Exploring the Educational Landscape of ChatGPT: A Topic Modeling Approach on Twitter Data

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Abstract

In the rapidly evolving landscape of Artificial Intelligence (AI), platforms like ChatGPT are reshaping the educational domain, prompting deeper explorations into the nature and depth of this intersection. This study aimed to systematically uncover the prevailing sentiments, concerns and discussions on Twitter surrounding ChatGPT's role in education. Through an extensive data collection process, over 3.8 million tweets were initially gathered, followed by rigorous refining processes that included expert-driven tweet labelling and subsequent classification using Machine Learning (ML) and deep learning models. The cleaned dataset underwent a series of preprocessing steps and feature extraction and was ultimately subjected to Latent Dirichlet Allocation (LDA) for topic modelling. Our findings unveiled 15 distinct topics that broadly spanned common discussions, AI implementation, and its potential impacts. The data's visualisation using t-distributed stochastic neighbour embedding (t-SNE) showcased a dense central clustering of these topics. In conclusion, our research underscores the multi-faceted dialogues on AI, particularly ChatGPT, in education, emphasising the pressing need for continued discourse and research as AI tools further integrate into our educational paradigms.

Keywords: ChatGPT, Education, Tweets, Topic Modelling, Latent Dirichlet Allocation (LDA)

INTRODUCTION

In the rapidly evolving landscape of the 21st century, education is a testament to the enduring quest for knowledge and human advancement. Historically, every transformative epoch, from the invention of the printing press to the rise of the internet, has left an indelible mark on how we learn, teach and disseminate knowledge (Briggs & Burke, 2009). Today, as we traverse the digital age, Artificial Intelligence (AI) tools are emerging as the latest torchbearers, reshaping the contours of educational paradigms (Montenegro-Rueda et al., 2023).

The digital revolution, driven by advancements in AI and Machine Learning (ML), continues to impact myriad sectors, with education being a prime beneficiary and sometimes a subject of contention. Central to this transformation is the rising influence of AI chatbots, which have emerged as versatile tools in various domains, from customer service to health diagnostics and, notably, educational assistance (Bahroun et al., 2023). One of the most discussed chatbots recently has been ChatGPT by OpenAI (Hariri, 2023).

ChatGPT, powered by the ML models known as Generative Pre-trained Transformers (GPT), represents a powerful combination of cutting-edge technology and extensive training data. This innovative system has opened up educational possibilities. Its ability to offer learning experiences that support the creation of educational materials and overcome language barriers can significantly enhance teaching and learning outcomes (Kasneci et al., 2023). For instance, ChatGPT can aid teachers in developing tailored questions, quizzes, assignments and interactive educational content like games and simulations that cater to individual student learning styles. Additionally, ChatGPT can assist students in customising their learning journey and provide feedback (Li et al., 2023).

ChatGPT has attracted much interest from people in the tech community, educators, students, and researchers since its creation. This has made it a popular subject on media platforms like Twitter (Mujahid, Rustam, et al., 2023). These platforms offer a range of public opinions, conversations

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and debates that give us valuable insights into such impressive technologies' societal and educational impact. Recent studies have emphasised the value of Twitter data for sentiment analysis and topical exploration. Given its real-time nature, Twitter is a vibrant hub for tech discussions, reactions and forecasts. For instance, a study by (Montenegro-Rueda et al., 2023) utilised tweets to gauge the public's reception towards virtual reality in education, while another (Arambepola, 2020) elucidated the perceptions surrounding online learning platforms during the pandemic.

In this study, we analyse data collected from Twitter, which was renamed to X as part of a rebranding in July 2023. However, for clarity and consistency, we continue to use the name 'Twitter' throughout this paper. The research and data collection was conducted during the early part of 2023, prior to the rebranding, specifically up until June 2023.

Harnessing these vast, unstructured data troves necessitates advanced techniques that can navigate the intricacies of human language and sentiment. ML and Natural Language Processing (NLP) can be used for that. These computational methodologies evolved over decades of research and now equip us with tools to analyse, classify and derive insights from text data at unprecedented scales (Heumann et al., 2023). Deep learning, a subset of ML with architectures like Long Short-Term Memory (LSTM), has shown remarkable efficacy in handling sequential data, such as tweets (Ain et al., 2017). Furthermore, topic modelling algorithms breathe life into raw data, illuminating underlying themes and trends that might remain obscured (Taecharungroj, 2023).

In this study, we researched ChatGPT and education-related tweets gathered from various sources. The main objective of this research was to analyse tweets related to ChatGPT and education. The aim was to identify topics using topic modelling techniques. Additionally, the study aimed to categorise these topics into three domains: topics, implementation topics and impactful topics. The research also looked into aspects of ChatGPT, such as its performance in subject areas, potential uses in education, challenges, and possible solutions. Additionally, the study delved into the difficulties and risks that ChatGPT may pose in education and proposed immediate steps to lessen their impact.

The findings of this research have implications for education and how ChatGPT can be utilised in teaching and learning settings. It provides insights into how ChatGPT can serve as a technology in education while emphasising the need to address specific challenges to enhance learning rather than hinder it. Moreover, the study highlights the significance of research in exploring ChatGPT's potential in education and developing strategies for integrating it into teaching and learning practices.

