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Application of artificial intelligence AI for text and picture creation on the topic of “sustainability in the clothing industry”

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ABSTRACT

Artificial intelligence (AI) offers tools for text generation, text compression, literature search, image creation and translation. The current paper presents the application of three different AI tools (ChatGPT, Gemini and Claude) on these five areas in relation to the actually prominent topic “sustainability in the clothing industry”. These AI tools are used in their non-cost (free function) version. The main focus is the text creation with the aim to realize an essay which can be useful as a study work in a bachelor program. Even if there are differences in style and length of the essay created by the different AI tools, the quality is adequate with reasonable language and no typing errors. The lengths of the created texts are in the range of 366 to 1097 words. By text compression, a compression rate in the range of 41 to 83% is done. The results for translation can be described as good with no typing errors. In contrast, AI created images contain several significant language and typing errors. As drawback a bias in selection of sources and literature references by AI might be seen, which are quite often governmental or NGO owned webpages. For that reason, certain opinions might be more pronounced in the AI created texts. Considering this dominance of a certain type of sources, a careful check of AI created content might be useful and recommended. Finally, the presented paper is a case study for applying AI tools in academic writing and can support the evaluation of text creating for teaching purposes.

Keywords
artificial intelligence,
AI tool,
sustainability,
clothing industry,
text creation,
image creation,
translation

1 Introduction

Academic teaching and writing have been changed during the recent years drastically. There are mainly two events pushing these developments. First, the COVID-19 pandemic, which drastically forces to the use of online tools for teaching and also examination purposes [1-5]. Second, it is the broad introduction and cheap availability of AI tools which change clearly the way of academic writing and text creation in teaching processes [6,7]. Both events changed teaching and academic life drastically. Nevertheless, there is a big difference. The COVID-19 pandemic is ended and tools established at that period are nowadays modified or even a turn back to conventional teaching is seen [5]. In contrast to this, AI tools will not disappear as the COVID-19 pandemic did. AI tools will stay and their further improvement will happen. A current study at German universities indicates that nearly 90% of teachers at universities use AI tools for different teaching and study purposes [8]. Mainly mentioned are the applications as preparation of lectures, preparation of exams and the supervision of students and co-workers [8]. Further, several authors report their evaluation and experience with AI tools for teaching purposes and academic writing. The use of AI tools is evaluated for training and enhancing academic writing skills in teaching situations [9-11]. AI tools are especially seen as method to improve writing motivation of students who use English as a foreign language [9,11]. Even the term AI-powered pedagogy is raised to describe the fundamental change in traditional English writing teaching for teachers and students [10]. A further study reports on the knowledge and using behavior of Pakistani students for AI tools on academic writing [12]. It is clear that the students are broadly aware of AI tools and the possibilities these AI tools are opening. Following this, there are two main conclusions of Rashid et al. [12]. First, AI tools should be introduced as kind of pedagogical tool to improve the comprehension, productivity and writing quality of students, and second, a policy should be implemented to equip all students with knowledge and techniques to use this AI technology equally [12]. AI is described as valuable tool for enhancing soft skills during education in the fields of sustainability, fashion, textile and design [13]. However, also a negative impact of AI tools on the development of student skill is considered recently [14]. Additionally, the risks and challenges due to hallucinations in AI based large language models (LLM) in education are mentioned recently [15,16]. Here the emerging of hallucinations in tutoring systems and instructional content is presented [15]. Strategies to avoid or detect hallucinations are described [16]. Additional to the use of AI tools for educational purposes and training of language and writing skills, AI can be used in academic writing to realize scientific essays [17]. In a broad study focused on essays in the field of physics, Yeadon et al. compare the academic writing quality and detectability of authorship between human and AI-generated scientific texts. Finally, no significant differences in scoring of text quality between the two types of authors (human or AI) are determined [17]. Even if this earlier study is limited to physics essays, it might be concluded that probably each published review paper without containing experimental data may be created by AI faster and in similar or even better quality than human authors are able to. Examples for such data collecting reviews which publication might be avoided in future are even published recently in the field of innovative textiles [18,19]. An interesting approach is reported by Gao et al., who compared real scientific abstracts from the medical area with abstracts generated by an AI tool [20]. In this study, human reviewers and software AI output detectors are used and compared in their ability for detection of AI generated text. Both the humans and the detection software are able to identify a certain amount of the AI generated abstracts [20]. However, also in this study a clear identification of all AI created texts is not possible [20]. With this background, the question is set how students can use freely available and non-cost AI tools for text creation and other purposes necessary to create an essay or a study work or even a thesis. This text creation is done on the popular topic “sustainability in the clothing industry”. The topic “sustainability” is nowadays one of the most discussed issues in the field of textiles and for this reason chosen as target for the AI based text creation [21-24]. To the best of our knowledge, no study is published which investigated this topic similarly in the exactly same context. For purpose of the actual study, the AI tools ChatGPT, Gemini and Claude are used to create a short essay on this topic. These three AI tools are used in their non-cost (free function) version, because the use of AI tools by students in academic writing is one aim of the investigation and students mainly are not used to pay for any internet services. However, it is clear that the premium versions of these AI tools might produce different and improved results. Further, the capabilities for text compression, translation and picture creation in relation to this topic are evaluated. Finally, the capability of AI tools is

