FLORIDA ATLANTIC UNIVERSITY
Department of Electrical Engineering and Computer Science
College of Engineering & Computer Science

Florida Atlantic University, Boca Raton, FL 33431

https://eecs.fau.edu

Data Driven Approaches to Integrating AI in K-12 Education Using Social Media Analysis

PI Team: Hari Kalva, Hanqi Zhuang, Nancy Romance

Graduate Students: Paulina DeVito , Akhil Vallala, Kasra Danesh

Undergraduate Students: Sean McMahon, Yaroslav Hinda, Benjamin Thaw

1. Introduction

In this project, we studied conversations on social media platforms to begin to understand the perceptions of teachers and students on the use of AI in education. Topic modeling, sentiment analysis, and authorship attribution are used as a part of data analysis. The data for this project was collected from the popular social media platform Reddit. The data collected includes Reddit posts from November 2022, a milestone in GenAI – launch of ChatGPT, to the present day. Users express their ideas or opinions in posts on Reddit and other users respond to the posts. Posts were manually labeled and filtered for relevance to the overall subject of generative AI in education, resulting in 1,199 relevant posts and 14,017 comments associated with those posts.

This study was structured into two key phases: data preparation and data analysis. In the data preparation stage, relevant datasets were created, organized, cleaned, and preprocessed for analysis. The data analysis phase consisted of topic modeling for identifying the perspectives within the data, sentiment analysis to understand the emotional tone of those perspectives, and authorship attribution to determine which groups of people expressed those perspectives. Figure 1 shows a high-level overview of the data preparation and analysis steps involved in the study.

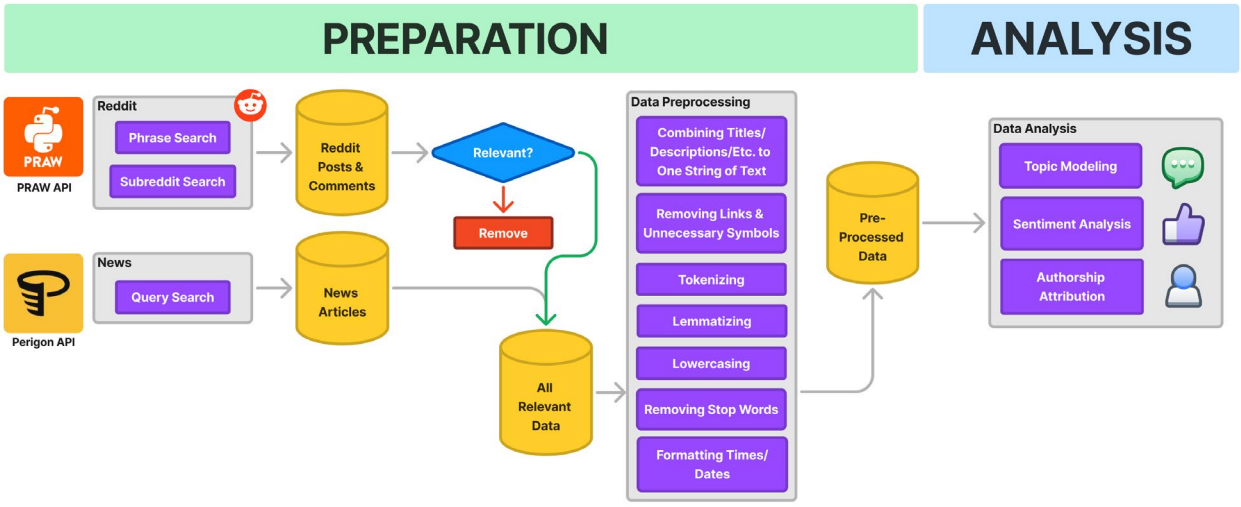

Fig 1. Process overview

2. Data Collection

The data used in this study comes from Reddit and spans from November 2022 to August 2024. The data collection was conducted using a custom Python script leveraging the PRAW (Python Reddit API Wrapper) library. The script workflow was structured to collect Reddit data based on keyword phrases combined with categorical sorting. Figure 2 shows the keyword phrases used to collect the data.

