

## Aspect-Based Sentiment Analysis in the Education

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**Abstract:** In the current digital era, the education sector generates a large amount of feedback data from students in the form of surveys, reviews, and textual responses. This data contains valuable information about student experiences, satisfaction levels, and expectations from educational institutions. However, traditional methods of analyzing such data are often limited to basic statistical summaries and fail to capture deeper insights. These methods do not provide a clear understanding of how students feel about specific aspects such as teaching quality, curriculum structure, infrastructure, or placement opportunities. To overcome these limitations, this study focuses on aspect-based sentiment analysis, which enables a more detailed and fine grained evaluation of student feedback. In this research, a structured survey consisting of multiple questions was designed to capture both quantitative and qualitative responses from students. The collected responses were processed using natural language processing techniques to extract meaningful patterns and sentiments. A transformer-based language model was used to analyze the textual responses and classify them into sentiment and emotion categories. The analyzed data was then visualized using an interactive dashboard, which provides a clear and user-friendly representation of insights through graphs, charts, and key performance indicators. The results of this study show that aspect-based sentiment analysis provides a more comprehensive understanding of student feedback compared to traditional approaches. It helps in identifying strengths and weaknesses in different areas of education, thereby enabling institutions to take data driven decisions for improvement.

**Keywords:** Aspect Based Sentiment Analysis, Education Analytics, Sentiment Classification, Text Mining

### I. Introduction

The quality of education is directly influenced by how well institutions understand and respond to student feedback. Students are the primary stakeholders in any educational system, and their opinions play a crucial role in shaping teaching methods, curriculum design, and institutional policies. Traditionally, educational institutions collect feedback through surveys and forms, but the analysis of this data is often limited to calculating average scores or percentages. This approach does not provide a detailed understanding of student concerns and fails to highlight specific areas that require attention. With the advancement of data analytics and natural language processing, it is now possible to analyze feedback at a much deeper level. Aspect-based sentiment analysis is one such approach that allows the identification of sentiments related to specific aspects within the feedback. Instead of providing a single overall sentiment, this method breaks down the feedback into multiple components such as faculty performance, syllabus quality, practical exposure, and placement support. This enables a more targeted analysis and helps in identifying the exact source of satisfaction or dissatisfaction among students. In this research, a comprehensive survey was conducted to collect student feedback across multiple dimensions of the educational experience. The responses include both rating-based inputs and descriptive comments. These responses were processed using a language model capable of understanding contextual meaning and emotional tone in student opinions. The analysis helps institutions identify strengths, weaknesses, and areas that require improvement. By applying sentiment analysis techniques, educational institutions can make data-driven decisions that improve the overall learning environment and enhance student satisfaction. The results were then presented using a Streamlit-based dashboard, which provides an interactive platform for visualizing and interpreting the data. This approach not only improves the accuracy of analysis but also enhances the usability of the results for decision-making.

### II. Literature Review

Previous studies show that analyzing feedback is important for improving quality in different fields, especially in education. Traditional methods mainly focus on overall ratings, which do not provide detailed insights into specific issues. Researchers have suggested breaking feedback into different aspects to better understand user opinions. Recent approaches also emphasize analyzing written feedback to capture deeper meanings and emotions. These methods help organizations make more informed decisions based on detailed feedback analysis.

### **III. Problem Definition**

Despite the availability of large amounts of student feedback data, extracting meaningful insights remains a significant challenge. Traditional analysis methods focus mainly on overall ratings and fail to capture the complexity of student opinions. For instance, a student may provide a moderate rating, but the underlying reason could be dissatisfaction with a specific aspect such as placement support or teaching methods. Without detailed analysis, such issues remain hidden. Another major challenge is the handling of textual data. Students often express their opinions in different ways, using varied vocabulary, sentence structures, and emotional tones. This makes it difficult to analyze the data using simple keyword-based or rule-based methods. Additionally, the presence of informal language, spelling errors, and mixed sentiments within a single response further complicates the analysis process. There is also a need for a system that not only performs accurate analysis but also presents the results in a clear and understandable format. Without proper visualization, even the most accurate analysis may not be useful for decision-making. Therefore, the problem addressed in this research is to develop a system that can effectively analyze both structured and unstructured student feedback at an aspect level and present actionable insights through an interactive dashboard.