clearly demonstrated. However, as well few drawbacks are identified which should be considered if AI tools are used for academic writing, text creation and picture creation.

2 AI tools and usage

Three AI tools are used for the current study – ChatGPT (OpenAI), Gemini (Google) and Claude (Anthropic). These AI tools are used in their non-cost (free function) version [25-27]. Premium versions of these AI tools might generate different and improved results. The AI tools are used for the following purposes – text creation, literature research, text compressing, picture creation and translation from English to German language. The text creation is done on the topic “sustainability in the clothing industry” with the purpose to create an essay which can be used as part of a study work. The prompt is – create a text on the topic of sustainability in the clothing industry. This text creation is done in German language to evaluate especially the performance of the AI tools in a non-English language. Literature and references to the topic should be also suggested by the AI tools. The text compression is done on this created text, using the prompt – create a summary of the generated text. For evaluating the image creation on the topic, the prompt is used – create a picture for the topic of sustainability in the clothing industry. For each used AI tool, the query was only run once.

3 Applications

3.1 Text creation & literature recherche

Following the task of text creation on the topic “sustainability in the clothing industry”, all three AI tools create a well structured and reasonable text. According to typing, grammar and style no kind of mistakes are obvious. Handling the German language is for these AI tools no problem. These results are gained even if each AI tool was queried only once. Different or even improved results might be generated by multiple or iteratively changed runs of the AI tools on this task. However, a difference is determined in the size of the created text (Figure 1). Two AI tools deliver a shorter essay with around 2300 characters and around 300 words. In contrast, for the text created by the AI tool Claude, around three times more characters and words are observed.

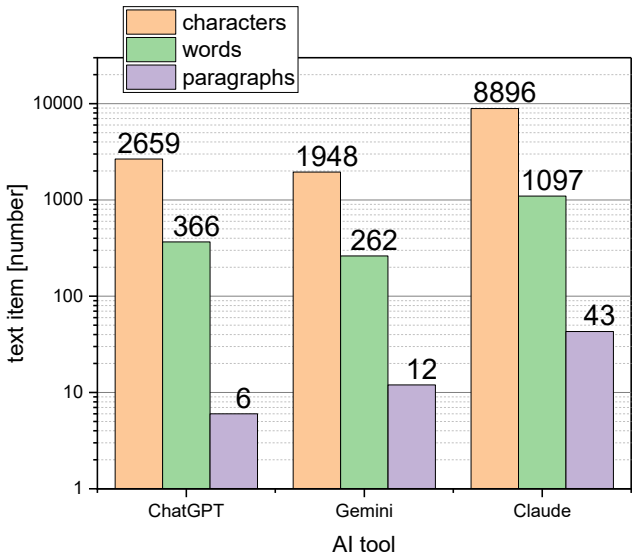

Fig. 1 Length of the AI created texts demonstrated by containing text items: characters, words and paragraphs – the numbers are compared for the different AI tools.