LITERATURE REVIEW

AI's potential in education has been highly anticipated for a while now. The stages of AI in education mainly focused on Intelligent Tutoring Systems (ITS) (McCalla, 1992), which aimed to customise learning experiences based on each student's unique data. More recent advances have been significantly more comprehensive, employing AI for everything from curriculum design to administrative tasks (Kannan & Munday, 2018). Educators and researchers alike have emphasised the potential of AI-driven tools in enhancing the teaching and learning experience. ML algorithms, for example, can predict student performance and offer interventions in real-time (Khan et al., 2021). These predictions can help educators tailor curriculum and resources to individual student needs.

Arguably, one of the most groundbreaking advancements in AI in recent times is the development and refinement of GPT models. GPT models are computer programs that can create human-like text without being explicitly programmed to do so. As a result, they can be fine-tuned for a range of NLP tasks, including question-answering, language translation and text summarising. (Lund et al., 2023) showcased the versatility of GPT-3 across a range of tasks without domain-specific training, marking a paradigm shift in ML from task-specific models to more generalised, adaptable systems. The potential of GPT models in education is vast. From aiding in content creation to acting as learning assistants, GPT models offer students and educators tools to revolutionise traditional pedagogies (Rudolph et al., 2023).

Social media platforms, particularly Twitter, have evolved into rich data sources reflecting societal trends, sentiments and discourses. Twitter is one of the most popular social media platforms, and it is a rich source of data that can be analysed to gain insights into various topics, including education-related discussions. Educators, schools and students have been actively using Twitter as a tool for a range of purposes within the educational community. The platform has become an essential resource for development opportunities to enhance classroom engagement (Davis III et al., 2015). Hence, analysing tweets offers a window into the collective consciousness of the education sector and its stakeholders.

Over the years, some fascinating advancements in NLP and ML have provided us with fresh opportunities to analyse and understand social media data. Social media has become a part of our lives, serving as a platform where people can openly share their thoughts, viewpoints and personal encounters. ML and NLP have long been tools for effectively understanding and utilising textual information. Traditional ML models like Support Vector Machines and Decision Trees have proven helpful in sentiment analysis and topic classification (Sharma & Dey, 2012). A new era for NLP has emerged with the rise of deep learning, especially with architectures like LSTM. LSTM's ability to remember patterns over long sequences makes them particularly adept for tasks involving sequential data like tweets or textual conversations (Graves et al., 2016). This has been complemented by word embeddings, such as GloVe and BERT, that provide dense vector representations of words, capturing semantic meanings in previously infeasible ways (Van Loon & Freese, 2023).

Topic modelling is a technique that can be used to identify topics in a collection of documents, such as education-related tweets (Devi et al., 2022). Topic modelling, most popularly associated with algorithms like Latent Dirichlet Allocation (LDA), provides a method to discover abstract "topics" within a body of text (Jelodar et al., 2019). For platforms like Twitter, where discourse is vast and varied, topic modelling helps condense information into coherent themes, revealing

underlying structures and patterns. Recent research endeavours have deployed topic modelling on tweets to understand various phenomena. For instance, (Mee et al., 2021) analysed tweets to discern public sentiments towards climate change, revealing a spectrum of opinions and concerns.

Over the years, Twitter has evolved as a rich data source for academic and applied research across many contexts. Twitter data has been widely used in fields like disaster response (Kankanamge et al., 2020; Kuhaneswaran et al., 2020), political sentiments (Hitesh et al., 2019; Xia et al., 2021), crime reporting (Adeeba et al., 2023; Sandagiri et al., 2021), customer satisfaction (Kumar & Zymbler, 2019), pandemic outbreaks (Kankanamge et al., 2020; Kariyapperuma et al., 2022; Long et al., 2020) and stock market movements (Guo & Li, 2019; Padmanayana & Bhavya, 2021). This platform's many users and real-time data make it a valuable resource for understanding opinions, tracking emerging trends and monitoring events. Researchers have used methods like prediction models (Guo & Li, 2019; Padmanayana & Bhavya, 2021; Sandagiri et al., 2021), classification algorithms (Kariyapperuma et al., 2022; Mujahid, Kanwal, et al., 2023) and sentiment analysis (Devi et al., 2022; Hitesh et al., 2019; Mee et al., 2021; Mujahid, Rustam, et al., 2023; Tubishat et al., 2023; Xia et al., 2021) to extract patterns and valuable insights from the vast amount of tweets. This combination of Twitter data and research shows how versatile the platform is as a study tool. It also highlights the significance of social media analytics in research approaches. However, it is important to recognise that Twitter data usage in research falls between primary and secondary data analysis, and researchers need to consider ethical, legal and privacy issues when conducting research using Twitter data.

Tubishat et al. (2023) conducted a sentiment analysis of tweets related to ChatGPT in education. The study found that the majority of tweets related to ChatGPT are positive. A paper by Feng et al. (2023), who discussed the impact of ChatGPT on streaming media platforms like Twitter and Reddit, analysed the impact of ChatGPT on streaming media using Twitter and Reddit data. The study found that ChatGPT-generated text is acceptable for news articles but detrimental for school essays.

