud, 2024; Microsoft, 2023).

h. Apple Intelligence: This is a GAI solution developed by Apple that can be used on devices running MacOS or IOS operating systems. It can be used to rewrite texts in different tones (academic, formal or informal tones) (Apple, 2024)

In light of the information in Table 1, GAI applications have many functions in academic studies, such as producing content such as text, graphics, and videos, writing texts in different tones (academic, formal, or informal), summarizing texts, and translating texts. In this context, answers to the following research questions are sought.

RQ1: Do the differences and similarities between texts prepared by a researcher and texts prepared by GAI applications vary according to the language of the text generated by GAI applications?

RQ2: Do the plagiarism rates of texts generated by GAI applications vary according to the language used? What ethical implications can be derived from these findings?

RQ3: What should a researcher be aware of when preparing a text using GAI as part of their academic work?

3. Methodology

To address the research questions posed by the study, three Turkish texts were prepared from the researcher's previously published studies. These texts were directly translated into English, resulting in three English texts. The document translator tool in Microsoft Office 365 Word was used for translation. The translated texts were reviewed by the researcher. The themes of the texts prepared by the researcher are shown in Table 2.

Table 2. Subject Themes and Sources Of The Texts Prepared By The Researcher

Subject Theme	Name of Study	Reference
The relationship between industry 5.0 Process and ESG process Abbreviation: I50	The relationship between industry 5.0 Process and ESG process: A qualitative analysis in the context of Türkiye's Bist Sustainability 25 Index white good sector	Yoşumaz, İ., & Uzun, H. (2024). The relationship between industry 5.0 Process and ESG process: A qualitative analysis in the context of Türkiye's Bist Sustainability 25 Index white good sector. Environmental Research and Technology.

		17(4) https://doi.org/10.35208/ert.1431800
Metaverse and Industril Metaverse Abbreviation: MV	Industrial Metaverse as a New Component of Digital Transformation: A Bibliometric Analysis	Yoşumaz, İ. (2024). Industrial Metaverse as a New Component of Digital Transformation: A Bibliometric Analysis. Bilişim Teknolojileri Dergisi, 17(4), 251-265. https://doi.org/10.17671/gazibtd.1487061
Technology Development Zones in the Industry 5.0 Process Abbreviation: TECH	Vırtual Technology Development Zone Model Proposal For Technology Development Zones In The Industry 5.0 Process	Yoşumaz, İ. (2024). Virtual Technology Development Zone Model Proposal For Technology Development Zones In The Industry 5.0 Process. Akademik Yaklaşımlar Dergisi, 15(2), 822-843. https://doi.org/10.54688/ayd.1385039

The GAI applications selected for the study were ChatGPT 4o (Chat Generative Pre-trained Transformer 4 Omni), Google Gemini 1.5, and Claude 3 Haiku. When selecting the generative AIs, care was taken to ensure that the AI models they used were different. For example, Microsoft Copilot and Apple Intelligence were not included in the study because they use GPT technology, which is the same AI infrastructure as ChatGPT. GAI applications are state-of-the-art AI applications that simulate human-like conversations based on user input. GAI analyzes a given input (question, document, image, Excel spreadsheet, etc.) and generates an output according to the user's request (Takagi, Watari, Erabi, & Sakaguchi, 2023). The selection of 3 GAI applications with different AI infrastructures within the scope of the study has both expanded the scope of the study and made it possible to compare the content generated by GAI applications with different AI infrastructures.

The GAI applications were provided with the inputs shown in Table 3, and a total of 18 texts were generated from each of them, 3 texts in Turkish and 3 texts in English. The Turkish and English texts are not translations of each other. For the texts generated in Turkish, the user account logged in to the GAI applications and the user accounts logged in to the GAI applications were selected differently from each other while the English texts were generated, and it was ensured that the text production according to the language was done transparently. The number of samples in the study was increased to 24, with 6 texts prepared by the researcher. Detailed information about the texts used in the sample of the study is presented in Table 4. Abbreviations were used in naming the sample. The names of the texts used in the sample began with the theme abbreviation of the texts. If the text was prepared by the researcher, RS was added to the theme abbreviation, CGPT if the text was prepared by ChatGPT, CLA if the text was prepared by Claude 3 Haiku, GEM if the text was prepared by Google Gemini 1.5. TR if the text language is Turkish and EN if the text language is English. For example, the text on the theme of relationship between Industry 5.0 process and ESG, prepared by the researcher and in Turkish, is named as I50-RS-TR. The text on the theme of metaverse and industrial metaverse, prepared by Claude 3 Haiku in English, was named as MV-CLA-EN. Table 4 shows the text naming in detail.

Table 3. Inputs (Prompts) Used For Producing Texts From GAI Applications

Inputs	I50	MV	TECH
Input (TR)	Endüstri 5.0 Süreci ve ESG İlişkisine odaklanan 3 sayfalık ve 697 kelimelik bir metin hazırla. Kelime sayısı biraz az veya biraz fazla olabilir. Ancak fazlalık veya eksiklik 50 kelimeyi aşmasın. Bu metnin içereceği hususlar şu şekilde olsun. 1. Ana bir başlık koy	Metaverse ve Endüstriyel metaverse ile ilgili 506 kelimelik bir metin hazırla. Kelime sayısı biraz az veya biraz fazla olabilir. Ancak fazlalık veya eksiklik 50 kelimeyi aşmasın. Bu metnin içereceği hususlar şu şekilde olsun. 1. Ana bir başlık koy	Endüstri 5.0 Süreci ve Teknoloji Geliştirme Bölgeleri ile ilgili 819 kelimelik bir metin hazırla. Kelime sayısı biraz az veya biraz fazla olabilir. Ancak fazlalık veya eksiklik 50 kelimeyi aşmasın. Bu metnin içereceği