The AI tools suggest several sources and references on the topic “sustainability in the clothing industry”. These sources are probably also used by the AI tools for text creation. The number and type of sources given are compared in Figure 2. A simple categorization of the sources is done into government

dependent, NGO dependent and independent sources (meaning non-governmental and non-NGO). Government dependent sources are e.g. governmental webpages related to sustainability and clothing which are available e.g. from the European Union, German ministries or public offices. NGO dependent sources are often prominent webpages from organizations acting in the environmental sector or on social issues. Independent sources are sources which are not related to webpages of governments or NGOs, e.g. scientific publications as the review paper of Niinimäki et al. “The environmental price of fast fashion” [28]. Of course, also sources categorized here as “independent” are considered to have owners, relations and certain dependencies. A totally independent source of information cannot exist. However, this term is used here to describe the absence of a direct dependency on a governmental organization or an NGO. The use and recommendation of governmental and NGO dependent sources is clearly dominant in comparison to independent sources. A strong internet availability of the NGOs due to an excellent marketing might be an explanation for the dominance ot NGO related sources in comparison to other sources. The NGO dependent sources are especially related to challenges and problems in the textile sector leading mainly to the problematic issues in clothing industry. The same trend is also seen for the European and German governmental web pages. The use of those sources leads probably to an essay which clearly describes the problems and challenges but underestimates possible chances and positive issues. Probably the webpages are the sources with the easiest availability. For this reason, they are probably mainly considered. Also, the mentioned scientific paper from the group of Niinimäki et al. has a broad presence with a citation rate of more than >2900 on google scholar. However, also this research group emphasizes mainly disadvantageous aspects in clothing industry reflected by the buzzwords in the title “environmental price” and “fast fashion” [28]. The dominant use of dependent sources containing a certain opinion might be a disadvantage for the use of AI tools in academic writing, where a topic should be openly discussed under consideration of different opinions. Such a focus on governmental or NGO dependent sources might be avoided by specific instructions to the AI tool, as e.g. “use only peer-reviewed academic articles as sources”. In general, it might be useful to replace the original quite general request to the AI tool by more academic specific requests.

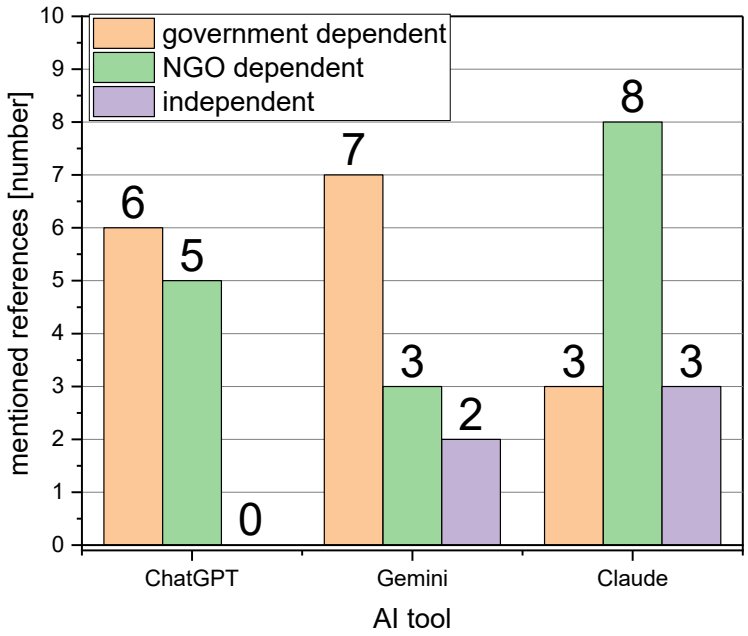

Fig. 2 Overview and categorization on sources and references mentioned by the different AI tools.

3.2 Text compression

The aim of text compression is to select the most significant content of a longer text and present it in a clearly structured way within a shorter version. For testing the capability of AI tools in the field of text

compression, the text created on the topic “sustainability in clothing industry” discussed in section 3.1 is used for text compression. In this investigation the AI tool used to create the original text is as well used to compress this earlier created text into a shorter version. All three used AI tools deliver compressed text versions of clear structure, adequate language and without typing errors. The extent of observed text compression is presented in Figure 3. In this figure, the number of words and characters before and after compression are presented. Also, a compression rate as percentage value is determined. In the actual case study, for the two AI tools ChatGPT and Gemini with shorter original texts, the compression rates are quite similar around 43%. For the AI tool Claude delivering a larger original text, the compression rate is with around 80% significantly higher. In fact, the finally generated compressed texts of all three AI tools exhibit nearly a similar length.