Another research paper by Heumann et al. (2023) analysed social media conversations and scholarly articles. Their goal was to explore perspectives on ChatGPT, its potential misuse for plagiarism, and the comparatively lower interest in GPTZero, which is designed to combat AI-driven plagiarism. The study utilised techniques like sentiment analysis and topic modelling through NLP to uncover challenges and opportunities associated with ChatGPT and GPTZero. According to the survey, ChatGPT shows promise in offering personalised learning experiences, enhancing student engagement and reducing teachers' workload. However, there are concerns that it may inadvertently perpetuate biases and discrimination within education while also making teaching more formulaic. Additionally, there is apprehension about students using ChatGPT to cheat on assignments.

Overall, this research provides insights into how ChatGPT can be effectively integrated into educational settings as an assistive technology. It highlights the importance of addressing challenges to ensure that ChatGPT facilitates learning rather than hinders it. These findings have implications for education and the responsible use of ChatGPT in teaching and learning contexts. The research emphasises the importance of investigating how ChatGPT can be utilised in education and devising successful approaches for integrating ChatGPT into the teaching and learning process.

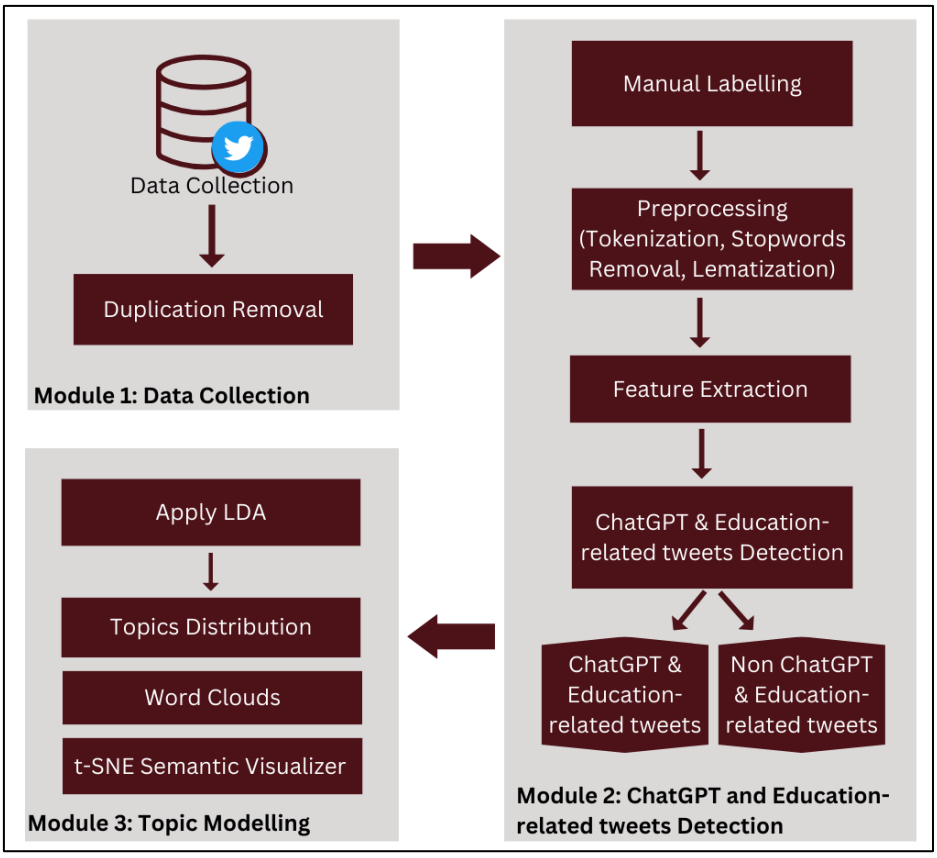
In a study conducted by Mujahid, Rustam, et al. (2023), they investigated how people perceive the popular trend of ChatGPT on a global scale. The study is significant as it gathers data and examines individuals' sentiments towards this important advancement. The researchers employed the LDA method to extract topics discussed in the ChatGPT tweets dataset. This analysis offers insights into the common themes and subjects frequently discussed. Sharma et al. (2023) conducted a semi-automated analysis of over 1,006,000 tweets to assess the sentiment of tweets regarding ChatGPT. The study found that users have mixed feelings about ChatGPT, with some expressing positive opinions and others expressing negative views. "Tracking Public Attitudes toward ChatGPT on Twitter using sentiment analysis and topic modelling" by Koonchanok et al. (2023) investigated public attitudes toward ChatGPT using sentiment analysis and topic modelling techniques. The study found that the overall sentiment is largely neutral to positive, which also holds across different occupation groups.