	2. Endüstri 5.0 süreci ile ilgili bir başlık koy 3. ESG süreci ile ilgili bir başlık koy 4. Endüstri 5.0 ve ESG süreci ile ilgili bir başlık koy.	2. Metaverse ile ilgili bir başlık koy 3. Endüstiyel metaverse ile ilgili bir başlık koy.	hususlar şu şekilde olsun. 1. Ana bir başlık koy 2. Endüstri 5.0 süreci ile ilgili bir başlık koy 3. Teknoloji Geliştirme Bölgeleri ile ilgili bir başlık koy
Input (EN)	Prepare a 3-page, 697-word text focusing on the Industry 5.0 Process and ESG Relationship. The word count can be a little less or a little more. However, the excess or deficiency should not exceed 50 words. This text should include the following points. 1. Put a main title 2. Put a title related to the Industry 5.0 process 3. Put a title related to the ESG process 4. Put a title related to Industry 5.0 and ESG process.	Prepare a 506-word text about the Metaverse and the Industrial metaverse. The word count can be a little less or a little more. However, the excess or deficiency should not exceed 50 words. This text should contain the following points. Put a main title Put a title related to Metaverse Put a title related to Industrial metaverse.	Prepare an 819-word text on the Industry 5.0 Process and Technology Development Zones. The word count can be a little less or a little more. However, the excess or deficiency should not exceed 50 words. This text should contain the following points. Put a main title Put a title related to the Industry 5.0 process Put a title related to Technology Development Zones

Although the number of words required to be included in the texts generated by GAI applications is specified in Table 3, GAI applications did not consistently comply with the specified word count. However, this was not taken into attention as it did not affect the reliability of the study.

Table 4. Knowledge About the Texts in the Sample

Text Numbers (N = 24)	Text Name	Theme	Prepared / Generated by	Language	Word Count
Text -1	**I50-RS-TR**	**I50**	**RS**	**TR**	**697**
Text -2	I50-CGPT-TR	I50	CGPT	TR	520
Text -3	I50-CLA-TR	I50	Claude 3 Haiku	TR	431
Text -4	I50-GEM-TR	I50	Gemini 1.5	TR	516
Text -5	**MV-RS-TR**	**MV**	**RS**	**TR**	**506**
Text -6	MV-CGPT-TR	MV	CGPT	TR	453
Text -7	MV-CLA-TR	MV	Claude 3 Haiku	TR	219
Text -8	MV-GEM-TR	MV	Gemini 1.5	TR	395
Text -9	**TECH-RS-TR**	**TECH**	**RS**	**TR**	**819**
Text -10	TECH-CGPT-TR	TECH	CGPT	TR	757
Text -11	TECH-CLA-TR	TECH	Claude 3 Haiku	TR	319
Text -12	TECH-GEM-TR	TECH	Gemini 1.5	TR	413
Text -13	**I50-RS-EN**	**I50**	**RS**	**EN**	**1203**

Text -14	I50-CGPT-EN	I50	CGPT	EN	758
Text -15	I50-CLA-EN	I50	Claude 3 Haiku	EN	632
Text -16	I50-GEM-EN	I50	Gemini 1.5	EN	357
Text -17	**MV-RS-EN**	**MV**	**RS**	**EN**	**676**
Text -18	MV-CGPT-EN	MV	CGPT	EN	564
Text -19	MV-CLA-EN	MV	Claude 3 Haiku	EN	572
Text -20	MV-GEM-EN	MV	Gemini 1.5	EN	324
Text -21	**TECH-RS-EN**	**TECH**	**RS**	**EN**	**1083**
Text -22	TECH-CGPT-EN	TECH	CGPT	EN	1045
Text -23	TECH-CLA-EN	TECH	Claude 3 Haiku	EN	783
Text -24	TECH-GEM-EN	TECH	Gemini 1.5	EN	423

In the study, descriptive content analysis, one of the qualitative analysis techniques, was used to answer the first research question within the framework of 24 samples prepared by RS and generated by GAI. To ensure the reliability of the study in descriptive content analysis, the coding and text content prepared by the researcher were re-evaluated by 5 expert researchers. The researchers were asked 5 questions about whether the text content was sufficient, whether the selected GAI applications could be used within the scope of the study, and whether the coding structure prepared by the researcher was sufficient to evaluate the content of the texts. A total of 25 responses were received, of which 23 agreed and 2 disagreed. The questions on which there was disagreement recommended the use of more coding for the MV and TECH themes of the study. In this context, as reported by Miles and Huberman (1994, p. 64), the reliability of the study was calculated as 92% over 70% according to the formula Reliability = Agreements (23) / (Disagreement (2)+ Aggreements (23)) as a result of the responses of 5 researchers.

NVivo (version 13), one of the qualitative analysis tools, was used to easily determine the number of words and the most frequently used words in the texts analyzed in the study, to compare the texts in terms of content, to easily apply the codes used in comparing the texts, and to generate word clouds. Information about the codes used in the analysis of the texts and the number of times each code was used in the text are given in Tables 5, 10 and 15.

The plagiarism rates of the texts were evaluated using the iThenticate application, which was chosen because the researcher's institution provides free access to this service through an institutional agreement. While evaluating the plagiarism rates, both 24 samples were evaluated and the texts generated by GAI applications in English were directly translated into Turkish in order to make a more detailed examination, and in addition to 24 samples, 8 newly generated samples were included in the scope of the examination where only the plagiarism rates were evaluated and the plagiarism rates of 32 samples were evaluated. Since the English texts prepared by the researcher are translations of the Turkish texts, they were not translated back into Turkish in the evaluation of plagiarism rates.

4. Findings and Discussions

The findings and discussion section of the study is structured into three distinct chapters, each addressing a specific research question. The first chapter compares the texts prepared by RS and generated by CGPT, CLA and GEM in both TR and EN languages. The second chapter evaluates the texts based on their plagiarism rates, further examining the ethical implications associated with the use of GAI, considering these plagiarism rates. The third chapter assesses the key considerations that should be considered when utilizing GAI in academic research.

4.1. RQ1. Do the differences and similarities between texts prepared by a researcher and texts prepared by GAI applications vary according to the language of the text generated by GAI applications?

The following tables 5, 10 and 15 present the codings made according to the themes of the English and Turkish texts and the number of times the codes were used in the texts. These tables allow for a comparison of the texts.

4.1.1. Comparison of I50-themed Turkish texts prepared by RS and generated by GAI applications

The comparison of I50-themed texts according to the given codings is presented in Table 5 for both Turkish and Englishs.

