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Media, media education, GAI and radical uncertainty

Media, educazione ai media, GenAI e incertezza radicale

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Abstract. The study examines the transformative potential impact of Generative AI (GAI) on society, media, and media education, focusing on the challenges and opportunities these advancements bring. GAI technologies, particularly large language models (LLMs) like GPT-4, are revolutionizing content creation, platforms, and interaction within the media landscape. This radical shift is generating both innovative educational methodologies and challenges in maintaining academic integrity and the quality of learning. The study aims to provide a comprehensive understanding of how GAI impacts media education by reshaping the content and traditional practices of media-related higher education. The research delves into three main questions: the nature of GAI as an innovation, its effect on media research and knowledge acquisition, and its implications for media education. It introduces critical concepts such as radical uncertainty, which refers to the unpredictable outcomes and impacts of GAI, making traditional forecasting and planning challenging. The paper utilizes McLuhan's tetrad to analyze GAI's role in media, questioning what it enhances or obsoletes, retrieves, or reverses when pushed to extremes. This theoretical approach helps in understanding the multifaceted influence of GAI on media practices and education. Overall, the research underscores the dual-edged nature of GAI in media education, where it presents significant enhancements in learning and content creation while simultaneously posing risks related to misinformation, academic integrity, and the dilution of human-centered educational practices. The study calls for a balanced approach to integrating GAI in media education, advocating for preparedness against its potential drawbacks while leveraging its capabilities to revolutionize educational paradigms.

Keywords: generative AI, media, media education, radical uncertainty, tetrad of media effects.

Riassunto. Lo studio esamina il potenziale impatto trasformativo dell'Intelligenza Artificiale Generativa (GAI) sulla società, sui media e sulla media education, concentrandosi sulle sfide e sulle opportunità che questi progressi comportano. Le tecnologie GAI, in particolare i modelli di linguaggio di grandi dimensioni (LLM) come GPT-4, stanno rivoluzionando la creazione di contenuti, le piattaforme e l'interazione all'interno del panorama mediatico. Questo cambiamento radicale sta generando sia metodologie educative innovative sia sfide nel mantenimento dell'integrità accademica e nella

qualità dell'apprendimento. Lo studio si propone di fornire una comprensione complessiva di come la GAI influenzi l'educazione ai media, rimodellando i contenuti e le pratiche tradizionali dell'istruzione superiore legata ai media. La ricerca approfondisce tre questioni principali: la natura del GAI come innovazione, il suo effetto sulla ricerca sui media e sull'acquisizione di conoscenze e le sue implicazioni per la media education. Vengono introdotti concetti critici come l'incertezza radicale, che si riferisce agli esiti e agli impatti imprevedibili della GAI, rendendo difficile la previsione e la pianificazione tradizionali. Il documento utilizza la tetrade di McLuhan per analizzare il ruolo della GAI nei media, interrogandosi su cosa essa potenzi o renda obsoleta, recuperi o ribalti quando viene spinta agli estremi. Questo approccio teorico aiuta a comprendere l'influenza sfaccettata della GAI sulle pratiche e sull'educazione ai media. Nel complesso, la ricerca sottolinea la natura ambivalente della GAI nell'educazione ai media, dove presenta miglioramenti significativi nell'apprendimento e nella creazione di contenuti, ma allo stesso tempo pone rischi legati alla disinformazione, all'integrità accademica e alla diluizione delle pratiche educative incentrate sull'individuo. Lo studio invita a un approccio equilibrato nell'integrare la GAI nell'educazione ai media, sostenendo la necessità di essere preparati contro i suoi potenziali svantaggi e sfruttando al contempo le sue capacità di rivoluzionare i paradigmi educativi.

Parole chiave: IA generativa, media, educazione ai media, incertezza radicale, tetrade degli effetti dei media

1. INTRODUCTION

Artificial intelligence applications, especially those based on large language models (LLMs) like generative AI (GAI), are revolutionizing society and the media landscape in unprecedented ways. A significant milestone in this process was the public release of OpenAI's ChatGPT in November 2022.

In the media field, this means the emergence of new types of content, platforms, and interaction relationships, whose long-term stability and impacts are difficult to predict. For social and consequently media studies, GAI is expected to signify a shift in operating methods.

GAI opens up new possibilities for data collection and analysis, yet it places researchers in a situation where traditional research methods and assumptions are tested.

GAI also poses challenges to higher education. It offers innovative ways for learning and teaching, yet it also presents challenges concerning academic integrity, the quality of learning, and future work readiness.

This article examines the effects of GAI on society, media and media education. It also explores the connection between AI development and research and knowledge acquisition from a social science and media studies perspective. In the results section will be assessed how GAI's impact can be approached through theoretical frameworks.

The research primarily targets media education, where the opportunities and challenges are shaped in two ways. On one hand, the rapid development of AI and its effects on media content, production, distribution, and consumption are transforming the content of media education, thereby challenging traditional models. On the other hand, the aforementioned effects of GAI on the general operational practices of higher education are also evident in media education and its organization.

In theoretical terms we relate to media ecology, that examines the intersections of media and technology, and how they affect human perception and experience (McLuhan & McLuhan, 1988). From this perspective, GAI can be defined as a new media and yet another communicative technology that reshapes how we perceive and engage with reality (Petricini, 2024). This literature review aims to contribute to a critical understanding of GAI in media education and media research (cf. Luttrell & al., 2020).

2. RESEARCH QUESTIONS, CONCEPTS, METHOD, AND MATERIAL

The purpose of this research article is to answer three questions.

The first question (1) is, what type of innovation is generative AI and how deeply does it change society and thereby media at the structural and operational practice levels?

The second question (2) asks, how generative AI affect the possibilities for conducting research, especially media research, and acquiring knowledge and information.

Thirdly (3), the research asks what the implementation of generative AI means for media education given the potential changes in media and higher education?

2.1. Concepts and theoretical background

Artificial intelligence involves a multitude of concepts that one must be familiar with to understand relevant writings and produce content on the topic. Among the key concepts in this article are "generative AI" (GAI) and "large language model" (LLM), which have numer-

ous definitions available online, and AI itself can define these terms upon request. According to UNESCO (Miao & Holmes, 2023):

> Generative AI (GenAI) is an artificial intelligence technology that automatically generates content in response to prompts written in natural-language conversational interfaces. Rather than merely curating existing webpages, generative AI produces new content.

Technology company Gartner defines large language models (LLM) briefly as following:

> A large language model (LLM) is a specialized type of artificial intelligence (AI) that has been trained on vast amounts of text to understand existing content and generate original content.

Alongside GPT-4, other notable LLMs include Google's LaMDA, BERT, Meta's LLaMa, and Baidu's ERNIE. Platforms that currently offer conversational services include ChatGPT and Gemini (Google), formerly known as BARD.