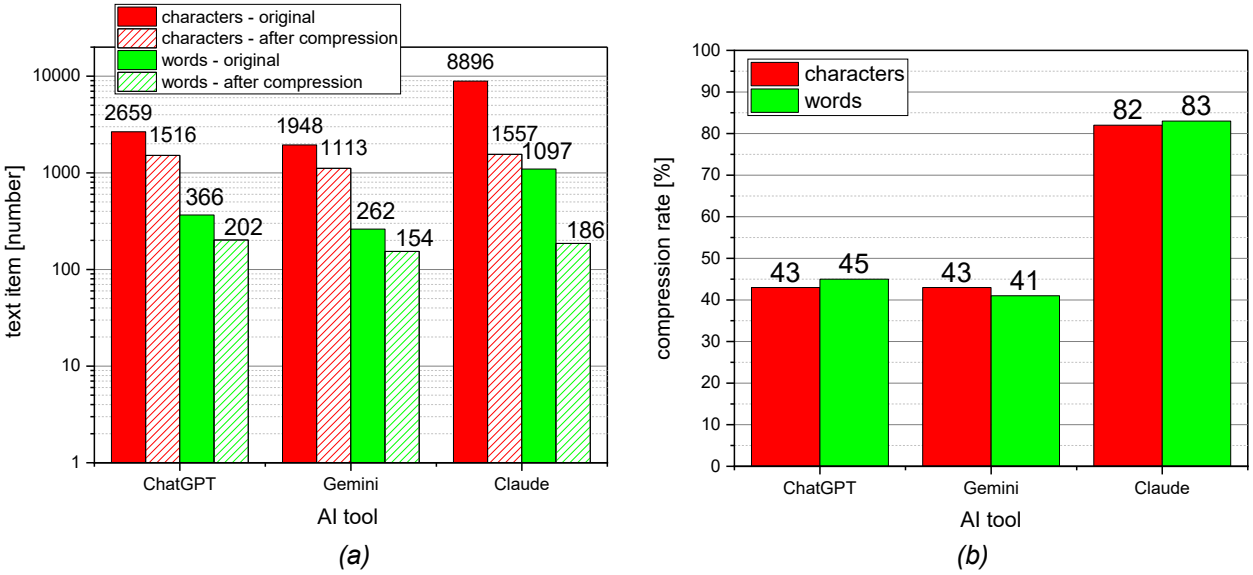

Fig. 3 Extent of text compression for the different AI tools – (a) comparison of the length of the AI created texts before and after text compression demonstrated by (a) number of text items: characters and words; (b) percentage value for compression according to reduction of characters and words.

3.3 Image creation

For investigation of the image creation capability as AI tools, the task was set to create an image describing the topic “sustainability in the clothing industry”. The realized images are compared in Figure 4 to 6. These images are completely different in style and content. Here, also the text content in the images is created in German language. In contrast to the previously described text creation, the text shown in the images contains several typing errors. However, it can be expected that due to fast evolution of AI tools, the actually observed spelling mistakes in AI created images will be avoided by future versions of AI tools.

Fig. 4 AI created image for the topic sustainability in the clothing industry – created by ChatGPT.

Fig. 5 AI created image for the topic sustainability in the clothing industry – created by Gemini.

Fig. 6 AI created image for the topic sustainability in the clothing industry – created by Claude.

ChatGPT creates the most detailed and colorful image, which mainly presents the positive aspects of sustainability. The dominant color in this picture is green standing probably for nature and eco-friendliness. Wind mills are shown referring to clean energy production. As positive buzzwords, “fair fashion”, “second hand” and “bio-becowolle” are included in the picture. With the term “bio-becowolle”, a typing error is obvious – probably ment is “bio-baumwolle”, meaning “bio-cotton” or “organic cotton”. The images created by the other two AI tools are structured around a cycle, which could be seen as a hint to the wished circularity of processes. The Gemini created image exhibit a headline of 15 words and out of this number, 5 words exhibit clear typing errors – meaning 33% of the words in this image are written wrong. This is a clear disadvantage which might be avoided by repeating runs of the AI tool or using the premium version. While the AI tool Gemini put different images together to create the final image, the image created by the AI tool Claude is more based on the arrangement of buzzwords. The Claude picture could be best used to describe different issues and categories of sustainability in the clothing industry and is also useful in connection with the essay created on this topic. In comparison, the picture created by ChatGPT has a high visual attractivity and might find applications of poster presenting the positive aspects of sustainability in the clothing industry.