Table 5. Comparison of I50-themed texts according to the codes prepared by RS

Codes (N= 24)	I50-CGPT-EN	I50-CGPT-TR	I50-CLA-EN	I50-CLA-TR	I50-GEM-EN	I50-GEM-TR	I50-RS-EN	I50-RS-TR
Artificial Intelligence	0	1	0	0	1	1	1	1
Business Resilience	0	0	0	0	1	1	1	1
Data and Knowledge Cycle	1	0	0	0	0	0	0	0
Digital Transformation	1	1	1	1	1	1	1	1
Employees	1	1	1	1	1	1	1	1
Environmental	1	1	1	1	1	1	1	1
Environmental Sustainability	1	1	0	1	1	1	3	3
Environmetal (ESG) - (I50) Sustainability Relationship	1	1	1	1	1	1	1	1
ESG Definition	1	1	1	1	1	1	1	1
Governance	1	1	1	1	1	1	1	1
Governance (ESG) - (I50) Business Resilience	1	0	1	0	1	0	1	1
Human Intelligence	0	0	1	0	0	0	1	1
Hybrid Intelligence	0	0	1	0	0	0	2	2
I50 Definition	1	1	1	1	1	1	1	1
Industry 4.0	1	1	0	0	0	0	1	1
Data and Knowledge	2	1	1	1	1	1	1	1
Social	1	1	1	1	1	1	1	1
Social (ESG) - (I50) (Employee - Society) Relationship	1	1	1	2	1	1	1	1
Society 5.0	0	0	0	0	0	0	1	2
Technology Support	2	1	1	0	0	1	1	1
Technology - human collaboration	2	1	3	1	1	1	1	1
Main Title	1	1	1	1	1	1	1	1
Subtitle	3	3	3	3	3	2	3	3
Conclusion	1	0	0	0	0	1	0	0

A1. Comparison of I50-themed Turkish texts prepared by RS and generated by GAI applications

Analyzing Table 5, it can be seen that Turkish texts on the I50-themed are generally similar to each other in terms of content and subject integrity. When comparing the Turkish texts on the I50-themed, Table 6 shows how the codes given according to Table 5 differ.

Table 6. I50-themed Coding Differentiated Texts in the Turkish

Codes	I50-CGPT-TR	I50-CLA-TR	I50-GEM-TR	I50-RS-TR
Artificial Intelligence	1	0	1	1
Business Resilience	0	0	1	1
Data and Knowledge Cycle	0	0	0	0
Governance	1	1	1	1
Governance (ESG) - (I50) Business Resilience	0	0	0	1
Human Intelligence	0	0	0	1
Hybrid Intelligence	0	0	0	1
Industry 4.0	1	0	0	1
Society 5.0	0	0	0	2
Technology Support	1	0	1	0
Conclusion	0	0	1	0

Examining Table 6, it can be seen that the conclusion section in the Turkish texts with the I50-themed is included only in the text generated by GEM and not in the other texts, business resilience, which is a component of the Industry 5.0 process, and its relationship with the ESG process are included in the texts generated by GEM and prepared by RS, hybrid intelligence, which describes the cooperation of HI and AI, is found only in the text prepared by RS, Industry 4. 0 process are mentioned only in the texts generated by CPGT and prepared by RS, and the mention of the Society 5.0 process is included only in the text prepared by RS.

For a comparison made according to the repetition of the 24 codings given in Table 5 at least once in the texts with the I50-themed in Turkish, the results are shown in Figure 1. According to Figure 1, it can be seen that the text generated by GEM is the closest text to the total number of codes that the text prepared by RS has among the texts with I50-themed in Turkish.

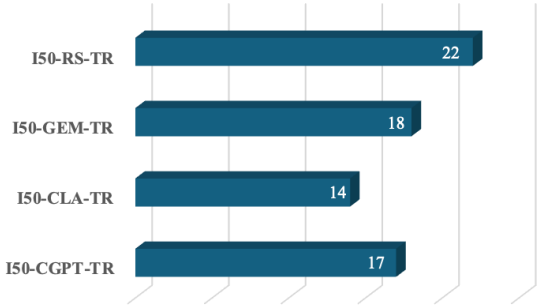


Figure 1. Total number of codes contained in I50-themed Turkish texts

I50-themed word cloud consisting of the 15 most frequently used words in Turkish texts is shown in Table 7.

Table 7. I50-themed Word Cloud Consisting of the 15 Most Frequently Used Words in Turkish Texts

I50-RS-TR	I50-CGPT-TR	I50-CLA-TR	I50-GEM-TR
			

A2. Comparison of I50-themed English texts prepared by RS and generated by GAI applications

Analyzing Table 5, it can be seen that English texts on the I50-themed are generally similar to each other in terms of content and subject integrity. When comparing the English texts on the I50-themed, Table 8 shows how the codes given according to Table 5 differ.

Table 8. I50-themed Coding Differentiated Texts in the English

Codes	I50-CGPT-EN	I50-CLA-EN	I50-GEM-EN	I50-RS-EN
Artificial Intelligence	0	0	1	1
Business Resilience	0	0	1	1
Data and Knowledge Cycle	1	0	0	0
Environmental Sustainability	1	0	1	3
Human Intelligence	0	1	0	1
Hybrid Intelligence	0	1	0	2
Industry 4.0	1	0	0	1
Society 5.0	0	0	0	1
Conclusion	1	0	0	0

Examining Table 8, it can be seen that in the English texts on the I50-themed, the conclusion section is included only in the text generated by CGPT and not in the other texts, business resilience, which is a component of the Industry 5.0 process and its relationship with the ESG process, are included in the texts generated by GEM and prepared by RS, hybrid intelligence, which describes the collaboration of HI and AI, are found in the texts generated by CLA and prepared by RS, unlike the Turkish texts, Industry 4.0 process is mentioned in the texts prepared by CPGT and RS as well as in the Turkish texts, and mention of the Society 5.0 process is included only in the text prepared by RS.