### **IV. Objectives & Scope**

The first objective of this research is to design and collect a structured dataset of student feedback using a survey that captures multiple aspects of the educational experience. The second objective is to analyze both numerical ratings and textual responses using advanced natural language processing techniques to identify sentiment and emotional patterns. The third objective is to develop an interactive dashboard that visualizes the analysis results in a clear and intuitive manner, enabling easy interpretation and decision-making.

**Technological Scope** The scope of this study covers multiple dimensions of technology, functionality, and industry application. From a technological perspective, the study involves data collection, preprocessing, sentiment analysis, and visualization using modern tools and frameworks. It demonstrates how machine learning and natural language processing can be applied to real-world problems in the education sector.

**Functional Scope** From a functional perspective, the study focuses on collecting survey responses, processing the data, analyzing sentiments and emotions, and presenting the results through interactive visualizations. The system is designed to provide insights at both overall and aspect levels, making it useful for identifying strengths and weaknesses in different areas. **Industry Scope** From an industry perspective, the study is highly relevant to educational institutions, including schools, colleges, and universities. It provides a systematic approach to analyzing student feedback and improving the quality of education. The methodology can also be adapted for other domains where feedback analysis is important.

### **V. Research Methodology**

#### **Data Collection and Preprocessing**

Data used in this study consists of structured responses along with textual feedback collected from students. The dataset includes multiple aspects of education such as teaching quality, curriculum, learning experience, and placement support. Before analysis, the data is cleaned and preprocessed. This includes removing irrelevant characters, converting text to lowercase, and eliminating stop words. Additional preprocessing steps such as tokenization and normalization are applied to prepare the data for analysis.

#### **Analysis Approach**

The study applies aspect-based sentiment analysis to identify sentiments related to specific educational components. Both numerical and textual data are used to derive sentiment labels. Textual responses are analyzed to extract meaningful patterns, while structured data helps in identifying overall trends. The combination of these approaches allows for a more comprehensive analysis.

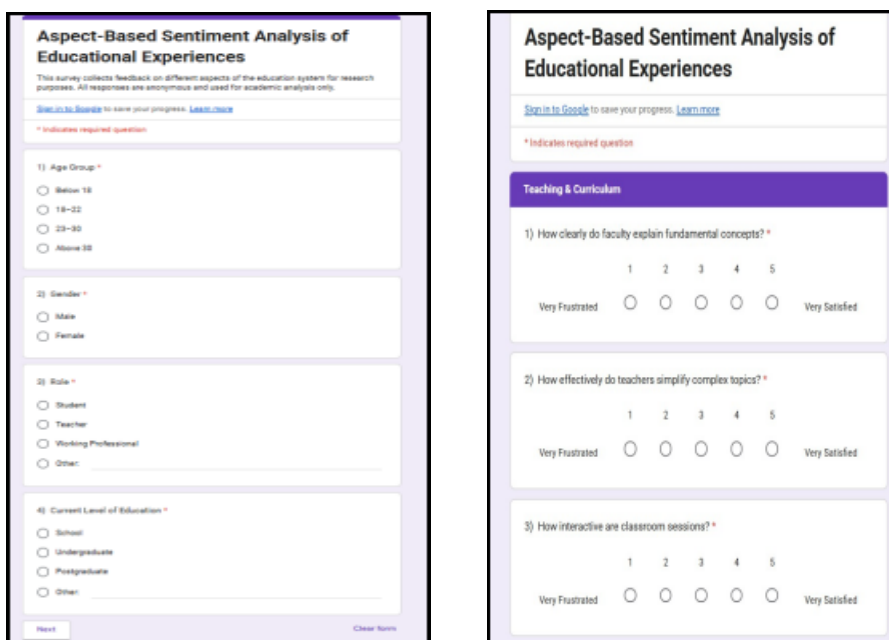
#### **Evaluation**

The performance of the analysis is evaluated using standard metrics such as accuracy, precision, recall, and F1-score. These metrics help in assessing the effectiveness of the approach in correctly identifying sentiment categories.