Theoretical concepts

In this paper the unique features of GAI in the media is explored through Marshall McLuhan's tetrad concept (McLuhan & McLuhan, 1988). McLuhan's tetrad boils down to four questions against which any technology or media can be examined:

- What does it enhance or intensify?
- What does it render obsolete?
- What does it retrieve that had been obsolesced?
- What does it flip into when pushed to extremes?

The term "radical uncertainty" refers to situations where the range of possible future outcomes is unknown, and their probabilities cannot be meaningfully calculated. This term is often used in economics and decision theory, but it has broader applications for example in social sciences.

The roots of the concept of radical uncertainty are in 20th century economists like Frank Knight and John Maynard Keynes. Knight distinguished between measurable risks, whose probabilities can be determined, and immeasurable uncertainties, which later evolved into discussions of radical uncertainty.

In scenarios of radical uncertainty, decision-makers must consider a wider range of possible outcomes, including unknown or previously unexperienced events. The focus is on building resilience and flexibility rather than optimizing predicted scenarios.

2.2. Material and Method

The literature review and background research involved an examination of 56 articles related to the role of GAI across various societal functions. The analyzed articles can be categorized as peer-reviewed (34 out of 56), conference or workshop papers (6/56), under review (2/56), master's thesis (1/56), others (not peer reviewed, working paper, preprint) 13/56. The selection is based on a decision to only include papers that have been published after launch of ChatGPT3. This is why other than peer reviewed papers were included. Research papers on GAI have been published at an accelerated rate since early 2023, mirroring the trends in search queries for ChatGPT and similar conversational robots.

The methodology of this research involved a comprehensive literature search focused on articles published in 2023 and 2024, using Google Scholar as data base, and generative artificial intelligence (GAI) as main keyword, combined with media, society, higher education, research, LLM, and methods. Out of an initial set of 262 articles, 56 were selected based on their relevance to the study's themes, which included GAI's role in society, media, and higher education, as well as its contributions to media education. The abstracts, introductions, and conclusions of these articles were manually reviewed, and AI models ChatGPT3.5 and ChatGPT4o were employed to generate summaries of key findings, ensuring consistency through a comparison with manual reviews.

The methodology also involved thematic categorization and synthesis, applying qualitative research techniques to manage large datasets. A triangulation strategy was used to enhance reliability by combining human and AI insights. Researchers first established a baseline understanding of the selected articles through manual analysis, then cross-referenced these findings with AI-generated summaries to ensure accuracy and reduce biases. This integrated approach allowed for a more balanced and comprehensive analysis, positioning AI as a supportive tool rather than the primary method of interpretation.

3. LITERATURE REVIEW BY RESEARCH THEMES

In this section we present the results from the literature review in relation to three themes: (1) GAI in society, (2) GAI in societal and media research, and (3) GAI in education. The theme of GAI in society is further divided into three areas: (1a) Societal implications of GAI in general, (1b) the societal reception of GAI, and (1c) GAI as an "agent" in society. Regarding societal and

Table 1. Summary of research themes, analysed articles and share of peer reviewed articles in data.

Research Themes	Analysed Articles	Number of peer reviewed articles	Total number of articles
Social implications of GAI in general	Alawida & al. (2023), Holmström & Carroll (2024), Li (2024), Polyportis & Pahos (2023), Retkowsky & al. (2024), Shou (2023)	5	6
The societal reception of GAI	Bukar & al (2023), Draxler & al. (2023), Heumann & al. (2023), Karanouh (2023), Korkmaz & al. (2023, Lian & al. (2024), Menon & Shilpa (2023), Talafidaryani & Moro (2024)	3	8
GAI as an agent in society	Allaham & Diakopoulos (2024), Dougrez-Lewis & al. (2024), Haim & al. (2024), Hubert & al. (2024), Koubaa & al. (2023), Pock & al. (2023), Rozado (2023), Tang (2023)	4	8
Societal and media research in the era of GAI	Alshami & al (2023), Anjos al. (2023), Bail (2024), Burger & al. (2023), Espinosa & Salathé (2024), Grossmann & al. (2023), Hamilton & al. (2023), Huh & al. (2023), Khlaif & al. (2023), Liu & al. (2023), Olinski & al (2024), Ziems & al. (2024)	9	12
The performance of GAI in societal media research	Cheng & al. (2024), Elali & Rachid (2023), Fan & al. (2024), Lynch & al. (2023), Rathje & al. (2024), Romano & al. (2024), de Winter (2024), Zhang & al. (2023a), Zhang & al. (2023b), Zhou & al. (2024)	4	10
Higher Education	Ahmad & al. (2023), Baidoo-Anu & Owusu Ansah (2023), Bazelais & al. (2024), Chiu (2024), Dempere & al. (2023), Grassini (2023), Li & al. (2023), Polat & al. (2024), Williamson & al. (2023)	8	9
Media Education	Bdoor & Habes (2024), Gil de Zúñiga & al. (2023), Pavlik (2023)	3	3
Total		36	56

media research, we distinguish between two research areas (2a) societal and media research in the era of GAI, and (2b) the performance of GAI in societal and media research. Regarding GAI and education we examine two areas: (3a) GAI in higher education in general and (3b) GAI specifically in media education. Table 1 present the themes, the articles, and the number of (peer reviewed) articles in each category.

3.1. Generative AI in Society

The research data searches revealed that the role of GAI has been examined in previous studies both narrowly targeted at specific societal functions (e.g., online commerce) and more broadly across different areas of society.

Farina & Lavazza (2023) have approached this subject and discussed ChatGPT's role and impacts across various sectors such as security, politics, economy, culture, and education. Additionally, they consider the adoption of ChatGPT in relation to social bias, creativity, copyright issues, and freedom of speech.

The study concludes that while GAI offers many benefits, its potential drawbacks require careful evaluation. For instance, ChatGPT may produce plausible but inaccurate or nonsensical responses, and its use could lead to misuse. Furthermore, GAI could reinforce gender and ethnicity-related prejudices and be vulnerable to manipulation, which might later influence public opinion on significant issues.

According Holmström & Carroll (2024), ChatGPT improves innovations by reducing costs and introducing new possibilities, such as automating customer service or creating customized educational materials. The technology opens new avenues in various sectors by enabling the creation of innovative artistic content and improving service delivery efficiency.

In their bibliographic article, Alawida & al. (2023) review the performance and success of various LLMs in their roles as AIs and how different sectors of the business world have used and can use ChatGPT.

According to Shou (2023), one limiting factor appears to be data privacy: while ChatGPT can perform many tasks of a data analyst, companies are reluctant to use it for analytics purposes due to privacy and security concerns.