For a comparison made according to the repetition of the 24 codings given in Table 5 at least once in the texts with the I50-themed in English, the results are shown in Figure 2. According to Figure 2, it can be seen that the text generated by CGPT is the closest text to the total number of codes that the text prepared by RS has among the texts with I50-themed in English.

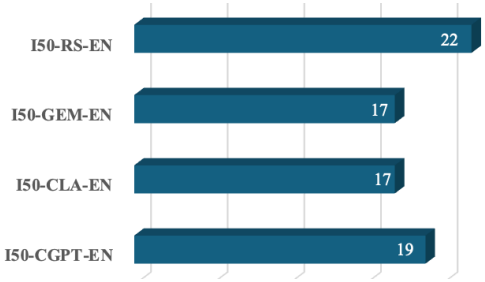


Figure 2: Total number of codes contained in I50-themed English texts

I50-themed word cloud consisting of the 15 most frequently used words in English texts is shown in Table 9.

Table 9: I50-themed Word Cloud Consisting of the 15 Most Frequently Used Words in English Texts

I50-RS-EN	I50-CGPT-EN	I50-CLA-EN	I50-GEM-EN
			

4.1.2. Comparison of MV-themed Turkish texts prepared by RS and generated by GAI applications

The comparison of MV-themed texts according to the given codings is presented in Table 10 for both Turkish and Englishs.

Table 10. Comparison of MV-themed texts according to the codes prepared by RS

Codes (N=16)	MV-CGPT-EN	MV-CGPT-TR	MV-CLA-EN	MV-CLA-TR	MV-GEM-EN	MV-GEM-TR	MV-RS-EN	MV-RS-TR
Artificial Intelligence	1	0	0	0	0	0	0	0
Augmented Reality	2	1	1	1	1	1	1	1
Avatar	1	0	0	1	0	1	1	1
Benefits	0	0	0	0	1	0	1	1
Blockchain	1	1	0	1	0	1	1	1
Cybersecurity	0	0	1	0	0	0	0	0
Digital Twins	0	1	1	1	1	1	1	1
Environmental Sustainability	1	1	1	0	0	0	0	0
Extended Reality	0	1	1	0	1	0	0	0
Industrial Metaverse Definition	1	1	1	1	1	1	1	1

IoT	1	0	1	0	0	0	1	1
Metaverse Definition	1	1	1	1	1	1	1	1
NFT	0	1	0	0	0	0	1	1
Virtual Reality	2	1	1	1	1	1	1	1
Main Title	1	1	1	1	1	1	1	1
Subtitle	3	2	3	2	3	2	2	2

B1. Comparison of MV-themed Turkish texts prepared by RS and generated by GAI applications

Analyzing Table 10, it can be seen that Turkish texts on the MV-themed are generally similar to each other in terms of content and subject integrity. When comparing the Turkish texts on the MV-themed, Table 11 shows how the codes given according to Table 10 differ.

Tablo11. MV-themed Coding Differentiated Texts in the Turkish

Codes	MV-CGPT-TR	MV-CLA-TR	MV-GEM-TR	MV-RS-TR
Artificial Intelligence	0	0	0	0
Avatar	0	1	1	1
Benefits	0	0	0	1
Cybersecurity	0	0	0	0
Environmental Sustainability	1	0	0	0
Extended Reality	1	0	0	0
IoT	0	0	0	1
NFT	1	0	1	1

Examining Table 11, it can be seen that the concepts of AI and cybersecurity are not included in any text, the concept of avatar, which is closely related to the metaverse, is not included in the CGPT text, the concepts of environmental sustainability and augmented reality are included only in the CGPT text, and the concept of IoT is included only in the text prepared by RS.

For a comparison made according to the repetition of the 16 codings given in Table 10 at least once in the texts with the MV-themed in Turkish, the results are shown in Figure 3. According to Figure 3, it can be seen that the text generated by CGPT is the closest text to the total number of codes that the text prepared by RS has among the texts with MV-themed in Turkish.

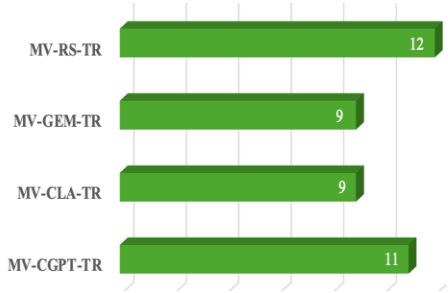
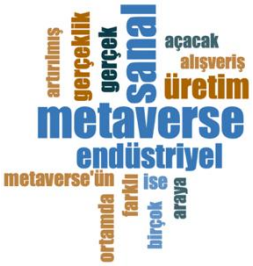


Figure 3: Total number of codes contained in MV-themed Turkish texts

MV-themed word cloud consisting of the 15 most frequently used words in Turkish texts is shown in Table 12.

Table 12: MV-themed Word Cloud Consisting of the 15 Most Frequently Used Words in Turkish Texts

MV-RS-TR	MV-CGPT-TR	MV-CLA-TR	MV-GEM-TR
			

B2. Comparison of MV-themed English texts prepared by RS and generated by GAI applications

Analyzing Table 10, it can be seen that English texts on the MV-themed are generally similar to each other in terms of content and subject integrity. When comparing the English texts on the MV-themed, Table 13 shows how the codes given according to Table 10 differ.

Table 13. MV-themed Coding Differentiated Texts in the English

Codes	MV-CGPT-EN	MV-CLA-EN	MV-GEM-EN	MV-RS-EN
Artificial Intelligence	1	0	0	0
Augmented Reality	2	1	1	1
Avatar	1	0	0	1
Benefits	0	0	1	1
Blockchain	1	0	0	1
Cybersecurity	0	1	0	0
Digital Twins	0	1	1	1
Environmental Sustainability	1	1	0	0
Extended Reality	0	1	1	0
IoT	1	1	0	1
NFT	0	0	0	1

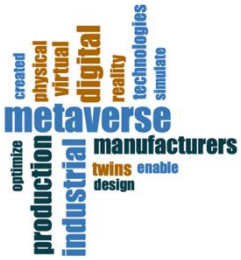
Examining Table 13, it can be seen that in the English MV-themed texts, unlike the Turkish texts, the concept of AI is included in the texts generated by CGPT and the concept of cybersecurity is included in the texts generated by CLA, while the concept of avatar, which is closely related to the metaverse, is not included in the texts generated by CLA and GEM, It is seen that the concept of environmental sustainability is included in the texts generated by CLA except CGPT, unlike the texts generated in Turkish, and the concept of IoT is included in all the texts except the texts generated by GEM, unlike the texts generated in Turkish.

