EVALUATING STUDENT CONTENTMENT IN HIGHER EDUCATION USING SENTIMENT ANALYSIS

A. Suganya PG & Research Department of Computer Science Quaid-e-Millath Government College for Women, India suganyaa.research@gmail.com
Dr. Ananthi Sheshasaayee PG & Research Department of Computer Science Quaid-e-Millath Government College for Women, India ananthi.research@gmail.com

ABSTRACT
After the COVID, education took on a new dimension. Higher education has completely shifted from offline to entirely online education, and this abrupt transformation has had a significant impact on students' perceptions of education. Thus, recognizing the demands of students is required to improve the institution's teaching and learning in the upcoming educational environment. To understand or extract the student's needs, comprehensive information needs to be collected and analyzed efficiently to acquire meaning. Thus, in this study, we examine student data using sentiment analysis to get and comprehend student perception. The sentiment analysis result was neutral, and the accuracy of machine learning methods such as Naive Bayes, multilayer perceptron, logistic regression, and SVM were compared, with multilayer perception having the highest accuracy of 96%. As a result, today's students have become disenchanted with the current educational system. As a result, the institution must seek to improve learners' fulfilment to create a better educational community.

Keywords:
sentiment analysis, student feedback, student contentment, educational data.

1   INTRODUCTION
The academic environment of higher education has experienced a considerable transformation because of technology.   The   researchers emphasize   the   different   ways   that   modern   technologies improve educational institutions. Technology has made it possible for teachers, pupils, and parents to communicate effectively, boosting interaction and sharing of data through educational institutions.
In teaching and learning the use of technology can enhance learner learning results, increase utilization of higher learning, and boost learner motivation [1]. The technological era has shifted the educational institution into a new light. In recent years, artificial intelligence has made inroads into the realm of education. AI is gradually being utilized by educational institutions to improve methods of instruction and learning. Artificial intelligence-powered tools offer personalized feedback, continuous reach and accessibility for educational resources, reduced expenses, improved interpersonal habits, and impact on learner performance [2]. In these current enhancements in education where students favor or oppose these changes, their opinions are not taken into account. Thus, acquiring and analyzing student feedback is critical to understanding student opinion. While gathering feedback from pupils is not that difficult, analyzing that data is tedious. Because the manual study of learner comments takes time, sentiment analysis can be utilized to analyze this data accurately [3]. The purpose of this article is to investigate how satisfied learners are with the current educational system by gathering input from students and analyzing the data using sentiment analysis to determine the maximum level of perception.

2   LITERATURE STUDY

Feedback is a critical component of institutions for improving the performance and learning of learners [4]. Student feedback is vital for assessing the effectiveness of educators and instructional quality [5]. The feedback responses can be leveraged to improve the standard of the current process of learning, allowing the educational goals to be met [6]. Feedback is extremely important for enhancing pupil's educational experiences. This has a substantial impact on the professionalization of higher education teaching. The majority of professors continue to use the traditional form of feedback. This type of feedback is frequently insufficient to fulfill the needs of students in terms of increasing their learning experience [7]. Thus, proper data collection procedures can further improve the feedback collection process. There are several methods for gathering feedback from learners, including Google Forms, open-ended questions, and real-time feedback apps. Later analysis of feedback can be done in a more advanced approach, making it more effective and allowing for a proper study of students' requirements and contentment.

When analyzing student feedback, instructors could utilize natural language processing (NLP) and sentiment analysis technologies. These approaches can assist instructors in analyzing gathered feedback data more swiftly and effectively, offering a significant understanding of student preferences and requirements. Sentiment analysis, especially employing natural language processing (NLP), is becoming more prevalent in the research of student feedback for comprehending their ideas and feelings, which may assist in enhancing instructional and educational tactics [8][9]. In the past decade, there has been an increasing interest in applying NLP approaches to analyze the emotions of learners who participate in MOOCs (Massive Open Online Courses) [10].

