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ARTIFICIAL INTELLIGENCE-GENERATED TEXT IN HIGHER EDUCATION – USAGE AND DETECTION IN THE LITERATURE

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ABSTRACT

Since ChatGPT launch in November 2022, artificial intelligence has become more and more widespread in all areas of life. Generative applications of artificial intelligence are proliferating in a wide range of fields. The technology has great potential for applications such as machine translation, voice recognition, education, or content creation, but it also raises concerns about misuse, ethical use, and plagiarism. As texts generated by artificial intelligence tools continue to improve, detection tools on the market will have to involve additional efforts to keep pace. This article uses data from the Scopus and Web of Science databases to map the current usability of detectors, of texts generated by artificial intelligence, in higher education and academia. One of the aims of the article is to provide an insight into the experiences with currently available detectors of texts generated by artificial intelligence in higher education.

KEY WORDS

artificial intelligence, AI-generated text detector, academic integrity, plagiarism, higher education

CLASSIFICATION

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APA: 3550

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INTRODUCTION

Artificial intelligence (AI) and Natural Language Processing (NLP) have made significant progress over the past decade, and in the last few years, the solutions and opportunities offered by new technology have spread to all areas of life. In addition to many other areas, generative AI for textual content is of course making huge strides forward. The new technology offers a great potential for applications such as machine translation, voice recognition, education, or content creation, but it also raises concerns about misuse, ethical use, and plagiarism.

In recent decades, higher education institutions have made great strides towards detecting plagiarism violations by students and researchers, with the help of the increasingly improved plagiarism detection systems available on the market. In many universities, plagiarism checks are a requirement as part of the education system for students' midterm papers, theses, and dissertations. At the Óbuda University, for example, a plagiarism detector has been part of the institutional repository under the control of the University Library since 2011. Its use is not only to check the students' theses, but also to check plagiarism in the university's journals and other publications. [1, 2].

In the literature, the use of AI-generated text is commonly confused with plagiarism or is part of the concept of plagiarism. On the one hand, it is understandable that we are talking about some kind of unconscious plagiarism, whereby the generative AI creates the text using available, previously published works, but in most cases the reference of the sources used by the AI is not visible in the final result. (*of course there are exceptions, platforms, and systems where the insertion of the appropriate reference is a function of the software*) In research on AI-generated writing, the phenomenon is often referred to as patchwriting or cryptomnesia. The research focuses on the conceptual definition of the phenomenon [3].

To create an AI-generated text, systems use huge amounts of text and other data available online (online contents, books, journals, webpages...). By recognising and further learning language patterns, relations, and contexts, they can evolve to create content similar to the original human-written texts in their datasets. This is where the problem begins, these generated texts are often not easily identifiable as generated text to the human eye. With the rapid advances in technology and the learning process, it is predictable that this will lead to ever more improved texts in the future.

The rise and use of generative AI in higher education is shown in the *BestColleges* survey conducted in autumn 2023. The survey included 1000 respondents who are currently studying at a university or college in the US. Students were asked to answer several questions related to AI use. 56% of students reported that they had already used an AI tool to complete assignments. In addition, 54% of respondents agreed with the statement that using AI to complete assignments is cheating or plagiarism.[4] The percentage of responses to this question is shown in Figure 1. A survey conducted six months earlier (March 2023), also by *BestColleges*, also asked whether students use AI tools to solve problems. The rapid development of the use of AI tools is shown by the fact that six months earlier, only 22% of students answered yes to the question [5].

The development of artificial intelligence, and in particular generative AI, can be predicted for the coming years and decades. Bloomberg's Autumn 2023 forecast shows the evolution of the generative AI market between 2020 and 2032. The market has grown from $14 billion U.S. in 2020 to $900 billion U.S. in 2023. The forecast is shown in Figure 2 [6].