From a broader economic perspective, Li (2024) suggests that AI technologies can promote high-quality economic development but also pose risks such as labour market disruptions, market monopolization, national security threats and fewer large companies control the AI platforms. The positive effects of GAI on the economy include fostering innovation, improving production efficiency, and revitalizing industrial activities.

Polyportis & Pahos (2023) emphasize that ChatGPT and similar tools can pose numerous societal risks, such as devaluing human relationships, unemployment, lack of privacy, prejudice, spreading misinformation, and digital inequality.

Researchers such as Retkowsky & colleagues (2024) have found that ChatGPT offers employees multiple opportunities, such as information retrieval, idea generation, content structuring, drafting initial versions, embellishing text, and reviewing work.

However, the study also highlighted detrimental side effects, such as reduced information sharing among colleagues. The use of ChatGPT can also complicate supervisors' ability to monitor work quality and understand the extent to which employees' output is based on human or AI activities.

The societal reception of GAI and LLMs

A significant area of research within GAI focuses on its use and reception in society. For instance, Draxler & al. (2023) analysed 1,500 American users of LLMs. Their findings highlighted that factors such as gender and age significantly predicted the use of LLMs, with men and younger age groups more likely to use these technologies. Technological education helped to equalize gender differences.

Menon & Shilpa (2023) conducted interviews with 32 Indian users of ChatGPT, revealing that both technological and social factors affect adoption. However, concerns about privacy and the perceived quality of interaction are significant factors affecting users' willingness to engage with this technology.

Social media has been extensively used to explore the reception of GAI. For example, Talafidaryani & Moro (2024) examined how the Reddit community perceives ChatGPT. Initially, the sentiment towards ChatGPT on Reddit was somewhat negative, but it has become more positive over time.

Korkmaz & al. (2023) analysed user emotions and opinions about ChatGPT using Twitter data from the first two months after its release. Sentiment analysis of 788,000 English-language tweets revealed that most early users of ChatGPT were mostly satisfied with their experience.

Lian & al. (2024) studied attitudes towards ChatGPT in China. They analysed 96,435 comments and 55,186 reposts in microblogging service Weibo. Concerns included risks of misinformation, technological unemployment, and the dynamics between humans and computers. The study highlights that social media plays a significant role in disseminating information of GAI, whereas traditional media and administrative units seem to have a more limited impact.

Bukar & al. (2024) examined LinkedIn comments. The results showed that ChatGPT could generate useful content, such as academic papers and research, but it also posed challenges, including risks of plagiarism and degradation of data accuracy.

Also. the reception of GAI in mainstream media has been studied with notable interest. Karanouh (2023) analysed 10,902 news headlines from November 2022 to March 2023. The findings indicated that ChatGPT and AI generally received positive media attention. However, the majority of headlines focused on the activities of large technology firms, with issues such as employment, diversity, ethics, and gender receiving minimal coverage.

Heumann & al. (2023) compared the popularity of GPTZero and ChatGPT. The findings highlighted significant interest in ChatGPT, while GPTZero received less attention despite being aimed at addressing concerns about plagiarism.

GAI as an "Agent"

The role and application of GAI in society is deeply connected to research assessing its capabilities and functionality. Dougrez-Lewis & al. (2024) examined ChatGPT's reasoning abilities by studying its skill in identifying various rumours. The results showed that while ChatGPT was effective in verifying statements from Wikipedia, it struggled with real-world rumours, especially those requiring abductive reasoning.

Hubert & al. (2024) found that GPT-4 provided more original and detailed responses than humans, even when response fluency was controlled. Also, originality and elaboration scores were higher for GPT-4 across all tasks compared to human participants and GPT-4's answers were also semantically broader. However, the creative potential of AI remains reliant on human assistance and guidance limiting its autonomy.

According to Tang (2023) ChatGPT appeared well-adapted to tasks involving societal values, excelling particularly in combating bias and detecting toxicity.

Rozado (2023) investigated political biases in ChatGPT, conducting 15 different political orientation tests. Most tests (14 out of 15) identified ChatGPT's responses as leaning left.

Haim & al. (2024) concluded the models like GPT-4 consistently showed biases against names typically associated with racial minorities and women, with names of black women receiving the most unfavourable responses.

Results of Pock & al. (2023) indicate that while LLMs can preliminarily "understand" moral concepts

and values, they do not necessarily reflect these values in the same way humans do.

The study by Allaham & Diakopoulos (2024) assessed the use of LLMs in predicting negative AI impacts in news media. As a result, a taxonomy focused on AI impacts was developed by analyzing thousands of news articles from around the world.

Koubaa & al. (2023) examined ChatGPT's capabilities and competence: It is capable of producing human-like language, which has been challenging for earlier models. This makes it superior in many areas, such as understanding context and generating complex responses.

3.2. Societal and media studies in the era of GAI

The utilization of GAI in scientific research have garnered increasing interest following the widespread release of ChatGPT.

The study of Khlaif & al. (2023) indicated that with detailed prompts and provided research context, ChatGPT could produce publishable, high-quality research. However, ChatGPT had limited impact on developing research frameworks and data analysis.

Alshami & al. (2023) found that ChatGPT significantly improved the efficiency and reliability of conducting systematic literature reviews. ChatGPT demonstrated excellent performance in screening and categorizing articles, which led to considerable time and effort savings. However, it was noted that ChatGPT was not best suited for extracting data from articles.

The development of social science research on ChatGPT was explored by Olinski & al. (2024) in their bibliometric article using 814 publications. The findings highlighted the rapid growth of ChatGPT's use in social sciences as a reflection of societal digital transformation.

Grossmann & al. (2023) considered how LLMs can be used to test new theories and create hypotheses quickly and on a large scale, enabling the development of novel research methods and the adaptation of research practices.

The article also contemplates how LLMs can substitute human experimenters in data collection, enabling the generation of realistic survey responses, for example, about consumer behaviour. Using LLMs can expand perspectives in policy analysis by simulating various theoretical or ideological views.

The study emphasized the limitations and potential ethical issues such as biased models and their effects on the reliability of research. There is a need for new guidelines for data protection, fairness in algorithms and environmental impacts. Integrating GAI into social sciences requires new skills from researchers, such as identifying model biases and validating AI data.

According to Bail (2024), GAI can enhance social scientific research in areas such as survey research, online experiments, automated content analysis, and agent-based models. GAI tools can assist with literature reviews, identifying new research questions, and routine research tasks such as writing, data cleaning, and programming.

Bail predicts that language models will need to be trained to better understand the science of social relations.

Further, social scientists need to work together to create collective goods before the architectures of GAI become deeply embedded in large corporations.

Burger & al. (2023) highlighted the benefits AI brings to management research such as objectivity and reproducibility, which can be utilized in research processes where human error is common.