For a comparison made according to the repetition of the 16 codings given in Table 10 at least once in the texts with the I50-themed in English, the results are shown in Figure 4. According to Figure 4, it can be seen that the text generated by CGPT is the closest text to the total number of codes that the text prepared by RS has among the texts with I50-themed in English.

Figure 4: Total number of codes contained in MV-themed English texts

MV-themed word cloud consisting of the 15 most frequently used words in English texts is shown in Table 14.

Table 14. MV-themed Word Cloud Consisting of the 15 Most Frequently Used Words in English Texts

MV-RS-EN	MV-CGPT-EN	MV-CLA-EN	MV-GEM-EN
			

4.1.3. Comparison of TECH-themed Turkish texts prepared by RS and generated by GAI applications

The comparison of TECH-themed texts according to the given codings is presented in Table 15 for both Turkish and Englishs.

Table 15. Comparison of TECH-themed texts according to the codes prepared by RS

Codes (N=6)	TECH-CGPT-EN	TECH-CGPT-TR	TECH-CLA-EN	TECH-CLA-TR	TECH-GEM-EN	TECH-GEM-TR	TECH-RS-EN	TECH-RS-TR
I50 Definition	1	1	1	1	1	1	1	1
I50 Main Charecteristics	1	1	1	1	1	1	1	1
I50-TDZ Relationship	1	1	1	1	1	1	0	0
TDZ Definition	1	1	1	1	1	1	1	1
Main Title	1	1	1	1	1	1	1	1
Subtitle	3	2	3	2	3	2	2	2

C1. Comparison of TECH-themed Turkish texts prepared by RS and generated by GAI applications

Analyzing Table 15, it can be seen that Turkish texts on the TECH-themed are generally similar to each other in terms of content and subject integrity. When comparing the Turkish texts on the TECH-themed, Table 16 shows how the codes given according to Table 15 differ.

Tablo16. TECH-themed Coding Differentiated Texts in the Turkish

Codes	TECH-CGPT-TR	TECH-CLA-TR	TECH-GEM-TR	TECH-RS-TR
I50-TDZ Relationship	1	1	1	0

Examining Table 16, it can be seen that the difference in the Turkish texts with the TECH-themed is due to the fact that the researcher did not mention the relationship between the Industry 5.0 process and technology development zones (TDZ). All other codings are covered by all texts.

For a comparison made according to the repetition of the 6 codings given in Table 15 at least once in the texts with the TECH-themed in Turkish, the results are shown in Figure 5. According to Figure 5, among the TECH-themed texts in Turkish, the total code of the text prepared by RS was lower than that of the GAI applications.

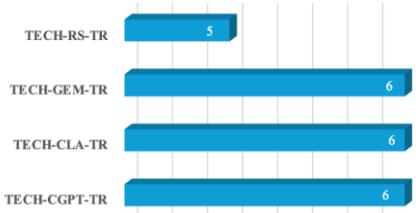


Figure 5. Total number of codes contained in TECH-themed Turkish texts

TECH-themed word cloud consisting of the 15 most frequently used words in Turkish texts is shown in Table 17.

Table 17. TECH-themed Word Cloud Consisting of the 15 Most Frequently Used Words in Turkish Texts

TECH-RS-TR	TECH-CGPT-TR	TECH-CLA-TR	TECH-GEM-TR
			

C2. Comparison of TECH-themed English texts prepared by RS and generated by GAI applications

Analyzing Table 15, it can be seen that English texts on the TECH-themed are generally similar to each other in terms of content and subject integrity. When comparing the English texts on the TECH-themed, Table 18 shows how the codes given according to Table 15 differ.

Table 18. TECH-themed Coding Differentiated Texts in the English

Codes	TECH-CGPT-EN	TECH-CLA-EN	TECH-GEM-EN	TECH-RS-EN
I50-TDZ Relationship	1	1	1	0

Examining Table 18, it can be seen that the difference in the English texts with the TECH-themed, as well as in the Turkish texts, is due to the fact that the researcher did not mention the relationship between the Industry 5.0 process and TDZs. All other codings are covered by all texts.

For a comparison made according to the repetition of the 16 codings given in Table 10 at least once in the texts with the TECH-themed in English, the results are shown in Figure 6. According to Figure 6, among the TECH-themed texts in English, the total code of the text prepared by RS was lower than that of the GAI applications.

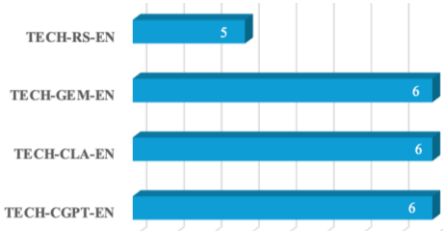


Figure 6. Total number of codes contained in TECH-themed English texts

TECH-themed word cloud consisting of the 15 most frequently used words in Turkish texts is shown in Table 19.

Table 19. TECH-themed Word Cloud Consisting of the 15 Most Frequently Used Words in English Texts

TECH-RS-EN	TECH-CGPT-EN	TECH-CLA-EN	TECH-GEM-EN
			

4.2. RQ2. Do the plagiarism rates of texts generated by GAI applications vary according to the language used? What ethical implications can be derived from these findings?

Table 20 illustrates the plagiarism rates of the Turkish texts prepared by the researcher and generated by GAI applications. Analyzing the plagiarism rates of the Turkish texts, it can be seen that the highest plagiarism rate is in the TECH-themed texts prepared by RS and generated by CLA. All other plagiarism rates are close to each other.