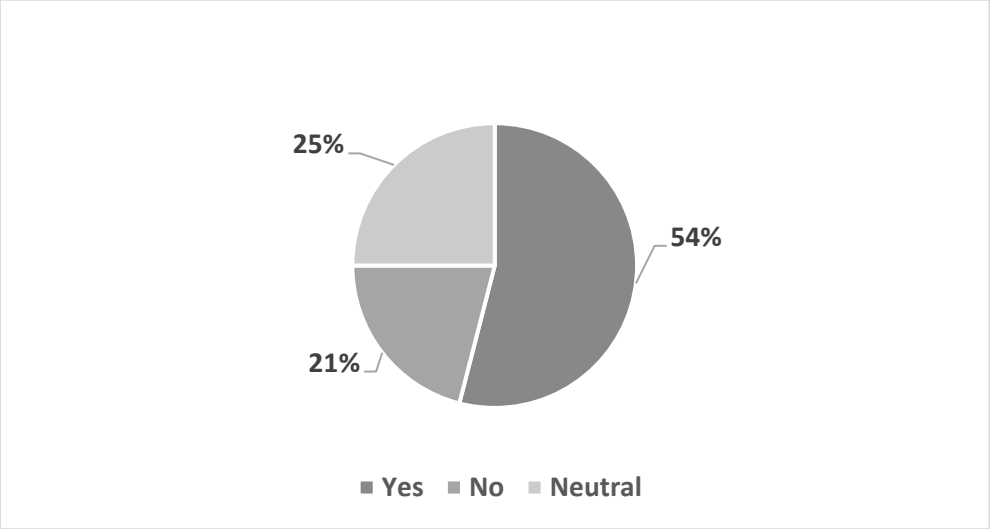

Figure 1. Using AI Tools to Complete Assignments or Exams is Cheating or Plagiarism| BestColleges 2023 [4].

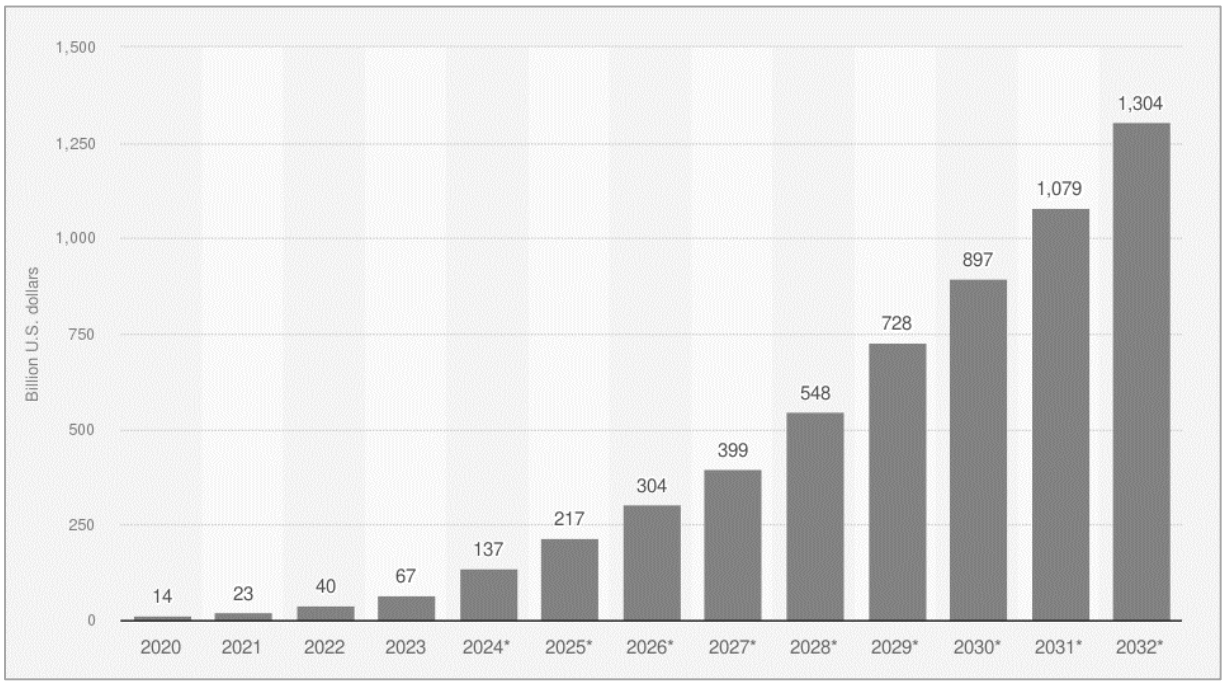

Figure 2. Generative AI revenue worldwide from 2020 with forecast until 2032 (in billion U.S. dollars) [6].

The literature review focuses on the role of generative AI in higher education institutions and academia. A review of the research results is presented to explore the effectiveness of AI generated text detectors. The research also focuses on the regulation of generative AI in higher education.

MATERIALS AND METHODS

The two major scientific databases used for the bibliographic search were Scopus and Web of Science. Zotero reference management software was used for data collection and further processing. Rayyan software was used for the deduplication of publications and for the screening and selection stage.