Zhou & al. (2024) showed that ChatGPT could effectively interpret emojis in various application scenarios, providing results comparable to human analysts.

Anjos & al. (2023) investigated the suitability of ChatGPT for studying and detecting fake news using a dataset of 200 newspaper articles. Results demonstrate that the GPT model can accurately classify texts.

Huh & al. (2023) reviewed the potential uses of ChatGPT in advertising research and emphasized the effects of AI on consumer experience, issues related to truthfulness in policy, and the use of AI in the advertising creation process.

The suitability of ChatGPT for recommendation research has also been studied (Liu & al., 2023).

The potential impact of LLMs on computational social science has been examined by Ziems & al. (2024), focusing on how LLMs can enhance social scientific research, particularly in zero-shot classification and explanatory tasks.

Performance of GAI in research

One of the areas of research thus far has addressed the capability of GAI to perform tasks that have traditionally been manually conducted by humans.

Hamilton & al. (2023) examined the potential of AI, specifically ChatGPT, to support qualitative research analysis. The results revealed similarities and differences between human and AI analyses, with human coders identifying some themes that ChatGPT did not detect, and vice versa.

A study by Lynch & al. (2023) indicated that in some cases, the narratives created by ChatGPT did not differ statistically significantly from real tweets in terms of sentiment analysis.

According to Espinosa & Salathé (2024) LLMs such as GPT can be effective tools for the rapid assessment of public opinion on health policy and interventions.

Zhang & al. (2023a) developed expert-driven frameworks that support the use of ChatGPT in thematic analysis. The results demonstrated that these frameworks improved the quality of thematic analysis.

Elsewhere, Zhang & Al. (2023b) found that GAI not only refines the qualitative analysis process but also raises its transparency, credibility and accessibility.

According to Fan & al. (2024), ChatGPT is competitive in topic segmentation compared to leading methods in speech analysis, but it still needs improvement in identifying discourse relations and parsing discourse.

The results of Rathje & al. (2024) indicated that GPT outperforms traditional English-language dictionary analysis methods, often achieving results as good as or better than the best machine learning models particularly in less commonly spoken languages.

Romano & al. (2024) explored theme-driven keyword separation in social media content on Reddit. The findings suggest that ChatGPT performs better than unsupervised keyword separation models.

De Winter's (2024) study highlights the potential of LLMs in scientometrics and suggests that artificial intelligence could support the peer review process in scientific publishing.

The study of Cheng & al. (2024) revealed that the impact of AI-generated texts in scientific publications is extensive and visible across various disciplines such as computer science and engineering sciences. The use of AI in manuscripts also correlates positively with the number of citations.

According to Elali & Rachid (2023), AI can be used to produce entirely fabricated research results, abstracts, and complete research articles that appear valid but are based on falsified information and outcomes.

3.3. GAI in higher education – opportunities and challenges

Given that generative AI can produce text nearly comparable to human output, it is not difficult to foresee its use in generating text and performing various tasks required in higher education. The articles analyzed for this research paper mainly highlighted opportunities for higher education but also challenges in implementation.

The study of Dempere & al. (2023) emphasized ChatGPT's potential to support research, automate assessments, and enhance human-computer interaction. It could also streamline enrolment processes, improve student services, enhance teaching quality, and increase student retention. The use of ChatGPT can promote innovative learning and personalized teaching, enhance administrative functions, and improve student support services. It also offers new ways to engage and assess students.

The challenges highlighted by the study include the security of online assessments, the risks of plagiarism, and broader societal and economic impacts, such as job reduction, digital literacy gaps, and AI-induced anxiety.

Polat & al. (2024) have demonstrated an exponential growth in interest in using ChatGPT for educational purposes. A key benefit is supporting teachers and innovating teaching technologies and enrich educational environments.

According to Grassini (2023) ChatGPT can assist teachers in evaluating student work and providing personalized feedback. It can also alleviate teachers' workload. AI tools can improve the translation of educational materials and support interactive learning environments that adapt to individual student needs.

However, the Gen AI may produce erroneous or even fabricated information. Its use could lead to plagiarism, and challenge academic integrity. The use of AI may also lead to job losses and alter labour markets, raising ethical questions and necessitating new regulatory measures.

According to Twitter analysis of Li & al. (2023) representatives from the technology, education, and media sectors play a central role in spreading ChatGPT concerns. According to the study, media actors should provide an accurate and unbiased depiction of ChatGPT, its capabilities, limitations, and potential applications in education.

Baidoo-Anu & Owusu (2023) suggest that the benefits of GAI can include personalized teaching, automatic essay grading, language translations, interactive learning and adaptive learning. Challenges include a lack of human contact, limited understanding, biases in training data, and a lack of creativity.

Chiu (2024) interviewed 51 students from three research-intensive universities. Students highlighted for example the need for AI literacy and interdisciplinary learning. They proposed new learning outcomes, such as the ability to learn and teach with the aid of GAI, and skills that prepare students for the workforce. The research emphasizes the importance of voices of students to be heard.

Bazelais & al. (2024) examined the acceptance and adoption of ChatGPT by students in the educational sector with 138 participants. The study revealed that performance (not reward for effort or social expectations) was linked to behavioural intentions.

Williamson & al. (2023) highlighted risks such as the possibility that LLMs may generate misleading or incorrect information. The examination raises ethical

and social questions, environmental impacts and the ideological issues of datafication as challenges.

According to Ahmad & al. (2023), AI has a significant impact on increasing human laziness, manifested as reduced activity and procrastination in tasks. AI affects also negatively people's ability to make decisions.

3.4. Media and media education in the age of artificial intelligence

This subsection will explore research where the primary focus has been on media or media education.

The study of Gil de Zúñiga & al. (2023) resulted in a comprehensive working definition of AI, encompassing AI's ability to perform tasks, solve problems, communicate, interact, and act logically, much like biological humans.

The study indicates that AI is transforming the dynamics of investigative journalism, news production, and distribution, including targeting audiences based on their news preferences.

Pavlik (2023) examined in article co-authored by a professor of journalism and media studies, and ChatGPT, how GAI impacts journalism and media industry education.

The review highlighted that ChatGPT can rapidly produce expert text on various topics, which could revolutionize news production and journalistic content. Furthermore, the review emphasized the need to teach media industry students the principles of using AI. The article also addressed ethical issues such as copyright and the authenticity of news.

According to Bdoor & Habes (2024) GPT has revolutionized journalism by enabling the processing of large data volumes and enhancing news functions such as editing and content personalization. GPT improves efficiency and productivity, but it also brings challenges, such as limited adoption in certain AI subfields and dependency on technology companies' funding. The research highlights AI's ability to produce high-quality content that competes with human-generated content but reminds us that AI cannot replace the unique touch and creativity of humans.