Table 20. Plagiarism rates of all Turkish texts

RS TR		**CGPT TR**		**CLA TR**		**GEM TR**	
I50-RS-TR	0 %	I50-CGPT-TR	0 %	I50-CLA-TR	0 %	I50-GEM-TR	1 %
MV-RS-TR	0 %	MV-CGPT-TR	2 %	MV-CLA-TR	4 %	MV-GEM-TR	2 %
TECH-RS-TR	**11%**	TECH-CGPT-TR	0 %	TECH-CLA-TR	**6 %**	TECH-GEM-TR	0 %

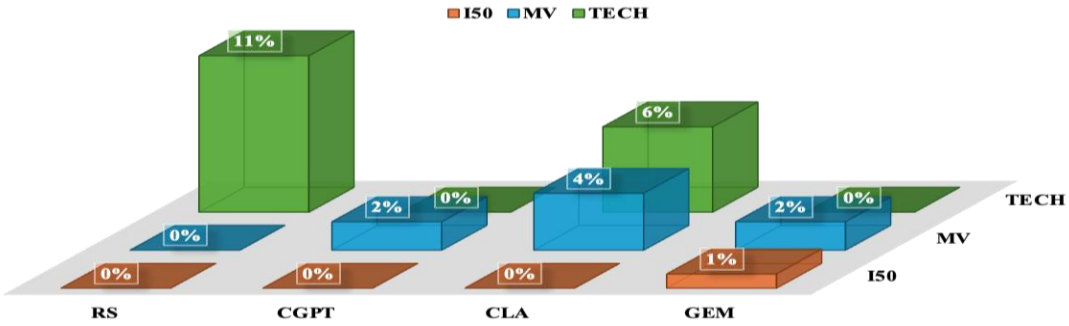


Table 21 illustrates the plagiarism rates of the English texts prepared by the researcher and generated by GAI applications. Analyzing the plagiarism rates of the English texts, it can be seen that the highest plagiarism rate is in the texts generated by GEM GAI application. Among English-language texts, the plagiarism rates of texts generated by GAI applications increased significantly.

Table 21. Plagiarism rates of all English texts

RS EN (Translated from TR to EN)		**CGPT EN**		**CLA EN**		**GEM EN**	
I50-RS-EN	9 %	I50-CGPT-EN	16%	I50-CLA-EN	19 %	I50-GEM-EN	34 %
MV-RS-EN	0 %	MV-CGPT-EN	13%	MV-CLA-EN	0 %	MV-GEM-EN	35 %
TECH-RS-EN	9 %	TECH-CGPT-EN	11 %	TECH-CLA-EN	15 %	TECH-GEM-EN	30 %

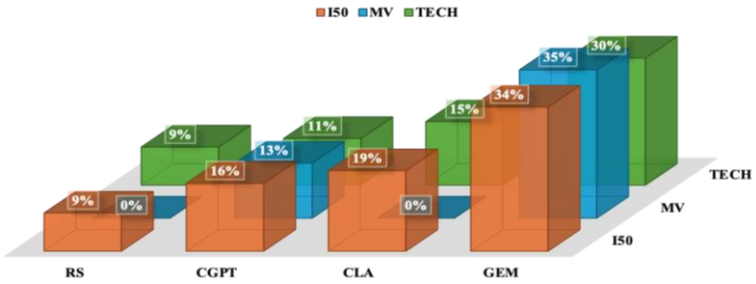
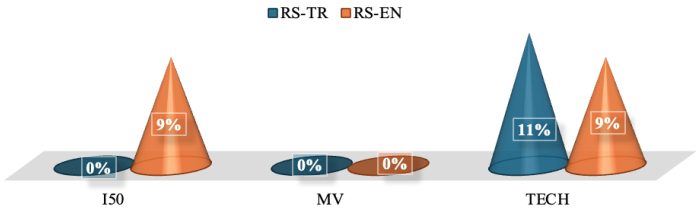


Table 22 compares the plagiarism rates of the texts prepared by RS in Turkish and English. Analyzing the plagiarism rates of the English texts, it can be seen that they are different from the Turkish texts in terms of plagiarism rates. In particular, the plagiarism rates of the English texts, which were obtained by directly translating the Turkish texts prepared by RS into English, are striking. The plagiarism rate of the I50-RS-TR text decreased from 11% to 0%, while the plagiarism rate of the I50-TECH-TR text increased from 0% to 9%.

Table 22. Plagiarism rates when Turkish texts prepared by RS are translated into English without any changes

Prepared Turkish Texts by RS		Translation of Turkish texts prepared by RS into English without any changes	
I50-RS- TR	0 %	I50-RS-EN	9%
MV-RS-TR	0 %	MV-RS-EN	0%
TECH-RS-TR	11 %	TECH-RS-EN	9%



The plagiarism rates of the texts generated by GAI applications also vary significantly. However, it should be noted that the texts generated by GAI applications in Turkish and English are not direct translations of each other. In order to examine this situation more closely, the texts generated by GAI applications in English were translated into English without any changes. The results are shown in Table 23.

Table 23. Plagiarism rates when English texts generated by GAI applications are translated into Turkish without any changes

CGPT Translated Text from EN to TR		CLA Translated Text from EN to TR		GEM Translated Text from EN to TR	
I50-CGPT-TRANSLATE-TR	1 %	I50-CLA-TRANSLATE-TR	0 %	I50-GEM-TRANSLATE-TR	0%
MV-CGPT-TRANSLATE-TR	4 %	MV-CLA-TRANSLATE-TR	0 %	MV-GEM-TRANSLATE-TR	8%
TECH-CGPT-TRANSLATE-TR	0 %	TECH-CLA-TRANSLATE-TR	0 %	TECH-GEM-TRANSLATE-TR	0%

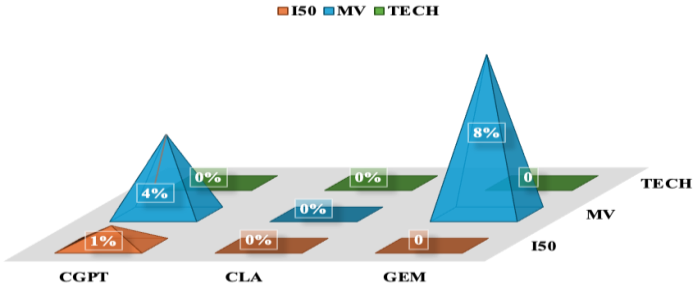


Table 24 shows a comparison of the plagiarism rates of the English texts generated by CPGT and the direct translations of the English texts generated by CPGT into Turkish. Analyzing Table 24, it can be seen that the plagiarism rate of the texts translated from English into Turkish is almost 0%.