Most studies on ChatGPT and education have used traditional methods like surveys and controlled experiments. However, few have explored how the public talks about these technologies on social media. In particular, no research has applied topic modeling to Twitter data to examine how people perceive ChatGPT in education. This study aims to fill that gap by using topic modelling to identify common themes and patterns in public conversations. By analysing real-time, unfiltered Twitter data, this research provides a fresh and detailed view of how people perceive ChatGPT, offering insights that traditional methods might miss. So, this research on identifying the topics and interpreting the perception would be a significant contribution to understanding public sentiment around ChatGPT in education, providing a fresh perspective

METHODOLOGY

Our research methodology, which focuses on thoroughness and careful management of data, aimed to explore the range of conversations about ChatGPT and its impact on education on Twitter. We employed a series of steps to prepare the data extract features and use topic modelling with LDA to gain insights into the predominant emotions, concerns and discussions surrounding AI-based educational tools. The overall process we followed is illustrated in Figure 1.

Figure 1: Methodology



Source: Developed by author, 2023

Data collection and initial screening

Our research involved gathering a dataset of education-related tweets focusing specifically on the keyword "ChatGPT." We chose Twitter as a platform due to its user base and abundant conversations on various topics, including the intersection of AI and education. We collected 3,821,843 tweets showcasing the significant interest and discussions surrounding ChatGPT in education. While a testament to the topic's importance, such a vast dataset also posed challenges in processing and extracting meaningful insights.

Data enrichment and tweet relevance classification

Even though ChatGPT and education-related keywords were used to fetch the Tweets, not all these tweets were guaranteed to be relevant to the educational context. We undertook a meticulous tweet-labelling process involving three academic experts to refine our dataset. Their expertise allowed us to categorise tweets with higher precision. Following this, a battery of models, both deep learning (like LSTM) and traditional ML (SVM, LR, DT), were employed to ascertain the relevance of each tweet to ChatGPT and education. We employed both GloVe and BERT as word embedding techniques to enhance the performance of our models during this phase. The complementary use of these methods improves the analysis by balancing efficiency and deeper contextual understanding. GloVe (Global Vectors for Word Representation) is a pre-trained, efficient, and lightweight method that captures word co-occurrences in a global context, making it ideal for general words. On the other hand, BERT (Bidirectional Encoder Representations from Transformers) is a transformer-based model that captures more complex, context-dependent relationships between words by considering both the left and right contexts in a sentence, providing a deeper understanding of semantic nuances. Using these methods together allows for a more comprehensive analysis, as GloVe provides robust embeddings for large-scale tasks. At the same time, BERT offers a fine-grained, context-aware approach to understanding public discourse on ChatGPT and education.

Preprocessing and data cleaning

Textual data, especially from social media platforms like Twitter, is often noisy and requires rigorous preprocessing to be fit for modelling.

Tokenisation: The initial step in our preprocessing journey was tokenisation. Tokenisation is the process of splitting textual data into individual words or tokens. This step is vital as it breaks down complex textual data into manageable units to be processed and analysed.

Stop word removal: Stop words, the frequently occurring words in any language that don't add significant meaning to the text, were removed. Common examples include words like "and", "the" and "is". However, given the specific nature of our dataset, we extended the list to include terms such as "more", "good", "one" and even context-specific words like "gpt", "chatgpt", "ai", "bot" and so forth. Removing these terms ensured that our models focused on words that genuinely carried the essence of the discussions around ChatGPT and education.

Lemmatisation: Finally, we performed lemmatisation. Unlike stemming, which crudely chops off inflexions, lemmatisation involves reducing a word to its base or root form. For

instance, “running”, “runs” and “ran” would all be converted to “run”. This process ensured uniformity in our dataset and removed variations of the same word, making our subsequent analyses more robust and meaningful.

Table 1: Raw tweets and processed tweets

Before preprocessing	After preprocessing
[GPT-3] This post discusses the need for an audit system for Artificial Intelligence (AI) to ensure safety and cooperation. It suggests that the development of AI should focus on creating a system of logic and cooperation https://t.co/iRNQQH8UjX	post discus need audit system artificial intelligence ensure safety cooperation suggests development focus creating system logic cooperation
@soniajoseph_ Gpt = black box = fancy statistics	black box fancy statistics
Today, I’m working on building my own AI writing assistant w/ GPT-3 <U+2728> Here’s the plan: - Explore OpenAI + Playground - Connect to GPT-3s API - Ship a web app + Chrome extension If this seems cool and you also wanna build it, check out @_buildspace: https://t.co/RrHDq23BRp	today working building writing assistant plan explore playground connect ship web app chrome extension seems cool also wanna build check
Ars Technica: OpenAI upgrades GPT-3, stunning with rhyming poetry and lyrics. https://t.co/RKFTixDexK	ars technica upgrade stunning rhyming poetry lyric
via @GoogleNews @RandomSprint @goth600 @jeremymstamper @heyorson Type of guy who talks like GPT-3 and can’t stop. Nobody believes he’s real	type guy talk stop nobody belief real

Source: Generated by author, 2023

Feature extraction

Post-preprocessing, the next pivotal step was converting the cleaned textual data into a format our models could ingest. For this, we employed the CountVectorizer from the Scikit-learn library. This tool transforms textual data into numerical data by counting the occurrences of each word. The result is a matrix where each row represents a tweet and each column represents a word from our dataset. The value in each cell of this matrix corresponds to the number of times a particular word (column) appears in a particular tweet (row).