4. THEORETICAL AND EMPIRICAL REFLECTIONS: MEDIA EDUCATION IN AI-DOMINANT SOCIETY

In this chapter, research questions will be addressed based on article analysis using existing theoretical literature as the conceptual framework.

4.1. Generative AI as innovation

The first research question—what kind of innovation GAI is and how deeply does it change society and thereby media—is addressed here based on the research articles.

A particularly relevant study describing ChatGPT's performance is by Koubaa & al. (2023), which emphasizes that ChatGPT represents a significant advancement in natural language processing, capable of producing human-like language, which has been challenging for previous models. This has made it superior to earlier technologies in areas such as understanding context and generating complex responses. ChatGPT utilizes transformer architecture, which allows more efficient and accurate training of language models compared to traditional methods.

While Koubaa & al. (2023) primarily refer to ChatGPT's technical performance, their research also allows for a broader interpretation. ChatGPT and other GAI applications act as radical or disruptive innovations when viewed through the lens of innovation adoption theories.

In the light of research material, GAI appears as a radical innovation. It brings significant change, typically creating new industries or rewriting the rules of existing markets with technological breakthroughs.

Although the societal adoption process is still ongoing, applications are forming, and technology is evolving, GAI not only elicits acclaim, wonder, and great expectations but also many questions tinged with fear. However, it has not raised significant doubts – in the research literature or in public discussion – about its status as a significant innovation.

Originally created by Clayton Christensen in the 1990s, the concept of disruptive innovation refers to an innovation that upends existing markets by introducing solutions that, although not immediately superior, become dominant through their accessibility, affordability, or convenience, often displacing established competitors.

Good & al. (2024) have stated ChatGPT as a disruptive innovation in the manner described by Christensen. Their study uses the Guo, Pan, Guo, Gu, and Kuusisto (2019) model to assess disruptive innovation and concludes that ChatGPT meets its criteria when used in a university environment. This is highlighted by the fact that ChatGPT has radically changed processes, products, and delivery methods in higher education, just as Christensen described disruptive innovations in other industries.

In education, research and media, GAI is potentially displacing traditional, labor-intensive methods in text analysis, content production, and data processing.

Although GAI does incorporate elements of incremental innovation through continuous improvements over previous language models, their ability to fundamentally change industries, create new forms of interaction, and democratize access to advanced natural language processing tools predominantly positions them as radical and disruptive innovations.

4.2. Research opportunities and challenges of GAI

The second question seeks to answer how the adoption of GAI impacts the ability to conduct analysis, particularly in media studies, and to acquire and produce knowledge in various ways.

Based on the literature, the use of GAI in research has been practically experimented with in various contexts, and its potential and performance have been evaluated. Its role as an independent or semi-independent agent producing various outputs, such as text, has also been examined. GAI has been studied through empirical experiments, by observing its use in different contexts, and through interviews. Additionally, traditional media news, scientific articles, and user writings on social media have been analysed.

The articles used in this paper also support the previously confirmed view that GAI is a radical innovation. While many articles in the dataset suggest that, for example, ChatGPT requires further development for research capabilities, it already achieves human-comparable performances by many measures.

In social sciences, numerous application areas include testing new theories, rapidly creating and testing hypotheses, comprehensive simulation regarding theories, ideologies, and subjects studied, automated surveys, identifying research questions, ensuring generalizability, objectivity, creative research tasks, interdisciplinary studies, and many other areas related to text and language research. These are also seen as great opportunities from a media research perspective.

However, there is a directional uncertainty and deliberation about the approach to GAI. Many articles in the dataset emphasize the need to pay attention to the ethical and social dimensions of GAI. Additionally, there is a call to examine issues such as environmental challenges, accountability, biases caused by algorithms, the potential for forgery, content errors and hallucinations, privacy issues, and the control (or ownership) of applications and algorithms. A key conclusion is that GAI currently causes much uncertainty about the future.

In this sense, the arrival of GAI as a radical innovation has reached the research world. Since even the research community does not have clear answers on how the great potential and currently identified sources of uncertainty of GAI will be realized in society going forward, it is reasonably identified through the concept of radical uncertainty. No direct threat is posed to anything, but the sociotechnical infrastructure is in an unstable state due to the adoption of radical innovation.

4.3. Media and media education under the pressure of GAI

The third question of the study contemplates what the implementation of GAI signifies for media education.

According to the data, higher education is undergoing a transformation of post-GAI. Studies suggest that GAI may enrich learning environments and promote innovative learning and personalized teaching, enhance administrative functions, and improve student support services. It could also support interactive and performance-adapted learning. For teachers, GAI offers innovative ways to educate and assess students, allowing for more personalized feedback. This might also reduce teachers' workload. These changes could in turn improve learning outcomes and engage students more effectively.

However, GAI presents challenges: cyber assessment security, plagiarism risks, erroneous or fabricated information, biases in data, broad ethical questions, environmental impacts and datafication.

In addition, significant concerns were documented in the data regarding academic honesty, effects on learning outcomes and skill development, limitations of capabilities, economic and societal concerns, labour challenges, lack of human contact, limited understanding by models, and lack of creativity.

The data suggests that GAI could have a passivating effect. Based on material, GAI may increase laziness and procrastination and reduces decision-making abilities.

Media faces particular pressures from various directions. According to the dataset, GAI is changing the dynamics of investigative journalism, news production, and distribution. Additionally, broader content creation, practical tasks such as editing, and targeting news audiences based on audience's preferences (personalization) are undergoing change. Moving forward, it will be necessary to monitor the effects of AI applications on general political opinion, as GAI applications are prone to producing opinions similar to their training data. GAI also enables media actors to process and utilize increasingly large data volumes.

Crucially for the transformation of media, GAI can quickly produce knowledgeable text about almost anything. There is little doubt that this is revolutionizing news production and journalistic content.

However, the dataset indicates that while GAI offer significant opportunities, its use also involves challenges, including ethical questions, copyright issues, and biases.

The penetration of generative AI into both higher education and the media offers fruitful opportunities, but also presents unprecedented challenges for media education. The pressures for change described above require the implementation of media education to embrace new concepts, which must be thoroughly designed based on facts.

5. DISCUSSION

The research data confirms the adoption of GAI is permeating all sectors of society and shows this happening in research, higher education, and media.

The research community's ability and willingness to respond to new technologies is well illustrated by the fact that many researchers published their first empirical studies on the ChatGPT in early 2023.

Since then, the effects of this new technology have been examined, and generally confirming the significant potential of GAI in various tasks. Notably, many studies concluded with a focus on the ethical questions.