2.1   Sentiment Analysis in Education

Sentiment analysis is extracting subjective information from text data. It entails determining if a text's sentiment or emotional tone is favorable, negative, or neutral. Natural language processing (NLP) methods and machine learning models are used in sentiment analysis approaches that detect content based on its sentiment [11]. Some studies emphasize the utility of sentiment analysis in detecting the progress of learners' curves, comprehending their demands, and forecasting their academic achievement [12].

The researcher from India performs a study to gather learner views from feedback and then categorize them as good, negative, or neutral using supervised learning algorithms. Researchers took a dataset of student comments obtained from an Indian institution and classified it using several supervised learning algorithms such as Naive Bayes, Support Vector Machine, and Random Forest. In regards to accuracy, the researchers discovered that the technique known as Naive Bayes outperformed the other algorithms [13].

Another researcher proposes a hybrid method for learner sentiment analysis based on classroom feedback gathered via Google survey forms and WhatsApp social media. Their research team classified the feedback as good, negative, or neutral using several sentiment analysis approaches such as TextBlob, VADER, and Naive Bayes. The research discovered that following the COVID-19 epidemic, the sentiment of learners shifted, with a fall in positive sentiment and a rise in negative emotion [14].

Another author collects the dataset of 700 written evaluations from Turkish learners and analysed them using sentiment analysis techniques to recognize and categorize user feelings as positive, negative, or neutral. To identify the feedback, the researchers employed several machine learning methods such as Naive Bayes, Support Vector Machine, and Random Forest. In terms of accuracy, the study discovered that the Naive Bayes method outperformed the other algorithms [15].

One of the researchers developed an innovative method for summarizing and organizing students' comments by applying machine learning sentiment analysis to analyze their attitude regarding a course as an aspect of language. The authors created a summative student course evaluation tool that can improve opinions' effectiveness in life science courses. The authors proposed that using machine learning sentiment analysis to provide more precise and valuable feedback to teachers might help enhance the quality of teaching and learning [16].

3   METHODOLOGY

Sentiment analysis has been growing in popularity over the past decade for analyzing and interpreting feedback from students. Numerous studies have been undertaken on the sentiment analysis of student feedback including a literature review [10]. A model for sentiment analysis constructed with TF-IDF and lexicon-based features [17]; and a study that employed sentiment analysis to analyze qualitative student responses [18]. The fundamental goal of this research is to gather important information about pupils' general contentment, concerns, and feelings toward various areas of their academic experience. Sentiment analysis may be utilized to quantify overall sentiment throughout an educational programme as well as to study how students feel about learning and their views towards a course [19].

3.1   Data Collection

Around 748 responses were received using the questionnaire given in Fig. 1 and Fig. 2, with 702 authentic responses from learners. The results are divided into population groupings based on demographics in Table 1.

Table 1. Demographic distribution of samples

S. No.	Demographic	Population (Total-748)
1	Gender (Male)	403
2	Gender (Female)	345
3	Urban	382
4	Rural	366
5	Bachelor Degree	354
6	Advanced Degree	292
7	Other Degree	102

3.2   Data Preprocessing

Raw information undergoes processing to eliminate noise, data that is unimportant, and individually identifying data. Text cleaning techniques like tokenization, stemming, and lemmatization are used to standardize the textual data.

3.3   Sentiment Analysis Technique

The objective of the study is to create an automated feedback analysis system that uses NLP and sentiment analysis to identify the polarity of pupil feedback. The sentiment analysis tools used for this kind of analysis are NLTK and spaCy. Sentiment polarity is measured on a positive-negative scale and can be categorized as extremely favourable, either positively or negatively negative, or extremely negative, but in this study, we have worked on positive, negative, and neutral sentiments. The study extracts significant characteristics, phrases, or words from feedback entries to better comprehend the factors influencing student attitudes.

Sentiment analysis data are visualized with charts, graphs, and visual aids to help grasp sentiment trends more clearly. This technique is consistent with the highest standards for visualizing sentiment and tendency data, which may give rapid insights, improve decision-making, and increase engagement.

4   RESULT AND DISCUSSION

The sentiment analysis of student responses produced informative results about their perspectives and experiences. The dataset, which included comments from a variety of sources, was submitted to natural language processing algorithms to assess the sentiment represented in each item. The sentiment analysis classified answers as favourable, negative, or neutral, offering a quantitative summary of the entire feedback environment.