LDA for topic modeling

With our data pre-processed and transformed, we were ready for the main event: topic modelling using LDA. LDA is a probabilistic model that assumes each document (in our case, a tweet) is a mix of topics and a topic is a mix of words. By applying LDA, we aimed to uncover the latent topics driving the discussions around ChatGPT in the educational sector. Given the richness of our dataset and preliminary insights, we settled on extracting 15 topics. The number was determined considering both the computational feasibility and ensuring comprehensive coverage of the diverse discussions. Once the LDA process was executed, we mined the outputs to discern the dominant topics and associated keywords, providing a structured view of the sprawling Twitter discussions.

We also performed multiple runs of the LDA algorithm with different random seeds to test the stability of the topics across different iterations. This process helped verify that our topics were consistent and not artefacts of specific initial conditions. Additionally, we experimented with different numbers of topics to identify the optimal number that best balanced computational efficiency with comprehensive coverage of the discussions. Finally, we conducted a qualitative assessment where domain experts reviewed the topics and associated keywords to confirm their relevance to the discussions on ChatGPT in the educational sector. These steps ensured that our topic modeling results were both robust and reflective of the underlying public discourse.

RESULTS

Education and ChatGPT-related tweets detection

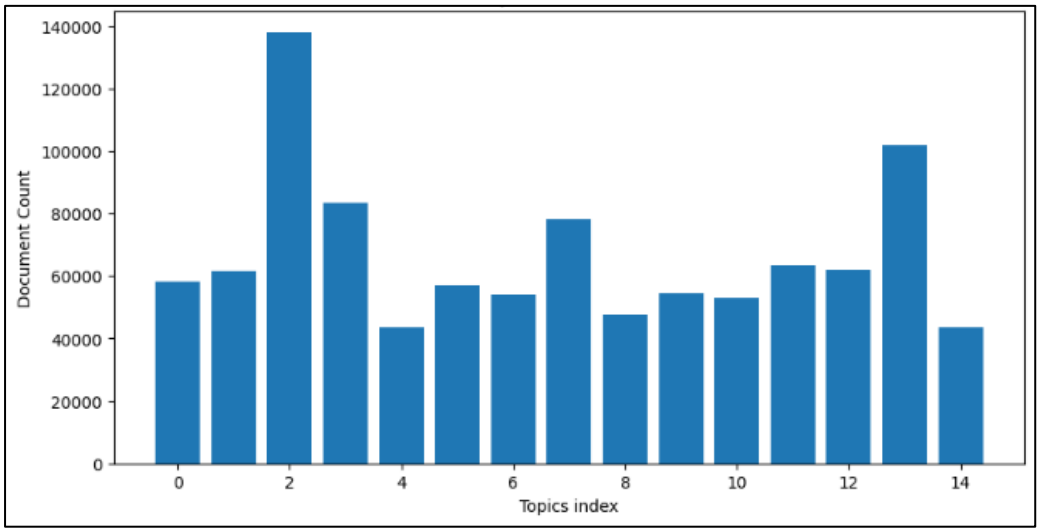
This phase's results emphasise the imperative of a comprehensive and multilayered approach to data classification and relevance assurance in social media analytics research, especially concerning extensive and varied platforms like Twitter. The nuanced and context-aware labelling by academic experts and the advanced model applications and word embeddings synergistically converged to elevate the data quality and research reliability. The standout performance of the LSTM model, especially when enhanced with GloVe embedding, highlights the continued advancement and applicability of deep learning techniques in social media data analysis.

Topic modeling

In this research, the team employed the LDA method to scrutinise tweets pertaining to education and their references to ChatGPT. Through this rigorous analysis, we identified 15 unique topics. These topics encompass a broad spectrum of discussions, spanning the influence of technology on business landscapes, the technical community's perspectives on AI and ML, and dialogues centred explicitly around education. Furthermore, conversations that delved into areas like code generation and the transformative potential of AI in supplanting human-driven tasks were also distinctly identified.

The collected tweets were evenly categorised across these 15 topics, as illustrated in Figure 2. This distribution affirmed that our chosen topics effectively captured the primary areas of discussion present within the dataset.

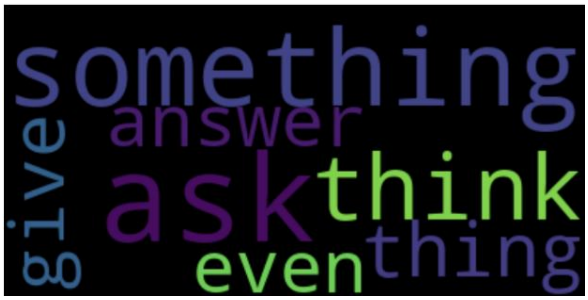
Figure 2: Distribution of documents in 15 topics in numeric scale



Source: Generated by author, 2023

Topic 2: Sharing and Generosity displayed here in Figure 3 has significant keywords like "something," "ask," "think," and "thing", which are generous words that make a conversation or phrase generous.

Figure 3: Topic 2; Sharing and generosity



Source: Generated by author, 2023

The topic Time and Fun are displayed in Figure 4 and have keywords related to time directly and keywords such as "game," "going," and "everyone" give the hint to name the topic as fun along with time.