The requirements for training AI have been raised as a necessity to improve GAI applications' ability to understand human behaviour and society in collaboration with social scientists. This is justified for example by various biases present in the applications.

However, in higher education and media education, the data does not show any recommendations for getting involved in developing or training GAI.

The features, performance, and suitability of GAI for a variety of tasks in different societal functions are making it a radical and disruptive innovation. It is partially replacing the tasks of some existing technologies and ICT applications due to its efficiency and user-friendliness.

Key topics that the research data does not answer include how much current efforts should be made in coding skills in GAI-related education, that is, whether natural language replaces programming languages in coding. Another significant uncertainty relates to the content of GAI and concerns when GAI applications operate based on real-time data? Thirdly and surprisingly, we have very little information on the type of guidance under which the most popular applications of generative AI are trained.

5.1. GAI through tetrad concept

Through McLuhan's tetrad (McLuhan & McLuhan, 1988), it is clear that GAI acts both as a radical and disruptive innovation, with profound effects on media, research, and society. It offers tremendous potential to advance knowledge, democratize information, and foster creativity. However, its impact requires careful examination of how it changes human cognition, social interaction, and the creation and dissemination of information. The future development and integration of GAI into society require a balanced approach, leveraging its benefits while mitigating risks and ethical concerns.

By McLuhan's terms GAI enhances the availability and scalability of information in data processing, communication, and content production. It enables complex text analysis, idea generation, and even emotional insights across languages and fields. This enhanced information processing and production supports media and academic research making advanced analyses more accessible to a broader audience.

GAI may render traditional, labor-intensive methods in text analysis, content production, and data processing obsolete. In education and research, traditional reliance on manual descriptions, narrative creation, and large dataset analysis may diminish as GAI takes over these tasks with enhanced efficiency and precision.

GAI retrieves the immediacy and adaptability of the oral tradition in the digital age. Just like oral storytelling adapted instantly to audience feedback, GAI can tailor content based on user input in real-time, reviving the dynamic and interactive nature of personalized communication. It also retrieves interdisciplinary thinking, as GAI can process and integrate information from various fields, reminiscent of the era before specialization.

Pushed to extremes, GAI may turn to producing misinformation, fostering dependence, and diminishing critical thinking skills. Its ability to quickly generate large amounts of content may lead to an overflow of content, making the distinction between quality, accuracy, and originality challenging. Additionally, extreme dependence on GAI in content production and decision-making may jeopardize human creativity, critical analysis, and the value of deep, specialized knowledge.

Regarding media and media education, an interesting question about GAI is whether the current or future iterations of GAI will become a new mainstream media. If so, what does this imply for the ownership, management, and training of GAI? Who controls information and the human mind if GAI directs media, science, and decision-making?

5.2. Radical uncertainty

This article employs the concept of 'radical uncertainty' to structure the situation that the adoption of GAI has fostered.

While the development and implementation of GAI and extensive language models have largely been met with positivity, warnings about their dangers and side effects have been voiced long before the public launch of ChatGPT. Critical assessments have highlighted environmental risks (energy consumption), data distortion and bias, ethical and social impacts (Bender & al., 2021). A central issue in Bender & al.'s (2021) article is to question how large language models can grow before their detriments outweigh their benefits.

Although research might demonstrate the effects of GAI in reinforcing radical uncertainty and even show that its detriments exceed its benefits (Bender & al., 2021), it seems unlikely that technology companies developing GAI would retreat from its advancement. Users and researchers might influence the training of extensive language models, but with the wheel of innovation turning, stopping it appears nearly impossible. We genuinely do not know where GAI will take our understanding of learning anew, acquiring knowledge, communication, and decision-making.

6. CONCLUSIONS

GAI technologies are revolutionizing content creation, platforms, and interaction within the media landscape. This radical shift is generating both innovative educational methodologies and challenges in maintaining academic integrity and the quality of learning.

This study underscores the dual-edged nature of GAI in media education, where it presents significant enhancements in learning and content creation while simultaneously posing risks related to misinformation, academic integrity, and the dilution of human-centered educational practices. This study calls for a balanced approach to integrating GAI in media education, advocating for preparedness against its potential drawbacks while leveraging its capabilities to revolutionize educational paradigms.

REFERENCES:

Ahmad, S.F., Han, H., Alam, M.M., Rehmat, M.K., Irshad, M., Arraño-Muñoz, M., & Ariza-Montes, A. (2023). Impact of artificial intelligence on human loss in decision making, laziness and safety in education. *Humanities and Social Sciences Communications, 10*(1), 311. https://doi.org/10.1057/s41599-023-01787-8

Alawida, M., Mejri, S., Mehmood, A., Chikhaoui, B., & Abiodun, O.I., (2023). A comprehensive study of ChatGPT: Advancements, limitations, and ethical considerations in natural language processing and cybersecurity. *Information, 14*(8), 462. https://www.mdpi.com/2078-2489/14/8/462

Allaham, M., & Diakopoulos, N. (2024). Supporting anticipatory governance using LLMs: Evaluating and aligning large language models with the news media to anticipate the negative impacts of AI. *arXiv*. https://arxiv.org/abs/2401.18028

Alshami, A., Elsayed, M., Ali, E., Eltoukhy, A. E., & Zayed, T. (2023). Harnessing the power of ChatGPT for automating systematic review process: Methodology, case study, limitations, and future directions. *Systems, 11*(7), 351. https://doi.org/10.3390/systems11070351

Anjos, L.S., Quincozes, S.E., Kazienko, J.F., & Quincozes, V.E. (2023). Investigating the performance of the GPT-3.5 model in fake news detection: An experimental analysis. *Anais do Simpósio Brasileiro de Segurança da Informação e de Sistemas Computacionais (SBSeg)*, 552–557. https://www.researchgate.net/publication/378063348_Investigating_the_Performance_of_the_GPT-35_Model_in_Fake_News_Detection_An_Experimental_Analysis

Baidoo-Anu, D., & Owusu Ansah, L. (2023). Education in the era of generative artificial intelligence (AI): Understanding the potential benefits of ChatGPT in promoting teaching and learning. *SSRN Electronic Journal*. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4337484

Bail, C. (2024). Can GenAI improve social science? *Perspective Social Sciences*. https://www.pnas.org/doi/10.1073/pnas.2314021121

Bazelais, P., Lemay, D. J., & Doleck, T. (2024). User acceptance and adoption dynamics of ChatGPT in educational settings. *Eurasia Journal of Mathematics, Science and Technology Education, 20*(2), em2393. https://doi.org/10.29333/ejmste/14151

Bdoor, S.Y., & Habes, M. (2024). Use ChatGPT in media content production: Digital newsrooms perspective. In *Artificial intelligence in education: The power and dangers of ChatGPT in the classroom* (pp. 545–561). Springer. https://link.springer.com/chapter/10.1007/978-3-031-52280-2_34