CRITERIA AND LIMITATIONS

The main data source for the study was Scopus; the data collected was supplemented by the results of a search of the Web of Science database. Additional data, mainly statistical, were collected from the Statista database. Search queries were conducted in May 2024 in both Scopus and Web of Science databases.

The search in Scopus and Web of Science did not exclude conference proceedings or book chapters. All content indexed in these databases were included in the analysis.

Several keywords were specified in order to identify relevant articles for the present analysis. (generated text, human-written, generated paper, generated essay) Additional keywords (detection, check, recognition) have been selected to restrict the topic to the perspective of detection and recognition. In the second search query, keywords (university, education, teacher, student) related to education were added to the search query.

Search Queries

The process of mapping the area began by identifying the relevant keywords, which are often used in the literature, to ensure the application of an accurate and exact search query.

Scopus search query #1

> *(*TITLE-*ABS-KEY ("generated text*") OR TITLE-ABS-KEY ("human-written") OR TITLE-ABS-KEY ("generated paper*") OR TITLE-ABS-KEY ("generated essay*") AND TITLE-ABS-KEY (detect*) OR TITLE-ABS-KEY (check*) OR TITLE-ABS-KEY (recognit*))*

Scopus search query #2

> *(*TITLE-*ABS-KEY ("generated text*") OR TITLE-ABS-KEY ("human-written") OR TITLE-ABS-KEY ("generated paper*") OR TITLE-ABS-KEY ("generated essay*")) AND (TITLE-ABS-KEY (detect*) OR TITLE-ABS-KEY (check*) OR TITLE-ABS-KEY (recognit*)) AND (TITLE-ABS-KEY (universit*) OR TITLE-ABS-KEY (educat*) OR TITLE-ABS-KEY (teacher*) OR TITLE-ABS-KEY (student*))*

Web of Science search query #1

> *(TS=("generated text*" OR "human-written" OR "generated paper*" OR "generated essay*")) AND (TS=(detect* OR check* OR recognit*))*

Web of Science query #2

> *(TS=("generated text*" OR "human-written" OR "generated paper*" OR "generated essay*")) AND (TS=(detect* OR check* OR recognit*)) AND (TS=(universit* OR educat* OR teacher* OR student*))*

OBJECTIVES

The following objectives have been identified:

- to examine trends in relevant publications on the subject,
- to identify the most significant related subject areas,
- to examine the volume of literature on AI generated text detection,
- to explore the literature on AI generated text detection,
- to map the test results of concrete AI detector tools in publications.

RESULTS

For the first, extended search term (*search query #1*), 725 results were found in the Scopus database. Figure 3 shows the number of research results in the last 10 years on the detection of

AI-generated text. It is clear that the number of related publications and research results in this field has been continuously increasing over the last 10 years, and from 2022 onwards there has been a significant increase in the number of publications on this topic (the query was made on 15 May 2024, so the data for 2024 is not for the full year).

