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Utilization of the AI-BERT Model for Analyzing Student Sentiments toward Campus Services at Higher Education Institutions in South Tangerang City

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Abstract: This study aims to evaluate students' satisfaction with academic services and analyze open-ended opinions using the Artificial Intelligence Bidirectional Encoder Representations from Transformers (AI-BERT) model. The research employed a quantitative experimental method, combining a five-point Likert scale survey across seven academic service indicators and AI-BERT sentiment analysis of 150 student comments. The results indicate that the overall student satisfaction level falls into the "good" category, with a Student Satisfaction Index (SSI) of 78.53%. The highest-rated indicator was access to academic information (mean = 4.21), while the lowest was administrative service speed (mean = 3.67). Sentiment analysis revealed 60.67% positive, 36.00% negative, and 3.33% neutral opinions, highlighting the need for improvement in service speed and staff responsiveness. Evaluation of the AI-BERT model demonstrated superior performance with an accuracy of 91.3% and an F1-score of 0.913, outperforming conventional methods such as SVM and Naïve Bayes. These findings provide a basis for recommendations on developing digital-based academic service strategies and leveraging AI technology to enhance service efficiency and quality.

Keywords: Academic services; AI-BERT; Sentiment analysis; Student satisfaction

Introduction

The advancement of information technology has driven a significant transformation in the governance of academic services at higher education institutions (Julianto & Lindawati, 2022). Fast, accurate, and responsive services have become a fundamental requirement to support the smooth learning process of students (Coccoli et al., 2014; Rumble, 2000). However, in practice, various services such as Course Registration Card (KRS) management, access to class schedules, and submission of administrative documents often face challenges that can affect student satisfaction (Azzahra et al., 2025). Students' perceptions of these services serve as an important indicator for assessing the quality of academic management and as a basis for continuous improvement (Bororing & Faeruzah, 2020).

The quality of academic services plays a strategic role in enhancing the competitiveness of higher education institutions and supporting students' academic success (Aithal & Maiya, 2023). Suboptimal academic services can reduce student satisfaction, which ultimately impacts the reputation of higher education institutions. Therefore, continuous monitoring and evaluation of student satisfaction has become an indispensable necessity. In the digital era, students increasingly express their opinions about campus services through social media, academic forums, and digital reviews (Al-Hail et al., 2023; Bulu et al., 2024). However, traditional survey methods have limitations,

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such as: lacking real-time responsiveness since they are conducted periodically, making it difficult to capture the dynamics of opinions; limited scale, representing only a small portion of the student population; and manual analysis, which is prone to bias and inefficient at a large scale (Martha, 2025).

In addition to conventional surveys, students' open-ended opinions collected through digital channels can provide deeper insights into their experiences. However, such data is unstructured and therefore requires an analytical approach capable of understanding the context of natural language (Hikmah Febryan et al., 2025). An Artificial Intelligence (AI) approach with Natural Language Processing (NLP) based on Bidirectional Encoder Representations from Transformers (BERT), or AI-BERT, was chosen due to its superior ability to understand sentence context and produce more accurate sentiment classification, particularly for students' opinions that are complex and unstructured (Putri & Ardiansyah, 2023). Meanwhile, traditional methods such as Naïve Bayes and Support Vector Machine (SVM), although simpler and faster, have limitations in capturing the nuances of language and sentence context as deeply as AI-BERT (Fitri et al., 2020).

This study employed a quantitative experimental method combining two approaches: (1) quantitative analysis through a five-point Likert scale survey on academic service indicators to measure student satisfaction, and (2) automated sentiment analysis using AI-BERT on students' opinions (Mas et al., 2021). This approach is expected to provide a comprehensive overview of students' perceptions while also offering strategic recommendations to enhance the quality of academic services in higher education institutions. This study is expected to support data-driven decision-making and improve the quality of academic services sustainably through the utilization of AI technology.

Method

Research Design

This study employed a descriptive quantitative method with an experimental approach, which involves collecting and analyzing numerical data to systematically, objectively, and measurably describe phenomena, while also observing certain variables under controlled conditions (Syahrizal et al., 2023). Using this method, the researchers can measure students' satisfaction with academic services through a Likert scale survey and analyze students' open-ended opinions using the AI-BERT model, thereby obtaining both quantitative and in-depth information on students' perceptions (Maulidan et al., 2024).

Research Location and Schedule

The study was conducted at several higher education institutions in South Tangerang City, namely STIE Ganesha, Universitas Islam Negeri (UIN) Syarif Hidayatullah Jakarta, Universitas Pamulang (UNPAM), and Universitas Muhammadiyah Jakarta (UMJ). The research was conducted from January 2025 to August 2025, encompassing the stages of instrument development, questionnaire distribution, collection of student opinions, and data processing using the AI-BERT model

Population and Sample

The sample size in this study was determined using the Slovin formula, as the population was finite and known, consisting of students from several higher education institutions in South Tangerang City with an estimated total of 1,000 individuals (N). The use of this formula aimed to obtain a representative sample while considering an acceptable margin of error (Azzahra & Wibowo, 2020):
The Slovin formula used is as follows Formula 1.

$$n = \frac{N}{1+N(e)^2} \quad (1)$$

Note:
n = Sample size
N = Population size
e = Margin of error

In this study, a margin of error of 10% (0.10) was applied. The selection of a 10% error level was based on the following considerations (Sugiyono, 2021).