Table 24. Plagiarism rates when English texts generated by CGPT are translated into Turkish without any changes

Procued English Texts via CGPT		Translation of English texts generated by CGPT into Turkish without any changes	
I50-CGPT- EN	1 %	I50-CGPT-TRANSLATE-TR	16%
MV-CGPT-EN	4 %	MV-CGPT-TRANSLATE-TR	13%
TECH-CGPT-EN	0 %	TECH-CGPT-TRANSLATE-TR	12%

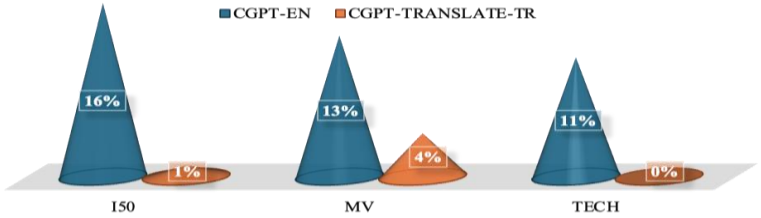


Table 25 shows a comparison of the plagiarism rates of the English texts generated by CLA and the direct translation of the English texts generated by CLA into Turkish. Table 25 shows that the plagiarism rates of the texts translated from English into Turkish have completely disappeared.

Table 25. Plagiarism rates when English texts generated by CLA are translated into Turkish without any changes

Procued English Texts via CLA		Translation of English texts generated by CLA into Turkish without any changes	
I50-CGPT- EN	19 %	I50-CGPT-TRANSLATE-TR	0%
MV-CGPT-EN	0%	MV-CGPT-TRANSLATE-TR	0%
TECH-CGPT-EN	15 %	TECH-CGPT-TRANSLATE-TR	0%

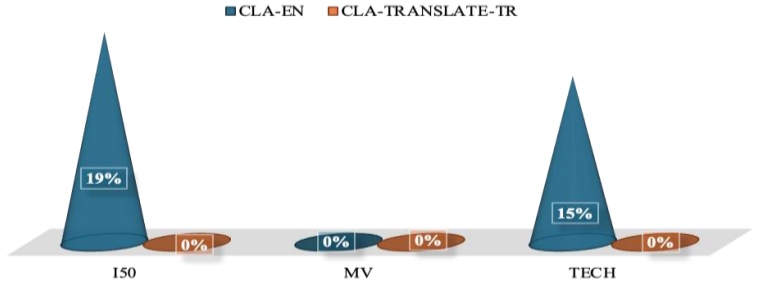
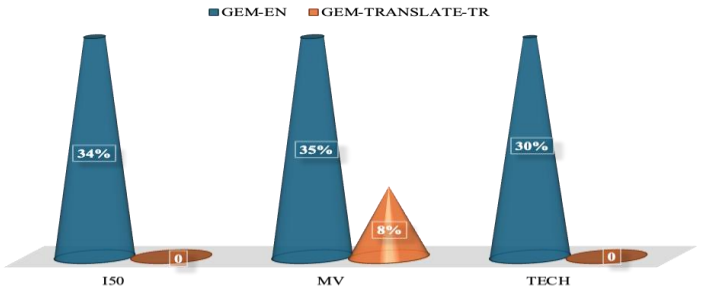


Table 26 compares the plagiarism rates of the texts generated by GEM in English and the texts generated by GEM in English and translated directly into Turkish. Analyzing Table 26, it can be seen that the plagiarism rates of the texts translated from English into Turkish have changed significantly.

Table 26. Plagiarism rates when English texts generated by GEM are translated into Turkish without any changes

Procuced English Texts via GEM		Translation of English texts generated by GEM into Turkish without any changes	
I50-CGPT- EN	34 %	I50-CGPT-TRANSLATE-TR	0%
MV-CGPT-EN	35 %	MV-CGPT-TRANSLATE-TR	8%
TECH-CGPT-EN	30 %	TECH-CGPT-TRANSLATE-TR	0%



By evaluating Tables 24, 25 and 26 together, it can be concluded that when the plagiarism rates of texts generated by GAI applications are translated from English to Turkish, the plagiarism rate of 17 texts has significantly decreased and one of them (MV-CGPT-EN) has not changed.

By evaluating Tables 22 and 23 together, when the plagiarism rates of the texts prepared by RS in Turkish are translated into English, it can be concluded that the plagiarism rate of 1 text has increased (I50-RS-TR), 1 text has decreased (TECH-RS-TR) and 1 text has not changed (MV-RS-TR).

When all the evaluations are examined from an ethical point of view, when the texts generated by the GAI applications in this study and the plagiarism program are evaluated, ethical problems arose due to the significant decrease in plagiarism rates by translating the texts from English to Turkish. It is important for researchers to pay attention to this issue, especially when using GAI applications, in order to avoid plagiarism problems related to their studies in the future.

4.3. RQ3. What should a researcher be aware of when preparing a text using GAI as part of their academic work?

a. In the ethical evaluation of content generated with GAI applications, language translation of scientific studies and texts, rewriting in different tones (such as academic or official), or simply academic writing should be separated from each other (Lin, 2024). In cases of language translation and rewriting in different tones, ethical problems cannot be mentioned. This is because in the process of language translation or academic writing by GAI applications, a value that has been scientifically proposed by the researcher retains its originality. On the contrary, in the process of producing the value to be scientifically proposed by GAI and presenting it as if it had been done by the researcher, major ethical problems arise.