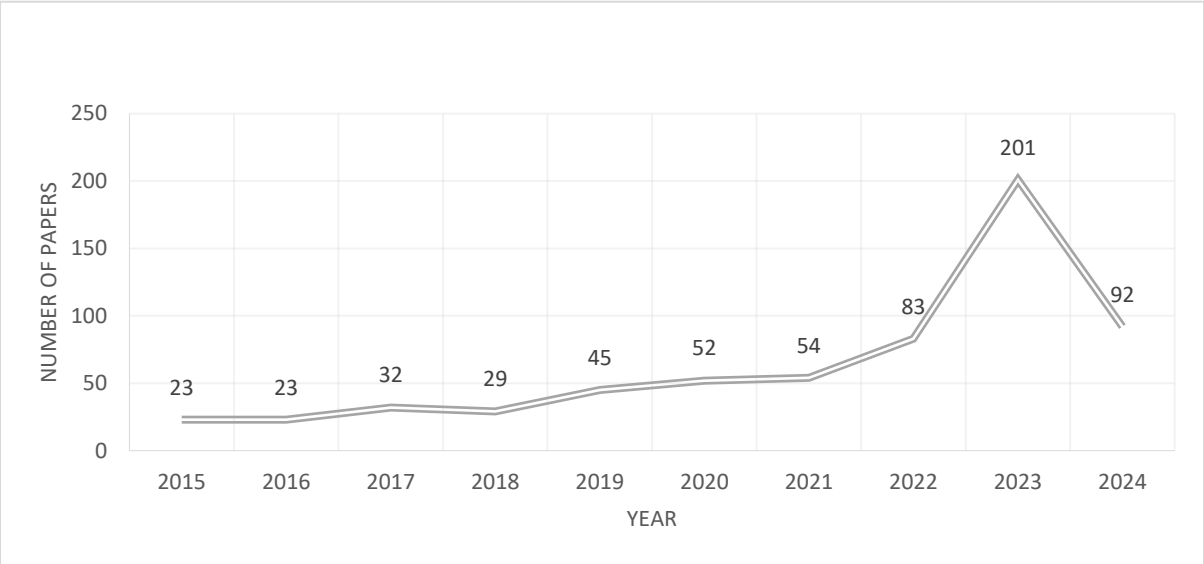

Figure 3. Distribution of publications by year, Scopus (*search query #1*).

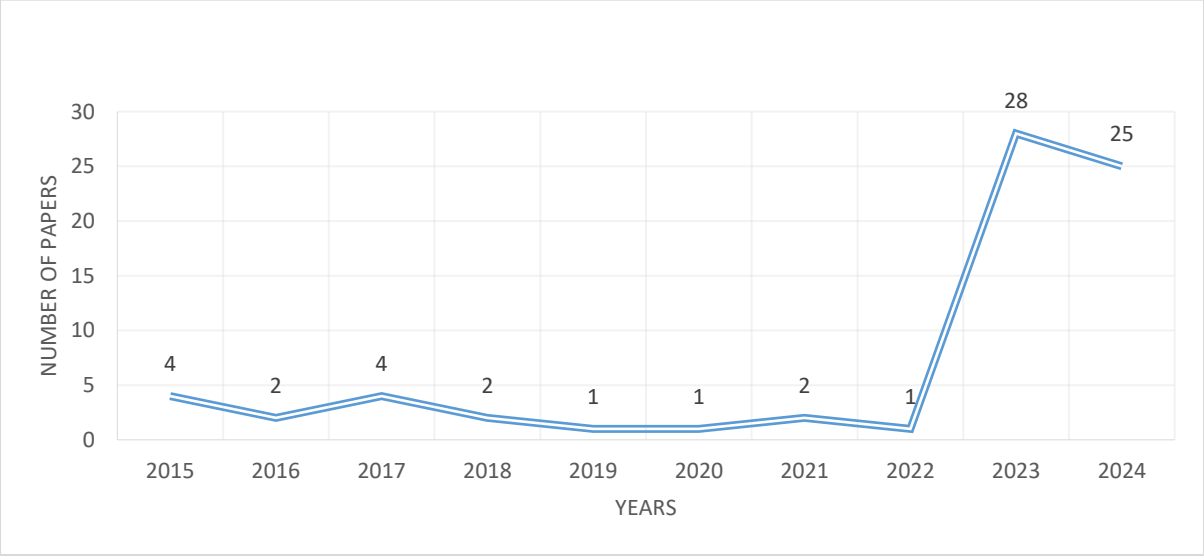

Figure 4. Distribution of publications by year, Scopus (*search query #2*).

The search result set has been tailored to the topic – university, field of education – in both Scopus and Web of Science. In the refined search, the search term was expanded to include education-related keywords (*university, education, teacher, student*).

The patterns shown in Figures 3 and 4 will probably persist in the next years as artificial intelligence and detecting systems and solutions continue to advance.

The Scopus results by subject area show the field of study of researchers working on the topic. Figure 5 shows which disciplines and approaches are most used to research AI generated text, AI writing.