#### **Model Design and Training**

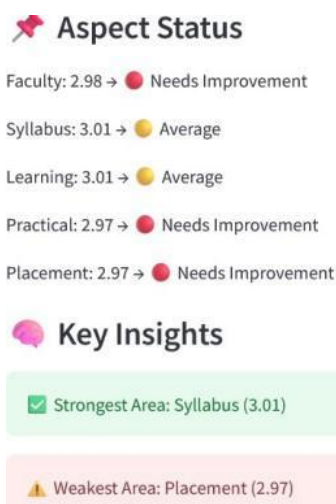
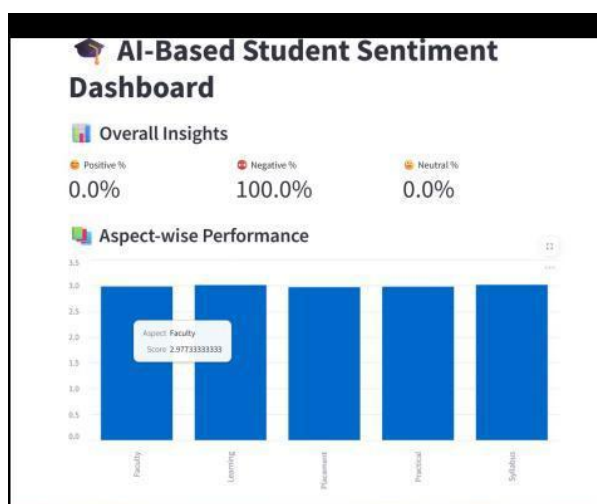
To perform aspect-based sentiment analysis, a deep learning-based transformer architecture was used. The model processes textual input and learns contextual relationships between words. A shared encoder is used to extract features, followed by separate output layers for classification tasks. The model is trained on labeled data to predict sentiment categories and emotional states. Training is performed over multiple epochs with

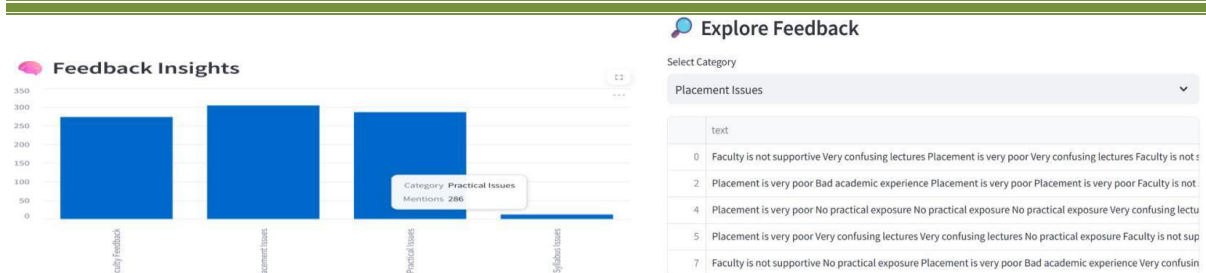
optimized parameters to improve accuracy and performance. This approach allows simultaneous learning of multiple outputs and improves the overall efficiency of sentiment classification.



## VI. Analysis & Findings

The analysis provides several important insights into student feedback: Teaching quality is generally perceived positively, indicating strong faculty performance. Curriculum-related aspects show mixed responses, suggesting the need for updates and improvements. Practical learning opportunities are identified as an area that requires more attention. Placement support is often rated lower compared to other aspects, highlighting a key concern among students. At the document level, sentiment analysis helps in understanding overall student satisfaction. At the sentence level, more detailed insights are obtained by identifying sentiments in individual statements. Fine-grained analysis further reveals specific strengths and weaknesses within each aspect. The results demonstrate that aspect-based sentiment analysis provides more meaningful insights compared to traditional methods.





## VII. Conclusion

This study proposes an effective approach to analyzing student feedback by combining structured surveys, sentiment analysis, and interactive visualization. Unlike traditional methods that rely only on average ratings, it captures both the intensity and emotional tone of responses across multiple aspects such as faculty, curriculum, placements, and infrastructure. By incorporating open-ended feedback, the system identifies deeper insights that numerical data alone cannot reveal. The use of dashboards makes the results easy to interpret and supports data-driven decision-making. Overall, the approach enables institutions to identify strengths and weaknesses more accurately and improve student experience in a scalable and efficient manner.

## VIII. Limitations & Future Scope

The system provides a strong foundation for student feedback analysis using sentiment analysis and structured surveys. Future enhancements include real-time processing, automatic aspect detection, deeper emotional analysis, and predictive analytics. Improved dashboards and system integration can enable continuous insights, and the approach can be extended to other domains like customer and employee feedback. The system has limitations such as reliance on predefined aspects, which may miss new concerns, and reduced accuracy due to informal or ambiguous language. Its performance depends on dataset quality, limiting generalizability. Additionally, it lacks real-time and predictive capabilities, and faces challenges in system integration and multilingual support.

## IX. References

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