3.4 Translation

For evaluation of translation capability of investigated AI tools, an English text related to environmental aspects of clothing industry is translated into German language. The original text is taken from the NGO Greenpeace Germany and is available online as Greenpeace report: clothing industry shows progress in cutting hazardous chemicals [29]. The title of this text is “The new Greenpeace Germany report launched today — Destination Zero: seven years of Detoxing the clothing industry”. This text is especially chosen for the translation task, because it has a strong relation to the topic “sustainability in the clothing industry” and is also a typical example for an NGO report in this field. Altogether the selected text contains 145 words and 860 characters. Additional to the translation by the three AI tools, this text is also translated using the tool Google translate. By using all four tools, the text is translated to clear standard German language without typing and language errors. However, the style and the used words differ in a certain range. The original English text exhibits 145 words built up by 860 characters. After translation to German, the number of words is in the range of 138 to 147 words depending on the used tool (Figure 7). The number of words after translation is mainly similar compared to the original text. The number of characters is in the

range of 999 to 1077, which is clearly higher compared to the 860 characters of the original English version. Most used German words contain more characters compared to the related English terms. In fact, different AI tools do not deliver one single and similar translation, they deliver a good translated text which may slightly differ depending on the type of used AI tool.

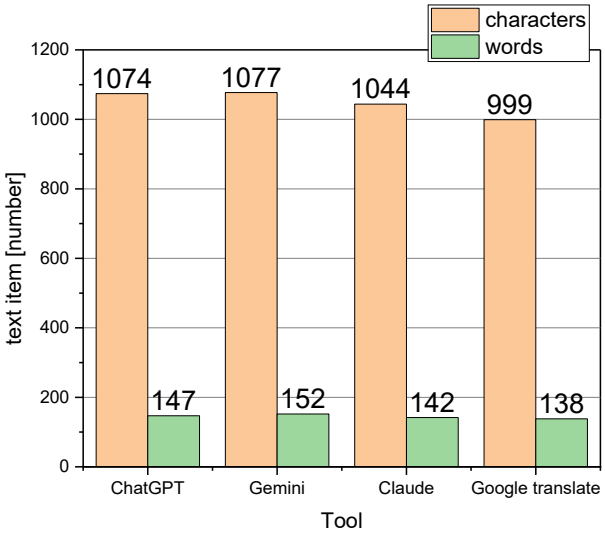

Fig. 7 Length of German text gained by AI created translations demonstrated by number of the text items characters and words – compared are the values for the different AI tools. The original English text contains 145 words and 860 characters.

4 Summary & Conclusions

Due to the actual development, AI tools can be seen as strong agents in the area of text creation and text work – as text compression or translation. In the current case study this is presented by application of publicly available different AI tools on the topic “Sustainability in the clothing industry”. As AI tools, the non-cost (free function) versions are used. Text creation and text compression are good from the technical point of view. As one drawback it might be seen that the AI tools mainly refer to governmental and NGO dependent sources and references. By this, a certain trend in the intention and content of the created text might be caused. In contrast to the text creation, the AI created images differ strongly in style and content depending on the type of AI tool used. In conclusion, the current study shows clearly that essays as result of academic writing on clothing related topics can be created by AI tools in adequate quality and in reasonably short time. By using these texts for academic purposes, it is recommended to check carefully the type and origin of used sources and references, to avoid a possible unbalance in their origin. An iterative application of AI tools might be considered to improve the output as well as the use of more “academic specific prompts” requesting the use of only peer-reviewed academic articles as sources. Some further limits of the actual study should be mentioned, as the single-run of the AI tools, the use of non-cost prominent AI tools and the restriction to only one topic evaluated only in a non-English language. Finally, the presented paper is a case study for applying AI tools in academic writing and can support the evaluation of texts creating for teaching purposes. Nevertheless, several questions are left open which could be the topics of following studies including also a human expert baseline for text quality comparison.