Limited Resources and Time

This study faced constraints in terms of time and budget; therefore, selecting a 10% margin of error was considered a realistic choice to obtain sufficiently representative data without overburdening research resources.

Exploratory Nature of the Study

This research aims to explore student sentiment patterns toward academic services using the AI-BERT model. Given its exploratory nature, a slightly higher margin of error (up to 10%) is still considered acceptable.

Compliance with Standards in Social Research

In social research and preliminary surveys, a 10% margin of error is still commonly used, particularly when the population is large and the research focuses more on identifying general trends rather than highly precise estimates.

Based on the calculation using the Slovin formula, with N = 1,000 and e = 10%, a minimum sample size of 91 respondents was obtained:

$$n = \frac{1000}{1+1000(0,1)^2} = 91 \quad (2)$$

However, in practice, this study successfully collected 150 respondents. The increase in sample size was made to enhance data representativeness and the reliability of the analysis results, so that even though a 10% margin of error was used, the study findings still maintain a good level of accuracy.

Research Instruments

The data collection instruments include: A closed-ended questionnaire using a 1–5 Likert scale (1 = very dissatisfied, 5 = very satisfied) to measure students' satisfaction with seven academic service indicators. Open-ended questions that allow students to provide free-form opinions regarding their experiences with academic services.

Research Procedure

The research procedure consisted of the following stages: Preparation, developing the instruments, validating them, and distributing the questionnaires via online platforms. Data Collection, conducting surveys using a Likert scale to measure student satisfaction. Collecting students' opinions for sentiment analysis. Data Preprocessing, survey data were processed to calculate mean scores, percentages, and the Student Satisfaction Index (SSI). Text data were cleaned through normalization, punctuation removal, tokenization, and stopword elimination (Azzahra & Wibowo, 2020).

Data Analysis

Descriptive Analysis: Calculating means, response distributions, and the satisfaction index; Sentiment Analysis: Conducted using AI-BERT via Google Colab, including model fine-tuning and sentiment classification (positive, negative, neutral); Model Evaluation: Performance of AI-BERT was measured using accuracy, precision, recall, and F1-score metrics, and compared with baseline methods such as Naïve Bayes and SVM.

Data Analysis Techniques

Descriptive Analysis:

Calculating the mean satisfaction and the Student Satisfaction Index (SSI) using the Formula 3.

$$\text{SSI} = \frac{\text{Total Actual Score}}{\text{Ideal Score}} \text{X } 100\% \quad (3)$$

Research Flow Diagram

The following is the research flow diagram illustrating the overall stages of the study.

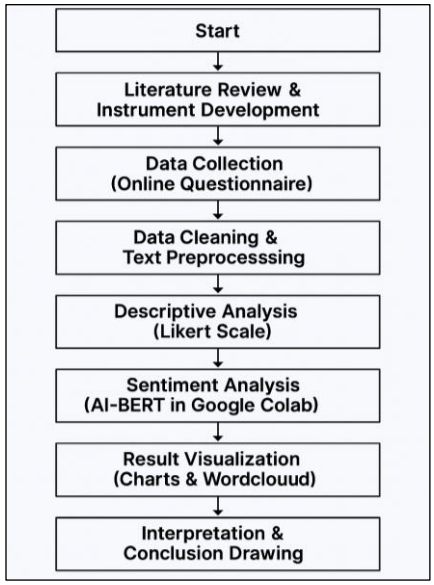

Figure 1. Research Flowchart

Sentiment Analysis

Grouping students' opinions into positive, negative, and neutral categories. The distribution of results showed: 60.67% positive, 36.00% negative, and 3.33% neutral, with the model's confidence level ranging from 0.88 to 0.93.

Result and Discussion

Results of Student Satisfaction Analysis

The measurement of students' satisfaction with academic services was conducted using a Likert scale across seven main service indicators (Mustikasari, 2019). Data processing results showed that the mean scores for all indicators fell within the 'satisfied' category, with a Student Satisfaction Index (SSI) of 78.53%.

Table 1. Recapitulation of Student Satisfaction Index by Indicator

Academic Service Indicator	Mean	Category
Access to academic information	4.21	Satisfied
Course Registration Management (KRS)	4.10	Satisfied
Clarity of administrative procedures	3.95	Satisfied
Speed of administrative services	3.67	Fairly Satisfied
Availability of online services	4.05	Satisfied
Responsiveness of academic staff	3.89	Satisfied
Accuracy of academic schedules	4.00	Satisfied

The highest-rated indicator was access to academic information (mean = 4.21), indicating that the

digitalization of information is functioning well. Meanwhile, the lowest-rated indicator was administrative service speed (mean = 3.67), which falls into the 'fairly satisfied' category and represents a key area for improvement.