1	"Generative AI in education"	9	"Challenges of AI in education"
2.	"AI teaching tools"	10	"Future of education with AI"
3	"ChatGPT educational applications"	11	“Generative AI and academic integrity"
4	"AI tutors in schools"	12	"Using AI for educational content creation"
5	"Generative AI impact on learning"	13	"AI in classroom experiences"
6	"AI writing tools in education"	14	"Student engagement with Generative AI"
7	"Educational AI technology trends"	15	"AI and educational equity"
8	"AI and personalized learning"		

Figure 2: Keyword Phrases for Reddit Data Collection

Reddit post categories “new,” “controversial,” “gilded,” “hot,” “random-rising,” “rising,” and “top” were used to collect relevant posts and comments using the keywords and phrases.

Subreddits where these posts appeared were scraped to collect relevant posts that did not make it to the Reddit categories. Posts were manually labeled and filtered for relevance since the keywords used sometimes produced off-topic results. To reduce bias, two individuals independently labeled the posts with binary values: 0 for "not relevant" and 1 for "relevant." Results were merged and conflicts were resolved jointly with consensus. This process left 1,199 relevant posts and 14,017 comments associated with those posts.

3. Topic Modeling

Latent Dirichlet Allocation (LDA) was used for topic discovery. This process resulted in 12 topics used in this analysis. Following the topic modeling stage, each post is assigned to a topic. The next stage of the analysis would predict the sentiment of the post (positive, negative, and neutral). Understanding the post sentiment would help understand the sentiment of each of the topics discovered. The post authors of interest to this analysis are teachers, students, parents, and others. Author attribution methods were developed to gain a better understanding of the public discussions.

4. Sentiment Analysis

Sentiment analysis studies in the recent past have generally used lexicon-based and/or machine-learning-based natural language processing (NLP) techniques. With GPT based approaches becoming more available, we also explored the effectiveness of GPT models compared to more “traditional” methods. DSPy, a tool for automatic prompt tuning recently proposed by Khattab et al. was used to optimize the prompts. Prompts were optimized using a few-shot approach that uses a few posts with manually labeled sentiments. Performance of GPT models was evaluated based on the manually labeled dataset of 2,500 comments (1,090 negative sentiment, 593 neutral sentiment, 817 positive sentiment) and 1,199 posts (425 negative sentiment, 520 neutral sentiment, 254 positive sentiment).

5. Authorship Attribution

The last process we performed was author labeling to determine the type of the author of the post. The post authors of interest to this analysis are teachers, students, parents, and others. A few-shot prompt optimization was used. Samples were manually labeled based on the post context (subreddit, self-identified, etc. The posts were generally long and provided sufficient context to infer

author type. A manually labeled dataset of 1199 posts was produced (482 students, 319 teachers, 19 parents, 379 others).

Following the authorship attribution, we have the key information needed to analyze the posts: post topic, sentiment, and type of poster. This forms the basis for understanding the perception of the stakeholders about the topics of conversation related to GenAI in education.

6. Key Findings

Analysis of conversations about GenAi and education on Reddit provided very interesting insights and opportunities for further development. The following is a list of key topics identified through data analysis with the percentage of total posts related to topic is given in the parenthesis.

Topic 1: AI in Education and Personalized Learning (18%)

Student and teacher sentiments are very closely aligned on the use of Gen AI for personalized learning. About 50% overall expressed positive sentiments toward the use of GenAI for personalized learning. Students and teachers are more negative than parents!

Topic 2: Ethics and Academic Integrity (30.6%)

Academic integrity issues more directly impact student grades and an acquisition can be expected to trigger a strong negative response from students. This suggests significant efforts are needed to effectively use GenAI including setting clear expectations and avoiding unreliable tools for academic integrity checks.

Topic 3: AI Tools and Technologies in Education (14.4%)

Currently available GenAI tools need significant improvements for effective use in education. All stakeholders have significant negative opinions about currently available AI tools. Teachers seem to be more satisfied with AI tools as these have been used to improve lesson plans and better classroom preparation. Students, on the other hand, are most negative among users as there no proper tools or proper guidelines to effectively use these tools.