Bender, E.M., Gebru, T., McMillan-Major, A., & Shmitchell, S. (2021). On the dangers of stochastic parrots: Can language models be too big? In *Proceedings of the 2021 Conference on Fairness, Accountability, and Transparency (FAccT '21)* (pp. 610–623). ACM. https://doi.org/10.1145/3442188.3445922

Bukar, U.A., Sayeed, M.S., Razak, S.F., Yogarayan, S., & Amodu, O.A. (2024). Text analysis of ChatGPT as a

tool for academic progress or exploitation. *arXiv*. https://dl.acm.org/doi/abs/10.1007/s42979-024-02714-7

Burger, B., Kanbach, D.K., Kraus, S., Breier, M., & Corvello, V. (2023). On the use of AI-based tools like ChatGPT to support management research. *European Journal of Innovation Management, 26*(7), 233–241. https://doi.org/10.1108/EJIM-02-2023-0156

Cheng, H., Sheng, B., Lee, A., Chaudary, V., Atanasov, A.G., Liu, N., Qiu, Y., Wong, T.Y., Tham, Y.-C., & Zheng, Y. (2024). Have AI-generated texts from LLMs infiltrated the realm of scientific writing? A large-scale analysis of preprint platforms. *bioRxiv*. https://doi.org/10.1101/2024.03.25.586710

Chiu, T.K. (2024). Future research recommendations for transforming higher education with GenAI. *Computers and Education: Artificial Intelligence, 6*, 100197. https://doi.org/10.1016/j.caeai.2023.100197

Dempere, J., Modugu, K., Hesham, A., & Ramasamy, L. K. (2023). The impact of ChatGPT on higher education. *Frontiers in Education, 8*, 1206936. https://www.frontiersin.org/journals/education/articles/10.3389/feduc.2023.1206936/full

Dougrez-Lewis, J., Akhter, M.E., He, Y., & Liakata, M. (2024). Assessing the reasoning abilities of ChatGPT in the context of claim verification. *arXiv*. https://arxiv.org/abs/2402.10735

Draxler, F., Buschek, D., Tavast, M., Hämäläinen, P., Schmidt, A., Kulshrestha, J., & Welsch, R. (2023). Gender, age, and technology education influence the adoption and appropriation of LLMs. *arXiv*. https://arxiv.org/abs/2310.06556

Elali, F.R., & Rachid, L.N. (2023). AI-generated research paper fabrication and plagiarism in the scientific community. *Patterns, 4*(3), 100706. https://doi.org/10.1016/j.patter.2023.100706

Espinosa, L., & Salathé, M. (2024). Use of large language models as a scalable approach to understanding public health discourse. *PLOS Digital Health*. https://doi.org/10.1371/journal.pdig.0000631

Fan, Y., Jiang, F., Li, P., & Li, H. (2024). Uncovering the potential of ChatGPT for discourse analysis in dialogue: An empirical study. *arXiv*. https://arxiv.org/abs/2305.08391v2

Gil de Zúñiga, H., Goyanes, M., & Durotoye, T. (2023). A scholarly definition of artificial intelligence (AI): Advancing AI as a conceptual framework in communication research. *Political Communication*. https://doi.org/10.1080/10584609.2023.2290497

Good, D., Maryott, K., Barlow, C. H., Jones, R., & Schwartz, R. (2024). Controlling disruptive technology: A business school's strategic approach to ChatGPT. *Developments in business simulation and experiential learning: Proceedings of the Annual ABSEL Conference* (Vol. 51). https://absel-ojs-ttu.tdl.org/absel/article/view/3394

Gartner. (2024). Information technology glossary: Large language models (LLMs). https://www.gartner.com/en/information-technology/glossary/large-language-models-llm

Grassini, S. (2023). Shaping the future of education: Exploring the potential and consequences of AI and ChatGPT in educational settings. *Education Sciences, 13*(7), 692. https://doi.org/10.3390/educsci13070692

Grossmann, I., Feinberg, M., Parker, D.C., Christakis, N., Tetlock, P.E., & Cunningham, W.A. (2023). AI and the transformation of social science research. *Science, 380*(6639), 1108–1109. https://www.researchgate.net/publication/371606949_AI_and_the_transformation_of_social_science_research

Guo, J., Pan, J., Guo, J., Gu, F., & Kuusisto, J. (2019). Measurement framework for assessing disruptive innovations. *Technological Forecasting and Social Change, 139*, 250–265. https://doi.org/10.1016/j.techfore.2018.10.015

Haim, A., Salinas, A., & Nyarko, J. (2024). What's in a name? Auditing large language models for race and gender bias. *arXiv*. https://arxiv.org/abs/2402.14875v2

Hamilton, L., Elliott, D., Quick, A., Smith, S., & Choplin, V. (2023). Exploring the use of AI in qualitative analysis: A comparative study of guaranteed income data. *International Journal of Qualitative Methods, 22*. https://doi.org/10.1177/16094069231201504

Heumann, M., Kraschewski, T., & Breitner, M.H. (2023). ChatGPT and GPTZero in research and social media: A sentiment-and topic-based analysis. *AMCIS 2023 Proceedings, 6*. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4467646

Holmström, J., & Carroll, N. (2024). How organizations can innovate with GenAI. *Business Horizons*. https://doi.org/10.1016/j.bushor.2024.02.010

Hubert, K.F., Awa, K.N., & Zabelina, D.L. (2024). The current state of artificial intelligence generative language models is more creative than humans on divergent thinking tasks. *Scientific Reports, 14*, 3440. https://doi.org/10.1038/s41598-024-53303-w

Huh, J., Nelson, M.R., & Russell, C.A. (2023). ChatGPT, AI advertising, and advertising research and education. *Journal of Advertising, 52*(4), 477–482. https://doi.org/10.1080/00913367.2023.2227013

Karanouh, M. (2023). Mapping ChatGPT in mainstream media: Early quantitative insights through sentiment analysis and word frequency analysis. *arXiv*. https://arxiv.org/abs/2305.18340

Khlaif, Z.N., Mousa, A., Hattab, M.K., Itmazi, J., Hassan, A.A., Sanmugam, M., & Ayyoub, A. (2023). The poten-

tial and concerns of using AI in scientific research: ChatGPT performance evaluation. *JMIR Medical Education, 9*(1), e47049. https://doi.org/10.2196/47049

Korkmaz, A., Aktürk, C., & Talan, T. (2023). Analyzing the user's sentiments of ChatGPT using Twitter data. *Iraqi Journal for Computer Science and Mathematics, 4*(2), 202–214. https://journal.esj.edu.iq/index.php/IJCM/article/view/618