Author Contributions

Rebecca Schramm: conceptualization, methodology, formal analysis, data curation and initial writing; Boris Mahltig: writing, original draft preparation, review, editing and visualization. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest

The authors declare no conflict of interest.

References

1. Gonzalez, T.; de la Rubia, M. A.; Hincz, K. P.; Comas-Lopez, M.; Subirats, L.; Fort, S.; Sacha, G. M. Influence of COVID-19 confinement on students' performance in higher education. *PloS one* **2020**, *15*, e0239490. DOI: 10.1371/journal.pone.0239490
2. Gil-Fernández, R.; León Gómez, A.; Calderón-Garrido, D. Influence of COVID on the educational use of Social Media by students of Teaching Degrees. *Education in the Knowledge Society*, **2021**, *22*, 1-7. DOI: 10.14201/eks.23623 | e23623
3. Steculła, K., Wolniak, R. Influence of COVID-19 pandemic on dissemination of innovative e-learning tools in higher education in Poland. *Journal of Open Innovation: Technology, Market, and Complexity* **2022**, *8*, 89. DOI: 10.3390/joitmc8020089
4. Mahltig, B. Conversion of a conventional to a digital lecture under the conditions of Covid19–an example from a bachelor lecture on finishing, dyeing & printing. *Communications in Development and Assembling of Textile Products – CDATP* **2021**, *2*, 173-186. DOI: 10.25367/cdatp.2021.2.p173-186
5. Mahltig, B. Comparison of conventional and digital lectures and examinations with respect to the conditions after COVID-19 period–an example for a bachelor lecture on textile finishing. *Communications in Development and Assembling of Textile Products – CDATP* **2023**, *4*, 284-293. DOI: 10.25367/cdatp.2023.4.p284-293
6. Lee, J.; Lee, S.; Lee, S. The influence of AI convergence education on students' perception of AI. *Journal of The Korean Association of Information Education* **2021**, *25*, 483-490. DOI: 10.14352/jkaie.2021.25.3.483
7. Mulyani, H.; Istiaq, M. A.; Shauki, E. R.; Kurniati, F.; Arlinda, H. Transforming education: exploring the influence of generative AI on teaching performance. *Cogent Education* **2025**, *12*, 2448066. DOI: 10.1080/2331186X.2024.2448066
8. Garrel, v.G.; Mayer, J.; Webe, L.S. Wie Hochschullehrende künstliche Intelligenz im Studium nutzen – Ergebnisse einer bundesweiten Befragung. *Die neue Hochschule – DNH* **2026**, *2026(1)*, 16-19. DOI: 10.5281/zenodo.18017027
9. Song, C.; Song, Y. Enhancing academic writing skills and motivation: assessing the efficacy of ChatGPT in AI-assisted language learning for EFL students. *Frontiers in Psychology* **2023**, *14*, 1260843. DOI: 10.3389/fpsyg.2023.1260843
10. Dong, Y. Revolutionizing academic English writing through AI-powered pedagogy: Practical exploration of teaching process and assessment. *Journal of Higher Education Research* **2023**, *4*, 52-57. DOI: 10.32629/jher.v4i2.1188
11. Bahari, A. Balancing syntactic complexity and clarity: the role of AI in enhancing academic writing proficiency. *Saudi Journal of Language Studies* **2025**, *5*, 271-290. DOI: 10.1108/SJLS-10-2024-0062
12. Rashid, S.; Malik, S.; Abbas, F.; Khan, J. A. Pakistani students' perceptions about knowledge, use and impact of artificial intelligence (AI) on academic writing: A case study. *Journal of Computers in Education* **2025**, *12*, 1053-1078. DOI: 10.1007/s40692-024-00338-7
13. Jung, D.; Suh, S. Enhancing soft skills through Generative AI in sustainable fashion textile design education. *Sustainability* **2024**, *16*, 6973. DOI: 10.3390/su16166973
14. Mahadevan, J. Prompten statt denken? Die Auswirkung generativer KI-Nutzung auf studentische Lernfähigkeiten. *Die neue Hochschule – DNH* **2026**, *2026(1)*, 8-11. DOI: 10.5281/zenodo.18017001
15. Danyaro, K.U.; Abdullahi, S.; Abdallah, A.S.; Chiroma, H. Hallucinations in large language models for education: Challenges and mitigation. *International Journal of Teaching, Learning and Education* **2025**, *4(6)*, 13-19. DOI: 10.22161/ijtle
16. Peltekova, E.; Miteva, D.; Patias, I. Hallucination in LLM-based educational tools: Risks and solutions for reliable learning. *Journal of Business Innovation and Governance* **2026**, *9(1)*, 22-37
17. Yeadon, W.; Agra, E.; Inyang, O. O.; Mackay, P.; Mizouri, A. Evaluating AI and human authorship quality in academic writing through physics essays. *European Journal of Physics* **2024**, *45*, 055703. DOI: 10.1088/1361-6404/ad669d
18. Sayam; Mostak, S.; Sarker, A.; Sultana, J.; Chy, M.S.R.; Das, S.; Dey, S.; Shil, S.; Bhowmik, S.; Shahjalal, M. Innovative approaches in textile functionalization with nanotechnology. *Tekstilna Industrija* **2025**, *73(4)*, 11-26. DOI: 10.5937/tekstind2504011S
19. Ovi, F.I.; Shova, R.J.; Rahman, M.H.; Ghosh, N.C. Smart Textiles: An Interdisciplinary Overview of Advances, Applications, and Future Prospects. *Biomaterials Connect* **2025**, *2(1)*, 1-10. DOI: 10.69709/BIOMATC.2025.148814