Topic 4 Impact of AI on Teaching and Teachers (3%)

This is small cluster with most authors classified as teachers. Strong negative sentiment among teachers reflects the fear that GenAI could replace teachers and uncertainty surrounding this issue.

Integrating GenAI should, therefore, carefully consider making teachers more effective and not create perceptions that GenAI could or would replace teachers.

Topic 5: Student Experience and AI (5%)

Strongly negative student experience with AI is a concerning revelation. Manual re-view showed that students are the main group being enticed to use AI and are the ones being punished for using it. Development of effective tools and clear guidelines is essential.

Topic 6: AI and Educational Policy (2%)

Students have mostly neutral and positive views of policy issues. Teachers and parents have strongly negative views of AI policy issues likely due to uncertainty of the policies.

Topic 7: AI in Higher Education and Research (12.4%)

This topic highlights the role of AI in university level education. Both teachers and students show a more neutral to positive sentiment. A possible explanation for this is that college students who are more mature have a more nuanced and neutral stance and are more open to possibilities.

Topic 8: AI and Language Learning (2.3%)

This cluster shows strongly positive sentiment across all stakeholders. This seems to indicate that GenAI is having a large positive impact on language learning. Studying the use of GenAI in language learning could offer insights into better integrating GenAI in education.

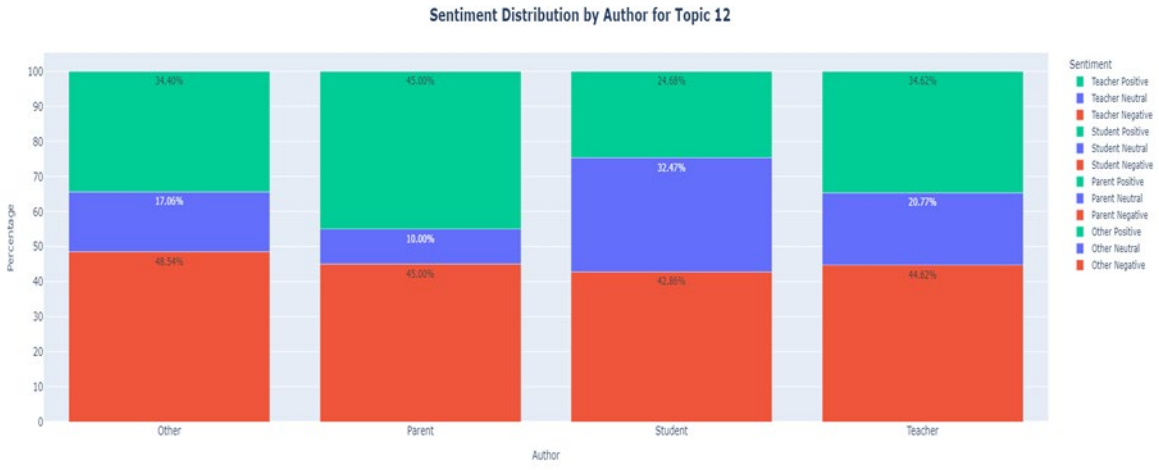

Fig. 3. Sentiment distribution for "AI and Future of Education"

Topic 12: AI and Future of Education (6%)

Fig 3. Shows the sentiment distribution across author types. This cluster shows strongly negative sentiment across all stakeholders. Uncertainty surrounding the use of AI is likely a major contributor. This suggests a need for clear policies and effective tools for integrating AI in higher education. Parents seem most positive, and students are least positive about the prospect of AI in future of education.

The overall sentiment of posts across topics is shown in Figure 4. Conversations on Topic 1, "AI in Education and Personalized Learning", are mostly positive, while conversations around ethics (topic 2) and student experiences (topic 5) are mostly negative.