The Student Satisfaction Index (SSI) is calculated using the Formula 4.

$$SSI = \frac{\text{Total Actual Score}}{\text{Ideal Score}} X\ 100\% \quad (4)$$

Based on the calculation results, the SSI value is 78.53%, which falls into the 'good' category.

AI-BERT Sentiment Analysis Results

Sentiment analysis was conducted on students' open-ended opinions collected through an online questionnaire. The AI-BERT model, run via the Google Colab platform, produced the following sentiment distribution: Positive Sentiment: 60.67%; Negative Sentiment: 36.00%; and Neutral Sentiment: 3.33%.

This distribution indicates that the majority of students expressed satisfaction with academic services, although a significant proportion of negative opinions should be noted.

In addition to sentiment distribution, the model's performance evaluation showed that AI-BERT achieved an accuracy of 91.3%, precision of 0.89, recall of 0.90, and an F1-score of 0.89, outperforming SVM (accuracy 82%, F1-score 0.82) and Naïve Bayes (accuracy 76%, F1-score 0.76).

Table 2. Comparison of Model Evaluation Metrics

Model	Accuracy	Precision (weighted)	Recall (weighted)	F1-Score (weighted)
AI-BERT	0.913	0.914	0.913	0.913
Naïve Bayes	0.760	0.765	0.760	0.763
SVM	0.820	0.823	0.820	0.823

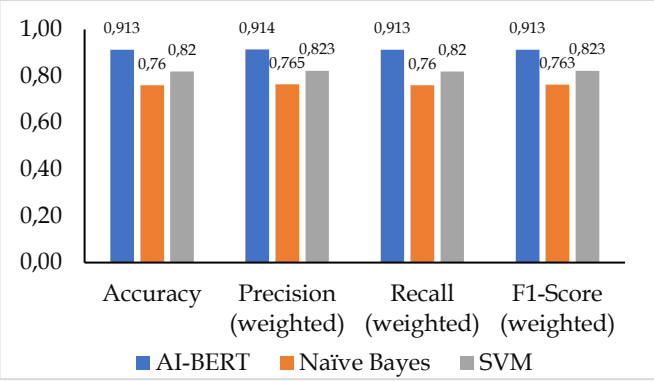

Figure 2. Comparison of Model Performance

Discussion

The study results indicate that, overall, students are satisfied with the academic services at higher education institutions in South Tangerang City, with an SSI of 78.53% (categorized as good). The highest-rated indicator, access to academic information, demonstrates that information digitalization has been effectively implemented. However, the lowest-rated indicator, speed of administrative services, indicates significant obstacles that reduce students' service experience.

Sentiment analysis reinforces the quantitative findings. While the majority of students' opinions were positive (60.67%), the 36% proportion of negative sentiment highlights real issues regarding the speed of service and responsiveness of academic staff.

Model evaluation showed that AI-BERT consistently outperforms conventional methods. The main advantage of AI-BERT is its ability to understand sentence context bidirectionally (Kasztelnik & Kamssu, 2025; Sri Widagdo et al., 2023). This enables it to capture the nuances of students' opinions more accurately compared to traditional models such as SVM and Naïve Bayes, which rely on simple word representations (Dervenis et al., 2024; Rahayu et al., 2022).

The implications of these research findings suggest that higher education institutions need to: Improve the speed of administrative services by digitalizing bureaucratic processes (Dormann et al., 2019; Kasmia & M'hamed, 2023; Nweke, 2025); Enhance staff responsiveness through excellent service training and AI-based monitoring systems; and Integrate AI-based chatbots and real-time analytics dashboards to accelerate responses to student complaints. Through this approach, higher education institutions can improve the quality of academic services while strengthening their competitiveness in the digital era.

Conclusion

This study indicates that students' satisfaction with academic services at higher education institutions in South Tangerang City falls into the 'good' category, with an SSI of 78.53%. The highest-rated indicator was access to academic information, reflecting the successful digitalization of information, while the aspect requiring serious attention was the speed of administrative services, which only reached the 'fairly satisfied' category. Sentiment analysis using the AI-BERT model reinforced the quantitative findings, showing that the majority of student opinions were positive (60.67%),

although 36% of negative sentiment highlighted weaknesses in administrative services and staff responsiveness. From a technical perspective, AI-BERT proved superior to SVM and Naïve Bayes, achieving an accuracy of 91.3% and an F1-score of 0.913, making it a reliable tool for analyzing student opinions more accurately and contextually. Therefore, it can be concluded that improving the speed of administrative services, enhancing staff responsiveness, and implementing AI-based digital solutions (such as chatbots and real-time analytics dashboards) are strategic steps for higher education institutions to enhance the quality of academic services while strengthening their competitiveness in the era of digital transformation.

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Author Contributions
All authors contributed jointly to the manuscript writing and approved the final version for publication.

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Conflicts of Interest
The author declares that there are no conflicts of interest affecting the conduct of this research or the writing of this article.

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