Figure 4: Topic 13; Time and fun

Source: Generated by author, 2023

The outcomes of the LDA analysis are presented in Table 2. Following the standard procedures, we set for analysing the perception, the identified topics were categorised into three primary domains: Common, Implementation and Impactful. Leveraging the prominent keywords associated with each topic, the authors, in collaboration with linguistics and academic experts, assigned meaningful and descriptive labels to each topic to ensure clarity and relevance.

This classification was strategically designed to capture the multi-faceted nature of discussions surrounding ChatGPT in

education. The Implementation domain focuses on practical aspects and strategies for integrating ChatGPT into educational environments, addressing the specific challenges and methodologies associated with its use. The Impactful domain examines the significant effects and outcomes of ChatGPT on educational practices, highlighting both positive and negative consequences. Topics not fitting into these two distinct categories were grouped under the Common domain, which considered general and frequently discussed themes that reflect broad public perceptions. This approach allows us to provide a structured analysis while maintaining clarity and relevance.

Each domain offers a unique lens through which the relationship between humans and technology, especially in the context of ChatGPT, is perceived and discussed.

Common topics

These topics diverge from specialised discussions on the technology's application or anticipated impacts. Instead, they reflect more general themes frequently observed in writings like blogs.

- Search and SEO: This topic delves into online search engines and optimisation (SEO). Keywords such as "Google," "search," "engine," and "SEO" indicate an emphasis on web search technologies. It spans discussions on search engine algorithms, website ranking and strategies to enhance online visibility.
- Jobs and Articles: Here, discussions pivot around career opportunities, job postings and various articles. Keywords like "job," "article," "well," and "coming" signal a concentration on employment-related content.
- Sharing and Generosity: This topic centres on professional growth and development. Discussions encompass job searching, career planning, networking, skill development and workplace dynamics. Owing to its wide-ranging nature, it finds a significant presence on platforms like Twitter.
- People and Thoughts: Anchored around human behaviour, thoughts and perceptions, keywords such as "think," "people," "know," and "human" manifest. Conversations often involve cognitive processes, decision-making, social dynamics and self-reflection.

Implementation topics

These subjects shed light on the tangible applications of AI and advanced technologies.

- Writing and Tweeting: Focusing on content creation and sharing on social media platforms, keywords like "project," "like," "ask," and "write" suggest an emphasis on content creation and public engagement.
- Content Writing and Tools: This topic revolves around content creation, the tools used and content marketing strategies. Keywords include "use," "content," "tool," and "marketing."
- Language Models and ML: A Deeper Dive into Advanced AI Technologies, especially Language Models and ML. Conversations touch upon NLP, data analysis and AI-driven solutions.
- Questioning and Responding: This topic addresses the interactive aspect of AI technology, focusing on querying and responding.
- Code and Problem-Solving: Participants discuss coding, programming and employing AI for technical solutions.
- Prompts and Creativity: Conversations revolve around creative content generation, storytelling, poetry and AI-generated prompts for artistic pursuits.

Impactful topics

These topics contemplate the transformative potential of technological advancements.

- Business and Technology: Exploring the confluence of business strategies with technological innovation, discussions vary from the role of tech in businesses to the legal dimensions of emerging technologies.
- Microsoft and AI: An in-depth look into Microsoft's pursuits in AI and its implications for the tech world.
- School and Education: Delving into how technology is revolutionising the education sector, discussions encompass chatbots, online learning platforms and the changing landscape of education.
- Time and Fun: Focusing on leisure in the digital age, this topic delves into how tech has redefined entertainment, including gaming and streaming.
- Use and Technology Replacement: Examining the evolving human-tech dynamic, discussions ponder instances where technology streamlines or replaces traditional human tasks.

Table 3 shows examples of Tweets for each of the three overarching domains: Common, Implementation and Impactful.

Table 2: Outcomes of the LDA analysis

Domains	Topics	Keywords	Definition
Common topics	Search and SEO	google, search, engine, thread, SEO, summary, extension, bing, result, mind	These topics encompass broad discussions and broad themes and cover a wide range of general subjects. They often involve common topics and questions that people discuss in various contexts.
	Jobs and Articles	job, article, well, na, people, may, take, coming, soon, gone	
	Sharing and Generosity	get, ask, something, think, could, thing, give, even, answer	
	People and Thoughts	think, people, know, work, like, even, still, time, human, need	
Implementation topics	Writing and Tweeting	project, like, ask, give, really, great, right, something, would, HTTP	Functional topics revolve around the practical applications and functions of technology and AI. It mainly focuses on how these technologies can perform specific tasks or solve problems.
	Content Writing and Tools	use, content, HTTP, tool, ai, help, way, life, writing, marketing	
	Language Models and ML	model, language, amp, learning, data, machine, generate, large, used, customer	
	Questioning and responding	asked, question, answer, write, ask, response, say, said, asking, gave	
	Code and Problem-Solving	use, HTTP, code, write, using, know, would, writing, help	
	Prompts and Creativity	chat, HTTP, write, asked, written, wrote, poem, using, story, style	
Impactful topics	Business and Technology	business, exam, power, potential, technology, future, marketing, YouTube, law, startup	These topics focus on the potential consequences, effects and implications of technology and AI on various aspects of society, business and education. This topic explores how these advancements might shape the future and have lasting impacts.
	Microsoft and AI	Microsoft, intelligence, artificial, company, billion, join, creator, technology, tech, investment	
	School and Education	school, month, user, education, year, version, chatbot, million, technology, chatbots	
	Time and Fun	time, day, going, thing, game, fun, everyone, around, go, first	
	Use and Technology Replacement	use, know, human, open, need, case, chatbot, replace, technology	