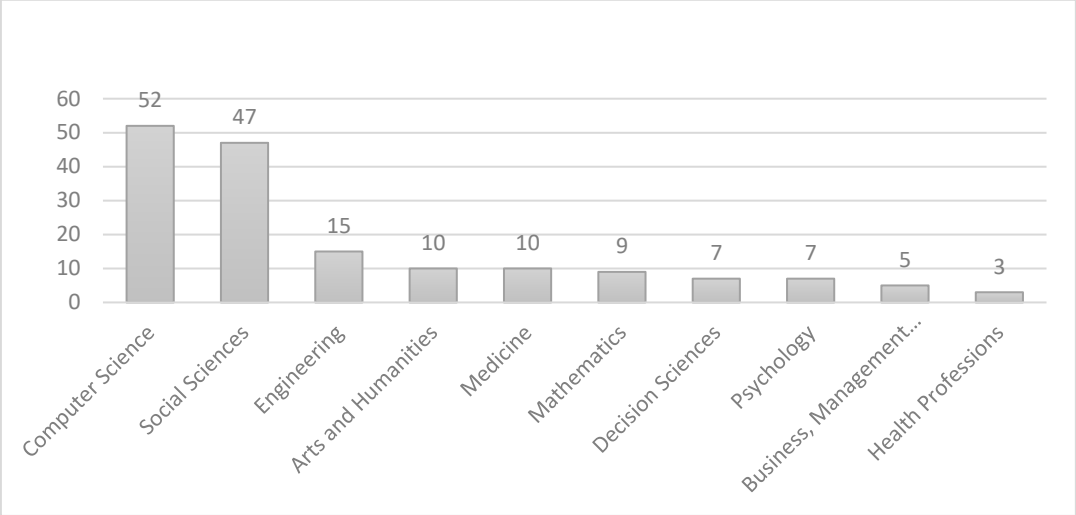

Figure 5. Number of publications by subject area, Scopus (*search query #2*).

It can be seen that, not surprisingly, most of the publications in the list of results limited by keywords were in the *Computer Science* subject. It is also noticeable, however, that the *Social Science* and *Ars and Humanities* subjects have more publications overall. In these fields, researchers are mostly concerned with the ethical rather than the technological aspects of the phenomenon.

Following the Scopus database search, the search query was also created for the Web of Science platform (WoS search query #1, #2). The metadata of the two filtered queries were exported in RIS format and imported into the Rayyan software. Data from 119 records were uploaded to the platform and 32 duplicates were filtered out. 87 records were entered into the screening phase, of which 39 were excluded.

COMPARISONS OF AI GENERATED TEXT DETECTORS

Several papers have concluded that the use of AI-generated text detection tools in combination with human judgement can achieve adequate efficiency. For example, the use of such a software can be a very useful tool for the reviewer in a journal or for the instructor in an educational institution. The found research results include several tests and comparisons of specific AI detectors, and these results can be useful for a higher education institution before taking measures and introducing regulations.

One of the related research projects involved testing the application of the AI generated text detector of the TurnItIn plagiarism detection platform. The study aimed to compare human – instructor – verification and the AI detector of TurnItIn. The results show that TurnItIn detected AI generated texts 91% of the time [7].

In the following research, 4 AI detectors (*Turnitin, OpenAI detector, GPTZero, Crossplag*) were tested on AI-generated, "mixed" (AI-generated and human-written) and 100% natural (student-written) texts. The results showed that the detectors were 100% or close to 100% efficient on fully AI-generated texts but produced very low results on "mixed" texts [8].

Previous research using 6 AI content detector software and 4 blinded reviewers examined 100 articles simultaneously to determine whether the paper was human-written or AI-generated. Of the 100 articles, 50 were original peer-reviewed papers from four high-impact journals, and the other 50 were text generated using ChatGPT and paraphrased using the Wordtun paraphrasing tool. The study tested 6 AI detector tools (*Originality.ai, Turnitin, ZeroGPT, GPTZero, Content at Scale and GPT-2 Output Detector*) to detect both AI generated texts and AI paraphrased texts.

Originality.ai performed best in recognizing AI generated text for both generated and rephrased text variants. In addition to Originality.ai, GPTZero, GPT-2 Output Detector and Turnitin also performed above 90% for ChatGPT generated text, but with much lower efficiency for non-human text recognition in the case of rephased text. The results of the research show that more experienced reviewers and more specific AI detectors can identify a high proportion of non-human-written articles [9].

In another study, the detection of texts generated by ChatGPT, YouChat and Chatsonic was investigated by testing 5 selected AI detection tools. (*GPTZero, OpenAI Text Classifier, Writer.com's AI Content Detector, Copyleaks AI Content Detector*) The generated texts were translated into German and Spanish using GoogleTranslate before the test detection. Based on the findings of the research, Copyleaks performed the best, but as stated in the paper, the 5 AI detectors tested are not yet ready to accurately detect AI-generated content [10].

In a comprehensive study testing 16 AI generated text detection tools (*Content at scale, ContentDetector.ai, Copyleaks, Crossplag, Grammica, GPT Radar, GPTZerob, IvyPanda, OpenAI, Originality.ai, Sapling, Scribbr, SEO.ai, TurnItIn, Writer, ZeroGPT*), 42 generated texts and 42 human-written works were examined. The study included papers generated with ChatGPT-3,5 and ChatGPT-4. The result of the study is that of the 126 papers examined, TurnItIn and Copyleaks were able to determine with 100% accuracy whether they were created by humans or AI. Originality.ai's results are also close to 100%. One of the findings of the research was that in many cases, the free AI detection services available for free also work quite well [11].