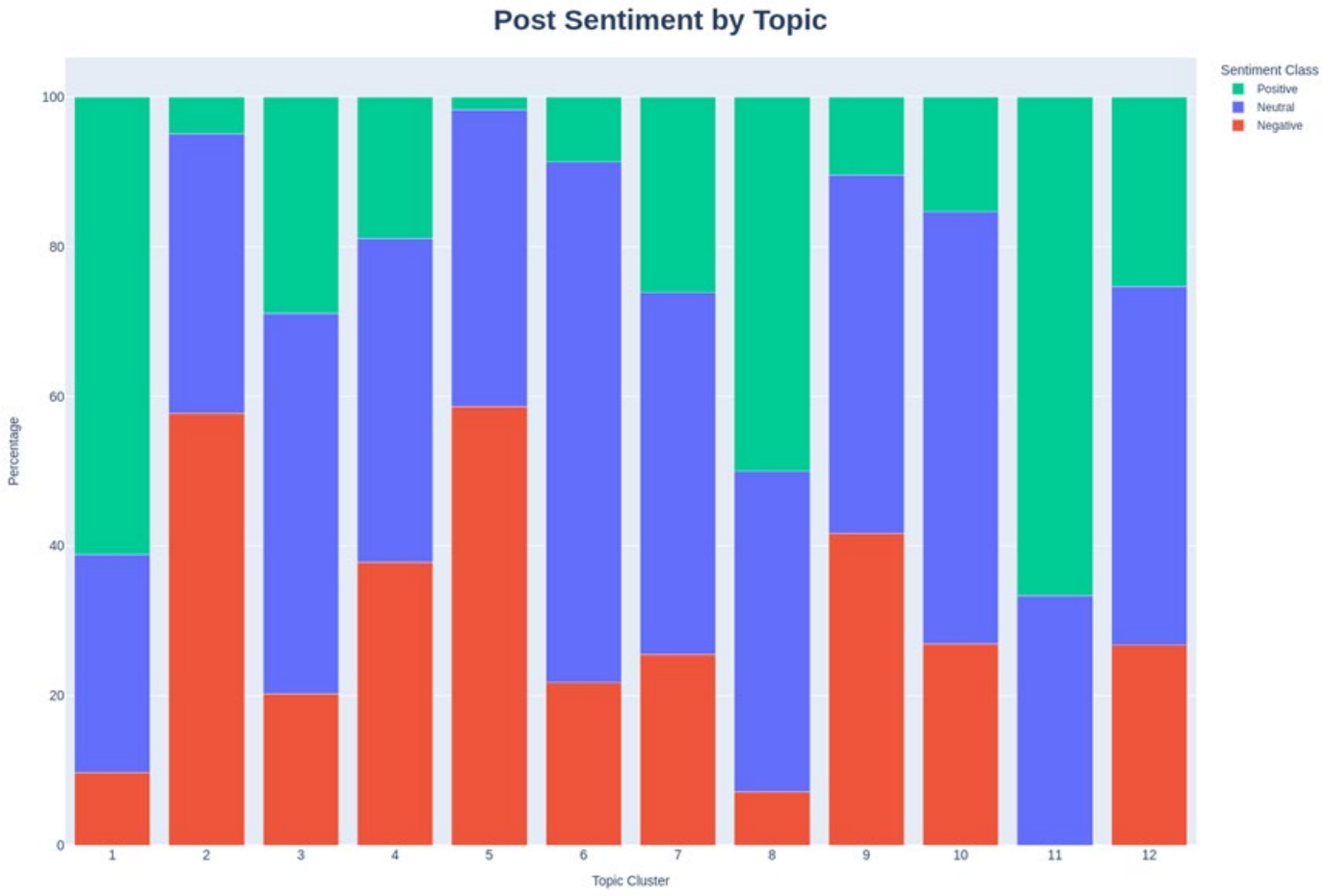

Fig 4. Overall sentiment of posts grouped by topic

7. Concluding Remarks

Analysis shows that conversations on social media networks can be fertile grounds to understand the evolving perceptions among key stake holders impacted by the influence of GenAI on education. Insights gained point to academic integrity issues and student experiences need most attention. All stakeholders are mostly positive about the potential of AI of personalized learning (topic 1). Further studies are necessary to gain a deeper understanding and influence the development in GenAI to positively impact K-12 education.

8. Acknowledgements

We are grateful to Trussed AI (https://www.trussed.ai) for providing the Trussed.ai Controller software that simplified the development and deployment of LLMs used in this project.