Source: Developed by author, 2023

Table 3: Examples of tweets for common, implementation and impactful domains

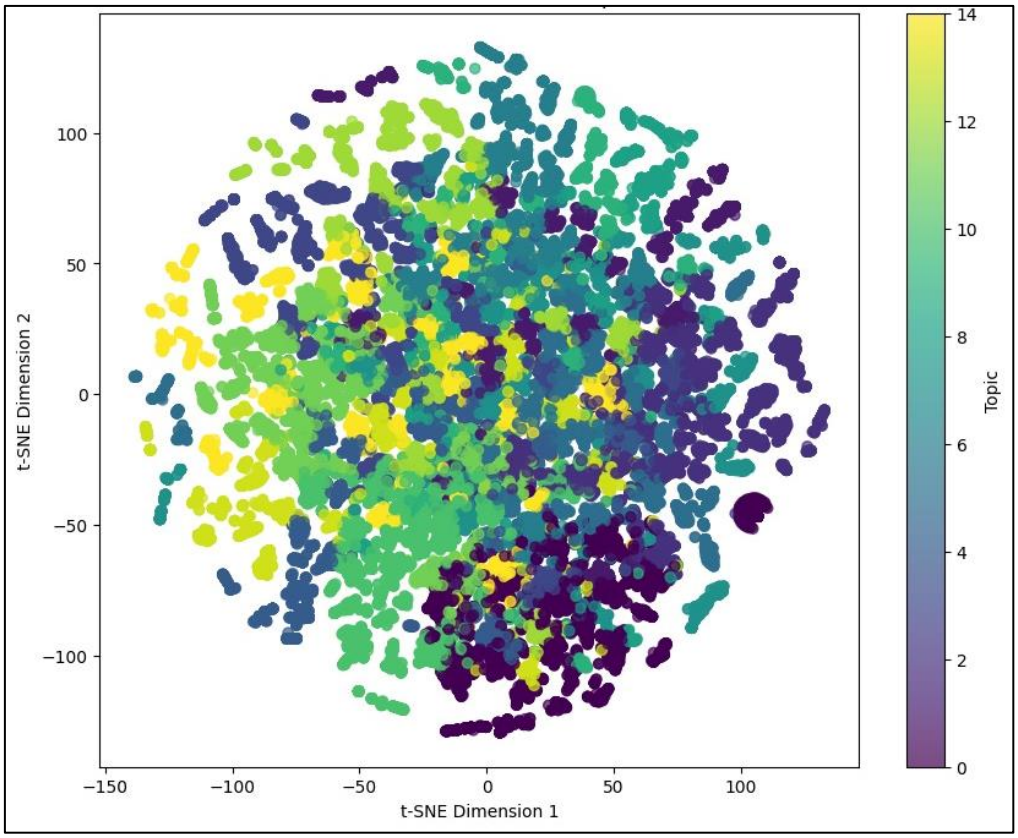
Common topics
ChatGPT is the latest version of â€œI am feeling luckyâ€ feature of Google search! Same construct, yet so advanced.
After having played with OpenAI's ChatGPT for 2 days. I can safely say that the game has changed.
Computers have led to the loss of writing skills
Yeah GPT 7.75 Final Chapter Prologue will probably be able to do a decent translation because google isn't too far off that now but /localisation/ is a different thing entirely and if you can't make your translation contextually & culturally relevant it isn't good.
ChatGPT doesn't understand homophones, it confuses them with rhyming words.
Implementation topics
ChatGPT is awesome. Not close to an AGI like Skynet or JARVIS, but more advanced than any chatbot I've seen. This project is so massive that I wonder what it will take to build an AI that can perform any intellectual task that a human can. Maybe when we crack Moravec's paradox?
It might be the end of corporate CEO/Marketing mumbling speeches, which is good but AI will also improve their output...
Which application are you addicted to and has become part of your life?
The "hook" would be that it would be as automated as possible. Even using AI to write chunks of dialogue via ChatGPT
[Post written by OpenAI GPT with the prompt "Make a prediction of when AI will generate most text, images and videos online, in very ganster style with one concrete example of best and worst scenarios, that maximises thoughtful comments when posted."]
@WilliamLamkin I did this with the previously available GPT interface, but learning Spanish was up there.
Impactful topics
â€œWrite an elevator pitch for a new startup CouchPoint an Independant travel brand between Airbnb and CouchSurfingâ€ https://t.co/Am9vSD6jZ6
Asked ChatGPT to write a simple Kotlin function and it did so surprisingly correctly along with an example input, I then told it to rewrite it without using var or other mutable types and it knew the functional equivalent. Like wow.
I have fun with it, but itâ€™s a cool technologyâ€¦arge
My guess is, Bing is going to get a heavy boost as a search engine with this https://t.co/oEeuysquc0 as Microsoft has exclusive license to all OpenAI properties.
#GPT #OpenAIChat #ArtificialIntelligence #Google #Microsoft #technology @sama @elonmusk #ELONMUSK @paulg #innovation
As Iâ€™ve noticed in this â€¦ conversation it has difficulty comprehending time. https://t.co/toMaLTJgfk
@cogentgene Working on launching a Shopify app soon with the core functionality completely built out by ChatGPT.