CONCLUSIONS

Apparently, in the US, the regulation of the use of generative AI at university level is more developed. In the previously mentioned BestCollege 2023 survey, more than half (58%) of responding students said their institution has a policy on the use of generative AI tools to complete assignments or exams. Students who responded that their university had such a policy reported that their institution had provided them with some form of detailed information about it [4]. It is crucial for professors, researchers, and students to have comprehensive knowledge about the procedures and university regulations regarding AI detection, same as the implementation of plagiarism control in educational institutions.

The primary aim of the paper was to examine the current state of the art of AI-generated text detection in education, in the academic context, in the light of the literature and research results. During the literature review, the research on tests of text detection tools was mapped and summarized in the study. In summary, while the various applications of artificial intelligence tools are useful tools in academia and in different areas of higher education (research - teaching - learning), they also have potential negative consequences. Teachers, researchers, and students need to be aware not only of the benefits of technology but also of the risks. It is the responsibility of the university or research institution to inform and train professors, students, and staff members on AI technology and to take measures to mitigate these risks. Most importantly, institutions need to create policies that are clear for students and staff to understand and follow, one that does not prohibit the usage of AI technology but focuses on its ethical use.

REFERENCES

[1] Berek, L.: *Long-term preservation and secure service of traditional and digital documents. In Hungarian.*
In: Rajnai, Z., ed.: Cyber Security. In Hungarian. Óbudai Egyetem, pp.155-166, 2018,

[2] Berek, L.: *Plagiarism detection and complete archiving. In Hungarian.*
In: Buzási, É.; Szabó, S. and Kiss, G., eds.: *Libraries at the service of science and higher education.* In Hungarian. Kaposvári Egyetem, pp.36-44, 2016,

[3] Jamieson, S.: *Patchwriting, Plagiarism, Pedagogy: Definitions and Implications*.
In: Eaton, S.E., ed.: *Second Handbook of Academic Integrity. Springer International Handbooks of Education*. Springer, 2024,
http://dx.doi.org/10.1007/978-3-031-54144-5_68,

[4] Nam, J.: *56% of College Students Have Used AI on Assignments or Exams.*
https://www.bestcolleges.com/research/most-college-students-have-used-ai-survey,

[5] Welding, L.: *Half of College Students Say Using AI on Schoolwork Is Cheating or Plagiarism.*
https://www.bestcolleges.com/research/college-students-ai-tools-survey,

[6] *Generative artificial intelligence (AI) revenue worldwide from 2020 with forecast until 2032 (in billion U.S. dollars).*
https://www.statista.com/statistics/1417151/generative-ai-revenue-worldwide,

[7] Perkins, M.; Roe, J.; Postma, D.; McGaughran, J. and Hickerson, D.: *Detection of GPT-4 Generated Text in Higher Education: Combining Academic Judgement and Software to Identify Generative AI Tool Misuse.*
Journal of Academic Ethics, **22**(1), 89-113, 2024.
http://dx.doi.org/10.1007/s10805-023-09492-6,

[8] Alexander, K.; Savvidou, C. and Alexander, C.: *Who Wrote this Essay? Detecting Ai-Generated Writing in Second Language Education in Higher Education.*
Teaching English with Technology **23**(2), 25-43, 2023,
http://dx.doi.org/10.56297/BUKA4060/XHLD5365,

[9] Liu, J.Q.J., et al.: *The great detectives: humans versus AI detectors in catching large language model-generated medical writing.*
International Journal for Educational Integrity **20**, No. 8, 2024,
http://dx.doi.org/10.1007/s40979-024-00155-6,

[10] Chaka, C.: *Detecting AI content in responses generated by ChatGPT, YouChat, and Chatsonic: The case of five AI content detection tools.*
Journal of Applied Learning and Teaching **6**(2), 94-104, 2023,
http://dx.doi.org/10.37074/jalt.2023.6.2.12,

[11] Walters, W.H.: *The Effectiveness of Software Designed to Detect AI-Generated Writing: A Comparison of 16 AI Text Detectors.*
Open Information Science **7**(1), No. 20220158, 2023,
http://dx.doi.org/10.1515/opis-2022-0158.