4.1   Sentiment Analysis Results

A machine learning system based on a labelled dataset was used to perform sentiment analysis on the student feedback dataset. The sentiment analysis results indicated the overall sentiment generated by students about course design and instruction. Positive, negative, and neutral sentiments were assigned to the sentiment scores.Several methods were utilized in the response classification analysis. Each algorithm was examined, and the results were almost neutral. In sentiment analysis, algorithms such as Naive Bayes, Logistic Regression, SVM, and Neural Networks were utilized to classify replies. The neural network achieved the highest level of accuracy in classification when compared to the other methods, as seen in Table 2.

Table 2. Accuracy of Classification Algorithm

Algorithm	Naive Bayes	SVM	Logistic Regression	Neural Networks
Accuracy	0.9533	0.9533	0.9533	0.9633

Precision, recall, F1-score, and support are essential measures used to assess the efficacy of machine learning classification systems. Precision represents the correctness of the classifier's positive predictions, whereas recall measures the classifier's capacity to locate all positive instances in the dataset. The amount of data points in each class in the test set is represented by support, which aids in understanding the dataset's class distribution. The distribution of the value for the classification algorithm is shown in Table 3.

Table 3. Precision, recall, and f1 score values for the classification algorithm

Algorithm	Sentiment	precision	recall	f1 score	support
Naive Bayes	negative	0	0	0	5
	neutral	0.96	1	0.98	126
	positive	0.89	0.89	0.89	19
SVM	negative	0	0	0	5
	neutral	0.96	1	0.98	126
	positive	0.89	0.89	0.89	19
Logistic Regression	negative	0	0	0	5
	neutral	0.95	1	0.97	126
	positive	1	0.89	0.94	19
Neural Network	negative	1	0.6	0.75	5
	neutral	0.98	0.98	0.98	126
	positive	0.85	0.89	0.87	19

According to the research, 70% of the overall feedback received displayed neutral emotion, suggesting a lack of strong positive or negative opinions, while roughly 28% had a positive sentiment, reflecting students' favorable view of the course structure and teaching. Approximately 2% of the input was negative, showing regions of concern by students or dissatisfaction shown in Fig. 14.
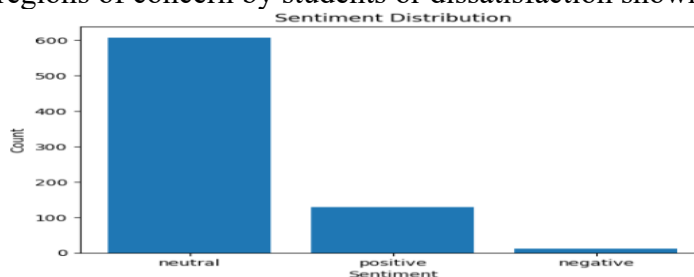

Fig. 3. Sentiment Analysis in Limitation of Current Course

Feedback is an essential element of education in raising student learning and performance [4]. Student feedback is crucial for evaluating the performance of teachers and the quality of teaching [5]. The results of the feedback can be used as input in improving the quality of the existing learning process so that learning objectives can be achieved [6]. There is a great importance of feedback in improving the learning experience for the students. This has also a significant effect in professionalizing teaching at the higher education level. However, feedback is considered a difficult issue in this arena. Most of the lecturers are continuing with the traditional form of feedback. This form of feedback often unable to satisfy the students in improving their learning experience.

CONCLUSION

Sentiment analysis of student comments found that 70% of replies were neutral, reflecting ambivalence. However, 28% of the comments were positive, highlighting the necessity of identifying and strengthening the factors that contribute to student contentment. Conversely, 2% of the input was unfavorable, emphasizing the importance of addressing issues to enhance the student experience. The study discovered that neural network models combine other methods, with an accuracy of 96%, indicating their dependability in estimating satisfaction levels. These insights not only offer light on

the present level of student contentment, but also serve as a platform for targeted changes and interventions, which are critical for fulfilling the academic their changing demands.

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