Koubaa, A., Boulila, W., Ghouti, L., Alzahem, A., & Latif, S. (2023). Exploring ChatGPT capabilities and limitations: A survey. *IEEE Access, 11*, 118698–118. https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=10290719

Li, Z. (2024). The impact of artificial intelligence technology innovation on economic development: From the perspective of GenAI products. *Journal of Education, Humanities and Social Sciences, 27*, 565–574. https://doi.org/10.54097/8eb1ks76

Li, L., Ma, Z., Fan, L., Lee, S., Yu, H., & Hemphill, L. (2023). ChatGPT in education: A discourse analysis of worries and concerns on social media. *Education and Information Technologies, 29*(1), 10729–10762. https://doi.org/10.1007/s10639-023-12256-9

Lian, Y., Tang, H., Xiang, M., & Dong, X. (2024). Public attitudes and sentiments toward ChatGPT in China: A text mining analysis based on social media. *Technology in Society, 102442*. https://doi.org/10.1016/j.techsoc.2023.102442

Liu, J., Liu, C., Lv, R., Zhou, K., & Zhang, Y. (2023). Is ChatGPT a good recommender? A preliminary study. *CIKM 2023 GenRec Workshop*. https://arxiv.org/abs/2304.10149

Luttrell, R., Wallace, A., McCollough, C., & Lee, J. (2020). The Digital Divide: Addressing artificial intelligence in communication education. *Journalism & Mass Communication Educator, 75*(4), 470–482. https://journals.sagepub.com/doi/full/10.1177/1077695820925286

Lynch, C.J., Jensen, E.J., Zamponi, V., O'Brien, K., Frydenlund, E., & Gore, R. (2023). A structured narrative prompt for prompting narratives from large language models: Sentiment assessment of ChatGPT-generated narratives and real tweets. *Future Internet, 15*(12), 375. https://www.mdpi.com/1999-5903/15/12/375

McLuhan, M., & McLuhan, E. (1988). *The laws of media: The new science*. University of Toronto Press.

Menon, D., & Shilpa, K. (2023). Chatting with ChatGPT: Analyzing the factors influencing users' intention to use the OpenAI's ChatGPT using the UTAUT model. *Heliyon, 9*(11), e20962. https://doi.org/10.1016/j.heliyon.2023.e20962

Miao, F., & Holmes, W. (2023). Guidance for generative AI in education and research. UNESCO. https://unesdoc.unesco.org/ark:/48223/pf0000386693?locale=en

Olinski, M., Krukowski, K., & Siecinski, K. (2024). Bibliometric overview of ChatGPT: New perspectives in social sciences. *Publications, 12*(1), 9. https://doi.org/10.3390/publications12010009

Pavlik, J.V. (2023). Collaborating with ChatGPT: Considering the implications of generative artificial intelligence for journalism and media education. *Journalism & Mass Communication Educator*. https://doi.org/10.1177/10776958221149577

Pock, M., Ye, A., & Moore, J. (2023). LLMs grasp morality in concept. *NeurIPS 2023 Moral Psychology and Moral Philosophy Workshop*. https://arxiv.org/abs/2311.02294

Polat, H., Topuz, A.C., Yildiz, M., Taslibeyaz, E., & Kursun, E. (2024). A bibliometric analysis of research on ChatGPT in education. *International Journal of Technology in Education, 7*(1), 59–85. https://doi.org/10.46328/ijte.606

Polyportis, A., & Pahos, N. (2023). Navigating the perils of artificial intelligence: A focused review on ChatGPT and responsible research and innovation. *Humanities and Social Sciences Communications, 11*(1), 107. https://doi.org/10.1057/s41599-023-02464-6

Rathje, S., Mirea, D., Sucholutsky, I., Marjieh, R., Robertson, C.E., & Van Bavel, J.J. (2024). GPT is an effective tool for multilingual psychological text analysis. *PNAS*. https://doi.org/10.1073/pnas.2308950121

Retkowsky, J., Hafermalz, E., & Huysman, M. (2024). Managing a ChatGPT-empowered workforce: Understanding its affordances and side effects. *Business Horizons*. https://doi.org/10.1016/j.bushor.2024.04.009

Romano, W., Sharif, O., Basak, M., Gatto, J., & Preum, S.M. (2024). Theme-driven keyphrase extraction to analyze social media discourse. *Proceedings of the Eighteenth International AAAI Conference on Web and Social Media (ICWSM2024)*. https://ojs.aaai.org/index.php/ICWSM/article/view/31391/33551

Rozado, D. (2023). The political biases of ChatGPT. *Social Sciences, 12*(3), 148. https://doi.org/10.3390/socsci12030148

Shou, S. (2023). Implement GenAI tools in analytics. *Master of Science in Management and Systems at the Division of Programs, Business School of Professional Studies, New York University*. https://archive.nyu.edu/handle/2451/69533

Talafidaryani, M., & Moro, S. (2024). Public perception of ChatGPT on Reddit social media platform: Topic

modeling and sentiment analysis study. *SSRN*. http://dx.doi.org/10.2139/ssrn.4716839

Tang, Y. (2023). Understanding societal values of ChatGPT. McKelvey School of Engineering Theses & Dissertations (848). https://openscholarship.wustl.edu/eng_etds/848

Williamson, B., Macgilchrist, F., & Potter, J. (2023). Re-examining AI, automation, and datafication in education. *Learning, Media and Technology, 48*(1), 1–5. https://doi.org/10.1080/17439884.2023.2167830

de Winter, J. (2024). Can ChatGPT be used to predict citation counts, readership, and social media interaction? An exploration among 2222 scientific abstracts. *Scientometrics, 129*(3), 2469–2487. https://doi.org/10.1007/s11192-024-04939-y

Zhang, H., Wu, C., Xie, J., Lyu, Y., Cai, J., & Carroll, J.M. (2023a). Redefining qualitative analysis in the AI era: Utilizing ChatGPT for efficient thematic analysis. *arXiv.* https://arxiv.org/abs/2309.10771

Zhang, H., Wu, C., Xie, J., Kim, C., & Carroll, J.M. (2023b). QualiGPT: GPT as an easy-to-use tool for qualitative coding. *arXiv*. https://arxiv.org/abs/2310.07061

Zhou, Y., Xu, P., Wang, X., Lu, X., Gao, G., & Ai, W. (2024). Emojis decoded: Leveraging ChatGPT for enhanced understanding in social media communications. *arXiv.* https://arxiv.org/abs/2402.01681

Ziems, C., Held, W., Shaikh, O., Chen, J., Zhang, Z., & Yang, D. (2024). Can large language models transform computational social science? *Computational Linguistics, 50*(1), 237–291. https://doi.org/10.1162/coli_a_00502