20. Gao, C.A.; Howard, F.M.; Markov, N.S.; Dyer, E.C.; Ramesh, S.; Luo, Y.; Pearson, A.T. Comparing scientific abstracts generated by ChatGPT to real abstracts with detectors and blinded human reviewers. *NPJ digital medicine* **2023**, *6*, 75. DOI: 10.1038/s41746-023-00819-6
21. Zhang, Y.Q.; Lykaki, M.; Alrajoula, M.T.; Markiewicz, M.; Kraas, C.; Kolbe, S.; Klinkhammer, K.; Rabe, M.; Klauer, R.; Bendt, E.; Stolte, S. Microplastics from textile origin–emission and reduction measures. *Green Chemistry* **2021**, *23(15)*, 5247-5271. DOI: 10.1039/D1GC01589C
22. Klinkhammer, K.; Kolbe, S.; Brandt, S.; Meyer, J.; Ratovo, K.; Bendt, E.; Rabe, M. Release of fibrous microplastics from functional polyester garments through household washing. *Frontiers in Environmental Science* **2024**, *12*, 1330922. DOI: 10.3389/fenvs.2024.1330922
23. Blanckart, L.; Munasinghe, E.A.; Bendt, E.; Rahaman, A.; Abomohra, A.; Mahltig, B. Algae-based coatings for fully bio-based and colored textile products. *Textiles* **2025**, *5(1)*, 1-17. DOI: 10.3390/textiles5010003
24. Rahaman, A.; Blanckart, L.; Hanelt, D.; Poller, M.J.; Heil, C.; Prova, S.M.; Ratovo, K.; Bendt, E.; Mahltig, B.; von Schwartzenberg, K.; Abomohra, A. Unraveling filamentous algae as a renewable bioresource for advanced moisture-absorbent innovative aquatic fibers. *Bioresources and Bioprocessing* **2026**, *13(1)*, 33. DOI: 10.1186/s40643-026-01028-1
25. OpenAI, ChatGPT webpage. https://openai.com/de-DE/ (accessed 2026-03-24).
26. Google, Gemini app webpage. https://gemini.google/de/overview/?hl=de (accessed 2026-02-24).
27. Anthropic, Claude webpage. https://claude.ai/login (accessed 2026-02-24).
28. Niinimäki, K.; Peters, G.; Dahlbo, H.; Perry, P.; Rissanen, T.; Gwilt, A. The environmental price of fast fashion. *Nature Reviews Earth & Environment* **2020**, *1*, 189-200. DOI:10.1038/s43017-020-0039-9
29. Greenpeace International 2018, Green peace report: clothing industry shows progress in cutting hazardous chemicals, publications at 12. July 2018 https://www.greenpeace.org/international/press-release/17739/greenpeace-report-clothing-industry-shows-progress-in-cutting-hazardous-chemicals/ (accessed 2026-01-13).