GAI applications can be valuable for providing researchers with initial ideas on a given topic. However, it is essential to recognise that the content generated by these applications may not be entirely accurate (Dien, 2023; Peres et al., 2023a). Moreover, the ethical implications of using content generated by AI necessitate a thorough literature review to ensure accuracy and integrity.

b. The content generated by GAI applications may vary depending on the language. Therefore, if GAI applications from prominent countries related to the research topic are available, it may be prudent to prioritise those applications to ensure more accurate and relevant content.

c. When employing a GAI application during research, it is crucial to define the scope of the research first through a comprehensive literature review. The scope of the text generated by the GAI application should then be compared with the scope established through the literature review. Content that can be incorporated into the researcher's study from the AI-generated text should be integrated within the researcher's literature review context. However, it is also essential to trace the origins of the added content in the literature, as institutions that do not recognise GAI as a legitimate source may reject the research.

d. The combination of the agility of GAI applications with the emotional intelligence and experience of human intellect leads to the concept of hyperintelligence (Liu & Zeng, 2021), which can enhance the quality of academic research, reduce preparation time, and improve content consistency. In this context, knowledge of prompt engineering is crucial to achieving the desired efficiency from GAI applications. This discipline ensures that the generated texts meet the researcher's expectations and are free from ethical issues. However, ethical responsibility ultimately lies with the researcher. While texts generated with AI can be made ethically sound, as suggested in the second research question of this study, detecting such issues in well-edited texts can be challenging. Thus, the researcher's transparency is critical.

e. GAI applications are instrumental in sparking new ideas for researchers. Traditionally, researchers may spend considerable time exploring various sources to develop and expand on new ideas inspired by different studies. GAI applications can significantly reduce this time, assisting researchers in their work.

Consequently, excluding GAI applications from research is not feasible. The key is to enhance the quality of research and expedite the process by using GAI applications that do not raise ethical concerns. For instance, a researcher writing a study in Turkish may use translation programmes like DeepL or Google Translate to prepare an English version of the text. However, texts prepared with translation programmes may have linguistic issues, particularly when intended for publication abroad. This is because translation programmes may not fully adhere to all grammar rules of the target language. To address this, after translating the text, GAI applications like CGPT can be employed to refine the text, ensuring it aligns with grammatical rules and even adjusting the tone to an academic style. Finally, using tools like Grammarly to check grammar can further resolve any language and fluency issues in the translated text. Texts prepared in this manner do not present ethical problems, as the primary content is authored by the researcher, with technology simply aiding in translation and fluency rather than relying on a human translator.

5. Conclusion and Evaluations

GAI applications are becoming more widespread across all industries and are having a significant impact on various fields of study. The concept of hyper-intelligence, resulting from the combination of human intelligence based on emotionality and experience with the agility of GAI applications, serves as a catalyst for researchers to generate new ideas. However, as in other sectors, the increasing use of GAI in academia raises ethical concerns and encourages continued research in this area (Peres et al., 2023; Habib et al., 2023).

The quality of work improves as the amount of academic effort expended in studies involving GAI applications increases. Academic work in GAI applications consists of knowing how to provide efficient input to GAI applications and understanding how to use the outputs. In order to provide the best input, it is important that the researcher who will be using artificial intelligence applications has a good command of the subject he/she will be researching and has done literature reviews. As a result, it can be stated that the integration of artificial intelligence with the intelligence of a researcher conducting academic research leads to the concept of hyperintelligence and has the potential to enhance the quality of studies by addressing ethical concerns. In order to embed the concept of hyperintelligence in the academic field, the concept of prompt engineering is of great importance in the use of GAI applications. This concept is based on providing the most efficient input to GAI applications and obtaining the most efficient output as a result.

In this study, 6 texts in Turkish and Englishs prepared by the researcher, 18 texts in Turkish and Englishs prepared by ChatGPT, Claude and Gemini GAI applications, 24 texts in total, were examined in terms of content, subject integrity, how the content and plagiarism rates change according to the language, and ethics.

The texts prepared by the researcher and the texts generated by the GAI applications were similar in terms of content and subject integrity. However, the plagiarism rates of the texts differed significantly. One of the most important results of the study is that the plagiarism rates of the texts generated by GAI applications decreased significantly when the texts were translated from English to Turkish. Accordingly, based on the samples in this study, it can be said that the concept of plagiarism is eliminated when the texts generated by GAI applications are translated from English to Turkish. This is an important issue that should be emphasized and discussed in the academic field. Especially in future research, comparing the plagiarism rates that occur when academic works written in English or in another language are translated directly into another language can provide important results. Reducing the plagiarism rate in a text generated with GAI applications should not be done through language translation. It should be the result of the researcher verifying the information obtained by GAI as a result of the literature review and interpreting it with his own intelligence. Presenting a text professionally generated by GAI as if it had been prepared by the researcher is contrary to ethical principles, particularly those of transparency (Schlagwein & Willcocks, 2023).

One of the points that can be criticized about this study is that the researcher compiled the texts prepared within the framework of the study from his own works. This criticism is justified. However, since the analysis processes in the study are very extensive and long, it was preferred to use the labor and time constraints in favor of the researcher.

One of the important issues in the use of GAI applications in academic research is the potential for misinformation that may arise in the texts generated by GAI applications. Incorporating such information into studies without verification can compromise the quality of the research. Despite this risk, it is undeniable that GAI applications speed up the research process. Therefore, it is crucial to establish appropriate regulations for the use of GAI in academic studies. The aim should not be to exclude GAI from science, but to ensure that its use is in accordance with ethical principles. In this context, at the end of each study, the researcher may be asked to provide information on the extent to which he/she used GAI applications in his/her study.

The increasing use of GAI in academic research should not be evaluated only in terms of content generation. GAI applications can provide significant benefits to reviewers in the process of evaluating academic studies. For example, these tools can quickly check whether the manuscript complies with grammar rules, whether the content is sufficient, whether the references cited in the text are used correctly, and whether the manuscript meets the requirements of the academic journal to which it is submitted. This can significantly reduce the time it takes to review academic papers.

The most important limitation of this study is that it does not examine how the plagiarism rates of texts prepared by human intelligence vary by language. Due to the excessive length of the study, time and labor constraints, this investigation could not be done.

For future researchers who wish to work in this area, it is possible to observe how the plagiarism rates of texts prepared by human intelligence vary according to language. It may also be important to focus on distinguishing texts generated by GAI from those generated by humans. Finally, studies on how to enhance the potential of GAI applications and human intelligence to work together can provide valuable insights for researchers.

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