Source: Generated by author, 2023

In summary, this study maps out how humans engage with technology, from shared curiosities to pragmatic applications and visionary outlooks on future implications. The Common domain captures the broad, frequently discussed themes that reflect general public attitudes and interests. The Implementation domain highlights specific strategies and challenges associated with integrating ChatGPT into educational practices, providing evidence of the practical considerations involved. The Impactful domain reveals the significant effects and outcomes of ChatGPT's use, offering insights into its broader implications for education. Together, these domains offer a comprehensive view of the multi-faceted relationship between humans and this technology. The evidence from our analysis underscores the complexity of these interactions and highlights the need for ongoing research and dialogue to fully understand and address the evolving role of such tools in our lives.

Figure 5 visualises the LDA results using t-distributed stochastic neighbour embedding (t-SNE). t-SNE is a dimensionality reduction technique designed to represent high-dimensional data in two dimensions, ensuring that the most crucial structures within the data are retained. The visualisation reveals that the 15 topics are primarily clustered in the centre, with a few outliers appearing at the extreme maximum and minimum values.

Figure 5: SNE of LDA distribution



Source: Generated by author, 2023

While formal validation techniques such as k-fold cross-validation, test-retest reliability, and inter-annotator agreement metrics were not applied in this study, we implemented a thorough manual validation process to ensure the reliability and validity of our model. This involved a qualitative review where domain experts examined the topics and keywords produced by the LDA model to assess their coherence and relevance to the public discourse on ChatGPT in education. The manual validation provided a robust check on the model's outputs, ensuring that the identified topics accurately reflected the discussions in our dataset. Furthermore, we compared the results with established baselines from prior research to contextualise and validate the effectiveness of our model. Although formal metrics were not used, these steps contributed to a reliable and credible analysis of the data.

Our findings align with previous studies that identify key themes such as implementation challenges and benefits of ChatGPT in education. However, we also observed distinct perspectives on future applications that were not highlighted in earlier research. This divergence suggests an evolution in public discourse and underscores the value of recent data in capturing emerging trends. By comparing our results with existing studies, we provide a clearer understanding of how perceptions of ChatGPT are shifting, thereby contributing new insights to the field.

CONCLUSION

The rapid advancement of AI, epitomised by platforms like ChatGPT, is forging novel intersections in various realms, education being a notable one. This research embarked on a meticulous journey, systematically weaving through the vast tapestry of Twitter discussions to unravel these intersections. By traversing a methodologically rigorous pathway from data collection to topic modelling, this study spotlighted the multi-dimensional dialogues encircling ChatGPT in the educational domain.

This research advances knowledge by theoretically exploring public perceptions of ChatGPT in education, empirically presenting new insights from recent social media data, and methodologically introducing the use of topic modeling on Twitter. These contributions enhance our understanding of AI in education and demonstrate the value of innovative data analysis techniques.

The sheer volume of tweets underscores the immense interest surrounding AI, specifically ChatGPT, in the education sector. Such volume highlights the relevance and importance of AI tools in contemporary discourse. The involvement of academic experts in tweet classification, combined with sophisticated ML and deep learning models, ensured a dataset of high relevance and contextual accuracy. The LDA-driven extraction of 15 distinct topics illustrates the varied dimensions of AI-related conversations. The exchanges span a broad spectrum, from general discussions of application-centric dialogues to the potential ramifications of AI integration.

The highlighted topics reflect the multi-faceted relationship between humans and AI. Whether it's the curiosity-driven discussions, practical applications of the tool, or future-gazing into the implications, it is clear that AI platforms like ChatGPT are more than mere tools; they're reshaping the ways we think, interact and envision our future. The t-SNE

visualisation further reinforced our topic modelling outcomes, showcasing dense central clustering and highlighting unique, outlier discussions.

While this research provides a comprehensive glimpse into the ongoing discourse, several avenues beckon deeper exploration. Future studies can assess the temporal evolution of these discussions. How have perceptions and dialogues shifted over time, especially with the rapid evolution of AI capabilities? Beyond the topics of discussion, it would be valuable to gauge the sentiment of these tweets. Are they generally optimistic, sceptical, or neutral concerning AI's role in education?

Further studies might delve deeper into linguistic nuances, understanding the tweets' tone, style and other subtleties. How do discussions on ChatGPT in education compare with other AI tools or platforms? A comparative analysis can offer broader insights into the AI education landscape. Directly linking ChatGPT to educational outcomes could provide empirical evidence of its effectiveness as a pedagogical tool.

This research is a single thread in the grand tapestry of AI and education. As AI continues to evolve and permeate diverse domains, sustained research endeavours will remain paramount in understanding, navigating and optimising this symbiotic relationship between humans and machines.

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